Socioeconomic inequalities in blood pressure in Chilean adults

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I, Andrea O. Guerrero-Ahumada confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Abstract

Background: In Chile hypertension is one of the main health problems and could be contributing importantly to health inequalities. Socioeconomic inequalities in blood pressure have been reported in different countries; however the results are not consistent

Aim: To analyse the magnitude of socioeconomic inequalities in blood pressure in Chilean adults and the changes between 2003 and 2010.

Methods: The project used two national household surveys conducted in Chile in 2003 and 2010. The analysis involved three stages. First, socioeconomic inequalities in blood pressure and the role of individual factors were examined using multivariable regression analysis. Second, relative and absolute socioeconomic inequalities were estimated using the relative and slope indices of inequality. Third, a multilevel approach was employed to assess the influence of area-level socioeconomic characteristics on the variation in blood pressure between small areas.

Results: Inverse social gradients, both in fully adjusted models and in terms of SII and RII, were observed mainly between SBP and education, in women and those aged 40-59. These inequalities tended to decrease between 2003 and 2010 but some inequalities observed in 2003 were still present in 2010. BMI was the strongest confounder affecting these social gradients. When using a multilevel approach, results revealed that in 2003, the higher the mean small area income, the lower the risk of raised SBP. In 2010, people living in small areas with lower level of schooling, higher unemployment rate and higher deprivation score had higher SBP while small area income was not associated with SBP.

Conclusions: There are socioeconomic inequalities in blood pressure in Chile and although these have decreased over time, social inequalities in women and in people aged 40-59 were still present in 2010. Results suggest that there are area-level socioeconomic factors affecting the variation in blood pressure between small areas.

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List of abbreviations

AUDIT Alcohol use disorders identification test
BMI Body mass index
DALYs Disability adjusted life years
DBP Diastolic blood pressure
DM Diabetes mellitus
ISCO88 International Classification of Occupations
JNC Join National Committee
MAR Missing at random
MCAR Missing completely at random
MI Multiple imputation
MLM Multilevel model
MNAR Missing not at random
NHS National health survey
NHS2003 National health survey 2003
NHS2010 National health survey 2010
OECD Organization for Economic Cooperation and Development
OR Odds ratio
PR Prevalence ratio
PSU Primary sampling unit
RII Relative index of inequality
SBP Systolic blood pressure
SDOH Social determinants of health
SEP Socioeconomic position
SII Slope index of inequality
WHO World Health Organisation

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Chapter 1.Introduction

Hypertension, one of the major cardiovascular risk factors, constitutes a rising global health problem,[1] and at the same time, shows marked inequalities across socio-economic position. [2,3] Raised blood pressure causes 7.5 million deaths in the world, which represents 13% of all deaths.[4] According to the World Health Organisation, prevalence of raised blood pressure in the world is around 40% and this prevalence is higher and tends to increase in low and middle-income countries.[1] Evidence of inequalities in high blood pressure shows that lower socioeconomic position (SEP) is associated with higher blood pressure in most studies from developed countries. Meanwhile, in lesser developed countries most affluent people tend to show higher level of blood pressure.[2,5] Considering the magnitude of this health problem and the inequalities seen, high blood pressure may constitute an important contributor of health inequalities, and this may become most marked in low and middle-income countries.

Health inequalities have been defined as a generic term used to refer to differences, inequalities or variations in the state of health of groups.[6] As Woodward and Kawachi[7] point out, these variations become unfair when poor health is itself the consequence of an unfair distribution of the social factors which determine health status. In addition, the World Health Organization[8] has identified that health inequalities have three characteristics: they are systematic, socially produced, and unjust. In this way, diminishing health inequalities is an ethical imperative which governments could address through public policies. At the same time, reduction of the burden of health in unprivileged people offers great potential for improving health status of the population as a whole.[9] In this sense new evidence about health inequalities may represent a contribution to the design and monitoring of policies on reducing the social determinants of health.[9]

In addition to social factors, inequalities in blood pressure can also be seen in countries with different levels of income. Although there is extensive evidence about socioeconomic inequalities in blood pressure, the majority of this evidence comes from high income countries, and results tend to be inconsistent.[2,10]

In Chile, an upper-middle income country[11], non-communicable diseases have become significant as a result of the advanced stage in demographic and epidemiologic transition.[12,13] Consequently, in Chile health indicators reflect one advanced ageing process and the predominance of chronic and degenerative problems in the population.[14] For example, life expectancy reached 79 years in the period 2010-2015[12] and in this same period the main cause of mortality was circulatory system diseases.[15] In addition, high blood pressure has become one of the main health problems in the adult population with 27% of the population aged 15 or older hypertensive.[16] According to the Study of Burden of Disease 84% of DALYs are caused by non-communicable diseases and hypertension is the main cause of DALY's[a] in Chile.[17] Furthermore, high blood pressure was responsible for 12,706 attributable deaths in 2004 (15% of all deaths).

Furthermore, marked socioeconomic inequalities in health are observed in Chile.[14,16,18-20] For instance, in 2004-2006, the life expectancy gaps between the most and least educated men and women were thirteen and eight years respectively.[19] Similarly, social inequalities are observed in blood pressure in morbidity, as well as mortality. For example, in whole population, the prevalence of high blood pressure and the deaths rates for those least educated are more than three times those of the most educated. [16]

Thus, considering that hypertension affects over one quarter of adults people in Chile, due to its high prevalence and mortality, and given that, social gradients are observed for this health problem, it is reasonable to suggest that high blood pressure may be contributing to shape health inequalities in Chile. Therefore, additional research on this topic would be useful to inform public health policy in Chile.

This thesis aims to provide new more in depth knowledge about the pattern of socioeconomic inequalities in health and its contributing factors, may guide decisions about designing and monitoring public policies to tackle social inequalities in health. The thesis is organised as follows. Firstly, it describes the context of the thesis in Chile, sets out key concepts and a review of the literature on four topics: social determinants of health and its different approaches, measurements of socioeconomic position and its use in health research, hypertension definitions and the association between socioeconomic position and blood pressure (Chapter 2). The literature review evaluates the evidence and identifies the research gap which this project aimed to address. The third chapter

[a] DALYs for a disease are calculated as the sum of the Years of Life Lost (YLL) due to premature mortality and the Years Lost due to Disability (YLD) (WHO. Metrics: Disability-Adjusted Life Year (DALY).

describes the aims, objective and hypothesis of this project. That is followed by the chapter presenting Methods, which includes the description of data sources, variables and management of missing data (Chapter 4). Chapters 5 and 6 present the methodology, the results and the discussion of the analysis to individual and small area levels respectively. Chapter 5 is focused on individual socioeconomic position and its impact on blood pressure. In this analysis the role of potential covariates is also investigated, and absolute and relative socioeconomic inequalities are examined. In turn, Chapter 6 describes the results of analyses performed using a multilevel approach aimed to assess the influence of small area socioeconomic characteristics on the variation in blood pressure between districts. Chapter 7 discusses the results of the project in the context of the existing literature, and policy implications, and finally in Chapter 8 are presented the general conclusions of this thesis.

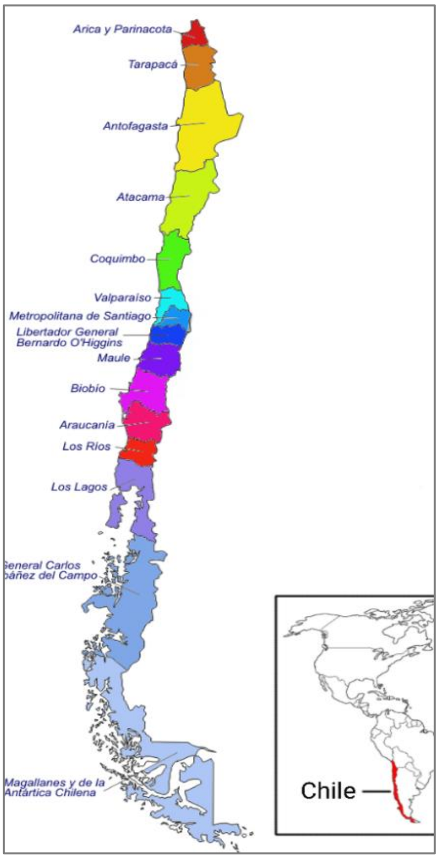
Chapter 2.Background

The purpose of this chapter is to provide context for this project by giving an overview of Chile and its general characteristics and of relevant concepts and existing literature related to social determinants of health, measurements of socioeconomic position, definition of hypertension and finally socioeconomic position and how it affects blood pressure.

2.1 Chile overview

The Republic of Chile is a Latin American country located in the southern part of South America. The population estimated for 2015, based on the 2002 national population census, was 18,006,407, of which 51% were women, and 49% were men. [21]Chile's population has become increasingly urbanised from 82% in the decade of the 80's to 89% in 2011-2015. [22] [21]

Figure 2-1: Chile and its regions



The political and administrative division of Chile has three levels, 15 Regions (First level), 54 provinces (Second level) and 346 districts (Third level)(Figure 2-1). About 63% of the total population is concentrated in three regions: Metropolitan, Bio Bio and Valparaiso.[23]

2.1.1 Demography

The population's demographic indicators in general have improved over the last few decades; fertility and mortality have sharply declined. Fertility rate decreased from 5.0 children per woman in the 60's to 1.8 in 2012 and mortality rate declined from 7.3 per 1,000 inhabitants in the 70's to 5.7 per 1,000 in 2012.[24] Meanwhile life expectancy at birth has increased from 60.5 years for men and 66.8 for women in 1970-1975 to 76.1 and 82.2 respectively in 2010-2015.[24] The increase in life expectancy associated with a reduction of birth-rates has led to population aging in Chile.[24] The latest estimation of the population distribution shows that 0-14 age-group decreased from 40% in 1970 to 20% in 2015, while 60 and older age-group increased from around 8% in 1970 to 15% in 2015 (Table 2-1). [21,24]

Table 2-1 Selected demographic indicators

Indicator	Value	Year
Life expectancy	79.1	2010-2015
Men	76.1	2010-2015
Women	82.2	2010-2015
Percentage of population aged under 15	20.4	2015
Percentage of population aged 60 and over	15.0	2015
Total fertility rate (children per woman)	1.8	2012
Overall mortality (per 1,000 inhabitants)	5.7	2012
Infant mortality (per 1,000 live births)	7.4	2012

Source: Census 2002. Chilean Ministry of Health.

Comparison of distribution of population in 2003 and 2010 also shows the ageing process in Chile, whereby the proportion of people aged 60 and over increased along with a decrease of percentage of people aged 15 or less (Table 2-2).[24]

Table 2-2: Distribution of population Chile 2003 and 2010

Age group	2003	2010
Under 15	24%	20%
15-59	65%	67%
60 and over	11%	13%

Source: National Institute of Statistics Chile [24]

The 2012 census found that the average household size was 3.28 people (including children).[25] Moreover, almost 47% of Chilean population were single, 44% married and around 8% widowed or divorced.[25] In 68% of the households, a man is reported as the household head, while 31% corresponded to female-headed households.[25] In Chile the retirement age is 65 years for men and 60 years for women. In this way people aged over 60 are mainly retired (Table 2-3).[26] Although there is a relationship between age and employment status, test for collinearity showed non collinearity between these two variables (VIF [b]= 2.5.)[26]

[b] Variance inflation factor: used to check for multicollinearity. VIF values greater than 10 may indicate collinearity and warrant further examination.

Table 2-3: Employment status by age group. Chile 2011

	20-39	40-59	60 and over
Employed	62%	70%	24%
Unemployed	8%	3%	1%
Inactive (students, retired, disabled)	30%	27%	75%

Source: CASEN Survey 2011. Ministry of Planning. Chile [26]

Regarding ethnic composition in Chile in 2012, 11% of people identified as being of indigenous origin. Of these people, 84% were of Mapuche origin, an indigenous people from the south of the country (Arucania Region). [25]

2.1.2 Epidemiological profile

As in many other developing countries, Chile is experiencing important demographic, epidemiological, and social transitions. The demographic transition and particularly the reduction in the fertility rate and increase in life expectancy have led to an aging population, and as a result, the profile of diseases has changed.[27] In this way, the burden of disease has shifted from having a preponderance of infectious diseases towards predominance of chronic and degenerative illnesses (Table2-4).[22,24] In turn, the last National Health Survey showed high prevalence of chronic diseases, for example 10 % of adult people had Diabetes Mellitus and 27% suffered from Hypertension. [15,16]

Table 2-4: Percentage of deaths by groups of causes. Chile 1960 and 2004.

Groups of causes	**1960**	**2004**
Infectious diseases	41.8	12.8
Cancers	5.2	24.1
Circulatory system diseases	12.3	28.2
External causes of mortality	3.3	8.7
Other	37.4	26.2

Source: National Institute of Statistics, Chile.

2.1.3 Socio-economic profile

According to the Census 2012 in Chile, 99% of the households had electricity, 93% had drinking water and 95% reported having garbage collection. In turn, in 88% of the dwellings, families reported using gas for cooking. The Census also showed that the proportion of dwellings with access to internet increased from 10% in 2002 to 44% in 2012.

With regard to educational indicators, in 2012, the percentage of literacy in Chile was 98% and the expected years of education between the ages of 5 and 39, was 17, less than the OECD countries average of 18 years. [25,28] Results of the Census 2012 showed that around 32% of people had completed primary education, about 28% had reached secondary education and around 24% had attained tertiary education.[25]

In Chile, during the last few decades the free market economic model has been consolidated by the democratic governments. The economic policies implemented have contributed to enhance productivity and move the country to a higher stage of development.[29] These economic improvements can be observed in different indicators. The GDP (Gross Domestic Product) per capita have increased from US$3,400 in 1986 to US$21,980 in 2014. In turn, the rate of unemployment has remained around 6-7% in the last few years. [30] The proportion of population living below national poverty line has declined from 39% in 1990 to 8% in 2013. [31] According to World Bank classification Chile is an upper-middle income country. [11]

However, despite substantial economic growth, large inequalities are observed in Chile. According to the Socioeconomic Health Surveys, the GINI index[c] have remained around 0.5 between 2006 and 2013, and the 10/10 index increased from 31 in 2006 to 35 in 2013. [32] According to this latter indicator, households in the highest decile obtained 35 times more income when compared to households in the lowest decile.[32] 10/10 index is the ratio between the average monthly per capita income of the richest 10% of the population and the poorest 10% of people. So that, the higher the index the higher the inequality.[32]

Analysis of changes between 2000 and 2011 of some socioeconomic measures show that in general socioeconomic conditions of Chilean people improved during that decade, continuing the trend observed since 90s (Table 2-5). As showed in table 2-5 poverty decreased 1.5% between 2000 and 2011, and the percentage of unemployed diminished from 6% to 4%.[26] In turn, Gini index experienced a decrease at national level from 0.55 to 0.49 between 2000 and 2011.[26] The proportion of poverty at regional level decreased

[c] GINI index measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution. Gini index of 0 represents perfect equality, and 100 implies perfect inequality. World Bank. http://data.worldbank.org/indicator/SI.POV.GINI

during this , and the variability of poverty between regions also diminished. There are no studies analysing socioeconomic characteristics by district in Chile between 2000 and 2010, however a United Nations Development Programme report showed that IDH by districts in Chile in general increased between 1993 and 2004, and the difference between extreme scores diminished during that period (IDH by districts in Table 2-5).[33]

Table 2-5: Socioeconomic indicators

	2000	2011
Poverty (%)	20.2	17.2
Labour condition		
Employed	50.1	51.6
Unemployed	5.8	4.3
Inactive	44.1	44.1
Schooling (years)		
Women	9.8	10.4
Men	10.1	10.6
Gini index	0.55	0.49
Poverty by regions (%) (range)	8.5-26.8	5.8 -22.9
	1993	2004
IDH by districts (range of score)	0.45-0.93	0.51 -0.95

Source: CASEN surveys. Ministry of Planning, Chile. National Human Development Report. United Nations 2006.

2.1.4 Health Sector

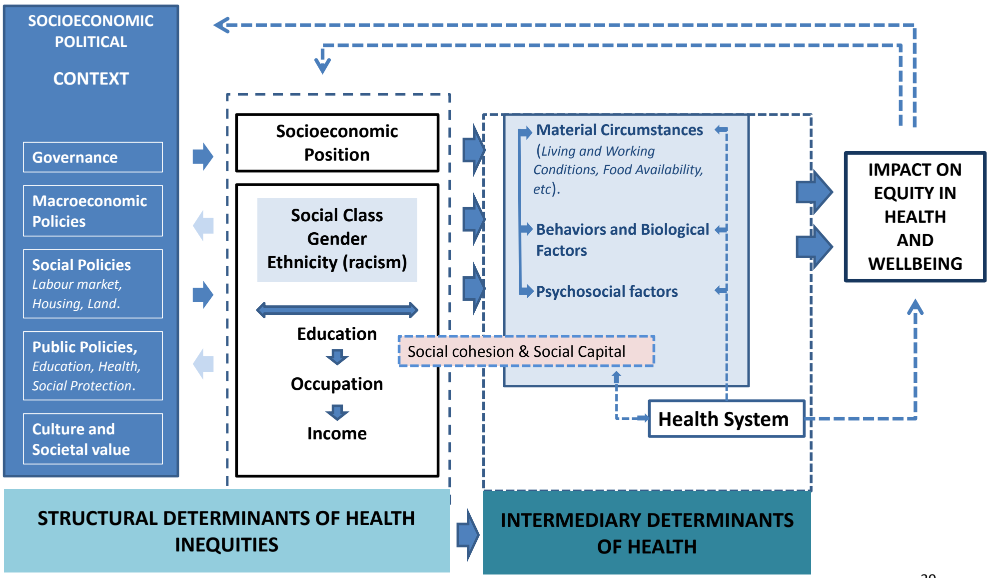
In Chile two main heath care systems coexist, public and private subsystems. The first one covers around 78% (in 2013) of population, basically the poor and the lower middle-class, and the retirees. In the public system, people contribute a fixed proportion of their income to buy a public insurance, which is administered by FONASA (National Health Fund). The health care is delivered by the National Health Services System (SNSS) and the Municipal System for Primary Care. Public subsystem is stratified into four groups according the level of income. Those in the group with the lowest levels of income correspond to Letter A, while those in the group with the highest levels correspond to letter D.[34] The private subsystem, in turn, covers around 14% of population, mostly the upper-middle class. The private sector provides private health plans administered through the Health Provision Institutions (ISAPRES) and the health care is delivered by private health care providers.[35,36] The remaining 8% of people have either, no insurance or Armed Forces health insurance.[35]

2.2 Social determinants of health conceptual framework

Health is determined by several factors, including genetic, behavioural and environmental factors, as well as access to health care. In addition, a growing body of research has reported associations between social factors and health outcomes. [37] To analyse inequalities in health, it is important to know the different factors which are intervening and the paths through which these elements influence health outcomes. In order to explain the socially patterned distribution of health, several frameworks have been developed.[38-42] In the context of this thesis, it is important to review the main conceptual frameworks since in general these are used to analyse socioeconomic inequalities in health in most research. In addition, it provides a conceptual background as well as contributing to better understanding of the findings of this thesis. The conceptual frameworks summarised in this section correspond to those that were designed with a broad focus, and therefore, can be used to analyse health inequalities in general population. Moreover, these frameworks were included considering that they identify the role of the individual as well as community factors in shaping health status.[39,41-43] Other conceptual models, have been developed some with a specific focus (e.g. gender, aboriginal people or environmental issues), others do not identify different levels of determinants.[42,44-47] However, both, appropriateness for general population and the recognition of the multilevel nature of the determinants of health are essential characteristics of models to be used in the development of the present thesis.

The model proposed by the World Health Organization (WHO)[39] identifies three main elements in the social determinants of health process (Figure 2-2). As shown in Figure 2-2, the first element is the socio-economic and political context. The second element refers to the place which people have in a social hierarchy depending on social class, educational level, occupational status and income. The third element is composed of intermediary determinants of health. This is a group of factors which operate on an individual level and constitute health-related behaviours and psychosocial factors. The model identified as a result of this process impacts on equity in health and wellbeing. It is possible to find measurable impacts on health status and outcomes among different groups of the population.[39] This model also includes a framework for tackling social determinant inequities which identifies four levels where policies and interventions can be targeted; these are individual level, level of community conditions, and the broadest levels of universal public policies and the global environment.

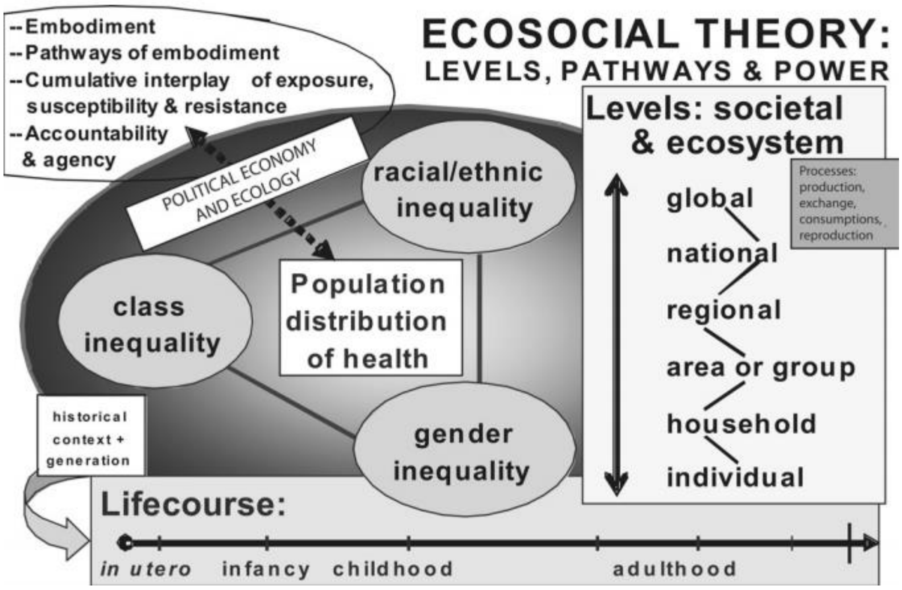
Figure 2-2: Social determinants of health model



Source: World Health Organization Commission on Social Determinants of Health, 2007.[39]

Another model which corresponds to an eco-social approach proposed by Krieger, seeks to integrate biological, social and political understanding of the determinants of health (Figure 2-3). At the same time, this model seeks to analyse current and changing population distributions of disease considering causal pathways operating at multiple levels and spatiotemporal scales. In this way, this model proposes that health results have been shaped by societal power relations, material conditions, biological and social processes of the populations, and this occurs in a historical context. Four eco-social concepts are included in this model, embodiment, pathways of embodiment, cumulative interplay between exposures, susceptibility and resistance and accountability and agency.[40,41] The concept of embodiment refers to how people incorporate, biologically, the material and social world across the life course, and is central to eco-social theory. [48] This model also suggests that embodiment is a multilevel phenomenon, and among these levels are individual, neighbourhood, regional or political jurisdiction, national and international levels.[48]

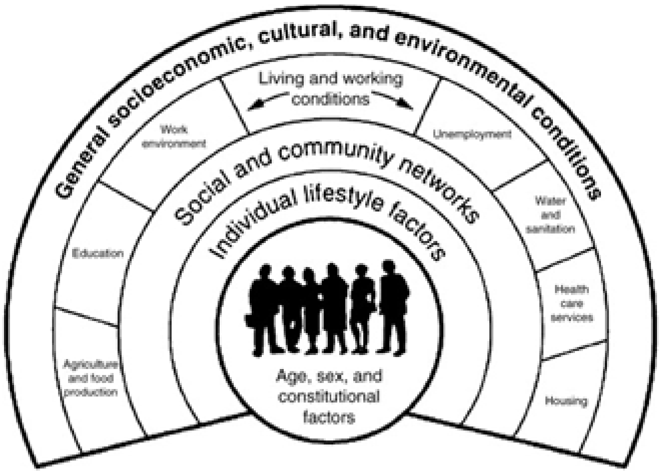
Figure 2-3: Diagram for eco-social analyses of disease distribution, population health, and health inequities



Source: Krieger, N. Proximal, Distal, and the Politics of Causation[41]

The third conceptual model reviewed, proposed by Whitehead and Dahlgren, has been widely used in health research [49] and states that policies and strategies in health should be based on an understanding of what are the factors influencing on individual health and well-being (Figure 2-4). These factors were grouped into categories according their influence, suggesting distinct levels of health interventions. In this way, the main determinants of health are illustrated in layers of influence, which are organised in five levels, 1) in the most outer layer are the overarching factors of population health: socio-economic status, culture and environmental conditions; 2) in the next layer are material and social conditions in which people live and work; 3) social and community networks, including mutual support from family, friends, neighbours and the local community; 4) surrounding fixed individual characteristics are individual life style factors, which are considered modifiable; and 5) in the centre, individual characteristics which are largely fixed, such as age, sex and constitutional features, over which there is little control.[43,49] This model was conceptualised to contribute to design of policies to tackle health inequalities, and therefore, different types of policies and strategies have been identified for each level of health-influencing factors.[43,49,50]

Figure 2-4: Conceptual Model of Health Determinants by Dahlgren and Whitehead.



Source: Dahlgren and Whitehead 1991 [49]

For this research, considering the availability of information in Chile, including data related to individual, life style and community factors, the conceptual model proposed by Whitehead and Dahlgren was chosen to analyse socioeconomic inequalities in high blood pressure.

2.3 Measurements of socioeconomic position

Socioeconomic position refers to the place occupied by an individual or family in a social hierarchy. All societies are hierarchically structured, and this system of stratification determine, in part, access to and control over key resources such as power, wealth, education, among other.[51-54] There are several indicators for SEP, which have been used in health research and are described below.[53,55-59,51,60,61]

2.3.1 Education

Education is considered as a positive asset defining access to a job and therefore determines socioeconomic position in adulthood.[51,62,63] Some authors point out that education may act by influencing life style behaviours and facilitating acquisition of social and psychological resources.[55,62] Educational level also may affect the way in which people can receive health-related education. [56] From life course viewpoint, it is considered that education may capture the SEP circumstances of the family of origin. [56,63]The advantage of education lies in the ease of measurement through questionnaires, and the associated high response rates. On the other hand, a disadvantage can be the variation of its meaning among cohorts and countries.[51,55-57,61-64]

2.3.2 Income

Income measures directly the material resources of a person or household. Income may reflect a cumulative effect on life but may also change in the short term.[63,65] Income affects health through different ways such as access to buy food, shelter or health care. It can also affect health in an indirect way through psychosocial factors.[51] The amount of money a person earns may also determine certain health-related behaviours such as alcohol or tobacco consumption.[51] The main advantage is that this measure combines, in a single indicator, the material living standards. The main limitation is that people often refuse to give information regarding their income and at the same time, this could be related to socioeconomic status.[51,61,64-67]

2.3.3 Occupation-based measures

Occupation is widely used as an indicator of socioeconomic position, particularly in high income countries.[63,51,57,60,61] Occupation has a direct association with income and therefore access to material resources determining standard of living and health.[63] Another mechanism is that the occupation would reflect social status, which may give access to certain privileges such as better access to health and/or access to education. [63] Moreover, occupation could be related to psychosocial factors such as support networks, stress in the workplace, control and autonomy.[68,63] Finally, the type of work may determine specific exposure to risks such as accidents or toxic environments.[51,61] The main advantage of this measure of SEP is that current occupation is collected in surveys in many countries. However, an important disadvantage is that it cannot be allocated to those who are not workers at the time of the study.[51,57,61,69,70] Similar to what happens with education, occupation may have different meanings in different cohorts and countries. [51,57,61,69,70]

2.3.4 Indicators based on the conditions of housing

Housing conditions may affect health through two mechanisms. In the first place, housing characteristics play an important role in everyday life due to being related with social hierarchy and the sense of control over life. Secondly, conditions within housing can determine specific exposures.[50-54]This type of indicator measures material circumstances through housing characteristics and includes housing status, housing tenure, amenities and overcrowding.[51] Although this kind of indicator is widely used because of the simple collection of data, it is other specific to a particular context, and therefore, comparability across studies may be difficult.[51,61,71-75]

2.3.5 Area level socio-economic position measures

This indicator, can be defined as the measure of socioeconomic condition of an area, and is reported to have an independent effect on health.[76] Area may be a neighbourhood, a city or a larger administrative area.[77] Aggregate data from individuals or small areas are used to construct these types of indicators, and these are commonly related to unemployment, social class, education or property ownership. In addition, a score can be calculated allowing the characterisation of areas on a scale between deprivation and affluence.[78-80,60,61,79,81] One disadvantage is that, in general, there are no indicators which have been designed to assess socioeconomic status by area, and therefore, it is necessary to use aggregate individual data.[61,80,82-84]

2.4 Definition of hypertension

Over time, diverse definitions of hypertension have been proposed. The Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC) is one of the organisations which has defined the parameters and thresholds for hypertension. Since 1977 this group has elaborated four reports in which a definition of hypertension has been proposed, and in each, changes based on new evidence have been incorporated. Table 2-6 shows the classifications of hypertension in people aged 18 years and older, by year of publication. [85-89]

According to the Seventh JNC report published in 2003, there are three categories of blood pressure: normal, prehypertension and hypertension. Levels of blood pressure equal to or higher than 140/90 are considered hypertension for adults aged 18 years and older (Table 2-6). Moreover, this is based on the average of two or more BP readings on each of two or more office visits.[88]

Table 2-6: Classification of hypertension. Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure 1977, 1980, 1997 and 2003.

Category	JNC1977	Category	JNC1980 (SBP/DBP)	JNCVI1997 (SBP/DBP)	JNC7 2003 (SBP/DBP)
DBP		**Optimal**		<120/80	
Normal	<85	**Normal**	<130/85	<130/85	120/80
High-Normal	85-89	**High Normal**	130-139/85-89	130-139/85-89	
Mild hypertension	90-104	**Prehypertension**			120-139/80-89
Moderate hypertension	105-114	**Hypertension**			
Severe hypertension	≥115	**Stage 1**	140-159/90-99	140-159/90-99	140-159/90-99
SBP		**Stage 2**	160-179/100-109	160-179/100-109	≥160/≥100
Normal	<140	**Stage 3**	180-209/110-119	≥180/≥110	
Borderline systolic hypertension	140-159	**Stage 4**	≥210		
Isolated systolic hypertension	≥160				

Source: JNC7 Report 1977, 1980, 1997, and 2003.[85-88]

In addition other organisations have proposed different definitions of hypertension (Table 2-7). These definitions vary with regard to JNC 7 definition not only in relation to the grades of hypertension, but also due to whether these incorporate an evaluation of total cardiovascular risk and the presence of markers of cardiovascular disease.[90-92]

Table 2-7: Classifications of Hypertension, according to JNC7, British Hypertension Society, European Society of Hypertension, and American Society of Hypertension.

JNC7	British Hypertension Society/European Society of Hypertension*	American Society of Hypertension*	SBP		DBP
Normal	Optimal	Normal	<120	and	<80
	Normal		<130	and	<85
	High Normal		130-139	or	85-89
Prehypertension		Stage 1	120-139	or	80-89
Stage 1 hypertension	Grade 1 hypertension	Stage 2	140-159	or	90-99
Stage 2 Hypertension		Stage 3	≥160	or	≥100
	Grade 2 hypertension		160-179	or	100-109
	Grade 3 hypertension		≥180	or	≥110
	Isolated systolic hypertension		≥140	and	<90

* These classifications also include evaluation of total cardiovascular risk factors and presence or absence of markers of cardiovascular disease.

In Chile, the Ministry of Health published in 2006 the guideline for treatment of primary hypertension. In this guideline the cut-off for hypertension used was JNC-7, but the category of prehypertension was not included.[93]

2.5 Socioeconomic Position and Blood Pressure

Currently, there is extensive evidence which shows that CVD and its risk factors are more common in lower socioeconomic groups.[55,94-99] However, this phenomenon is not constant and it can vary according to the group or place studied[2,98,100] and according to the measures of SEP used.[51,60] This section presents the literature review on the association between SEP and blood pressure. The literature review search methodology is presented below and tables of papers are in Appendix 1.

2.5.1 Literature review search methodology

In order to identify previous studies analysing socioeconomic inequalities in blood pressure relevant for the present project, a structured review search methodology was designed and used, and is described below.

1) Database: Medline and LILACS
2) Strategy of searching

    Search terms used:

    blood pressure OR *high blood pressure* OR *hypertension OR elevated blood pressure OR blood pressure* OR raised blood pressure

    AND

    Inequalities OR *socioeconomic factors* OR *Social Class* OR *Socioeconomic position* OR *Income* OR *Education* OR *Occupation or material circumstances* OR *deprivation* OR *poverty* OR *disadvantage* OR *disparities OR* poverty

    LIMIT TO “All adult (20 plus years)”

3) Inclusion criteria:

    i) Population based studies

ii) Studies that stratify by some indicator of SEP or use SEP as a determinant of health or disease (SEP: social class, education, occupation, income, poverty, wealth index).

iii) Studies in adults (20 plus years).

iv) Presents estimates of high or elevated blood pressure or hypertension as outcome.

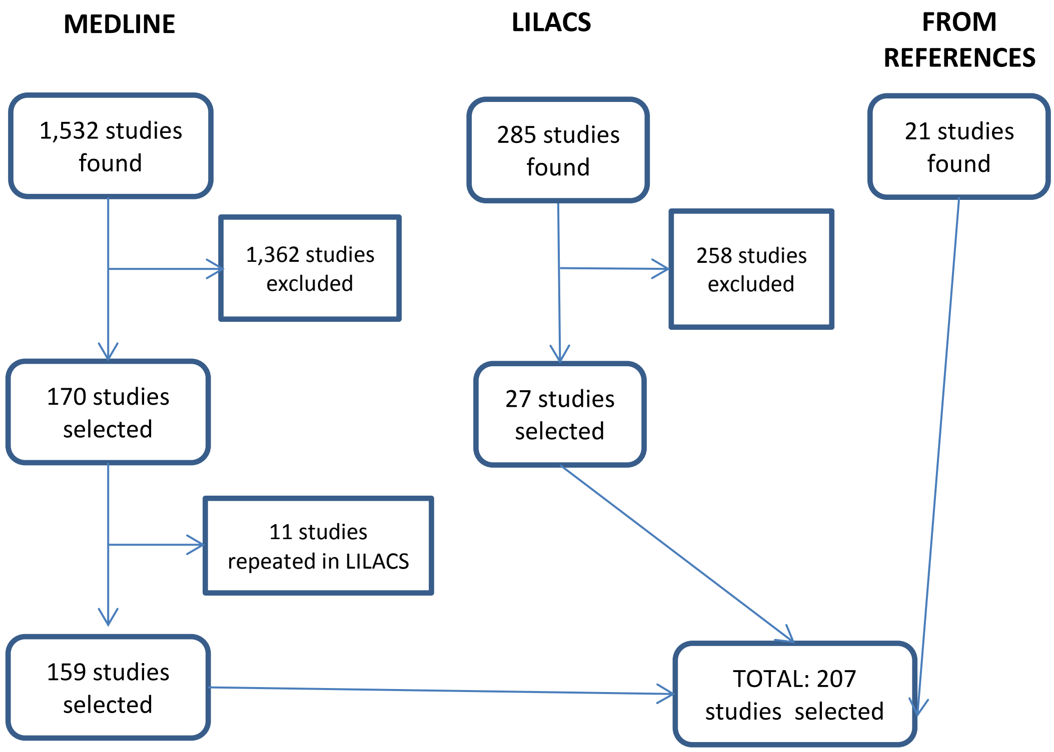
v) Language: English, Spanish, Portuguese

4) Complementary strategies: Other studies found through references which meet the criteria previously mentioned.

5) Studies excluded:

- Comparisons among socioeconomic levels of countries.
- Studies which analyse several cardiovascular risk factors among which is hypertension. However, studies which show independent association between HBP and SEP were included.
- Studies which analyse HBP as part of a composite cardiovascular risk factor

Figure 2-5: Flows of literature review method



2.5.2 Blood Pressure and Education.

Education is associated with blood pressure but the direction of this association is not constant. In this way, inverse gradient, direct association and no association have all been reported.[2]

An inverse gradient between education attainment and blood pressure was found in an important number of studies included in a review published in 1998.[2] Most of these studies were carried out in high income countries. Additionally, several of these studies, reported that the inverse educational gradient was stronger in women than in men.

After that review in 1998, other studies reported an inverse association between blood pressure and educational level. [10,55,95-99,101-150] Most of these studies were also conducted in high income countries, some were carried out in upper-middle income countries and only a few in a lower-middle or low income country. (Appendix 1, Table A1.1).

The outcome most commonly used was hypertension, followed by SBP and DBP, and only a few studies used the three outcomes. In most of the studies, hypertension was defined using the cut-off set by the Seventh Joint National Committee on Hypertension (SBP≥140 and DBP≥90). [88] Some studies which included both SBP and DBP as outcomes, reported a significant association with education stronger for SBP than DBP or only for SBP. [102,111,118]

About a half of these studies included risk factors of hypertension as covariates. Some results showed that, although the inclusion of the covariates tended to weaken the association, education was significantly inversely related to blood pressure even after full adjustment. [97,103,104,106,113-116,119,133,134,136,137] Conversely, some studies reported that after full adjustment with risk factors, the association between educational status and blood pressure was no longer significant. [117,124] In these cases BMI played an important role in weakening the association of blood pressure with education. In addition, some studies have reported that although the association between education and blood pressure remained significant after full adjustment, BMI was an important covariate which weakened the association. [116,119,138]

Another characteristic of these studies is that around in 15% of them the inverse association between blood pressure and education was stronger in women than in men.

[55,98,99,102,103,105,106,118,138,151-154] In addition, Dalstra et al. [98] found that in seven of eight European countries, educational inequalities, were stronger in people aged 25-59 than in those aged 60 and over.

A direct association between educational status and blood pressure has been reported; however the number is much smaller than those reporting an inverse gradient (Appendix 1, Table A1.2). In the overview published in 1998, [2] only two studies showed a direct association between education and blood pressure. And only in men, while an inverse association was observed in women.[2,138] Later, some studies reported that education was directly associated to blood pressure. [155-161] Only one of these was conducted in a high income country.

A third group of studies found no association between blood pressure and education (Appendix 1, Table A1.3).[162-188] While the majority of these studies were conducted in high or upper-middle income countries; four were carried out in a lower-middle income countries and one in a low-income country. In some of these studies an inverse association was found between blood pressure and other SES measures. [176-178,180,189] There were no obvious methodological aspects which could have influenced the results.

In addition, a few studies carried out in upper-middle-income countries reported other types of association between blood pressure and education, different from those aforementioned (Appendix 1, Table A1.4). [100,190-192] A half of them, carried out in China, found a u-shaped curve for the association between educational status and blood pressure; namely, the groups of people in the highest and the lowest educational levels had a higher risk of raised blood pressure than those in the middle level. Other study, carried out in Iran reported an inverted j-shaped curve between blood pressure and education, whereby those in the middle group had the highest risk, while those least educated had the lowest risk.

Some of the studies analysing the association between blood pressure and education were undertaken in Latin America.[10,139-143,145-150,161-166,192,193] Most of these studies found that education was inversely related to blood pressure, and only a few reported a stronger educational gradient in women than men (Appendix 1, Table A1.1 to Table A1.4). Only one study, reported a direct association. [161] Some studies found no association between education and blood pressure.[162-166] No studies were identified which analysed the association between educational attainment and blood pressure in Chile.

In general, studies analysing association between blood pressure and education adopted a cross sectional or longitudinal design with representative samples of adult population. Moreover, logistic or linear regression models were carried out according to the outcome used. Therefore, it can be considered that appropriate methods were used. However, some studies did not adjust for any covariate; therefore the association reported may be influenced by other biological or behavioural factors.[95,101,103,108,111,123,140,145,159,161,192,194] In another group of studies, only adjustment for age or sex was undertaken, and therefore effects of other risk factors were not controlled.[2,99,112,125,130-132,146,149,157,165,168,175,183,184,188,195-197] About a half of studies cited from Latin America did not adjust for covariates or only adjusted for age and gender (Appendix 1, Table A1.1 to Table A1.4).

Most studies reviewed in this section used measurement of blood pressure taken during the survey, with only a few using self-report of hypertension. Among those using self-report the majority were carried out in Brazil and Argentina (Appendix A1 Table A1.1). Most studies using self-report of hypertension as outcome, reported that education was inversely related to blood pressure. Although these corresponded to a limited number of studies, it would be possible to hypothesise that using self-report may introduce bias toward finding inverse social gradients of blood pressure.

In addition, the majority of the studies reviewed had the limitation of only one blood pressure outcome, with only about a tenth using three outcomes (SBP, DBP and hypertension). Considering that finding a significant association of blood pressure with SEP may depend on the outcome utilised, using less than these three outcomes may lead to wrong conclusions.

The way in that education is related to blood pressure varies between countries and among groups of populations within countries. These differences may be explained in part by nutrition transition. [198, 199] According with this approach[198], dietary and life style patterns of populations can be classified in five stages. These five stages are: (1) collecting food, diet is high in carbohydrates and fiber and low in fat; (2) famine, variety of food decrease and there are periods of acute scarcity; (3) receding famine, the consumption of fruits, vegetables, and animal protein increases, and starchy staples become less important in the diet, (4) degenerative diseases, in this stage, people tend to have an unhealthy diet (high in fat, cholesterol, sugar and other refined carbohydrates) and often accompanied by lack of physical activity. This leads to an increased prevalence of obesity and degenerative diseases. In turn, populations in the most advanced stage (Stage 5) experience behavioural changes and a new dietary pattern appears which is associated with the aim to prevent or delay degenerative illnesses and prolong health.

Different stages of nutrition transition can be observed in different geographic or socioeconomic subpopulations within a country. In this manner, in higher-income countries least privileged people, who can be classified in stage 4 of the nutrition transition, tend to be more likely to suffer obesity and chronic diseases, than those most privileged, who are in stage 5. Meanwhile, in low income countries, people in the higher levels of social hierarchy tend to be in stage 4 of nutrition transition, therefore they have a higher risk of degenerative diseases and direct gradients can be observed between some chronic conditions and socioeconomic status. [186,198,199]

In Latin America, high heterogeneity is observed due to some countries beginning their nutrition transition before others. In addition, important differences can be seen between cities and between regions within one Latin American country.[198]

In the studies analysed, the majority of those that found an inverse association were undertaken in high or upper-middle income countries. Meanwhile, those that found a direct association, were carried out in upper-middle or low-income countries. Differences in the direction of the association between blood pressure and education in upper-middle countries may be explained by the heterogeneity of nutrition transition in these countries.

Moreover, differences in the association between education level and blood pressure by gender may be explained by stress outside of work, and stress associated to low educational attainment, which could be most important in women. It has been observed that women with low educational attainment may have higher risk of psychosocial determinants of poor health, such as single-parenting, depression, low income among others.[118,200]

Aspects related to methodology should be taken into account when analysing the differences in the results of the studies investigating educational inequalities in blood pressure, in particular those referring to the population studied. In fact, most of the studies which found direct association between blood pressure and education were conducted in rural populations in low or middle income countries. Therefore, these findings may not be representative of the whole population of a country. Evidence suggests there may be differences between urban and rural eating patterns and these may be more marked in lower-income than in higher-income countries.[199] In general, people living in rural areas tend to have healthier diet and are more likely to be physically active, leading to lower risk of degenerative diseases.[198,199] Some factors explaining urban-rural differences in dietary intake have been identified: better transportation; greater influence of marketing activities on processed food; different occupational patterns, reduced compatibility of jobs with home food preparation in urban areas; different household structures.[198,199] In fact, it has been described in literature that urbanisation is highly associated with the shifts in diet and physical activity. In this way, according to the degree of urbanisation different stages of nutrition transition may be observed in different areas within a country, and therefore different associations between SEP and chronic disease may be found. [198,199]

Another aspect to consider is that the method to measure education may vary considerably among countries, which could lead to different results. However, in general studies had in common the setting of three levels of education to analyse the educational gradient of blood pressure. Therefore, findings may be considered in some degree comparable.

2.5.3 Blood Pressure and Income.

The association between income and health has been evidenced in both mortality and morbidity. [67,201] Moreover an important number of studies have analysed income as a determinant of blood pressure and different types of association have been reported. Among the studies reviewed, income was measured mainly as monthly household income and monthly per capita income. The type of measure used was not related to the direction of association between SEP and blood pressure found (Appendix 1, Table A1.5).

Among studies which studied association between income and blood pressure several found an inverse gradient (Appendix 1, Table A1.5). [10,99,101,105,113,117,120,123,129,134,137,138,140,144,163,178,194,195,202-210] Most of them were undertaken in high or upper-middle income countries. Similar to that observed for education and its association with blood pressure, some studies reported a stronger inverse association between income and blood pressure in women than in men. [10,138,144,194,209] In turn, one study which analysed age-specific inequalities reported an inverse association between hypertension and income in women aged 50-69 but not in other age groups or in men.[210] The majority of these studies used age and sex as adjustment variables, and other cardiovascular risk factors such as BMI, diabetes, salt intake, smoking, physical activity and alcohol consumption were included as covariates. Therefore, most of results reported controlled for the effect of the main covariates avoiding bias related to confounding and effect modification.

In contrast to the aforementioned publications, a few studies reported a direct association (Appendix 1, Table A1.6).[143,159,167,211]All these studies were conducted in middle and low income countries. In addition, in some of them, the direct association was found only in rural areas. [143,211] While the study conducted in Korea reported direct association in men and no adjustments were used. [159] Therefore, the positive association between blood pressure and income described in these studies may be non-representative of the whole population of their respective countries. As mentioned in the previous section, the stage of nutrition transition in which groups of population are located, may determine the type of association between SEP and chronic diseases and blood pressure observed. [198,199]

Furthermore, several studies found that income was not related to blood pressure.[55,114,115,127,141,142,145,152,154,157,164,176,180,188,212] (Appendix 1, Table A1.7). Some of these studies were conducted in high income countries and the majority in middle or low income countries. In most of these studies more than one measure of socioeconomic position was analysed and it is important to note that in an important group of them an inverse association was found for other SEP measures used.[55,114,115,127,141,142,145,152,154,157,164,176,180.] In most of these studies, an inverse association was found between blood pressure and education.

J-shaped and u-shaped associations were also reported in studies carried out in Jamaica and China, respectively (Appendix 1, Table A1.8).

No studies were identified analysing income related to blood pressure in Chile. However, several studies analysed the association between income and blood pressure in Latin America[10,140-143,145,152,163,164,166,193] (Appendix 1, Table A1.5 to Table A1.7). Some of these studies from Latin America found that income was inversely related to blood pressure, one study showed a direct association, a few observed no association and one found another type of association. This latter corresponds to a study undertaken in Jamaica where a j-shaped curve was described for blood pressure across income levels.

In general studies analysing the association between income and blood pressure used representative samples of adults, employed logistic or linear regressions to estimate social gradients and used objective measures of blood pressure. Studies using self-report of hypertension found both, inverse or direct social gradients, suggesting that self-report does not influence the results obtained. In addition, most studies reviewed in this section had the limitation of using only one outcome of blood pressure. Considering that studies have reported social gradient for one outcome of blood pressure, and at the same time no association or another type of association for others, using only one outcome may inevitably lead to incorrect conclusions.

As some authors have pointed out, income affects directly access to material resources and moreover influences self-esteem and social standing.[51] Through these mechanisms, income can affect health, and therefore, most privileged people show better health conditions. However, unlike education, in the case of income, reverse causality might be observed. Namely, people who have worse health can become poorer; as a result, health is the determinant of poverty but also vice versa. This could be avoided in longitudinal studies but not in cross sectional studies. Most of the aforementioned studies used cross sectional surveys, therefore reverse causality effects cannot be excluded for the results.

In addition, the indicator of income most commonly used was the monthly or annual household income, followed by family income and individual or per capita income. Indicators using total household or family income may be useful when analysis includes people who are not the main earner in the group, since it is assumed the total income within a household is distributed according the needs of their members. [51,213] Considering that the studies analysing the association between income and blood pressure included adults regardless of whether they have individual income, household income or family income may be a more suitable indicator. However, it has been recommended adjusting these indicators by the number of people either in the family or household, to be comparable across households, although this information is not always available in surveys.[51] This might be considered a weakness in an important number of the studies reviewed in this section including total household or family income.

Only a few studies found a direct association between income and blood pressure, and since these were conducted in middle and low-income countries, nutrition transition could be a factor which is influencing these results.[199] However, as some of these studies analysed only rural populations, methodological aspects could also be affecting the results.

Finally, a significant number of studies found no association between income and blood pressure. However, several of them found an inverse association for another SEP measure. This suggests that it is advisable to use more than one SEP measure in health research given that each SEP indicator may reflect different aspects which are intervening in the health-disease process. [51]

2.5.4 Blood Pressure and Occupation-based Social Class.

Since several decades ago, occupational social class has been analysed with respect to health, and association has been found with both mortality and morbidity.[214,215] In addition, several studies have used occupation-based socioeconomic measures to evaluate the association between SEP and blood pressure (Appendix 1, Table A1.9 to Table A1.11).

In the first place, several studies[83,109,120,122,128,131,134,185-187,214,216-229] found that occupational class was inversely related to blood pressure (Appendix 1, Table A1.9). Most of these studies were conducted in the UK, or other high income country. Some found a stronger association in women,[122,187,220,229] while only one study reported a stronger association in men. [214] The majority of these studies reported adjustment by risk factors such as: BMI, alcohol consumption and smoking. Two of them found a significant effect of BMI in the association between occupation and blood pressure.[220,225]

Another group of studies found a direct association between occupation and blood pressure. (Appendix 1, Table A1.10)[155,159,183,230-233] Higher occupational grade was associated with increased blood pressure. A half of these studies were conducted in low income countries, and the other half in high-income countries. Two studies reported a significant direct association only in men.[159,231] It worth noting that in some of these seven studies only crude estimations were reported. [159,232,233]

In addition, no association between occupation and blood pressure was found in most of studies analysing association between blood pressure and occupation, and most of them were conducted in high income countries. (Appendix 1, Table A1.11) [55,104,116,123,130,143,154,165,168,169,176,180,181,189,234-242] However, an important number of these studies found that blood pressure was significantly inversely related to another SEP measure.

The association between occupation and blood pressure in Latin America has been analysed only in a few studies, and inverse association and no association were reported (Appendix 1, Table A1.9 to Table A1.11). [143,165] No studies were found evaluating occupation as a determinant of blood pressure in Chile.

In general, studies reviewed in this section selected representative samples of population surveys, most included adjustment for relevant covariates and with only one exception, all studies used objective blood pressure measures. Analyses of occupational gradients of blood pressure were carried out performing appropriate linear or logistic regression according to the outcome used. However, as observed in the previous sections, studies often only one or two measures of blood pressure as outcomes, and as a result, findings cannot be considered comprehensive.

Several studies have analysed the pathway by which occupation affects blood pressure, and these have identified mental stress as a possible causative factor. Stress in work could result from a combination of high demand with low control in the workplace. [243,244] Since people in lower occupational level are more likely to be exposed to these conditions in the workplace, their risk of rising of blood pressure could be higher than in people who are in higher occupational level.

In addition, the direct association found in four studies could be explained in part by demographic and nutrition transition,[155,183,231,233] given that these were carried out in lower-middle-income countries. In addition, in two of these studies the sample corresponded to people living in rural areas,[155,233] therefore, these results would not be representative of the entire population. As mentioned in previous sections, results from rural areas can be different to those in urban areas, and this has been explained by the effect of the nutrition transition process and urbanisation on diet and physical activity patterns. [198,199] Even so, it seems to be that a direct association between occupation and blood pressure tends to be more frequently found in middle or low-income countries than in high income countries.

Moreover, there were a significant number of studies which found that occupational class was not related to blood pressure. Given that in more than one third of these studies an inverse association was found for another SEP measure, it is possible to suggest that occupation is a poor proxy for some socioeconomic aspects which affect blood pressure.[55,116,120,123,143,154,176,180,189] Davey Smith et al., found that occupation was better discriminator of differences in smoking and in non-cardiovascular mortality, yet education was strongly associated with death from cardiovascular causes.[56] This suggests that socioeconomic differentials in cardiovascular problems, including blood pressure, may be better captured by education or other indicators of social class than by occupation. This shows the convenience of choosing the SEP measure according the outcome studied, and further emphasises the importance of including more than one SEP measure.[51]

2.5.5 Wealth and housing conditions and blood pressure.

In order to analyse the influence of socioeconomic circumstances on blood pressure, some authors have used socioeconomic indicators which measure assets ownership. [245,246] These measures can include financial or physical assets. In some studies, the socioeconomic measure used has been wealth, which incorporates total assets, while other studies have used indices which only include physical goods. [219] Among assets most commonly included in these types of indices were, house ownership, house characteristics, car possession and furniture among others. [51,60]

Several studies have used wealth or physical assets as socioeconomic indicator to analyse social inequalities in blood pressure. (Appendix 1, Table A1.12 to Table A1.14) [102,133,136,141,146,147,153,156,158,175,183,184,186,219,247-250] Most of these studies used indicators based on housing conditions and also the majority were conducted in lower or lower-middle income countries.

With regards to the results, it is important to mention that the wealth measures and indices used in these studies were constructed in different ways; therefore their comparability could be questioned. A few studies found that wealth was significantly inversely related to blood pressure; and most of them were conducted in high income countries. (Appendix 1, Table A1.12).[136,153,219,247] Half of these studies reported that inequalities across wealth levels were observed only in women.

In contrast, some of the studies reviewed found that wealth was related directly to blood pressure; [158,183,184,249,250]and most of these were carried out in low and middle income countries (Appendix 1, Table A1.13). In addition, several studies found no association between wealth and blood pressure. Two of them were carried out in high income countries[102,248] and the majority in low or lower-middle income countries. (Appendix 1, Table A1.14).[133,141,146,147,156,175,186]

In Latin America, the association between housing conditions and blood pressure has been analysed in some studies.[141,146,147,250] The results obtained in most of these studies showed no association between the two variables studied neither before nor after adjustment. One study showed that wealth was directly related to blood pressure before full adjustment[250] (Appendix 1, Table A1.12 to Table A1.14). In some of the studies reporting no association between blood pressure and housing conditions, an inverse association between education and blood pressure was found. Therefore, this could be reflecting that education could capture better the health differences between social groups. No studies were found which evaluated the association between housing conditions or wealth and blood pressure in Chile.

Although only a few studies used wealth or indices based on material resources as determinants of blood pressure, and the results obtained were diverse, there was a trend to observe a direct association between SEP and blood pressure in low and middle-income countries. However, in studies conducted in Latin America no association was found in the majority of the studies. While in studies undertaken in high income countries no trend was observed in the direction of the association. Therefore, according to this evidence, it is possible to point out that the association between wealth and blood pressure is inconsistent.

In addition, almost all studies reviewed in this section used only one blood pressure measure as outcome, and this corresponded to hypertension. Among studies which found no association between wealth and blood pressure two used self-report of hypertension, which may suggest that using self-report would lead to underestimate social gradient.

2.5.6 SEP Composite measures and Blood Pressure.

Several studies which have analysed the influence of socioeconomic status on blood pressure have used composite indices including different dimensions of SEP such as income, education and occupation among others.[142,186,251-267] Although composite measures continue being used in several areas, their use in health research has decreased in the last few years. This could be due to increasing interest of researchers in understanding the way in which socioeconomic background affects health, rather than just identifying and describing the inequalities. [268] In this manner, it is possible to note that most of the studies analysing the association between SEP composite measures and blood pressure were carried out before 2000.

Among studies analysing the association between a SEP composite indicator and blood pressure, around a half were conducted in USA or in other high-income country (Appendix 1, Table A1.15 to Table A1.17). All studies analysing SEP composite indicator as determinant of blood pressure, used education, income or occupation as one of the variables of the composite index. An inverse association between a composite measure of SEP and blood pressure was found in the majority of these studies and in some of them this association was stronger in women. (Appendix 1, Table A1.15)[251,261,263,265] Most of these studies were undertaken in high income countries.[251,252,255,257-264] In contrast, a direct association was found in a few studies, which were carried out in India in urban and rural areas. (Appendix 1, Table A1.16)[253,254]

Finally, some studies, carried out in low or middle income countries, found no association between socioeconomic status and blood pressure. (Appendix 1, Table A1.17)[139,142,163,186,256,267]

In addition, this type of SEP indicator has been used in some Latin American studies. A half of these studies showed that the index was inversely related to blood pressure and the other half showed no association.[139,142,163,265,266,269] Two of these studies were conducted in Chile and corresponded to a baseline survey carried out in 1996-1997.[265,266] The sample used in both studies was representative for only one region. The results showed an inverse association between SEP and age-adjusted prevalence of hypertension only in women, and these were not adjusted for cardiovascular risk factors.

As with studies including housing conditions indicators, those using composite indices have limitations in comparability, since each index has been constructed in different way and has included different dimensions of socioeconomic position. Another limitation identified in this group of studies is that almost all of them included only one outcome of blood pressure, and therefore results may have ignored some significant associations due to these not being studied. Almost all studies reviewed in this section used objective measures of blood pressure; therefore there would be no effect of the type of measure on the associations found (Appendix 1, Table A1.15 to Table A1.17).

Results observed in studies using a socioeconomic composite index, showed a similar inverse social gradient to those found in studies using a single indicator. Likewise, some studies using composite indicators found a stronger social gradient in women. This may support the proposition of some authors that this type of composite measures are useful when SEP is analysed as a confounder, and not when it is the main exposure variable of interest, since this kind of measure would allow identifying inequalities but not the mechanism through which these inequalities might have been caused. [60,268]

2.5.7 Area based socio-economic position and blood pressure.

Since 1990s, context socioeconomic position indicators have been considered in research and planning related to health. [64,82] In the last few years, some studies have incorporated area based SEP as an additional determinant of inequalities in blood pressure and most of them have been carried out in high income countries (Appendix 1, Table A1.18). [83,113,116,120,125,126,128,135,144,176,211,238,255,270-273] Some authors have referred to the need to develop new indicators to explain inequalities in health which have not been explained completely through traditional individual level indicators used to measure SEP.[83,113] Furthermore, the features of an area could have an independent effect on health. [238] In addition, knowing individual and neighbourhood socioeconomic characteristics could be relevant to design public health policies considering different levels of intervention.[238,274]

Although all these studies used an area socioeconomic measure, the type of variables used varied. In several of these studies an index was built using dimensions such as household income, unemployment, assets, family structure, education, overcrowding among others, while in some of them a single context variable was utilised. [144,211,273,275] All studies, except one, used aggregated individuals data to make the index. Galobardes et al suggested that aggregated data may constitute a disadvantage, since these were not created with this objective.[83] In contrast, a study conducted in Geneva used an index which was made with data collected from the neighbourhood; which, although it can be more suitable to use, its application to large surveys can result complex (Appendix 1, Table A1.18).

In addition, in the aforementioned studies the size of area studied varied from neighbourhoods with 100 people, to regions with millions of inhabitants. Therefore the causal factors underlying the association between area SEP and blood pressure may be very different. Some authors have suggested that an appropriate area corresponds to the geographical distribution of the causal factors linking social context to health status. (Appendix 1, Table A1.18) [276,277]

Considering that both, the types of indices and the size of areas included in the studies reviewed in this section were different, there are limitations in comparability.

With respect to methodology used by these studies, roughly half used multilevel analysis. This approach may be more appropriate for ecological studies, since these models account for hierarchical clustering. [276] Some authors have pointed out that using traditional regression models to analyse nested data may lead to underestimating standard errors and consequently to high risk of Type I errors. [278-280] Therefore, results from studies not using a multilevel approach to analyse inequalities in blood pressure at area level may be questioned.

Regarding the results obtained from these studies, several found that blood pressure was higher in more disadvantaged neighbourhoods or areas.[113,116,120,125,128,135,176,270,271] In two studies, the association between social context and blood pressure was completely attenuated after adjustment for risk factors; with the main mediating variable being BMI. These findings suggest that environmental dimensions possibly have an influence on physical activity and dietary behaviour; and through this could indirectly affect blood pressure. (Appendix 1, Table A1.18)[113,116]

In contrast with the aforementioned studies, one study found that higher community income was related to higher blood pressure; however this association was only observed in rural areas.[211] Moreover, this study incorporated community income as a unique context variable, which may be a limitation (Appendix 1, Table A1.18).

In addition, some studies found that blood pressure was not associated to area-based SEP.[273,126,144,238,255] One of these was carried out in two towns in Scotland, which have the highest deprivation score of Scotland. Therefore, these results may only be valid for similar communities. More than half of these studies used self-reported hypertension outcome; which may introduce bias in the results. Moreover, one study found a higher risk of raised blood pressure in the middle group of area-based SEP.[83] This study included an index based on information collected from neighbourhood, and therefore, the characteristics of that measure differed from those made by aggregate individual data (Appendix 1, A2.18).

In Latin America only one study used an area based measure to analyse the influence of SEP on blood pressure. This was undertaken in Argentina and the indicator used was the percentage of residents with incomplete secondary education. The results showed that there was not association between area-based indicator and blood pressure, however the contextual socioeconomic factors were significantly related to BMI.[144]

2.5.8 Studies of trends of socioeconomic inequities in blood pressure

Since health inequalities began being studied, the way how they evolve over time has also been the focus of analysis.[215,281-284] In addition, the study of the changes in the magnitude of health inequalities has gained importance to such an extent that the governments of different countries and international organisations have established objectives to reduce inequalities in health.[285-288]

Regarding blood pressure, several studies, published between 1995 and 2014, have analysed the trend in socioeconomic inequalities.[97,109,121,130-132,204,206,207,228,289-294] All of them were conducted in high income countries, and no studies were found for Latin America (Appendix 1, Table A1.19). The SEP measures used were education, occupation, income and an index of deprivation.

The methods used in these studies to analyse the trend in inequalities in blood pressure were varied, among them were, difference in percentage points of prevalence, and differences in the Relative Index of Inequalities (RII) and the Slope Index of Inequalities (SII), and analysis over time through assessing interaction terms between time and the SEP measure.

RII and SII summarise in relative and absolute terms, the association between SEP and health across the whole social hierarchy. These indices can be interpreted as the ratio or difference between the outcomes at the extremes of the socioeconomic scale. The larger the score of SII or RII, the larger the differences between those at the bottom of the social hierarchy compared with those at the top. [295] RII was used as unique index of inequalities by Bartley et al, [228] to assess the variation of inequalities in blood pressure between two cross sectional studies, and the results showed that inequalities in DBP decreased, but changes in SBP were not significant.[228] Furthermore, other studies used SII to analyse the trend of inequalities in blood pressure in cross sectional studies.[130,204,293] In only one study, which analysed 4 surveys was a significant trend reported, such that inequalities in hypertension decreased between 1971-74 and 1988-94 and increased between 1994-98 and 1999-2002.[204] In addition, a study undertaken in Norway used both SII and RII to assess the variation over time in inequalities in blood pressure. The results showed that the trend of inequalities was different according the index used, with relative inequalities widening in both men and women, while absolute inequalities narrowed in women and were stable in men. [294] Different results may be obtained in the analysis of trend of health inequalities according the index used. In a context of overall improvement of health status, relative inequalities increase and absolute inequalities decrease when the rate of improvement is smaller in the most disadvantaged groups. On the other hand, when the rate of improvement is faster in the less privileged groups, relative and absolute inequalities diminish. [296]

Another group of studies analysed the trend of inequalities in blood pressure by including interaction terms in the models (Appendix 1, Table A1.19).[97,109,121,132,207,289,290,292] In some of them, the changes over time in inequalities in blood pressure were not significant[109,132,207,289,292], and in other inequalities increased only in women. [97,121,290] Results of the study in England suggested that increase in blood pressure inequalities in women may be related to increase in inequalities in obesity, diabetes and physical inactivity.[290]

Most studies reviewed used only one method to analyse trend of inequalities in blood pressure which may be a limitation. Kings et al., carried out a structured review, [297] which analysed use of relative and absolute measures in studies reporting health inequalities. Findings showed that 75% of the studies reported only a relative measure, 18% reported only an absolute measure and 7% reported both relative and absolute measures.[297] This diversity of methods used to analyse the trend of inequalities over time may be because of there is no consensus about which is the most suitable way to evaluate these changes. However, some authors agree in recommending use of both absolute and relative measures at the same time.[285,296-298] [299]

In addition, two studies used self-report of hypertension as outcome and in both no association was found, this may indicate that subjective measurement of blood pressure may be weaker in capturing changes over time.

2.6 Summary of Literature review and gaps

It has been shown that socioeconomic status plays a significant role in shaping inequalities in blood pressure. In the literature reviewed the association between SEP and blood pressure has been analysed using diverse socioeconomic measures. Table 2-8 summarises the results obtained in the studies reviewed.

Table 2-8: Summary of reviewed studies analysing association between SEP and blood pressure

Socio-economic measure	Total	Inverse	Direct	No Association	J-/U-Shaped
Education	132	97	11	13	11
Income	50	38	3	3	6
Occupation	47	23	7	11	6
Wealth	24	11	6	4	3
Composite index	21	17	2	2	0
Area based SEP	17	13	1	2	1
Total	291	199	30	35	27

Education has been the SEP measure most used to analyse the social gradient in blood pressure, followed by income and occupation (Appendix 1). Although an inverse social gradient in blood pressure has been reported in most of the studies, an important number of studies have found no association or other type of association. In this manner the analysis using different SEP measures do not show uniform findings. Therefore, use of more than one SEP indicator is advisable and it is possible that these measures relate to different causal mechanisms.

According to the literature, the type of association between SEP and blood pressure may depend on the stage of nutrition transition.[198,199] Moreover, nutrition transition is related to the development of a nation or subpopulations within a nation. Tables 2-9 and 2-10 summarise the studies reviewed in high income, and middle and low income countries respectively. An inverse gradient is the most common type of association in both groups; however, in high income countries the proportion of studies finding inverse gradient is higher than in middle and low income countries. Direct association is almost non-existent in high income countries, while in middle and low income countries this is the second most frequently observed after inverse association.

Table 2-9: Summary of reviewed studies in high income countries[d] analysing association between SEP and blood pressure

Socio-economic measure	Total	Inverse	Direct	No Association	J-/U-Shaped
Education	78	67	1	7	3
Income	22	21	0	0	1
Occupation	28	15	2	9	2
Wealth	6	4	0	1	1
Composite index	13	13	0	0	0
Area based SEP	15	12	0	2	1
Total	162	132	3	19	8

Table 2-10: Summary of reviewed studies in middle and low income countries analysing association between SEP and blood pressure

Socio-economic measure	Total	Inverse	Direct	No Association	J-/U-Shaped
Education	54	30	10	6	8
Income	28	17	3	3	5
Occupation	19	8	5	2	4
Wealth	18	7	6	3	2
Composite index	8	4	2	2	0
Area based SEP	2	1	1	0	0
Total	129	67	27	16	19

Despite the extensive evidence there is less information regarding inequalities in blood pressure in middle and low-income countries than high income countries, and at the same time, information available is less consistent. Similarly, only a limited body of evidence exists in the Latin American context [25 of 129 studies]. Furthermore, among these studies, more than a half were carried out in Brazil and almost all were representative only for one region.

[d] World Bank classification https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

Besides these issues, other methodological aspects may be mentioned. Among the studies reviewed, more than a half used only one blood pressure measure. It has been reported that SEP may be significantly related to one blood pressure measure, and at the same time may be not associated with another (Appendix 1). In addition a small group of studies (17) used self-report of hypertension as outcome, and it is not clear whether this may affect the direction of the association between SEP and blood pressure. Six of these studies using self-report of hypertension were carried out in Latin America, which may represent a further limitation.

Very few studies have analysed the association between SEP and blood pressure in Latin America using more than one measure of blood pressure as outcome and considering more than one SEP measure as exposure. Also, very few studies assessed the role of other cardiovascular disease (CVD) risk factors in such associations.

Among studies reviewed, social gradient in blood pressure was often reduced after adjustment for other cardiovascular risk factors, in particular, for variables related to weight. There is evidence that weight is associated with socioeconomic position and this would be also related to nutrition transition.[198,199] Inverse gradient of blood pressure across SEP has been reported in developed countries and direct gradient in developing nations.[300] Considering that overweight is a risk factor of hypertension, and both have showed association with SEP, analysis of inequalities in blood pressure should include adjustment for some weight indicator in order to control its effect.

It has also been observed that inequalities in blood pressure were different by gender and age. Previous studies have identified some factors which may determine larger inequalities in women, and these include political context, culture, women's roles and health-related mediators.[301] Moreover some psychosocial determinants of health such as single-parenting, low income, stress outside work, and depression, may affect women more than men in poorer groups, and therefore lead to larger inequalities between them.[118,200] Some studies have also reported differences in socioeconomic inequalities in blood pressure according to age group.[98,108] Three concepts have been pointed out to explain age differences, to the accumulative nature of socioeconomic disadvantages, mortality selection and improvement in social security and medical care in older people.[302-306] These latter processes may explain why socio-economic inequalities in health expand in middle age and tend to narrow again in old age. Therefore, based on literature, it is relevant to assess the role of gender and age in the association between SEP and blood pressure to study socioeconomic inequalities.

When studying trends in SEP inequalities over the time, the existing evidence suggests that it is advisable to evaluate both absolute and relative inequalities. It has been reported that differences may be found in inequalities depending on the method used. It is also important to use methods which allow comparison between populations with different distributions of SEP groups and to compare how inequalities evolve over time. [285,296-298 299]

Regarding the trend of inequalities in blood pressure over time, a few studies have analysed this topic and all of them have been carried out in high income countries. There are no studies analysing the trend of inequalities in blood pressure in Latin America. Furthermore, no studies have analysed blood pressure inequalities across socioeconomic position involving both absolute and relative measures of inequality in Latin America. These two types of measures in analyses of health inequalities have been recommended to compare changes over time or different populations. [296,298,307-310]

Moreover, there is a lack of research analysing the role of area-level socioeconomic factors on blood pressure inequalities. Only one study has been carried out in Latin America and this used traditional regression models to analyse two-level data. It is recommended to use multilevel regression models instead of traditional regression models to analyse hierarchical data to avoid misestimating the effect of area-level factors on health. [278-280]

Finally, to my knowledge, no study of inequalities in blood pressure in a national representative sample, and including more than one measure of socioeconomic status has been done in Chile. Also, no study has included other cardiovascular risk factors as covariates, examined the role of area level socioeconomic SEP on blood pressure in Chilean population, nor have been undertaken to analyse the trend of inequalities in blood pressure in Chile. Gaps related to analysis of blood pressure inequalities using more than one outcome and more than one SEP measure; including hypertension risk factors, examining relative and absolute inequalities; assessing the effect of area-level factors, and evaluating trend of inequalities over time in Latin America, will be addressed by the current study as described below in the aims, objectives and hypotheses of this thesis.

Chapter 3.Study Aims, objectives and hypotheses

Against the backdrop of socioeconomic inequalities in Chile and the large body of evidence showing significant socioeconomic inequalities in blood pressure presented in chapter 2, this project has the following aims and objectives:

3.1 Aims

i. To analyse the magnitude of socioeconomic inequalities in blood pressure in Chilean adults and its contributing factors.

ii. To examine the changes of socioeconomic inequalities in blood pressure in Chilean adults between 2003 and 2010.

3.2 Objectives and hypotheses

To address the first aim:

Objective 1. To describe socioeconomic inequalities in blood pressure in Chilean adult across different SEP measures, using the National Health Surveys 2003 and 2010.

Hypothesis:

According to the literature review presented in the previous section the direction of the association between SEP and blood pressure can vary according the stage of nutrition transition in which a population is located (Section 2.5.2). In general an inverse gradient is commonly observed in high income countries and in upper-middle income countries.[199,311,312] In turn, Chile is considered an upper-middle income (Section 2.1.3). [11]

Taking the abovementioned concepts into account, the following hypothesis is generated:

> Hypothesis (a): There is an inverse association between socioeconomic position and blood pressure in Chilean adults, and this can be observed for different SEP measures.

Objective 2. To analyse the effect of socio-demographic factors (age, gender, marital status) and health-related factors (weight, smoking, physical activity, family history of hypertension, diabetes mellitus) on socioeconomic inequalities in blood pressure.

Hypothesis:

The association between blood pressure and SEP may be affected by different factors, among them were socio-demographic and health related factors (section 2.3). Although some factors may weaken the association between SEP and blood pressure, significant associations have been observed after adjustments for covariates. In addition, the pattern of association between SEP and blood pressure may be different by gender and age group. Inverse gradients have been most commonly observed in women and in younger people (Section 2.5.2).[98] Inverse gradient in women may be related to a higher social vulnerability of women in the lowest levels of SEP due to a higher risk of psychosocial determinants of poor health. In turn, a decrease in health inequalities is observed in older people and this may be explained by mortality selection.[305,306] Considering the abovementioned concepts, the following hypotheses have been set up:

> Hypothesis (b): There are socioeconomic inequalities in blood pressure in Chilean adults independent of the effects of socio-demographic and health related individual factors.
>
> Hypothesis (c): Socioeconomic inequalities in blood pressure are larger in women than men.
>
> Hypothesis (d): Socioeconomic inequalities in blood pressure are larger in younger people than older people in Chile.

Objective 3. To analyse, using a multilevel approach, the role of district-level socioeconomic circumstances on the inequalities in blood pressure, using the NHS 2003 and NHS 2010 and a district-level deprivation index.

Hypothesis:

According to conceptual frameworks on social determinants of health mentioned in section 2.2, there are, besides individual factors, community factors affecting health status and social differentials in health. In addition, it has been reported that area socioeconomic characteristics may independently contribute to socioeconomic inequalities in blood pressure (Section 2.5.7). Based on the aforementioned postulates, the hypothesis presented below has been formulated.

> Hypothesis (e): There are district factors which are contributing to the socioeconomic inequalities in blood pressure in Chile.

To address the second aim:

Objective 4. To analyse changes in socio-economic inequalities in blood pressure in Chilean adults between 2003 and 2010, using SBP, DBP and hypertension as three outcomes.

Hypothesis:

Socioeconomic conditions in the Chilean population have improved in recent years, and this trend can be observed also between 2000 and 2010 (Section 2.1.3). Some indicators show that poverty and income inequalities have diminished over time.

> Hypothesis (f): Socio-economic inequalities in blood pressure in Chilean adults have decreased between 2003 and 2010.

Objective 5. To analyse relative and absolute socioeconomic inequalities in blood pressure in Chilean adults in 2003 and 2010 using the Slope Index of Inequality and the Relative Index of Inequality.

Hypothesis:

Changes over time in inequalities in blood pressure are not consistent and tend to vary according gender and according the method used to assess these changes (Appendix 1, Table A1.19). In Chile socioeconomic inequalities have decreased over time and this trend can be observed also between 2000 and 2010 (Section 2.1.3). Based on the review of the literature the following hypothesis was tested:

> Hypothesis (g): There are relative and absolute socioeconomic inequalities in blood pressure and hypertension and these have decreased over time.

Chapter 4.Methodology

4.1 National Health Surveys 2003 and 2010

Data from two cross-sectional population-based surveys were used for this thesis: National Health Survey 2003 (NHS2003) and National Health Survey 2010 (NHS2010). Both were conducted by the Ministry of Heath of Chile and their main objective was to determine the prevalence of the main chronic diseases in the country.[16,18]

The NHS2003 questioned 3,619 people aged 17 and older across the country and was representative of the national adult population. This survey constituted a sub-sample of the Quality of Life Survey 2000, which had as sampling frame the Population and Housing Census of 1992. This constituted a probabilistic, geographically stratified and multi-stage sample. The sampling stages included: sections or clusters, corresponding to groups of households within districts, household and people aged 15 and more.[18,313] This survey was nationally representative (Description of the sampling design is presented in Appendix 2).

NHS2010 had a sample of 5,414 people aged 15 and older and was representative of both the national and regional Chilean adult population. The NHS2010 sampling frame was the Population and Housing Census of 2002. This was a random, geographically stratified and multi-stage sample. Similar to NHS2003, the sampling stages were, clusters (groups of households) within districts, household and people aged 15 and more.[16] This is a national and regional representative survey. (Description of the sampling design is presented in Appendix 2).

Data Collection

Information in NHS2003 and NHS2010 was collected by doing two visits to the households. A trained interviewer made the first visit to the home and applied questionnaire about socioeconomic circumstances, health, lifestyle, psychosocial factors and quality of life (questionnaire 1). On the second visit, a nurse took measurements (weight, height, blood pressure), samples (blood and urine), and further applied a questionnaire on drug use and other background health (questionnaire). The response rates were 90% in NHS2003 and 85% in NHS2010.[16,18]

Survey weights

In order to achieve adequate inference of the results for the Chilean population, the sample design of the surveys 2003 and 2010 required that each valid observation was weighted by: 1) the probability of selection that this had at each stage; 2) no observed response and 3) the respective weights derived from demographic adjustment.

The resulting database was formed from the sample of individuals interviewed, in which the expansion factor corresponded to the inverse of the probability of selection of the individual (Description of the sampling design is presented in Appendix 2). Each dataset included weights for each valid observation which was estimated by using the probability of selection that it had on each stage. [16,18]

4.2 Study population and sample

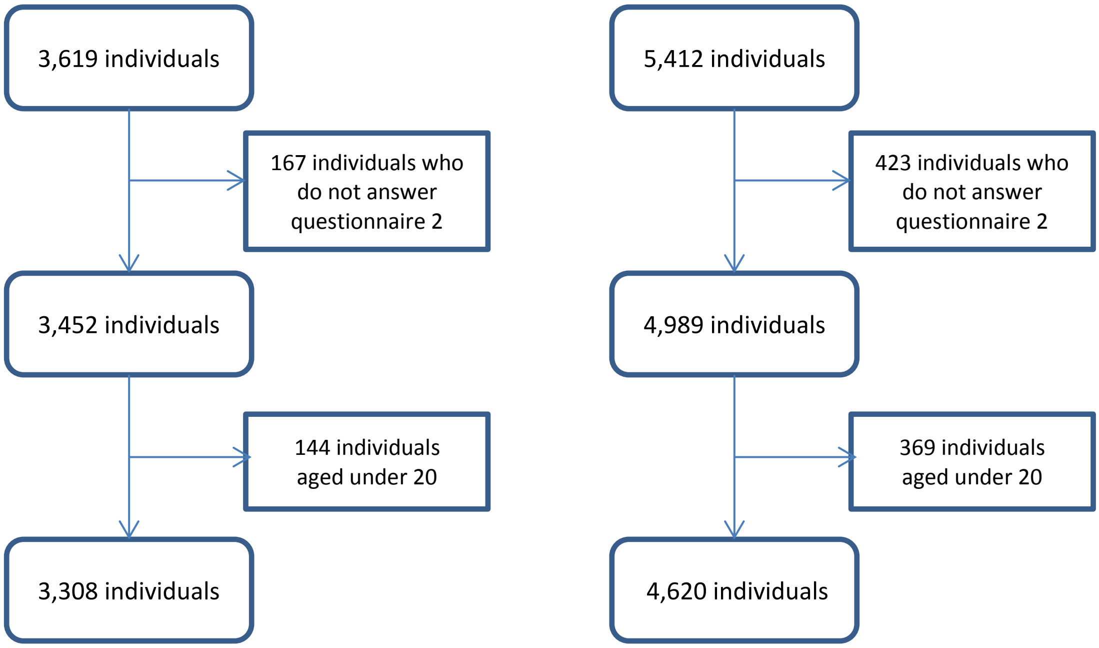
In the present thesis, data from Chilean National Health Surveys 2003 and 2010 were used. From a total of 3,619 individuals (1,646 men and 1,973 women) in 2003 and 5,412 in 2010 (2,198 men and 3,214), the final samples were selected according two inclusion criteria: (1) people who answered both questionnaires, had anthropometrics, blood pressure measures and blood samples, and (2) people aged 20 and over. After applying these criteria, the samples for 2003 and 2010 were 3,308 and 4,620 participants (Figure 4-1).

4.3 Individual level variables

4.3.1 Outcome variables

For this thesis three outcomes were defined, systolic blood pressure (SBP), diastolic blood pressure (DBP) and hypertension. Both SBP and DBP were analysed as continuous variables in mmHg and hypertension was studied as dichotomous variable (Hypertensive/Non hypertensive).

Figure 4-1: Study sample selection



In both surveys blood pressure was measured by a nurse with automated digital monitors. In 2003 the monitor OMRON-HEM 713C was used, while in 2010 OMRON-HEM 742 was utilised. In NHS2003, two blood pressure measures were taken, with a two minutes interval and after sitting for 5 minutes. Whereas in NHS2010 three measures of blood pressure were taken, also with a two minutes interval and after sitting for 5 minutes.

For this report and in order to make comparable the measurements in the two surveys, systolic blood pressure and diastolic blood pressure were defined as follows:

- In NHS2003, both SBP and DBP were the average of the two measurements available.
- In NHS2010, both DBP and SBP were defined as the averages from the two first measurements, leaving the third available measurement out of these calculations. This decision was made in order to have comparable measurements for both surveys (Appendix 3).

Hypertension was defined using two criteria. First, the cut-off set up by the seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure[88], this is SBP≥140 or DBP ≥90. Second, normotensive people who self-reported that they were taking blood-pressure lowering drug therapy were considered hypertensive.

4.3.2 Exposure variables

4.3.2.1 Education

Educational attainment was categorised into 3 groups: low education (less than 8 years of school), medium education (8 to 12 years of school) and high education (>12 years of school). These levels correspond to the Chilean official curriculum which are primary, secondary and higher education (technical or university).

4.3.2.2 Occupation

Occupation was incorporated as a categorical variable with 6 categories. This variable was created by combining information from two survey questions. In the first place, answers given to the question about occupation, which were coded according International Standard Classification of Occupations (ISCO-88) in the dataset, were grouped into three categories as follow (Table 4-1):

Table 4-1: Classification of occupation from ISCO-88 codes

ISCO-88	New categories
Legislators, senior officials, managers and professionals	Higher worker
Technicians, associate professionals, clerks, service workers and shop and market sales workers.	Intermediate worker
Skilled agricultural and fishery worker, craft and related workers, Plant and machine operators and assembler and elementary occupations	Routine and manual worker

Secondly, answers to the question about employment status, were grouped as is showed in Table 4-2.

Table 4-2 : Classification of occupation

NHS2003	NHS2010	New categories
Employed Independent worker (employer or self-employed)	Working for wage Without working but you have job Working for a relative without wage	Worker
Homemaker	Homemaker	Homemaker
Unemployed Looking for jobs for 1st time Student Inactive	Looking for a job, having worked before Looking for a job for first time Student Permanently disabled to work	Inactive
Retired	Retired	Retired
Do not know, no answer	Another status Do not know. No answer	Missing value

Finally, by combining occupation and employment status, the new occupation variable was created with 6 categories. People identified as worker in the question about occupation, were classified according their category of occupation, to which the other three categories were added, homemaker, inactive and retired. In this manner, the six types of occupation were set up: Higher worker, intermediate worker, routine and manual worker, homemaker, inactive and retired.

4.3.2.3 Material conditions (asset-based index)

An asset-based index was created from information available about assets in the two surveys. The assets included were: vehicle, computer, video recorder, microwave and hot water system. Although the NHS2010 contains information on more assets, such as information on head of household; the number of variables used in this index was limited by the information available in NHS2003.

In this manner, a score was assigned to individuals according the ownership of the assets. The minimum score was zero and the maximum score was five. Finally, considering that three categories were set up for education and for workers, three categories were also defined for assets-based index to facilitate comparisons. In this way, the index based on assets was categorised into low, middle and high level (Table 4-3).

Table 4-3 Asset-based index

Number of assets	SEP category
0	Low
1-3	Middle
4-5	High

4.3.3 Covariates

Age:

- Age was used as a categorical variable in analyses examining interaction effect of age on the association between blood pressure and SEP (Section 5.3.2). Age categorised into three groups was included in the interaction terms analysing interaction effect in order to facilitate the interpretation. Results from using categorical variables in interaction terms are easier to interpret than using continuous variables.
- Age categorised into three groups was also used in age-stratified analyses (Section 5.3.3). Three age groups were used considering that in public health it is relevant to identify more vulnerable groups of population who may need focused policies or strategies in health .
- Age was used as a continuous variable when this was included as an adjustment variable in the regression models (models stratified by gender in Chapter 5 and multilevel models in Chapter 6).

Sex: In both surveys gender of the individual was included as a categorical variable: men and women.

Place of residence: urban or rural.

Marital status: Marital status from both surveys was recoded to a variable with three categories: Single, married/cohabitee and divorced/separated/widowed.

Smoking status: this variable was included with three categories, current smokers, past smokers and never smokers.

Physical activity: Participants were asked about sport practiced last month or physical activity performed outside their working hours, for 30 minutes or more each time. Responses were categorized in three: 3 or more times per week; less than 3 times per week and did not practice sport.

Body Mass Index (BMI): It was calculated dividing the weight in kilograms by the square of the height in metres (kg/m^2). BMI was used as a continuous variable.

History family of hypertension: People who answered that either their mother or father has or had hypertension, and was included as a binary variable.

Diabetes Mellitus: This variable was constructed by combining two variables, blood glucose and self-report of diabetes mellitus. It was considered that a person had diabetes if the next criteria were met: fasting plasma Glucose higher or equal to 126mg/dl or self-report of physician diagnosis, excluding who were diagnosed during pregnancy. [314,315]

4.3.4 Outliers

Data range and consistency for all variables included in the analysis in the present project were checked for both survey samples. Values considered as clinically improbable and inconsistent answers were set as "missing values".

4.4 Adjusting SBP and DBP for antihypertensive therapy effects

Studies involving blood pressure require making adjustments in participants who are being treated for high blood pressure. Analysis of BP without corrections in treated people, could lead to distorted results. [168] In order to make adjustments for antihypertensive therapy when analysis of blood pressure is undertaken, some authors have recommended adding 10-15 mm Hg to treated SBP and of 5 mm Hg to DBP measurements. [316-319] Tobin et al., compared different methods of adjusting for treatment effects in simulated data sets and assessed the estimation bias and the loss of power that ensue when treatment effects are not appropriately addressed. From this comparison the authors concluded that two of the adjustment methods appeared to perform well across a range of realistic settings, and these are, the addition of a constant to the observed BP in treated subjects; and the censored normal regression model.[319] Adding a constant has the advantage of being a simple approach to address the blood pressure corrections. Therefore using this method of adjustment implies avoiding loss of power and bias resulting from using other methods such as: ignoring the problem and analysing observed BP in treated subjects as if it was their underlying BP; fitting regression model with treatment as a binary covariate; or excluding treated subjects from the analysis.[319] For this thesis, adjustment by adding a constant to the observed blood pressure was made. In this manner, based on previous studies[168,243,319] a constant of 10 mm Hg was added to SBP and a constant of 5 mm Hg to DBP, for individuals who reported taking antihypertensive medication.

4.5 Prevalence ratios (PR) instead of odds ratios

In this project associations between blood pressure and SEP were examined by fitting multivariable regression models. In these models, the blood pressure measures were introduced as the outcome variable, the SEP indicator as the explanatory variable, and age, gender, marital status and other biological and behavioural risk factors as covariates. Three blood pressure measures were used, as outcomes, SBP and DBP as continuous variables, and hypertension as a binary variable. When hypertension was used, prevalence ratios (PRs) were obtained using robust Poisson regression models. Prevalence ratios were estimated instead of odds ratios due to hypertension having a high prevalence.

Some authors have reported that the analysis of binary outcomes by using odds ratios, can lead to overestimating the risk ratios when the studied phenomenon has high prevalence (prevalence above 10%), and therefore, have suggested using prevalence ratios instead. [320-322] Different methods to obtain PRs have been compared to analyse outcomes with high prevalence, and Poisson regression with robust variance and log-binomial regression models have been recommended. [323-325]

In this thesis, robust Poisson regression models were used for hypertension, since these have been recommended to obtain PRs for outcomes with high prevalence, and because log-binomial regression showed convergence issues. Previous studies have reported problems of convergence with log-binomial models, these problems have been observed in models where the outcome has high prevalence, there is a continuous variable as covariate in the model, or analyses are carried out using dataset from surveys with complex sampling design (survey data). [320,321,324,326-328] Poisson regressions models have performed well in relation to continuous covariates and generate adequate estimates for prevalence ratios and confident intervals. [320,328] Some authors have recommended using Poisson method when log-binomial model does not converge. [320,321,328-330]

4.6 Assumptions of linear regressions

For this thesis three outcomes were used to analyse socioeconomic inequalities in blood pressure and two of them correspond to continuous variables, SBP and DBP. In order to evaluate if the models using these variables met the assumption of linear regressions, Shapiro-Wilk, Breusch-Pagan / Cook-Weisberg, variance inflation factor tests were carried out, and also some visual inspection of data plots (kernel density plot, standardized normal probability plot), were analysed. These analyses showed that outcome variables were normally distributed, residuals were also normally distributed and homoscedastic.

4.7 Area level variables

In the multilevel models were included five district-level explanatory variables, four proxies of socioeconomic position and a deprivation index built by combining those four indicators. The district socioeconomic position measures were: schooling, overcrowding index, unemployment rate and household income. These indicators were chosen based on previous studies analysing the effects of contextual socioeconomic status on blood pressure and considering that each of these may reflect different aspects of area-level SEP. [120,126,128,176,238] Data on these four indices were derived from the Chilean Socioeconomic Characterisation Surveys 2003 and 2009 (CASEN 2003 and CASEN 2009). These surveys have representativeness at the district, region and national levels. The sample in CASEN 2003 had 68,153 individuals nested in 301 districts, the sample in CASEN 2009 had 246,924 individuals nested in 334 districts.[26,331]

Schooling corresponds to the mean of years of schooling of people aged 25 and over within a district. Overcrowding index was estimated by dividing the number of people (including children) living in a household by the number of rooms in the household, excluding the bathroom. In this way, an increment in the score indicates a detriment in living conditions. Unemployment rate was calculated by dividing the number of unemployed in the district by the number of the economically active population (unemployed + working population). The household income, corresponds to the mean of autonomous income of the households within a district in 100.000 Chilean pesos[e]. Autonomous income refers to the income from wage and salary, earnings from independent work, or from other type of sources such as bonuses, rents or retirement pensions within the household, before tax transfers from the state.[331,332]

The deprivation index was created by integrating, in one score, the district socioeconomic indicators, so that, the index is composed by four domains, overcrowding, schooling, unemployment, and income. The first step consisted in normalising the four indicators values, so that the scores were rescaled to a range of [0, 1] *(5)*.

$$X_{new} = \frac{X - X_{min}}{X_{max} - X_{min}} \qquad (5)$$

Where X_{min} refers to the minimum value of the variable and X_{max} to the maximum value. Secondly, the values for schooling and household income were inverted in order to get the same direction in the four indicators. In this way for all scores "0" represented the best situation and "1" the worst. After that, the scores were added together and quintiles were estimated. As a result, the deprivation index ranged from quintile 1, least deprived districts and quintile 5, most deprived districts.

The sample sizes for the present analysis comprised 3,042 individuals nested in 195 districts in 2003 and by 4,055 individuals nested in 146 districts in 2010 (Table 4-4).

Table 4-4: Size, mean and range of the clusters in NHS2003 and NHS 2010

	Number of clusters	Mean size	Range of clusters size
2003	195	37.49	2; 117
2010	146	82.90	2; 263

[e] Peso: currency of Chile.

4.8 Missing data

4.8.1 Missing data in samples for comparison of Surveys 2003 and 2010

The percentage of missing data in the variables included in the analysis for the present project was in general low for both surveys, ranging between 0.1% and 5.7% (Table 4-5). However, the percentage of missingness estimated for the group of these variables, namely the proportion of individuals (records) with one or more missing value for this group of variables, was higher than those obtained by analysing single variables.

Analysis of missing values for the set of variables included in the analysis, showed that there were 370 missing values in 2003 and 753 in 2010, which represent 11% and 16% of participants respectively. Considering the final variables, namely those created from the original variables mentioned above, the numbers of records with missing values were 266 (8.0%) in 2003 and 565 (12%) in 2010. The number of missing values changed for the final variables due to the criteria used to make the new variables. In this manner the samples with complete cases for the final variables were 3,042 in 2003 and 4,055 in 2010 (Table 4-6).

Table 4-5: Missing data for selected variables. NHS 2003 and NHS 2010.

Variable	Missing 2003 N	Missing 2003 %	Missing 2010 N	Missing 2010 %
SBP 1st measure	20	0.6%	33	0.7%
SBP 2nd measure	26	0.8%	37	0.8%
DBP 1st measure	23	0.7%	31	0.7%
DBP 2nd measure	27	0.8%	36	0.8%
Question about treatment for HY	58	1.8%	103	2.2%
Question about type of treatment	65	2.0%	103	2.2%
Family history of hypertension	0	0.0%	265	5.7%
Fasting blood glucose	93	2.8%	220	4.8%
Self-report of Diabetes Mellitus	73	2.2%	137	3.0%
Years of schooling	8	0.2%	100	2.2%
Occupation	21	0.6%	255	5.5%
Employment status	2	0.1%	195	4.2%
Ownership of assets	102	3.1%	102	2.2%
Marital status	12	0.4%	94	2.0%
Question about smoke: Have smoked at least … (yes/no)	80	2.4%	144	3.1%
Question about current smoking	80	2.4%	156	3.4%
Physical activity	153	4.6%	102	2.2%
Weight	19	0.6%	47	1.0%
Height	21	0.6%	69	1.5%

Table 4-6: Survey sample, 2003 and 2010

Criteria of selection	2003	2010
Questionnaire 1 respondents *	3,619	5,412
Questionnaire 2 (Q2) respondents**	3,452	4,989
Q2 respondents and aged 20 and over	3,308	4,620
Missing values in any of the original variables included in the analysis	370	753
Missing values in any of the final variables included in the analysis	266	565
Q1 + Q2 respondents aged 20 and over, with complete data for final variables included in the analysis	3,042	4,055

*Questionnaire 1 contains questions about socio-demographics information

**Questionnaire 2 contains questions about health, physical measures and exams

4.8.2 Addressing missing data

Missing data is a common problem in health research which may affect the accuracy of the analyses. [333] Therefore, appropriate handling of the missing data could be considered an important issue in a research. Three mechanisms underlie missing data:

Missing completely at random (MCAR): The probability of missingness is independent of observed or unobserved data.

Missing at random (MAR): The probability of missingness depends only on observed variables.

Missing not at random (MNAR): The probability of a missing value depends on unseen observations. [334]

Usually, researchers address missing data by including in the analysis only the complete cases.[335] Nonetheless, it has been argued that the complete case approach may ignore the possible systematic differences between the complete cases and incomplete cases, and therefore it could introduce bias.[336] Complete case analysis approach has been recommended to addressing missing data when the missingness is less than 5% and this is completely at random. [337]

Different procedures have been created for dealing with missing data.[338] One of these is the Single Imputation approach, which assigns a specific value to the missing data (e.g. mean). [335] This method does not account of the uncertainty in the imputed values, instead the imputed values are considered as known, which may lead to incorrect conclusions. Another approach is the Maximum likelihood methods. Although this can be a feasible way of addressing missing data, it is applicable only for certain models such as longitudinal or structural equations models.[335] A third method, named multiple imputation, has been considered as a flexible alternative for dealing missing data, and moreover, this has some advantages over the other approaches. [336,338-340]

Multiple Imputation creates a set of plausible values, which replace missing values. By performing different regression models, the missing values are imputed based on observed data, since observed variables are included in imputation models as predictors. Also, multiple imputation has been recommended for large data files from sample surveys and censuses. [240,341-343]

Multiple imputation comprises of two techniques to create imputed datasets, these are imputation using the multivariable normal model and imputation using the chained equations approach.[337] Imputation using the multivariable normal model assumes that the variables are continuous and normally distributed. [344] Chained equations procedure performs a series of multiple regression models, whereby each variable with missing data is modelled by using other variables in the data set as predictors, therefore, each variable is modelled according its distribution. It has been set up that, when missing data correspond to Missing at Random, but not Completely At Random, analyses based on complete cases may be biased. In these cases, multiple imputation may be the method suggested to overcome biases. In this manner, this technique operates under the assumption that the missing data are Missing At Random. [345-347]

For this project an assessment of missing data was carried out in order to decide which would be the best procedure to adopt for addressing missing data.

In the first place a comparative analysis was undertaken for means and proportions resulting from the complete cases sample and from missing values sample. Wald test for categorical variables and T-test for continuous variables were analysed in order to determine the level of significance of the differences of means and proportions.

The results for the comparative analysis between complete cases sample and missing values, showed that it is plausible that missing data in both 2003 and 2010 correspond to Missing at Random type of missing data, [84,240] since the probability of missing values may be related only to observed values. However, comparison of individuals with missing data and complete cases revealed that in 2003 there were significant differences only for age and occupation in 2010, and for age, sex, educational level, assets-based index, occupation, systolic blood pressure, family history of hypertension and smoking in 2010 (Tables 4-7 and Table 4-8).

The percentages of the missing data in both surveys were over 5%. In addition, according to the literature, complete cases analysis is recommended to handle missing data when its percentage is less than 5%, and when these fall into category of completely missing at random.[348] Therefore, given that the proportions of missing data in the datasets used in this thesis were over 5% and comparative analysis between missing data and complete cases showed that missingness may be Missing at Random, for this research, complete cases approach and multiple imputations were compared.

Table 4-7: Weighted descriptive statistics for study variables for complete cases and those with missing data in any of the study variables. Survey 2003

Variables	*Missing data in at least one of the study variables (number of records = 266)*	*Complete cases (Number records = 3,042)*	*Significance level of the differences (P value*)*
Age (mean)	46.8	42.6	**P < 0.01**
Sex (women)(%)	48.0	51.6	NS (P=0.57)
Marital status (%)			NS (P= 0.06)
Married/cohabiting	57.5	62.1	
Single	25.2	28.7	
Divorced/Separated/Widowed	17.4	9.3	
Place of residence (urban)(%)	88.8	85.7	NS (P=0.46)
Educational level (%)			NS (P=0.09)
High	31.0	18.9	
Middle	41.7	53.9	
Low	27.3	27.3	
Assets-based index (%)			NS (P=0.23)
High	6.4	14.6	
Middle	64.1	61.1	
Low	29.5	24.3	
Occupation (%)			**P=0.02**
Higher worker	17.4	11.1	
Intermediate worker	14.5	10.8	
Routine and manual worker	15.9	27.5	
Homemaker	23.5	26.6	
Inactive	13.3	16.7	
Retired	15.3	7.3	
Hypertension (%)	37.9	35.7	NS (P=0.54)
Systolic blood pressure (mean)	126.3	129.1	NS (P=0.25
Diastolic blood pressure (mean)	78.5	80.8	NS (P=0.10)
BMI (mean)	26.8	27.1	NS (P=0.41)
Diabetes Mellitus (%)	9.7	6.5	NS (P=0.22)
Family history of hypertension (%)	38.9	42.3	NS (P=0.52)
Physical activity (%)			NS (P=0.70)
Three or more times per week	6.2	9.7	
Less than three times per week	15.2	17.6	
Do not do PA	78.6	72.6	
Smoking (%)			NS (P=0.05)
Never smoker	32.8	43.1	
Past smoker	25.7	14.8	
Current smoker	41.5	42.1	

*P value: Wald test for categorical variables and T- test for continuous variables.

Table 4-8: Weighted descriptive statistics for study variables for complete cases and those with missing data in any of the study variables. Survey 2010

Variables	*Missing data in at least one of the study variables (number of records = 565)*	*Complete cases (Number records =4,055)*	*Significance level of the differences (P value*)*
Age	51.0	43.9	**P<0.01**
Sex (women)	40.0	53.4	**P<0.01**
Marital status			NS (P=0.48)
Married/cohabiting	62.1	59.9	
Single	26.2	30.4	
Divorced/Separated/Widowed	11.8	9.7	
Place of residence (urban)(%)	82.0	87.5	NS (P=0.04)
Educational level (%)			**< P=0.01**
High	16.5	27.4	
Middle	45.2	54.2	
Low	38.3	18.4	
Assets-based index			**< P=0.01**
High	35.6	47.0	
Middle	45.6	44.4	
Low	18.8	8.6	
Occupation (%)			**P<0.01**
Higher worker	3.7	9.0	
Intermediate worker	12.4	21.5	
Routine and manual worker	24.9	26.6	
Homemaker	16.3	21.4	
Inactive	18.7	11.1	
Retired	24.0	10.5	
Hypertension (%)	38.4	30.3	P=0.04
Systolic blood pressure (mean)	132.0	127.4	**P<0.01**
Diastolic blood pressure (mean)	77.7	77.2	NS (P=0.56)
BMI (mean)	28.2	27.8	NS (P=0.39)
Diabetes Mellitus (%)	15.2	9.5	P=0.04
Family history of hypertension (%)	26.3	44.7	**P<0.01**
Physical activity (PA) (%)			NS (P=0.26)
Three or more times per week	7.6	8.9	
Less than three times per week	9.9	14.2	
Do not do PA	82.5	76.9	
Smoking (%)			P=0.01
Never smoker	43.7	43.2	
Past smoker	28.5	17.4	
Current smoker	27.8	39.5	

*P value: Wald test for categorical variables and T- test for continuous variables.

4.8.2.1 Multiple imputations

Multiple imputations (MI) were carried out to handle missing values and compare with complete cases approach. Given the different types of variables included in the analysis, chained equation was the technique chosen to impute missing data. The model for MI by using chained equation was set up as follows:

The imputation model included all the variables that were used in the analysis of this project, including the outcome variables.[344,349,350] When variables included in the analysis were built by combining or mathematically manipulating other variables, only the original variables were included in the model. [333] The variables included in the model are shown in Table 4-9.

Structural variables such as strata, and cluster were included in the imputation model as factor variables. [341,350-352] Due to the large number of clusters and strata, these were reduced by collapsing in a smaller number of categories. [353] The clusters were collapsed into three categories according to size of the town in urban area and one category for rural area. Strata were collapsed in regions. Also, it has been recommended to include survey weights as factor variable in the imputation model. [354] In this manner quintiles of survey weight were set up and the variable weight was included with five categories.

Based on Rubin's analysis, ten imputations were made.[343] His study showed that the efficiency of an estimate based on *m* imputations has only a slight increase, and unless the rate of missing information is very high, there is only a little advantage to producing and analysing more than a few imputed datasets. Table 4-10 shows different levels of efficiency achieved according to the values of *m* and rates of missing data as reported by Rubin (1987). It is possible to see that where 10% is missing, which is near the proportion of the missing data of this project, the efficiency of creating 10 imputations is 99%.

Table 4-9: Variables included in the imputation model

Original variables included in the imputation model	Variables which were included in the subsequent analysis
SBP 1st measure SBP 2nd measure	Average of systolic blood pressure
DBP 1st measure DBP 2nd measure	Average of diastolic blood pressure
Question about treatment for hypertension (yes/no) Question about type of treatment	Use of drugs treatment for hypertension
Family history of hypertension	Family history of hypertension
Years of schooling	Educational level
Employment status in 5 categories Occupation: 3 categories of worker	Occupation
Ownership of assets: car Ownership of assets: pc Ownership of assets: hot water system Ownership of assets: video recorder Ownership of assets: microwave	Assets-based index
Marital status	Marital status
Question about smoking: Have you smoked at least … (yes/no) Question about condition of smoker	Smoking
Question about physical activity	Physical activity
Weight Height	BMI
Fasting blood glucose Self-report of Diabetes Mellitus	Diabetes Mellitus

Table 4-10: Level of efficiency of number of imputations by rate of missing data

	Proportion of missing data				
Number of imputations	0.1	0.3	0.5	0.7	0.9
3	97	91	86	81	77
5	98	94	91	88	85
10	99	97	95	93	92
20	100	99	98	97	96

Source: Rubin DB, 1987

As described above, multiple imputations were undertaken by using chained equations method. Dummy variables were created for categorical variables (occupation and employment status); and logistic regression models were set up for each of these variables. Even though the place of residence variable was included in subsequent analysis, this was excluded from the imputation model due to collinearity with strata variable. In addition, restrictions were set up in the imputations models for occupation and smoking. Restrictions refer to conditions under which a variable should or should not be imputed. This applies to hierarchical questions (also known as skip patterns) in a questionnaire instrument. In this case, the condition for occupation was to impute only those observations whose employment status was worker, and for smoking status only for who referred having smoked some time in life. The model was run by survey year, namely the process of imputation was made separately for the 2003 and 2010 survey.

Multiple imputations were carried out in Stata 12. Commands *mi impute chained* and *augment* [351] were used to obtain the 10 imputations of the 26 variables.

4.8.2.2 Multiple imputation assessment

After multiple imputations were made, a diagnostic of the imputed data was carried out in order to identify any potential problems with the imputation model. Analysis included comparisons of means and proportions between imputed and complete cases. Differences in proportions and means between the imputed and observed data were found in some variables. However, these differences can be explained by clustering of the missing data in these variables.

Differences observed between imputed and observed values for systolic blood pressure (in 2003 and 2010), diastolic blood pressure (in 2010) hypertension treatment (in 2003 and 2010) self-report of diabetes mellitus (2003 and 2010), years of schooling (2003), occupation (2003), physical activity (2010) and smoking (in 2003) can be explained by age. For example, a lower mean of systolic blood pressure was observed for imputed values than complete cases in 2003. However, analysis showed a large proportion of people younger 65 years old in the missing data (near 74%) in this variable. In addition, a larger proportion of people who refer to being medicated for hypertension were observed for imputed values, and at the same time, all the missingness in these variables corresponded to people older than 55 years. So that, these groups of missing values for elderly people, have effectively a higher risk of high blood pressure and of being medicated (Table 4-11).

Table 4-11: Mean of SBP and percentage of people medicated in 2003
(Complete weighted sample)

Group of age	Mean	Medicated for hypertension (%)
20-34	119.8	1%
35-44	127.7	6%
45-54	136.3	15%
55-64	145.9	31%
65 and older	154.6	47%

Similarly, larger proportions of older people in missing data led to a lower mean of years of schooling, a lower proportion of intermediate and manual workers, a lower proportion of physical activity and a lower proportion of smoking in imputed values in 2003.

Moreover, a larger proportion of ownership of assets (car, pc, hot water system, microwave) was found in 2003. This difference could be explained by the fact that 70% of missingness was clustered in urban area, where it is most frequent for people to be owners of these types of assets (Table 4-12).

Finally, the mean of height and weight were lower in imputed data in 2003. However, an important proportion of missing values in these variables correspond to women, who in turn have a lower mean of height and weight than men, sex may be the clustering factor that determined the differences.

Abayomi has pointed out that some deviations between observed and missing values do not necessarily indicate violations of the missingness assumptions or problems with the imputation model, but these can be expected under MAR. The results obtained in the imputations for this project resulted in slight deviations, which can be explained by clustering of the missing data, therefore important violations to the missingness assumptions could be discarded.

Table 4-12: Proportion of ownership of assets by place of residence,
(Complete weighted sample, 2003)

Asset	Urban	Rural
Car	30.4	22.6
PC	20.8	3.6
Video recorder	5.4	0.8
Microwave	32.2	8.4
Hot water system	71.1	30.4

4.8.2.3 Sensitivity analysis

A sensitivity analysis was carried to study the influence of two different methods of handling missing data on the study results. In this manner, a set of analyses were performed by using complete case analysis and multiple imputation.

In the first place, a descriptive analysis was undertaken in which means and proportions obtained from the complete cases sample and the multiple imputed samples were studied for both, 2003 and 2010. Means and proportions obtained from the complete cases sample and the multiple imputed sample were analysed, and these resulted very similar in both, 2003 and 2010 (Appendix 4, Table A4.1).

Secondly, the association between blood pressure and assets-based index in 2003 and blood pressure and occupation in 2010 were analysed. These predictors were chosen since these showed the largest number of missing values, and therefore, it was more likely that the results for these predictors would be influenced by the method of handling missingness used. The association between all three outcomes variables and assets-based index and occupation in 2003 and 2010 respectively, was assessed in both the basic (adjusted for age and sex) model and fully adjusted models (additionally adjusted for marital status, area, BMI, diabetes mellitus, family history of hypertension, smoking and physical activity) (Appendix 4, Table A4.2 and Table A4.3).

In 2003, analysis showed no significant differences between estimates resulting from the complete cases sample and the multiple imputed sample for the three outcomes. In 2010, similarly to that observed for 2003, there were not significant differences between results obtained from complete cases and imputed sample, nor between basic and full adjusted models. Based on these results it can be concluded that complete cases analysis approach could be used to address missing data in this project, without a high[355,356] risk of bias in the analysis (Appendix 4, Table A4.2 and Table A4.3).

4.9 Ethical issues

These surveys were reviewed and approved by the Ethics Committee of the Pontifical University of Chile Catolica and by the Ethics Committee of the Ministry of Health. The ethical aspects of the National Health Surveys 2003 and 2010 met the recommendations of international studies of this type.[16,18]

Chapter 5.Individual Socioeconomic Position and Blood pressure

5.1 Introduction

This chapter examines the association between blood pressure and individual socioeconomic position. Analyses included in this section are 1) descriptive analysis of samples, 2) effect of age and gender on the association between blood pressure and SEP, 3) multivariable analyses of the association between blood pressure and SEP, 4) relative and absolute socioeconomic inequalities in blood pressure, and 5) additional analysis for 2010 survey.

5.2 Methodology

5.2.1 Descriptive analysis

This initial stage of the analysis addresses objective number 1 “To describe socioeconomic inequalities in blood pressure in Chilean adult across different SEP measures, using the National Health Surveys 2003 and 2010”. This consists in a descriptive analysis to study the distribution of the variables incorporated in the research using NHS2003 and NHS 2010. Thus, a summary of the characteristics of the samples was carried out.

5.2.2 Role of age and sex on the association between blood pressure and socioeconomic position.

This section addresses partially Objective 2: “To analyse the effect of socio-demographic factors on the socioeconomic inequalities in high blood pressure” while focusing on the role of age and sex in the association between study outcomes and three measures of socioeconomic position.

As shown earlier, in the literature review (Chapter 2.5), several studies in the past have found that inequalities in blood pressure can differ according to the age group and gender.[98,108,155,255] In addition, most past studies investigating the association between socioeconomic position and adult blood pressure adjusted their estimates for age and sex. However, detailed formal information about potential effect modification by these variables has not been usually given. Considering age and sex as potential effect modifier of the association between blood pressure and socioeconomic position, analyses to examine this effect were carried out.

Age as potential effect modifier of the association between blood pressure and SEP

Some authors have found that socioeconomic inequalities in blood pressure may vary for different age groups.[290]

In addition, some authors have found that inequalities in blood pressure may be larger from middle age (45-50 years). [155,255,290] Other authors have pointed out that the differences of blood pressure or other health inequalities across socioeconomic position which start to widen in middle-aged adults (45-50 years), might start to shrink again in older adults (65-70 and over). [98,306] Therefore, there is no consensus about the cut off to define age groups to evaluate changes in inequalities in blood pressure.

The potential interaction effect of age on the association between blood pressure and SEP was evaluated since evidence suggests that there are differences in blood pressure socioeconomic inequalities by age group. The assessment was carried out by including interaction terms with age as a categorical variable with three categories mentioned earlier (20-39; 40-59 and 60 and older)

So that, interaction terms between age as categorical variable and the SEP measures were created as follow:

age(3 categories)*SEP(categorical) = age 2 group*SEP level 2
age 2 group*SEP level 3
age 3 group*SEP level 2
age 3 group*SEP level 3

In this manner, regression models were fitted using SBP, DBP and hypertension as outcomes and education, assets-based index and occupation as exposures, and these included two-way interaction terms between each measure of SEP and age variable. Wald test was used for determining statistical significance of the interaction terms. The level of significance of the interaction terms were tested after adjustment for sex.

In addition, estimates stratified by age groups are reported. P-value for trend was used to test the level of significance of socioeconomic gradients. Wald test was used for determining statistical significance of inequalities in non-hierarchical SEP measure (occupation including workers and non-workers).

Sex as potential effect modifier on the association between blood pressure and SEP

Besides investigating interaction effect between measures of SEP and age, potential effect modification by sex on the association between blood pressure and SEP, was studied. In this way, interaction effect between sex and each SEP measure were evaluated by including interaction terms in the models for each of the three outcomes (SBP, DBP and hypertension) and three SEP measures (education, assets-based index and occupation). Models including interaction terms between sex and SEP measures were adjusted for age as a continuous variable.

Estimates stratified by sex are also reported. P-value for trend was used to test the level of significance of socioeconomic gradients and Wald test was used for determining statistical significance of the interaction terms and differences among non-ordered categories of SEP.

Potential interaction effect of age and sex on the association between blood pressure and SEP

As final step of this section, all models were stratified by age and sex (both) taking into account possible role of age and possible role of sex evaluated in previous steps.

5.2.3 Multivariable regression analyses

This stage addresses objective number 2 and 4 “To analyse the effect of socio-demographic factors and health-related factors on the socioeconomic inequalities in blood pressure” and “To analyse changes in socio-economic inequalities in blood pressure in Chilean adults between 2003 and 2010”.

Multivariable regression analyses were carried out to assess to what extent covariates other than age and sex influenced the association between measures of SEP and blood pressure. As in previous sections, the outcomes were SBP and DBP as continuous variables and hypertension as a binary variable. In this manner, linear regressions models were performed using SBP and DBP as dependent variables and Poisson regressions models were used when hypertension was the dependent variable.

The analysed exposures were again highest achieved educational level with three categories, assets-based index with three categories, and occupation in two versions: one using workers and non-workers and the other using only workers as defined in section 4.3.2.

The models analysing association between outcomes and exposures were performed stratified by sex and age group. Models stratified by age group were adjusted for sex as a binary variable; place of residence as a binary variable; marital status as a categorical variable, body mass index (BMI) as a continuous variable; diabetes mellitus (DM) as a binary variable, family history of hypertension as a binary variable, smoking habit as a categorical variable and physical activity as a categorical variable. In turn, models stratified by gender were adjusted for age as a continuous variable, place of residence as a binary variable; marital status as a categorical variable, body mass index (BMI) as a continuous variable; diabetes mellitus (DM) as a binary variable, family history of hypertension as a binary variable, smoking habit as a categorical variable and physical activity as a categorical variable. These covariates were described in more detail earlier in section 4.3.3.

With the aim to assess the effect of each covariate on the association between blood pressure and SEP measures, these were added one at a time after adjustment for sex or age. The statistical significance of the gradient across socioeconomic position was tested using p-value for trend for each model using hierarchical SEP measures as exposures, namely, education, assets index and occupation with three categories of workers. Wald test for homogeneity was used for testing differences between the categories of occupation when six categories of workers and non-workers were included.

5.2.4 Relative and absolute socioeconomic inequalities in blood pressure 2003 and 2010

This stage focused on dealing with the Objective 5 “To analyse relative and absolute socioeconomic inequalities in blood pressure in Chilean adults in 2003 and 2010 using the Slope Index of Inequality and the Relative Index of Inequality”.

Relative and absolute measures of inequalities have been used to monitor the magnitude of health inequalities. In addition, the RII and SII have been widely used to analyse socioeconomic inequalities over time in mortality and morbidity. [228,309,357-360]Also inequalities in hypertension have been investigated by using either one or both of these indices.[130,228,293,361] Several authors agree in recommending use of both, relative and absolute index of inequalities, in particular when change of the inequalities over time are analysed. [296,298,309,310]

The RII can be interpreted as the ratio of the morbidity or mortality of those at the bottom of the social hierarchy compared with those at the top of the hierarchy, considering the entire population, and the SII corresponds to the difference of rates between groups, instead of rate ratios. A large value on the indices implies large differences in the health status between high and low positions in the social hierarchy.[70,295,310] In this manner, the RII and SII summarise in one single value the association between the socioeconomic position and the outcome of interest considering all socioeconomic groups at once.[295,310,362] Another characteristic of the RII and SII is that these not only retain the inherent order of the categories of the SEP, but also they consider the proportion of the population the categories reflect. [310] This latter property results particularly useful to compare health inequalities over time or among countries, where it is needed to take into account changes in the size of the categories of SEP over time and the different distribution of the population across SEP in different countries.[295,309,310,359] In this way, these summary measures of health inequalities avoid variability in the size of socioeconomic groups that may be a source of variation in the magnitude of inequalities.

RII and SII are regression-based measures, estimated through a regression analysis of a dependent health variable on an indicator of the cumulative relative position of each group with respect to a socioeconomic variable. The RII can be obtained by logistic regression, Poisson or log-binomial regressions. [70,294,310,362,363] The RII by logistic regression is the odds ratio of the health outcome at the lowest and highest levels of socioeconomic position, whereas, the RII by Poisson or log-binomial regression is the prevalence ratio between two ends of socioeconomic hierarchy. [322] In the analyses with the socioeconomic groups ordered from highest to lowest, values of RII will be larger than one when the health indicator increases with decreasing socioeconomic status and less than one when it declines as the socioeconomic position decreases. In turn, SII can be obtained by linear regression models and can be interpreted as the average change in the health indicator over the entire population ordered by level of socioeconomic position.[310,364] When socioeconomic variable is ordered from highest to lowest the slope will have positive values when health indicator increases with lower levels of SEP, and negative when the indicator increases as the socioeconomic status increases.

In addition, RII and SII assume linear association between socioeconomic position and the outcome. Therefore, a non-linear association may induce a bias in the estimated RII and SII. [295,365]

In this thesis, the Relative Index of Inequality and the Slope Index of Inequalities were estimated to analyse socioeconomic inequalities in blood pressure in Chile and their changes over time. RII and SII were estimated for the association between each measure of blood pressure and three SEP indicators, education, assets-based SEP and occupation including only the three categories of workers. This latter, considering that these indices can be applied to socioeconomic variables which can be ordered hierarchically.

The RII and SII were calculated in two steps. In the first step SEP groups were ordered from highest to lowest level of each SEP measure and for each survey and each group was assigned a score between 0 (highest SEP) and 1 (lowest SEP). In this manner a variable was created for education, assets-based SEP and occupation for each survey, based on the distribution of people in these ordered categories. The score was estimated by calculating the midpoint of the relative position in the cumulative population distribution in each group. For instance, if the highest level of the SEP of interest comprises 10% of the population, a value of 0.05 (0.1/2) was assigned to this category, and if the second level of SEP includes 20% of the population, its range is from 10% to 30%, thus it was assigned a value of 0.2 (0.1+(0.2/2)), and so forth.

In the second step, these weighted scores measure of SEP were related to SBP, DBP and hypertension by means of regressions analyses, adjusting for age as a continuous variable, marital status as a categorical variable with three categories, and sex and place of residence as binary variables. As recommended in the literature, generalised linear models were used to estimate the indices.[294,321,322] In the case of SBP and DBP, a normal distribution was specified and a logarithmic link function was added for the estimation of the RII, and an identity link option was included in the models for SII. In turn, the indices for RII and SII for hypertension, because of convergence troubles, were estimated by using robust Poisson and linear regression models respectively. These models have been utilised in other studies as an alternative to generalised linear regression (log-binomial regression) models or when convergence problems were faced.[366-368] Both indices were estimated with 95% confidence intervals.

In order to compare inequalities in blood pressure between genders, two-way interaction terms between each weighted SEP measure and sex were included for each outcome and by each survey. Differences by age in RII and SII at each survey were also assessed by inclusion of the two-way interaction term weighted SEP measure by age group for each survey.

For the comparison of inequalities in blood pressure between 2003 and 2010, interaction effects between SEP measures and survey year were estimated to test for significant differences in relative and absolute inequalities over time. Two-way interaction terms between each weighted measure of SEP and the survey year were introduced in the models, and the levels of significance of their coefficients are reported as part of the results.

Considering that RII and SII assume linear association between SEP and the outcome, statistical testing of linearity assumption were carried out by including a quadratic term of the each SEP score to each of the models. If the coefficient of the quadratic term is significant, then the association between the outcome and SEP is considered non-linear.[295,365]

5.3 Results

This section presents the results obtained for descriptive analysis of the samples in 2003 and 2010, gender and age effects on the association between blood pressure and SEP in 2003 and 2010, multivariable analysis of the association between blood pressure and SEP in 2003 and 2010, relative and absolute inequalities in blood pressure in 2003 and 2010, and additional analysis in 2010.

5.3.1 Descriptive characteristics of analytical samples

Characteristics of the sample, including frequencies and percentages and means in weighted samples are summarized in Table 5-1 and 5-2. The sample comprised 3,042 participants aged 20-97 years in 2003 and 4,055 participants aged 20-100 years in 2010. The mean age in 2003 was 42.6, while in 2010 this was 43.9 (Table 5-1).

About 60% of the individuals in both samples were married/cohabiting couples and more than 80% lived in urban areas in both 2003 and 2010.

Regarding to the distribution of the samples across SEP, there was a slight difference in educational attainment between men and women in both surveys. The proportion of women in the lowest level of education was higher than men in both surveys (Table 5-1). About half of individuals in both samples were in the intermediate group of education in both 2003 and 2010 but proportion of those with higher education increased both in men and women in 2010. The distribution of individuals according assets-based index changed markedly between 2003 and 2010. While about 15% of the individual were in the highest level of this SEP in 2003, this proportion raised to nearly 50% in 2010.

The distribution across occupation showed large differences by gender. About 70% of men in both surveys were workers, while only 31% of the women in 2003 and 42% in 2010 reported being a worker. In 2003 there were no home-makers among men, and only 24 men (2%) reported being a homemaker in 2010.

A larger proportion of men than women were classified as having hypertension in both surveys. Likewise a higher mean of SBP and DBP was observed among men than women (Table 5-2). The three blood pressure measures decreased between 2003 and 2010. Meanwhile, mean BMI and prevalence of DM were higher in women than men, in both, 2003 and 2010, and these measures increased between the two surveys (Table 5-2). Proportion of people who did not do physical activity outside work was over 60% in men and over 80% in women, in both surveys, and also tended to increase slightly between the two surveys (Table 5-2). Smoking prevalence (current smoker) was over 40% in men and over 30% in women in both years. The proportion of men who reported being current smoker decreased between 2003 and 2010 from 48% to 43%. Among women, prevalence of smoking remained stable over time (Table 5-2).

Descriptive analysis by three age groups and by the three SEP measures used in this thesis is shown in Table 5-3 to Table 5-5. As expected prevalence of hypertension and levels of SBP and DBP are higher in older people. Similarly, the proportion of people with diabetes mellitus is also larger in people aged 60 and over (21-25%). In addition, older people are less educated than those younger and 40-50% of them are retired.

Regarding distribution by SEP, in general people in the lowest level of education have higher levels of blood pressure and higher BMI, have larger prevalence of diabetes mellitus and are most sedentary than most educated (Table 5-4). Unlike, people less educated have the lowest prevalence of smoking. Differences across assets-based SEP are less marked than across education (Table 5-4). Analysis by occupational class shows differences in particular for retired people who have higher levels of blood pressure and higher prevalence of diabetes mellitus (Table 5-5).

Table 5-1: Socio-demographic characteristics of the samples 2003 and 2010. Estimated weighted proportions and means.

	2003				2010			
	Men		Women		Men		Women	
	N	%/mean	N	%/mean	N	%/mean	N	%/mean
Age mean		41.6		47.9		43.0		44.8
Age groups (%)								
20-34	574	39.0	558	35.5	627	33.2	635	29.3
35-44	347	23.6	356	22.7	469	24.8	539	24.9
45-54	248	16.9	265	16.9	349	18.5	414	19.1
55-64	165	11.1	186	11.9	253	13.4	290	13.4
65 and over	138	9.4	204	13.0	191	10.1	288	13.3
Marital Status (%)								
Married/cohabiting	933	63.4	955	60.8	1,196	63.3	1,234	57.0
Single	476	32.3	397	25.3	582	30.8	650	30.0
Divorced/Separated/Widowed	63	4.3	218	13.9	111	5.9	282	13.0
Place of residence (%)								
Urban	1,235	83.9	1,374	87.5	1,640	86.8	1,906	88.0
Rural	237	16.1	196	12.5	249	13.2	260	12.0
Level of education (%)								
High	315	21.4	259	16.5	527	27.9	585	27.0
Middle	820	55.7	820	52.2	1,065	56.4	1,131	52.2
Low	337	22.9	491	31.3	297	15.7	451	20.8
Assets based SEP (%)								
High	224	15.2	220	14.0	945	50.0	962	44.4
Middle	890	60.5	967	61.6	786	41.6	1,016	46.9
Low	358	24.3	383	24.4	158	8.4	188	8.7
Occupation (%)								
Higher worker	236	16.0	100	6.4	160	8.5	203	9.4
Intermediate worker	135	9.2	193	12.3	467	24.7	405	18.7
Routine and manual	642	43.6	195	12.4	795	42.1	284	13.1
Home-maker	0	0.0	810	51.6	34	1.8	832	38.4
Inactive	306	20.8	201	12.8	246	13.0	204	9.4
Retired	153	10.4	71	4.5	187	9.9	238	11.0

Table 5-2: Health related characteristics of the samples 2003 and 2010. Proportions and means estimated with weighted samples.

	2003				2010			
	Men		Women		Men		Women	
	N (weighted sample)	%/mean weighted sample	N (weighted sample)	%/mean weighted sample	N (weighted sample)	%/mean weighted sample	N (weighted sample)	%/mean weighted sample
Hypertension (yes) (%)	567	38.5	518	33.0	604	32.0	622	28.7
Systolic blood pressure (mean)	1,472	132.9	1,570	128.0	1,889	132.2	2,166	125.1
Diastolic blood pressure (mean)	1,472	84.1	1,570	79.0	1,889	80.0	2,166	75.7
Body mass index (mean)	1,472	26.7	1,570	27.5	1,889	27.3	2,166	28.2
Diabetes Mellitus (%)	93	6.3	105	6.7	168	8.9	219	10.1
Family history of hypertension (%)	599	40.7	688	43.8	714	37.8	1,098	50.7
Physical activity (%)								
Three or more times per week	152	10.3	146	9.3	232	12.3	130	6.0
Less than three times per week	396	26.9	140	8.9	376	19.9	199	9.2
Do not do physical activity (sedentary)	924	62.8	1284	81.8	1281	67.8	1837	84.8
Smoking (%)								
Current smoker	708	48.1	572	36.4	810	42.9	791	36.5
Past smoker	264	17.9	188	12.0	391	20.7	314	14.5
Never smoker	500	34.0	810	51.6	688	36.4	1,061	49.0

Table 5-3: Characteristics of the samples 2003 and 2010 by three age groups (years). Proportions and means estimated with weighted samples.

	2003						2010					
	20-39		40-59		60 and over		20-39		40-59		60 and over	
	N (weighted sample)	%/mean weighted sample	N (weighted sample)	%/mean weighted sample	N (weighted sample)	%/mean weighted sample	N (weighted sample)	%/mean weighted sample	N (weighted sample)	%/mean weighted sample	N (weighted sample)	%/mean weighted sample
Level of education (%)												
High	412	27.8	177	16.6	23	4.6	674	38.8	305	19.5	101	13.4
Middle	909	61.3	567	53.3	137	27.7	947	54.5	965	61.6	264	35.0
Low	162	11.0	320	30.1	335	67.7	115	6.7	295	18.8	389	51.6
Assets based SEP (%)												
High	221	14.9	166	15.6	49	9.9	857	49.3	728	46.5	281	37.2
Middle	878	59.2	654	61.5	328	66.3	762	43.9	682	43.6	359	47.6
Low	384	25.9	244	22.9	118	23.8	118	6.8	155	9.9	114	15.2
Occupation (%)												
Higher worker	176	11.8	160	15.0	19	3.8	195	11.3	123	7.9	35	4.6
Intermediate worker	237	16.0	100	9.4	6	1.2	451	26.0	355	22.7	53	7.1
Routine and manual	399	26.9	366	34.4	47	9.5	460	26.5	519	33.1	106	14.1
Home-maker	319	21.5	298	28.0	181	36.5	286	16.5	412	26.3	155	20.6
Inactive	346	23.3	102	9.6	54	10.8	337	19.4	112	7.1	29	3.8
Retired	6	0.4	39	3.7	189	38.2	6	0.4	44	2.8	376	49.8
Hypertension (yes)(%)	222	15.0	487	45.8	369	74.6	174	10.0	534	34.1	515	68.3
Systolic blood pressure (mean)		119.6		134.9		153.2		117.8		130.0		149.7
Diastolic blood pressure (mean)		76.3		85.9		87.4		74.2		80.4		80.3
Body mass index (Mean)		26.0		28.3		28.0		26.8		28.4		28.6
Diabetes Mellitus (%)	8	0.5	90	8.5	104	21.0	21	1.2	185	11.8	189	25.1
Familiy history of hypertension (%)	650	43.8	514	48.3	118	23.8	765	44.1	711	45.4	287	38.0
Physical activity (%)												
Three or more times per week	179	12.1	87	8.1	28	5.6	215	12.4	114	7.3	39	5.2
Less than three times per week	356	24.0	145	13.6	34	6.9	382	22.0	194	12.4	46	6.1
Do not do physical activity	947	63.9	833	78.3	433	87.5	1139	65.6	1257	80.3	669	88.7
Smoking (%)												
Never smoker	570	38.4	419	39.4	295	59.7	681	39.2	654	41.8	408	54.1
Past smoker	132	8.9	209	19.6	136	27.4	168	9.7	357	22.8	214	28.3
Current smoker	781	52.7	436	41.0	64	12.9	888	51.1	553	35.4	133	17.6

Table 5-4: Characteristics of the samples 2003 and 2010 by education and assets-based index.

	2003						2010					
	Education						Education					
	High		Middle		Low		High		Middle		Low	
Hypertension (yes)(%)	128	22.4	514	31.3	453	54.7	212	19.1	628	28.6	393	52.5
Systolic blood pressure (mean)		121.9		127.8		141.3		122.6		127.2		140.7
Diastolic blood pressure (mean)		78.4		80.7		85.1		76.8		77.5		79.6
Body mass index (Mean)		26.2		26.9		28.2		27.1		27.6		29.1
Diabetes mellitus(%)	8	1.5	80	4.8	119	14.4	70	6.26	181	8.2	153	20.4
Family history of hypertension(%)	284	49.5	729	44.4	263	31.8	483	43.4	977	44.5	301	40.2
Physical activity(%)												
Three or more times per week	86	15.0	172	10.5	37	4.4	183	16.5	166	7.6	16	2.1
Less than three times per week	136	23.6	323	19.7	77	9.3	211	19.0	316	14.4	40	5.4
Do not do physical activity	352	61.3	1145	69.8	714	86.3	718	64.5	1712	78.0	692	92.5
Smoking (%)												
Never smoker	217	37.8	626	38.2	443	53.6	406	36.5	922	42.0	412	55.1
Past smoker	95	16.5	201	12.2	182	22.0	192	17.3	396	18.1	157	21.0
Current smoker	262	45.7	813	49.6	202	24.4	514	46.2	876	39.9	179	23.9
	Assets-based index						Assets-based index					
	High		Middle		Low		High		Middle		Low	
Hypertension (yes) (%)	127	28.6	685	36.9	274	37.0	519	27.2	605	33.6	129	37.2
Systolic blood pressure (mean)		126.1		130.8		131.8		125.9		130.4		131.8
Diastolic blood pressure (mean)		79.7		81.8		81.6		77.4		78.0		77.7
Body mass index (Mean)		26.2		27.3		27.3		27.3		28.3		27.2
Diabetes mellitus (%)	19	4.2	132	7.1	53	7.1	174	9.10	180	10.0	56	16.3
Family history of hypertension(%)	206	46.3	810	43.6	260	35.1	845	44.3	769	42.7	146	42.3
Physical activity(%)												
Three or more times per week	77	17.3	169	9.1	47	6.4	227	11.9	110	6.1	22	6.5
Less than three times per week	85	19.1	345	18.6	104	14.0	282	14.8	241	13.4	37	10.6
Do not do physical activity	282	63.5	1341	72.2	591	79.7	1360	71.3	1371	76.1	279	80.7
Smoking (%)												
Never smoker	185	41.7	793	42.7	327	44.1	780	40.9	809	44.9	161	46.6
Past smoker	62	13.9	274	14.8	116	15.6	362	19.0	317	17.6	69	19.9
Current smoker	197	44.4	790	42.5	298	40.2	765	40.1	677	37.6	116	33.5

Table 5-5: Characteristics of the samples 2003 and 2010 by occupational status.

	Occupation											
	2003											
	Higher worker		Intermediate worker		Manual worker		Homemaker		Inactive		Retired	
Hypertension (yes) (%)	123	36.5	61	18.5	277	33.1	321	39.6	144	28.5	157	70.3
Systolic blood pressure (mean)		130.5		120.7		130.1		131.9		125.0		152.2
Diastolic blood pressure (mean)		84.2		76.4		82.7		80.8		78.8		88.4
Body mass index (Mean)		27.7		25.9		26.9		28.3		25.9		27.6
Diabetes mellitus (%)	17	5.0	11	3.3	33	4.0	67	8.3	31	6.2	46	20.7
Family history of hypertension(%)	181	54.0	168	51.2	321	38.3	328	40.5	211	41.7	65	29.2
Physical activity(%)												
Three or more times per week	49	14.5	23	7.0	74	8.9	61	7.5	75	14.8	14	6.4
Less than three times per week	82	24.4	67	20.4	205	24.6	72	8.9	82	16.1	26	11.5
Do not do physical activity	205	61.2	238	72.7	557	66.5	678	83.7	350	69.1	184	82.1
Smoking (%)												
Never smoker	131	39.1	128	39.1	278	33.3	463	57.2	172	33.9	111	49.5
Past smoker	60	17.8	32	9.6	130	15.5	116	14.3	71	13.9	72	32.2
Current smoker	145	43.1	168	51.3	429	51.3	231	28.5	264	52.1	41	18.2
	2010											
Hypertension (yes) (%)	85	23.5	209	24.0	296	27.4	276	31.9	85	18.8	304	71.6
Systolic blood pressure (mean)		123.9		123.0		129.7		127.6		122.2		148.8
Diastolic blood pressure (mean)		78.5		77.3		79.2		76.7		75.3		78.9
Body mass index (Mean)		28.7		27.3		27.5		28.7		25.9		28.8
Diabetes mellitus (%)	18	5.0	42	4.8	64	5.9	88	10.2	29	6.5	99	23.4
Family history of hypertension(%)	154	42.4	411	47.1	418	38.7	449	51.8	213	47.4	150	35.3
Physical activity(%)												
Three or more times per week	44	12.3	78	8.9	74	6.9	48	5.6	96	21.3	13	3.0
Less than three times per week	64	17.8	163	18.7	180	16.7	64	7.3	79	17.5	22	5.2
Do not do physical activity	254	70.0	631	72.3	825	76.5	754	87.1	275	61.2	390	91.8
Smoking (%)												
Never smoker	126	34.8	305	34.9	446	41.3	446	51.5	197	43.8	228	53.6
Past smoker	83	22.8	161	18.5	189	17.5	122	14.0	48	10.6	124	29.1
Current smoker	154	42.4	406	46.6	444	41.2	298	34.4	205	45.5	73	17.3

5.3.2 Analysis of the association between socio-economic position and blood pressure, age and sex effects

5.3.2.1 National Health Survey 2003

The results reported in this section examine the association between blood pressure and socioeconomic position, and the effects of age and sex on this association. The analytical procedure consisted of a series of regression analyses with SBP, DBP[f] and hypertension as outcomes, educational level, assets-based index and occupation as exposures, and age and sex as potential confounders or modifiers of this association. This analytical strategy has been described in detail in section 5.2.2 and it is briefly reiterated below.

Linear regression models for SBP and DBP and Poisson regressions models for hypertension were fitted to determine the individual association between each of the three outcomes and the three SEP measures. Crude, age-adjusted, sex-adjusted and age-sex-adjusted means and rates were estimated for each measure of socioeconomic position included in this project. Additional analysis was carried out in order to analyse the effect of age and sex on the association between each of the three outcomes studied in this research and each of the three socioeconomic measures. In this manner, interactions between age group and three measures of SEP, and between sex and measures of SEP, were assessed, and depending on the results, stratified analysis was conducted.

Results are firstly shown for education, followed by analysis related to assets-based index, and finally, the results are shown for the analysis related to occupation status.

The role of age and sex in the association between blood pressure and education

Crude rates of hypertension and crude means of SBP and DPB showed marked inverse gradients across educational levels (Appendix 5, Table A5.1). For example, the mean of SBP was around 6 mmHg higher for the middle level of education than that for the most educated people. Less educated, in turn, had a mean of SBP around 20 mmHg higher than the group with the highest level of education. In the case of hypertension, prevalence

[f] SBP and DBP were adjusted people who reported being on treatment with antihypertensive drugs (see section 4.3.5).

ratios were 1.5 and 2.6 for the intermediate and the lowest educational respectively compared to the highest level. Namely, less educated people had a higher risk, while the most educated had the lowest risk of raised blood pressure.

Adjustments for age and sex

After adjusting for age (as a continuous variable) the inverse gradient across educational levels flattened dramatically. So much so, that the association remained statistically significant only for SBP (Appendix 5, Table A5.1). Besides weakening the association between SBP and education, adjustment for age also supressed the gradient between educational levels and DBP and hypertension. Adjustment for only sex, resulted in a slightly increase in the inverse gradient between blood pressure and education (Appendix 5, Table A5.1). For instance, beta coefficients for SBP changed from 5.9 and 19.4 in intermediate and the lowest educational levels to 6.2 and 20.3 after adjustment for sex (Appendix 5, Table A5.1).

Modifying effect of age on the association between blood pressure and education

Effect modification of age as categorical variable on the association between blood pressure and education was assessed. These evaluations were undertaken by categorising age into three age groups.

The assessment carried out for interactions between education and age categorised into three groups showed that these were significant for SBP, DBP and hypertension ($p=0.01$; <0.01 and $p=0.06$ respectively) (Table 5-6 and Figures 5-1 to 5-3). These results suggest that age categorised into three groups acted as an effect modifier.

Table 5-6: Effect of 3 age groups on association between educational group and blood pressure outcome, adjusted for sex. NHS 2003.

		SBP			DBP			Hypertension		
Education	N	Coef	95% CI	P value	Coef	95% CI	P value	PR	95% CI	P value
Age 20-39										
High	574	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1640	2.67	[-0.12,5.46]	0.06	0.86	[-1.33,3.06]	0.44	1.62	[0.84,3.13]	0.15
Low	828	4.25	[-0.50,9.00]	0.08	1.57	[-2.04,5.18]	0.39	1.86	[0.83,4.21]	0.13
P-value for trend				*0.04*			*0.35*			*0.09*
Age 40-59										
High	574	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1640	4.50	[-0.45,9.44]	0.07	1.56	[-1.69,4.82]	0.35	1.13	[0.82,1.58]	0.46
Low	828	10.70	[5.94,15.42]	<0.01	4.18	[1.13,7.23]	0.01	1.38	[1.02,1.89]	0.04
P-value for trend				<0.01			<0.01			0.01
Age 60 and over										
High	574	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1640	19.60	[7.34,31.82]	<0.01	11.00	[4.20,17.73]	<0.01	0.98	[0.79,1.21]	0.85
Low	828	16.80	[5.81,27.81]	<0.01	8.24	[1.75,14.72]	0.01	0.95	[0.79,1.14]	0.55
P-value for trend				0.46			0.83			0.52
p-value for age-education interaction			*0.01*			*<0.01*			*0.06*	
Sex (ref: men)		-6.7	[-8.48,-4.93]	<0.01	-5.77	[-6.95,-4.58]	<0.01	0.79	[0.71,0.89]	<0.01

Education was significantly negatively associated to SBP, DBP and hypertension in people aged 40-59 (p-value for trend <0.01, <0.01 and 0.01 respectively) (Table 5-6). An inverse gradient was also observed for SBP and for hypertension in the group aged 20-39. In group aged 60 and over individuals in the highest educational level showed the lowest risk of raised SBP and DBP, whereas the intermediate and the lowest levels of education showed the highest levels of SPB and DBP (see Figures 5-1 and 5-2). Otherwise in the case of hypertension, people in the highest level tended to show the highest risk, which may be because people in high education group at this age may be more likely to take antihypertensive drugs. In fact, analysis of the proportion of antihypertensive drugs consumption by educational level showed that effectively people in the highest level of education were more likely to take these drugs (see Table 5-7).

Table 5-7: Consumption of antihypertensive drugs by educational level. NHS 2003

Level of education	% people taking antihypertensive drugs
Low	40%
Intermediate	43%
High	51%

Figure 5-1: Predictive means of systolic blood pressure for interaction between education and age group, adjusted for sex. NHS 2003

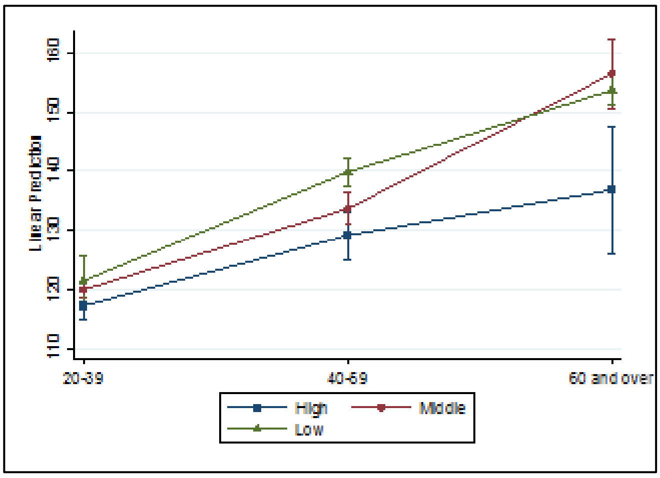


Figure 5-2: Predictive means of diastolic blood pressure for interaction between education and age group, adjusted for sex. NHS2003

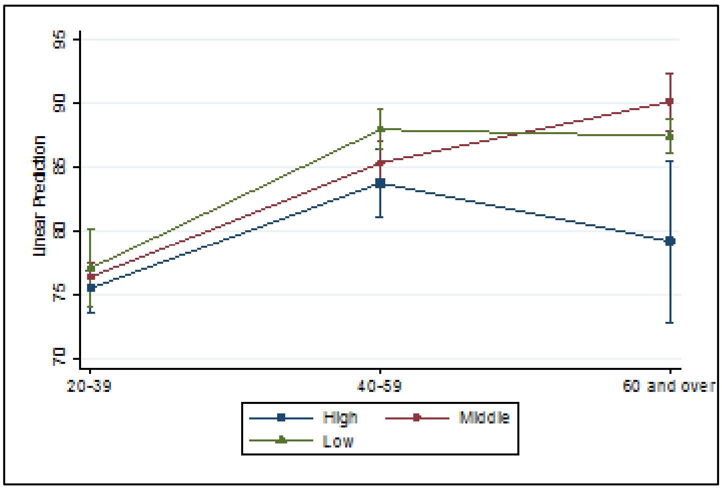
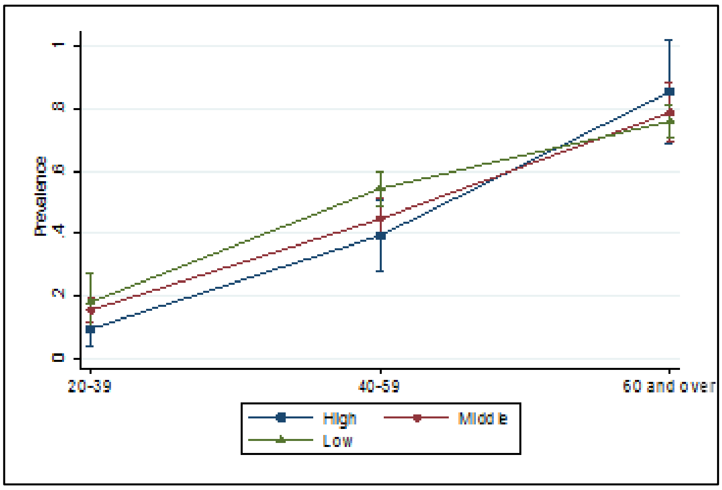


Figure 5-3: Predictive prevalence of hypertension for interaction between education and age group, adjusted for sex. NHS2003.



Modifying effect of sex on the association between blood pressure and education

In addition, effects of sex on the association between blood pressure and education were analysed. In this way, interactions between sex and education were assessed, after adjustment for age as a continuous variable, for each of the three outcomes studied. Results obtained showed significant interactions of sex and education for the three outcomes ($p<0.01$, $p=0.02$ and $p=0.02$ respectively) (Table 5-8 and Figures 5-4 to 5-6). As it can be seen in Figures 5-4 to 5-6 the effect of educational level on blood pressure was greater in women than men, and moreover this was more marked for SBP and hypertension.

Table 5-8: Effect of sex on association between educational group and blood pressure outcome, after adjustment for age as a continuous variable. NHS 2003.

		SBP			DBP			Hypertension		
	Weighted N	Coef	95% CI	p value	Coef	95% CI	p value	PR	95% CI	p value
Men										
High	574	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1640	-0.22	[-3.69,3.24]	0.90	-1.13	[-3.72,1.47]	0.39	0.96	[0.73,1.26]	0.77
Low	828	-0.49	[-4.50,3.53]	0.81	-1.35	[-4.36,1.65]	0.38	0.92	[0.70,1.22]	0.57
P-value for trend				*0.85*			*0.42*			*0.60*
Women										
High	574	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1640	6.67	[3.01,10.34]	<0.01	4.01	[1.31,6.71]	<0.01	2.11	[1.12,3.97]	0.02
Low	828	9.95	[5.87,14.03]	<0.01	4.05	[1.14,6.97]	0.01	2.24	[1.20,4.18]	0.01
P-value for trend				*<0.01*			*0.02*			*<0.01*
P for sex-education interaction			*<0.01*			*0.02*			*0.02*	
Age		0.78	[0.71,0.85]	<0.01	0.31	[0.28,0.35]	<0.01	1.04	[1.03,1.04]	<0.01

Figure 5-4: Predictive means of systolic blood pressure for interaction between education and sex, adjusted for age as a continuous. NHS2003.

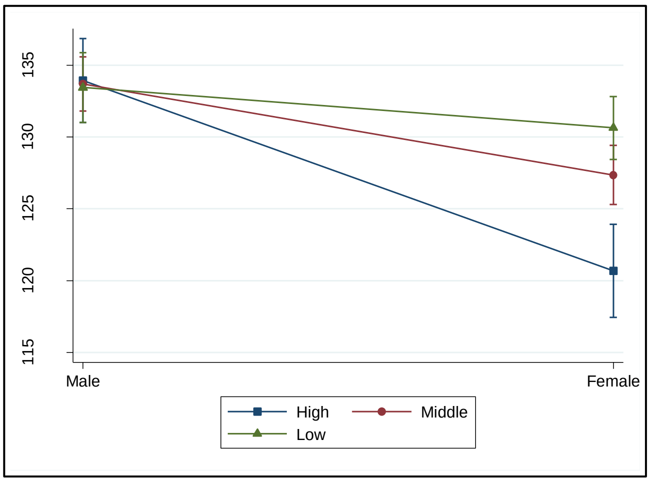


Figure 5-5: Predictive mean of diastolic blood pressure for interaction between education and sex, adjusted for age as a continuous. NHS2003

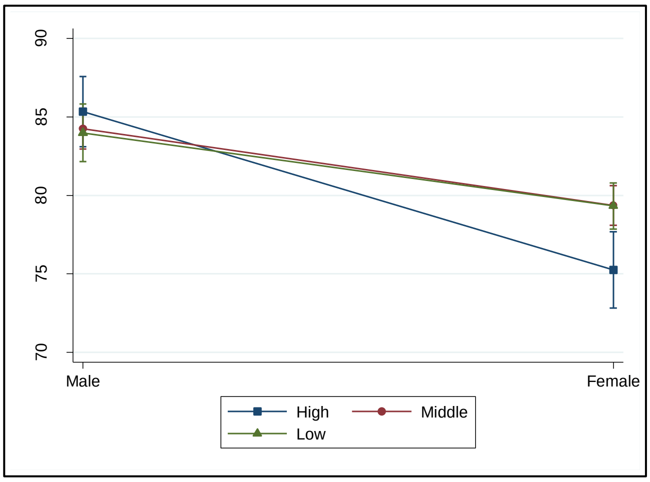
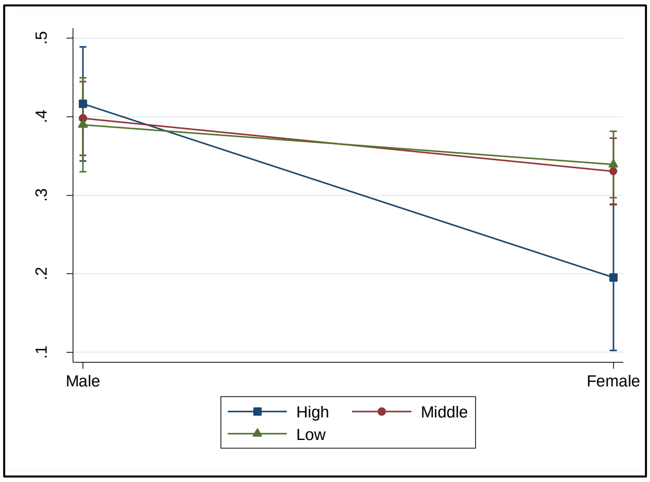


Figure 5-6: Predictive prevalence of hypertension for interaction between education and sex, adjusted for age as a continuous. NHS2003.



Moreover, regressions parameters showed that education was significant and negatively related to SBP (p-value for trend <0.01) (Table 5-8). In turn, regression estimates for DBP showed that women with intermediate and lower levels of education had similar risk of raised DBP, and at the same time, a higher risk than those in the highest level of education (p-value for trend = 0.02) (Table 5-8). Similarly, prevalence ratios of hypertension showed that women in the middle and in the lowest levels of education had twice higher risk than those in the highest level of education (p-value for trend <0.01) (Table 5-8). There were not association between education and all the three outcomes in men (Table 5-8).

In summary, results in this section suggest that sex was acting as an effect modifier of the association between blood pressure and education, and findings showed educational gradients in women but not in men.

Modifying effect of age and sex on the association between blood pressure and education.

Given that interaction terms between education and age and between education and sex were both significant, interactions between education and age group with three categories were assessed after adjustment for the interaction between education and sex and vice versa. Results showed that interactions between age with three categories with education were significant for the three outcomes (Table 5-9 to 5-11). Interactions between education and sex after adjustment for the interaction between education and age group resulted significant for the three outcomes (Tables 5-9 to 5-11).

These results also showed that women aged 20-39 and 40-59 had significant inverse gradients of SBP across educational levels. In older women, those with intermediate level and the lowest level of education had a higher risk of raised SBP than those most privileged women, but the p-value for trend of this association was not significant (Table 5-9). In men, the association between SBP and education showed an inverse gradient in those aged 40-59. Men aged 20-39 had a no significant association between education and SBP (Table 5-9). In older men (60 and over), those in the intermediate group had the highest risk of SBP (Table 5-9).

Table 5-9: Effect of 3 age groups and sex on association between SBP and education. NHS 2003

	Men and 20-39 years (Ref)				Women and 20-39 years (Ref)			
	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
High	574	Ref	-	-	574	Ref	-	-
Middle	1640	-0.44	[-3.56,2.67]	0.78	1640	6.40	[2.32,10.48]	<0.01
Low	828	-1.69	[-6.80,3.42]	0.52	828	9.85	[3.91,15.78]	<0.01
P-value for trend				*0.77*				*<0.01*
	Men and 40-59 years (Ref)				Women and 40-59 years (Ref)			
	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
High	574	Ref	-	-	574	Ref	-	-
Middle	1640	1.24	[-4.06,6.53]	0.65	1640	8.08	[3.11,13.05]	<0.01
Low	828	4.72	[-0.47,9.90]	0.07	828	16.30	[11.41,21.10]	<0.01
P-value for trend				*0.04*				*<0.01*
	Men and 60 and older (Ref)				Women and 60 and older (Ref)			
	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
High	574	Ref	-	-	574	Ref	-	-
Middle	1640	18.30	[4.86,31.77]	0.01	1640	25.20	[11.82,38.49]	<0.01
Low	828	12.70	[0.19,25.20]	0.05	828	24.20	[12.21,36.26]	<0.01
P-value for trend				*0.93*				*0.13*
Interaction education*age group after adjusting for education*sex								0.06
Interaction education*sex after adjusting for education*age								<0.01

Table 5-10: Effect of 3 age groups and sex on association between DBP and education. NHS 2003.

	Men and 20-39 years (Ref)				Women and 20-39 years (Ref)			
	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
High	574	Ref	-	-	574	Ref	-	-
Middle	1640	-1.70	[-4.02,0.63]	0.15	1640	3.85	[0.51,7.19]	0.02
Low	828	-1.53	[-5.27,2.20]	0.42	828	4.77	[0.29,9.25]	0.04
P-value for trend				*0.54*				*0.05*
	Men and 40-59 years (Ref)				Women and 40-59 years (Ref)			
	Weighted N							
High	574	Ref	-	-	574	Ref	-	-
Middle	1640	-1.08	[-4.69,2.53]	0.56	1640	4.47	[1.16,7.77]	0.01
Low	828	1.02	[-2.57,4.61]	0.58	828	7.32	[4.22,10.43]	<0.01
P-value for trend				*0.40*				*<0.01*
	Men and 60 and older (Ref)				Women and 60 and older (Ref)			
	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
High	574	Ref	-	-	574	Ref	-	-
Middle	1640	9.61	[1.96,17.26]	0.01	1640	15.20	[7.75,22.56]	<0.01
Low	828	6.41	[-1.06,13.87]	0.09	828	12.70	[5.52,19.90]	<0.01
P-value for trend				*0.62*				*0.33*
Interaction education*age group after adjusting for education*sex								<0.01
Interaction education*sex after adjusting for education*age group								0.01

Table 5-11 Effect of 3 age groups and sex on association between hypertension and education. NHS 2003

	Men and 20-39 years (Ref)				Women and 20-39 years (Ref)			
	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
High	574	Ref	-	-	574	Ref	-	-
Middle	1640	1.28	[0.68,2.41]	0.44	1640	2.73	[1.06,7.06]	0.04
Low	828	1.34	[0.59,3.01]	0.48	828	3.38	[1.18,9.67]	0.02
P-value for trend				*0.31*				*0.01*
	Men and 40-59 years (Ref)				Women and 40-59 years (Ref)			
High	574	Ref	-	-	574	Ref	-	-
Middle	1640	0.88	[0.63,1.24]	0.47	1640	1.88	[1.03,3.44]	0.04
Low	828	0.98	[0.71,1.35]	0.92	828	2.49	[1.40,4.42]	0.00
P-value for trend				*0.69*				*<0.01*
	Men and 60 and older (Ref)				Women and 60 and older (Ref)			
	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
High	574	Ref	-	-	574	Ref	-	-
Middle	1640	0.90	[0.71,1.15]	0.41	1640	1.93	[0.97,3.81]	0.06
Low	828	0.79	[0.64,0.98]	0.03	828	2.00	[1.03,3.87]	0.04
P-value for trend				*<0.01*				*0.06*
Interaction education*age group after adjusting for education*sex								<0.01
Interaction education*sex after adjusting for education*age group								0.02

Patterns observed for DBP were similar to those for SBP. In this manner, inverse gradients were observed in women in 20-39 and 40-59 age groups, while in older women, the intermediate level of education had the highest risk (Table 5-10). In men, there were no differences among educational levels in those aged 20-39. Moreover, men aged 40-59 showed a significant inverse gradient for SBP (p-value for trend =0.04) but not for DBP. In turn, men aged 60 and over with intermediate level of education had the highest risk of raised DBP (Table 5-10).

In addition, significant inverse gradient across educational levels were observed for hypertension in women aged 20-39 and 40-59 (Table 5-11). An inverse gradient was also found for women aged 60 and over. There were not significant associations between education and hypertension in men aged 20-39 and 40-59. In men aged 60 and over, a significant positive gradient was observed, so that those most educated had the highest risk (Table 5-11).

Summary and main findings about the role of age and sex in the association between blood pressure and education in 2003

In summary, association between blood pressure and education is different according the outcome used in the analysis and is affected by age and sex.

After analysing the effect of age, it is possible to point out that age was acting as an effect modifier of the association between SBP and education. According to the results obtained, the effect of age with three age groups showed that the interaction was significant for the three outcomes. Considering that the association between blood pressure and education is affected by age, subsequent analysis included age-stratified analyses using age categorised into three groups.

On the other hand, analysis showed that gender interacted with the association between education and blood pressure. So that gender was acting as an effect modifier for each of the three outcomes. As a result, the variable sex and the interaction terms between education and sex should be included as variables of adjustment in subsequent analysis of the association between SBP, DBP and hypertension and education. Similarly, analysis stratified by sex was undertaken in the subsequent stages of this project.

Stratified analysis by three age groups showed that 20-39 and 40-59 age groups tended to show inverse gradient of blood pressure across educational level, and j-shaped associations were observed in people aged 60 and over. In addition, stratified analysis by sex showed that blood pressure was inversely related to education in women. When analysis of the association between blood pressure and education was carried out adjusting for interaction terms between education and age and education and sex, at the same time, it was possible to observe that women aged 20-39 and 40-59 showed inverse gradients for the three outcomes. In men, the association did not show a consistent pattern.

The role of age and sex in the association between blood pressure and assets-based SEP

Adjustments for age and sex

Crude means of SBP showed a significant inverse gradient across assets-based index (p-value for trend = 0.01). Adjustments for age, for sex, and for age and sex tended to strengthen this gradient (p-value for trend <0.01) (Appendix 5, Table A5.4). Neither crude nor adjusted estimates for the association between assets-based index and DBP and hypertension, were significant (Appendix 5, Table A5.4).

Modifying effect of age on the association between blood pressure and assets-based SEP

In order to determine the effect of age on the association between blood pressure and SEP based on assets, interactions terms between education and age as categorical variable were assessed.

The interaction term between assets-based index and age (three groups) was significant only when hypertension was the outcome (p<0.01) (Table 5-12 and Figure 5-7 to Figure 5-9). Regarding associations between blood pressure and SEP, inverse and significant associations were observed between SBP and assets-based index for people aged 20-39 and 40-59 but not for people aged 60 and over (p=0.02 and p<0.01 respectively) (Table 5-12). Assets-based index was not related to DBP or hypertension in any of the three age groups analysed (Table 5-12).

Modifying effect of sex on the association between blood pressure and assets-based index

The effect of sex on the association between blood pressure and assets-based index was also analysed before and after adjustment for age (as a continuous variable) and this was not significant for all three outcomes (Table 5-13 and Figures 5-10 to 5-12).

Although sex-assets index interaction terms were not significant, results by sex are shown in Table 5-13 for comparison purposes. A statistically significant inverse gradient of SBP across assets index was observed in women (p-value for trend <0.01) (Table 5-13). In men, although an inverse gradient was found for SBP, this was not significant (p-value for trend = 0.15) (Table 5-13). For DBP the risk was higher in the intermediate and in the lowest levels than in the highest level of assets-based index, in both genders, but these associations were not significant due to wide confident intervals (p-value for trend >0.05) (Table 5-13). The risk of hypertension was higher in the middle and in the lower levels of assets index groups than those in the highest level in women (Table 5-13).

Table 5-12: Effect 3 age groups on association between assets index and blood pressure outcomes. NHS 2003.

		SBP			DBP			Hypertension		
	N	Coef	95% CI	P value	Coef	95% CI	P value	PR	95% CI	P value
Age 20-39										
High	444	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1857	1.92	[-1.91,5.74]	0.33	0.62	[-2.02,3.26]	0.64	1.90	[0.85,4.22]	0.12
Low	741	4.45	[0.50,8.40]	0.03	1.67	[-1.17,4.51]	0.25	2.02	[0.88,4.63]	0.10
P-value for trend				*0.02*			*0.22*			*0.11*
Age 40-59										
High	444	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1857	8.42	[3.69,13.14]	<0.01	4.20	[1.46,6.94]	<0.01	1.35	[0.95,1.93]	0.09
Low	741	9.02	[3.78,14.26]	<0.01	3.23	[0.10,6.35]	0.04	1.40	[0.97,2.01]	0.07
P-value for trend				*<0.01*			*0.11*			*0.07*
Age 60 and over										
High	444	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1857	-6.28	[-21.64,9.08]	0.42	-0.07	[-6.41,6.26]	0.98	0.75	[0.67,0.83]	<0.01
Low	741	-0.55	[-16.11,15.01]	0.94	0.68	[-5.98,7.34]	0.84	0.82	[0.75,0.90]	<0.01
P-value for trend				*0.70*			*0.76*			*0.07*
P for age-assets interaction			*0.09*			*0.41*			*<0.01*	
Sex (ref: men)		-6.13	[-7.94,-4.31]	<0.01	-5.53	[-6.73,-4.34]	<0.01	0.8	[0.72,0.90]	<0.01

Figure 5-7: Predictive means of SBP for interaction between age (as categorical variable) and assets-based SEP. NHS 2003.

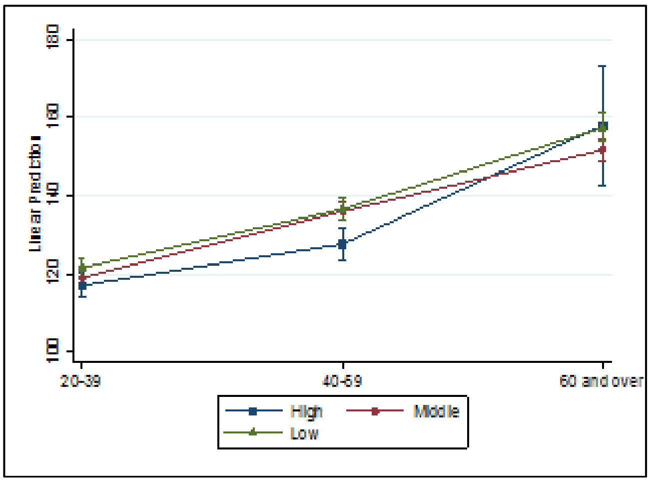


Figure 5-8: Predictive means of DBP for interaction between age (as categorical) and assets-based SEP. NHS2003.

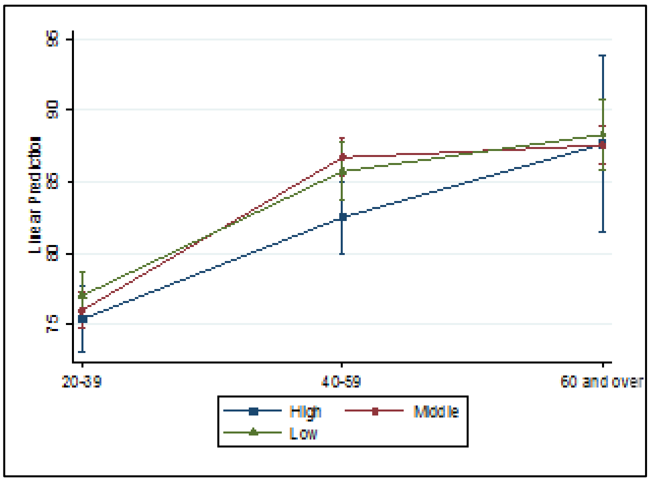


Figure 5-9: Predictive prevalence of hypertension for interaction between age (as categorical) and assets-based SEP. NHS2003

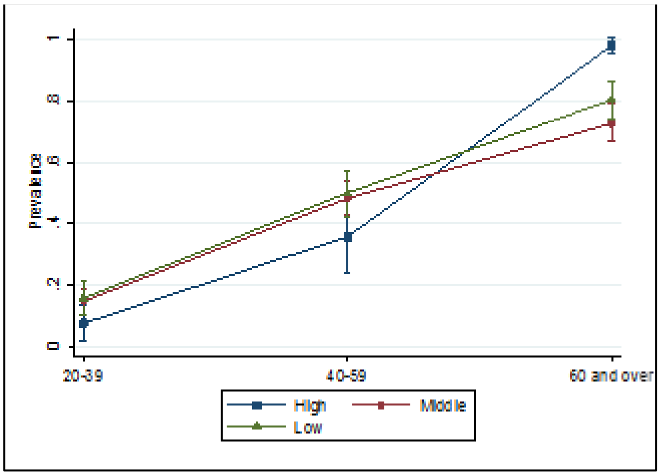


Table 5-13: Effect of sex on association between assets-based index and blood pressure outcomes. NHS 2003

		SBP			**DBP**			**Hypertension**		
	Weighted N	Coef	95% CI	p value	Coef	95% CI	p value	PR	95% CI	p value
Men										
High	444	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1857	1.25	[-3.06,5.56]	0.57	0.77	[-1.97,3.50]	0.58	1.01	[0.78,1.33]	0.91
Low	741	3.06	[-1.51,7.64]	0.19	0.91	[-2.15,3.97]	0.56	1.06	[0.78,1.44]	0.72
P-value for trend				*0.15*			*0.59*			*0.69*
Women										
High	444	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1857	5.75	[1.24,10.26]	0.01	2.75	[0.20,5.31]	0.03	1.43	[1.05,1.94]	0.02
Low	741	7.38	[2.49,12.27]	<0.01	2.68	[-0.20,5.57]	0.07	1.43	[1.03,2.00]	0.03
P-value for trend				*<0.01*			*0.13*			*0.06*
P for sex-assets interaction			*0.34*			*0.57*			*0.27*	
Age		0.82	[0.77,0.88]	<0.01	0.32	[0.29,0.36]	<0.01	1.04	[1.03,1.04]	<0.01

Figure 5-10: Predictive SBP of interaction between assets index and sex, after adjustment for age as a continuous variable. NHS 2003

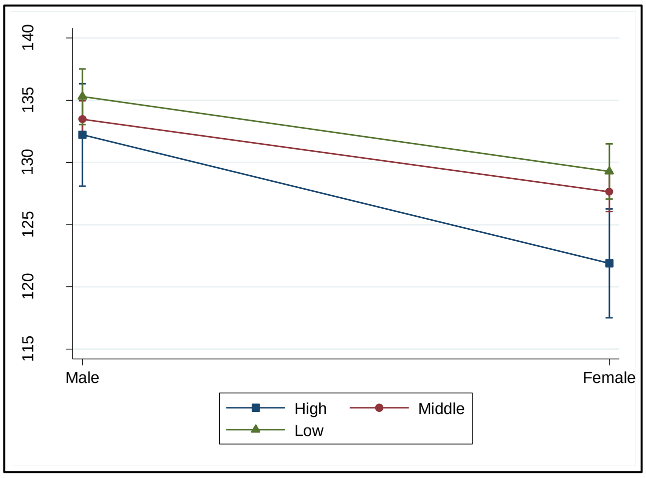


Figure 5-11: Predictive DBP of interaction between assets index and sex, after adjustment for age as a continuous variable. NHS 2003.

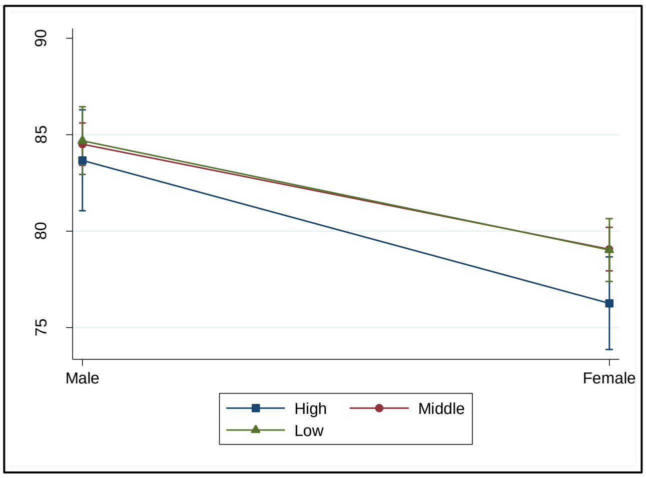
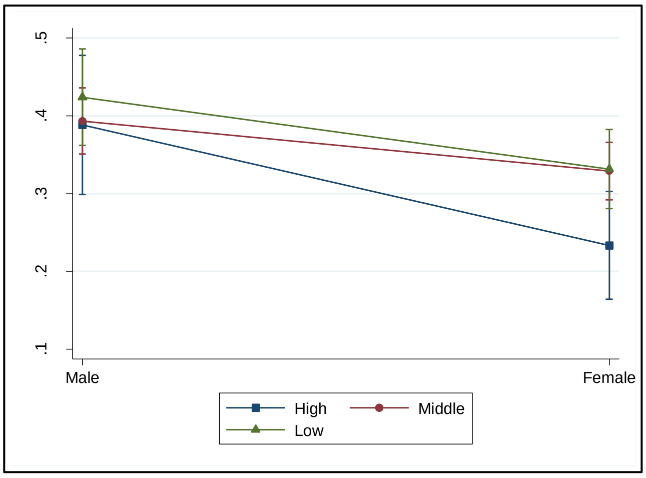


Figure 5-12: Predictive prevalence of hypertension of interaction between assets index and sex, after adjustment for age as a continuous variable. NHS 2003



Summary and main findings about the effect of age and sex on the association between blood pressure and assets-based socioeconomic position in 2003

Analysis of the effect of age and sex on the association between blood pressure and assets-based socioeconomic position showed that in general these variables had less effect than that observed for the association between blood pressure and education. For assets-based SEP, age as categorical variable with three categories was effect modifier only for hypertension. In this manner, subsequent analysis of the association between blood pressure and assets index should be adjusted for age. Also stratification by three age groups was undertaken or interactions terms between assets index and age as categorical was included in further analyses.

In turn, sex was neither effect modifier nor confounder on the association between assets based index and blood pressure, for any of the measures of blood pressure used. Therefore, subsequent analysis of the association between blood pressure and assets-based only included adjustment for sex, but not adjustment for the interaction term. In order to maintain the comparability with the analysis using other SEP measures, stratification by sex was carried out.

The role of age and sex in the association between blood pressure and occupation

In this section the association between occupation and blood pressure is analysed for the National Health Survey 2003. The first analysis is focused on the association between blood pressure and occupation considering six categories of workers and non-workers. The second part analyses the association between blood pressure and occupation but this time focuses on workers, namely on the three hierarchical categories of the occupation variable included in this research.

Analysis using occupation with six categories

Considering the important differences of the occupation variable found between genders (See descriptive characteristics of the sample Section 5.3.1 Table 5-1), estimations were undertaken stratified by sex. Crude estimates for the association between blood pressure and occupation showed that there were significant inequalities among the six categories of occupation for each of the three outcomes and for both genders (Appendix 5, Table A5.7).

Adjust*t*ments for age

Important changes were observed in the association between blood pressure and occupation after adjustment for age. The results for each of the three outcomes stratified by sex and adjusted for age as a continuous variable are shown in Appendix 5, Table A5.8. Inequalities in SBP among categories of occupation were not significant in either gender ($p > 0.05$). Differences in DBP across occupation were significant in men ($p<0.01$) and were near to reach statistical significance in women ($p=0.06$). In both gender, higher workers tended to show the highest risks of raised DBP. Similarly, inequalities of the risk of hypertension across occupation were significant for men and were in the limit of significance for women ($p<0.01$ and $p=0.06$ respectively). Higher workers had the highest risk of hypertension in men, whereas homemakers had the highest risk in women (Appendix 5, Table A5.8).

Modifying effect of age on the association between blood pressure and occupation

In addition, the effect of age on the association between blood pressure and occupation was assessed by including an interaction term between occupation and age with three categories. Models carried out to analyse the effect modifier of age as categorical variable on the association between occupation and hypertension did not reach convergence, therefore age was also assessed with other type of categories. Models using interaction term between age with two categories and occupation reached convergence for all the three outcomes, therefore, estimates from these models are shown in this section. Findings showed that age was not effect modifier when categorised into two groups in men, whereas in women, age acted as an effect modifier for the three outcomes (Table 5-14 and Table 5-15).

Regarding to the association between occupation and blood pressure, significant differences were observed in men only for SBP and only in those aged 45 and over (Table 5-14). In turn, in women significant inequalities were observed for all the models with the exception of hypertension in 20-44 age group (Table 5-15).

Analysis using occupation with three categories of workers

Additional analyses were undertaken to examine the role of age and sex on the association between blood pressure and the hierarchical measure of occupation, namely the three levels of workers.

Crude regression parameters showed no significant gradient across the three levels of occupation (p-value for trend >0.05) (Appendix 5, Table A5.11). Age adjusted estimates for hypertension and for SBP and DBP showed changes in the coefficients and in the prevalence ratios but, with no changes in the level of significance of the gradient across occupation (Appendix 5, Table A5.11). Similarly, sex adjusted estimates showed some changes in the coefficients and prevalence ratios but, the gradient remained not significant (p-value for trend > 0.05). The same was observed for age and sex adjusted estimates (Appendix 5, Table A5.11). Although throughout intermediate workers estimates for SBP and DBP seem to have significance reduced (Appendix 5, Table A5.11).

Table 5-14: Effect of 2 age groups on association between occupation and blood pressure outcomes, men. NHS 2003.

Men		SBP			DBP			Hypertension		
SBP	Weighted N	Coef	CI 95%	p-value	Coef	CI 95%	p-value	Coef	CI 95%	p-value
20-44										
Higher worker	169	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	110	-1.67	[-7.29,3.95]	0.56	-2.36	[-7.58,2.87]	0.38	0.63	[0.29,1.37]	0.24
Routine worker	422	-0.50	[-4.39,3.39]	0.80	-1.01	[-4.00,1.97]	0.51	0.84	[0.53,1.33]	0.46
Homemaker	0	NA								
Inactive	214	-3.75	[-8.32,0.83]	0.11	-4.00	[-7.50,-0.50]	0.03	0.62	[0.31,1.22]	0.17
Retired	6	0.52	[-15.73,16.76]	0.95	-4.17	[-15.26,6.92]	0.46	0.64	[0.09,4.38]	0.65
Test for homogeneity				*0.46*			*0.16*			*0.63*
45 and over										
Higher worker	67	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	25	-9.09	[-22.59,4.41]	0.19	-5.54	[-14.40,3.33]	0.22	0.82	[0.46,1.44]	0.49
Routine worker	220	-1.22	[-7.85,5.42]	0.72	-5.17	[-8.80,-1.55]	0.01	0.83	[0.64,1.08]	0.17
Homemaker	0	NA								
Inactive	92	1.65	[-7.01,10.32]	0.71	-3.01	[-8.63,2.62]	0.29	1.00	[0.71,1.41]	0.99
Retired	147	9.01	[2.70,15.31]	0.01	-4.21	[-7.97,-0.45]	0.03	1.01	[0.79,1.29]	0.93
Test for homogeneity				*<0.01*			*0.09*			*0.25*
P for age-occupation index interaction			*0.35*			*0.22*			*0.63*	

Table 5-15: Effect of 2 age groups on association between occupation and blood pressure outcomes, women. NHS 2003.

Women		SBP			DBP			Hypertension		
SBP	Weighted N	Coef	CI 95%	p-value	Coef	CI 95%	p-value	Coef	CI 95%	p-value
20-44										
Higher worker	41	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	166	-10	[-18.99,-1.06]	0.03	-8.9	[-17.28,-0.52]	0.04	0.54	[0.13,2.32]	0.41
Routine worker	130	-2.48	[-10.89,5.93]	0.56	-2.05	[-10.26,6.16]	0.62	0.72	[0.17,2.99]	0.65
Homemaker	407	-4.04	[-11.78,3.70]	0.31	-4.33	[-12.14,3.48]	0.28	0.69	[0.19,2.41]	0.56
Inactive	168	-10.90	[-18.97,-2.91]	0.01	-8.74	[-16.82,-0.65]	0.03	0.35	[0.08,1.56]	0.17
Retired	2	-12.90	[-38.68,12.83]	0.32	-9.39	[-33.03,14.26]	0.44	0.99	[0.09,11.40]	0.99
Test for homogeneity				<0.01			<0.01			0.62
45 and over										
Higher worker	59	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	27	3.89	[-11.81,19.58]	0.63	-0.12	[-8.40,8.15]	0.98	1.10	[0.47,2.58]	0.83
Routine worker	65	1.23	[-11.04,13.51]	0.84	-0.91	[-6.11,4.29]	0.73	1.46	[0.75,2.83]	0.27
Homemaker	403	13.90	[3.08,24.81]	0.01	4.99	[0.43,9.55]	0.03	2.01	[1.09,3.70]	0.03
Inactive	33	14.70	[1.80,27.51]	0.03	5.05	[-0.52,10.62]	0.08	1.87	[0.97,3.61]	0.06
Retired	69	26.30	[13.05,39.61]	<0.01	7.70	[2.49,12.91]	<0.01	2.57	[1.38,4.78]	<0.01
Test for homogeneity				*<0.01*			*<0.01*			*<0.01*
P for age-occupation index interaction		*<0.01*			*<0.01*			*<0.01*		

Modifying effect of age on the association between blood pressure and occupation (workers)

Effect of age on the association between blood pressure and occupation focused on workers, was evaluated by analysing interaction terms of age as categorical variable and occupation (workers). Results showed that there were effect modification for DBP but not for SBP or hypertension (Table 5-16 and Figures 5-13 to 5-15).

Regarding the association between blood pressure and occupation (workers), only a significant association was found for DBP in people aged 60 and over, where the risk was higher in intermediate workers (p=0.03)(Table 5-16).

Modifying effect of sex on the association between blood pressure and occupation (workers)

In order to investigate if sex, besides acting as a confounder had an effect modification in the association between blood pressure and occupation, interaction terms between each of the three outcomes and occupation were assessed. These interactions resulted not significant for the three outcomes (Table 5-17 and Figures 5-16 to 5-18). In addition, there were no significant associations between occupational SEP and blood pressure in both genders (Table 5-17).

Table 5-16: Effect 3 age groups on association between occupation (workers) and blood pressure outcomes, adjusted for sex. NHS 2003.

		SBP			DBP			Hypertension		
	N	Coef	95% CI	P value	Coef	95% CI	P value	PR	95% CI	P value
Age 20-39										
Higher worker	336	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	328	-5.97	[-11.07,-0.88]	0.02	-5.15	[-9.27,-1.03]	0.01	0.58	[0.23,1.51]	0.27
Routine worker	837	-0.29	[-4.54,3.95]	0.89	-1.18	[-4.65,2.30]	0.51	0.87	[0.46,1.67]	0.68
P-value for trend				*0.60*			*0.96*			*0.87*
Age 40-59										
Higher worker	336	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	328	-2.30	[-10.88,6.28]	0.60	-3.56	[-9.61,2.48]	0.25	0.75	[0.46,1.20]	0.23
Routine worker	837	-1.16	[-6.41,4.08]	0.66	-2.57	[-5.68,0.53]	0.10	0.84	[0.62,1.13]	0.24
P-value for trend				*0.68*			*0.11*			*0.29*
Age 60 and over										
Higher worker	336	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	328	0.47	[-24.93,25.87]	0.97	6.77	[-6.19,19.72]	0.31	1.26	[0.82,1.93]	0.30
Routine worker	837	-8.82	[-20.19,2.54]	0.13	-6.26	[-12.76,0.25]	0.06	0.94	[0.68,1.29]	0.69
P-value for trend				*0.09*			*0.03*			*0.49*
P for age-occupation interaction			*0.41*			*0.03*			*0.26*	
Sex (ref: men)		-8.31	[-11.22,-5.40]	<0.01	-6.69	[-8.66,-4.71]	<0.01	0.65	[0.50,0.85]	<0.01

Figure 5-13: Predictive means of SBP for interaction between occupation and age as categorical variable, adjusted for sex. NHS 2003.

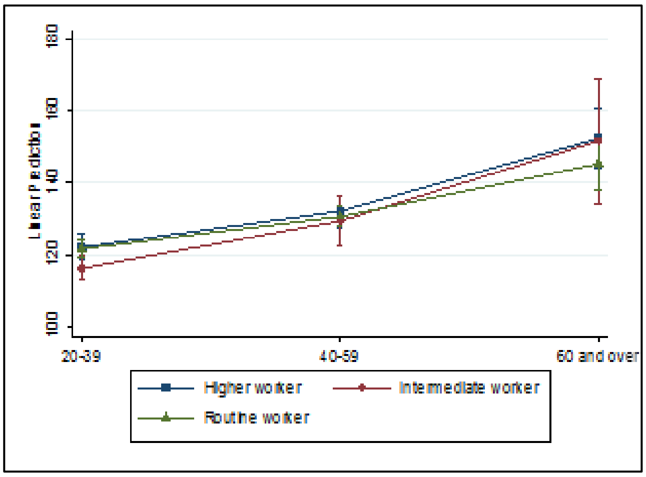


Figure 5-14: Predictive means of DBP for interaction between occupation and age as categorical variable, adjusted for sex. NHS 2003.

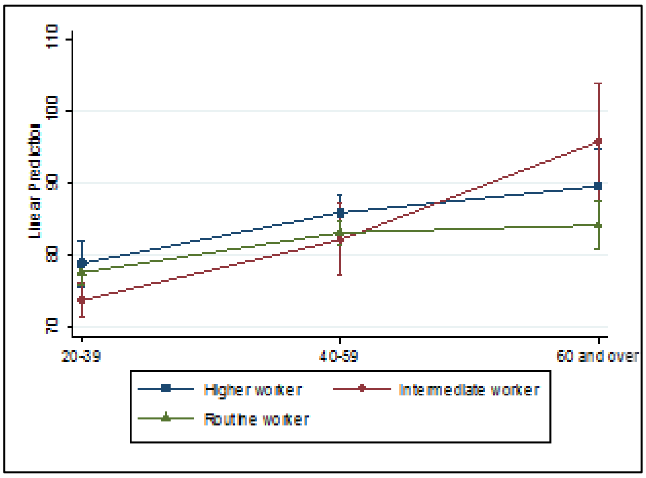


Figure 5-15: Predictive prevalence of hypertension for interaction between occupation and age as categorical variable, adjusted for sex. NHS 2003.

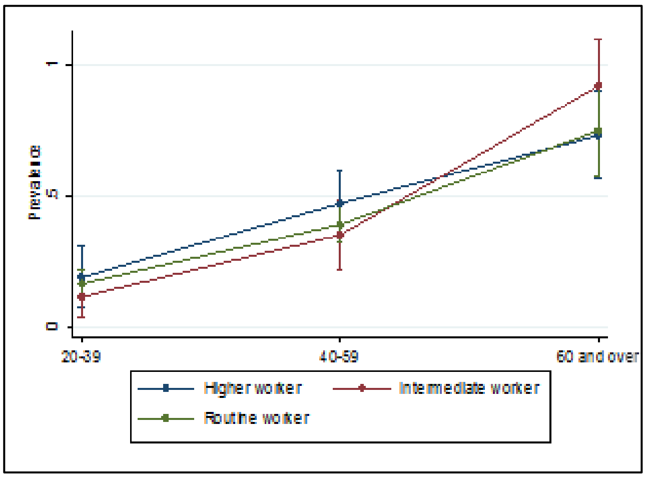


Table 5-17: Effect of sex on association between occupation and blood pressure outcomes, adjusted for age (as a continuous variable). NHS 2003.

		SBP			**DBP**			**Hypertension**		
	Weighted N	Coef	95% CI	p value	Coef	95% CI	p value	PR	95% CI	p value
Men										
Higher worker	336	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	328	-2.68	[-8.50,3.15]	0.37	-3.07	[-7.83,1.69]	0.21	0.73	[0.44,1.21]	0.22
Routine worker	837	-0.91	[-4.08,2.26]	0.57	-2.33	[-4.64,-0.03]	0.05	0.81	[0.62,1.06]	0.13
P-value for trend				*0.71*			*0.08*			*0.18*
Women										
Higher worker	336	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	328	-4.77	[-12.97,3.44]	0.25	-4.66	[-10.17,0.86]	0.10	0.88	[0.39,1.98]	0.76
Routine worker	837	-0.33	[-7.86,7.19]	0.93	-0.43	[-5.42,4.56]	0.87	1.19	[0.61,2.33]	0.61
P-value for trend				*0.78*			*0.73*			*0.53*
P for sex-occupation interaction			*0.79*			*0.35*			*0.49*	
Age		0.69	[0.57,0.81]	<0.01	0.33	[0.26,0.41]	<0.01	1.04	[1.04,1.05]	<0.01

Figure 5-16: Predictive SBP for interaction of occupation and sex. Adjusted for age as a continuous variable. NHS 2003.

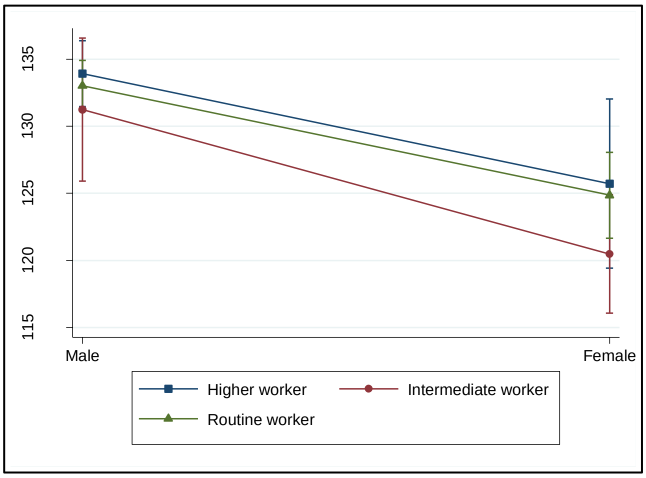


Figure 5-17: Predictive DBP for interaction of occupation and sex. Adjusted for age as a continuous variable. NHS 2003.

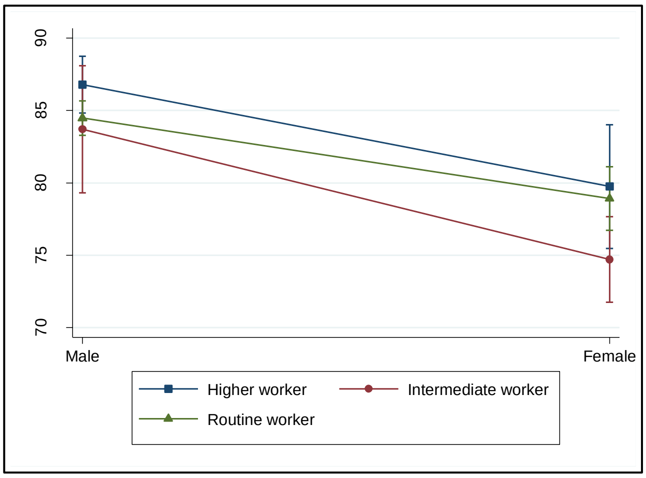
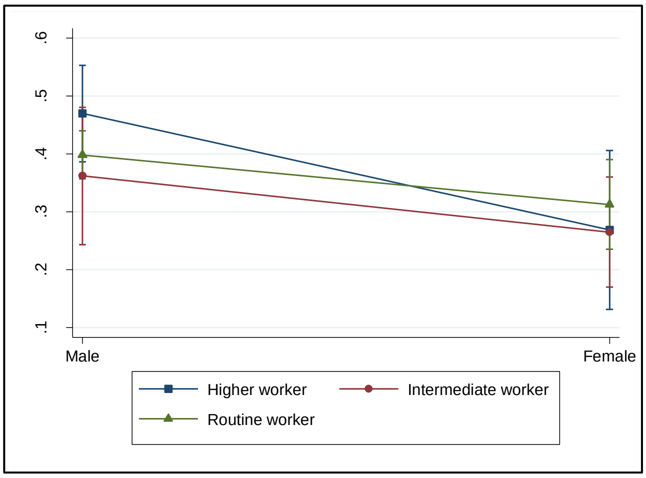


Figure 5-18: Predictive prevalence of hypertension for interaction of occupation and sex. Adjusted for age as a continuous variable. NHS 2003.



Summary and main findings about the role of age and sex on the association between blood pressure and occupation in 2003

Analysis of the effect of age and sex on the association between blood pressure and occupation was carried out separately for two types of occupation variable, the first one including workers and non-workers, and the second one focused only on workers. The results were different according the type of occupation variable used.

When occupation is used as variable with six categories, namely including workers and non-workers, age as a continuous variable acted as confounder for SBP and DBP and as an effect modifier for hypertension in women. Moreover, age categorised into two groups acted as an effect modifier of the association between the three outcomes and occupation in women but not in men. Sex-stratified analysis of the association between blood pressure and occupation showed significant differences between the six categories of occupation when DBP and hypertension were the outcomes, and these was observed for both genders.

When the analyses were focused on workers, age as categorical variable with three categories acted as an effect modifier of the association between DBP and occupation. In turn, sex acted also as a confounder but not as an effect modifier for any of the three outcomes.

In addition, analyses of the association between blood pressure and occupation (workers) stratified by three age groups and by sex showed no gradient of blood pressure across levels of occupation.

Considering that effect modifier was found by age in several of the associations between blood pressure and occupation subsequent analyses of this association should consider the inclusion of interaction terms between age and occupation. In addition, due to important differences in the pattern of occupation by gender, all subsequent analysis are presented stratified by sex.

Summary of role of age and sex in the association between blood pressure and three SEP in 2003.

The effect of age and sex on the association between blood pressure and socioeconomic status did not display a unique pattern, but these effects varied according the outcomes and exposures utilised. Likewise, association between blood pressure and socioeconomic position was different according the measure of SEP and the measure of blood pressure used.

After analysing the effect of age on the association between blood pressure and SEP, it is possible to point out that age acted as a confounder some cases. The effect modifier of age, however, was present mainly on the association between blood pressure and education. The effect of age on the association of blood pressure with assets-based SEP and occupation was weaker than that observed when education was the exposure (Table 5-18).

Age as categorical variable with three groups, appeared as effect modifier for two of the three outcomes used (Table 5-18). When occupation was used including only workers, age was effect modifier only for DBP.

On the other hand, the effect of sex on the association between blood pressure and socioeconomic status showed that gender was acting as a confounder of the association between the three outcomes with the three SEP measures. In addition, gender interaction was observed for the association of blood pressure with education, but not with assets-based SEP or occupation.

Table 5-18: Modifying role of age and sex on the association between blood pressure and SEP NHS 2003

Education	**SBP**		**DBP**		**Hypertension**	
Education and age 3 categories	✓		✓		- (p=0.06)	
Education and sex	✓		✓		✓	
Assets-based SEP						
Assets-based SEP and age 3 categories	-		-		✓	
Assets-based SEP and sex	-		-		-	
Occupation 6 categories	Men	Women	Men	Women	Men	Women
Occupation and age 2 categories	-	✓	-	✓	-	✓
Occupation (workers)						
Occupation and age 3 categories	-		✓		-	
Occupation and sex	-		-		-	

Notes: ✓: significant interaction term. -: no significant interaction term. Models assessing interaction terms between SEP and age as categorical variable were adjusted for sex. Models assessing interactions terms between SEP and sex were adjusted for age as a continuous. N/A: Non assessed due convergence issue.

Table 5-19 summarises the results from analyses of the associations between each measure of blood pressure and each socioeconomic position measure, stratified by three groups of age and by sex.

Analyses for the association between blood pressure and education showed consistent inverse gradients for the three outcomes in women and in people aged 40-59. Also it was observed that SBP was inversely related to education in younger people (20-39).

In turn, assets-based index was inversely related to SBP and hypertension. This was observed for women and for people aged 40-59. There was no association between DBP.

When the association between blood pressure and occupation was analysed, significant differences among categories of occupation were observed for the three outcomes in both genders. These differences seem to be influenced mainly for the group of retired, which resulted significant in several of the models assessed. When the analyses focused on workers, only one significant association between blood pressure and occupation was found and this showed a higher risk in intermediate workers.

Table 5-19: Summary of the association between blood pressure and SEP 2003

	Education	Assets index	Occupation	Occupation (workers)
SBP	Inverse gradient in 20-39 and 40-59 age groups. Inverted j-shaped in people aged 60 and over (SBP 20 and 17 mmHg higher in intermediate and in the lowest level than reference respectively). Inverse gradient in women.	Inverse gradient in 20-39 and in 40-59 age groups. U-shaped in people aged 60 and over. Inverse gradient in women. Inverse gradient in men (SBP 1.3 and 3.1 mmHg higher in intermediate and in the lowest level respectively than reference group).	Significant differences in 45 and over age group in men and in women in two age groups.	In 20-39 age group intermediate workers had 6 mmHg lower SBP than higher workers. In 60 plus age group routine workers had SBP 8mm Hg lower than higher workers. In men and women, intermediate workers had 3 mmHg and 5 mmHg lower SBP than higher workers respectively.
DBP	Inverse gradient in 40-59 age group. Inverted j-shaped in people aged 60 and over (DBP 11 and 8 mmHg higher in intermediate and in the lowest level than reference respectively). Inverse in women.	Inverse gradient in 40-59 age group (DBP 4.2 and 3.2 mmHg higher in intermediate and in the lowest level respectively than reference). Inverse gradient in women (SBP 3 mmHg higher in intermediate and in the lowest level than reference group).	Significant differences in women in two age groups.	In 20-39 age group Intermediate workers had 5 mmHg lower DBP than higher workers Inverted j-shaped curve in 60 plus age group (Routine worker had 9 mmHg lower DBP than higher workers). In men and women, intermediate workers had 3 mmHg and 5 mmHg lower SBP than higher workers respectively.
Hypertension	Inverse gradient in women and in 20-39 age group (PR 62% higher in intermediate level and 86% higher in the lowest level); in 40-59 age group, and in women aged 60 + .	Inverse gradient in 20-39 age group (PR 90% and 200% higher in intermediate and in the lowest level resp.) in 40-59 and 60+ age groups. Higher PR in intermediate and lower levels of SEP in women (PR 43% higher than reference group).	Significant differences in women in 45 and over age group.	In people aged 20-39 and 40-59, intermediate and routine workers had lower PR than higher workers.

Note: When differences in mmHg or PR are given analyses correspond to effect size. When differences are not mentioned, results are based on p-values.

5.3.2.2 National Health Survey 2010

The methods used are described in detail in section 5.2.2. In the first step a place analysis using education as exposure is shown. Secondly, analyses related to assets-based index, and thirdly to occupation status are shown.

The role of age and sex in the association between blood pressure and education

Crude estimates for the association between blood pressure and education showed a clear inverse gradient for the three outcomes. In the case of SBP, the means for the middle and the lowest levels of education were about 5 mmHg and 18 mmHg higher than the most educated respectively (Appendix 5, Table A5.14). For DBP gradient across educational levels was more subtle than those for the other outcomes but it was equally significant (Appendix 5, Table A5.14). In turn, prevalence ratio of hypertension for the intermediate educational level was 1.54, while that for the lowest level was 2.61 with respect to the highest level, respectively (Appendix 5, Table A5.14).

Adjustments for age and sex

Estimates for the association between blood pressure and education showed dramatic changes after adjustments for age. For SBP although a slight inverse gradient across educational levels remained, this was no longer significant (p-value for trend <0.01 before adjustment, and p-value for trend =0.1 after adjustment for age) (Appendix 5, Table A5.14). In the case of DBP, the association with education not only changed the magnitude, but also the direction of this association inverted (Appendix 5, Table A5.14). In the case of hypertension, also the association with education also weakened after adjustment for age and was no longer significant (Appendix 5, Table A5.14).

In contrast to changes observed when adjusting for age, adjustments for sex tended to increase the socioeconomic gradient for each of the three outcomes and remained statistically significant (Appendix 5, Table A5.14).

Modifying effect of age on the association between blood pressure and education

To investigate the potential for age to modify the association between blood pressure and education, interaction terms between age and educational level were evaluated for each of the three outcomes. Effect modification was evaluated for age as categorical variable with three groups and results were not significant for any of the three outcomes (Table 5-20 and Figures 5-19 to 5-21).

Table 5-20: Effect of 3 age groups on association between education and blood pressure outcomes, adjusted for sex. NHS 2010.

		SBP			DBP			Hypertension		
	N	Coef	95% CI	P-value	Coef	95% CI	P-value	PR	95% CI	P-value
Age 20-39										
High	696	Ref	-	-	Ref	-	-	Ref	-	-
Middle	943	0.13	[-2.41,2.66]	0.92	-0.58	[-2.59,1.44]	0.57	1.22	[0.60,2.48]	0.57
Low	99	1.89	[-1.92,5.69]	0.33	0.88	[-3.12,4.88]	0.67	0.62	[0.21,1.83]	0.39
P-value for trend				*0.62*			*0.89*			*0.89*
Age 40-59										
High	306	Ref	-	-	Ref	-	-	Ref	-	-
Middle	977	3.90	[-0.50,8.30]	0.08	-0.90	[-3.60,1.81]	0.52	1.37	[0.96,1.94]	0.08
Low	281	7.99	[1.46,14.52]	0.02	-0.75	[-4.08,2.57]	0.66	1.39	[0.93,2.09]	0.11
P-value for trend				*0.01*			*0.64*			*0.09*
Age 60 and over										
High	110	Ref	-	-	Ref	-	-	Ref	-	-
Middle	276	2.89	[-5.74,11.51]	0.51	-0.39	[-3.93,3.15]	0.83	1.07	[0.78,1.47]	0.69
Low	368	7.11	[-0.37,14.58]	0.06	0.15	[-2.92,3.22]	0.92	1.14	[0.85,1.53]	0.39
P-value for trend				*0.03*			*0.80*			*0.28*
P for age-education interaction			*0.41*			*0.98*			*0.52*	
Sex (ref: men)		-8.78	[-10.71,-6.85]	<0.01	-4.82	[-5.97,-3.67]	<0.01	0.81	[0.71,0.94]	<0.01

Figure 5-19: Predicted means of SBP for interaction between age (as categorical variable) and education, adjusted for sex. NHS 2010.

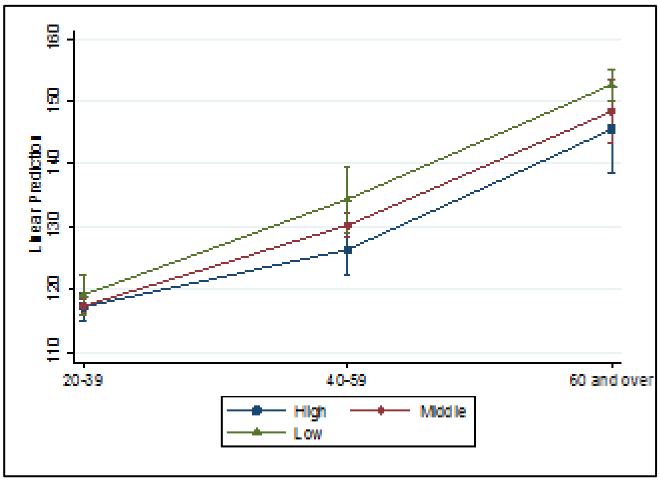


Figure 5-20: Predicted means of DBP for interaction between age as categorical variable and education, adjusted for sex. NHS 2010.

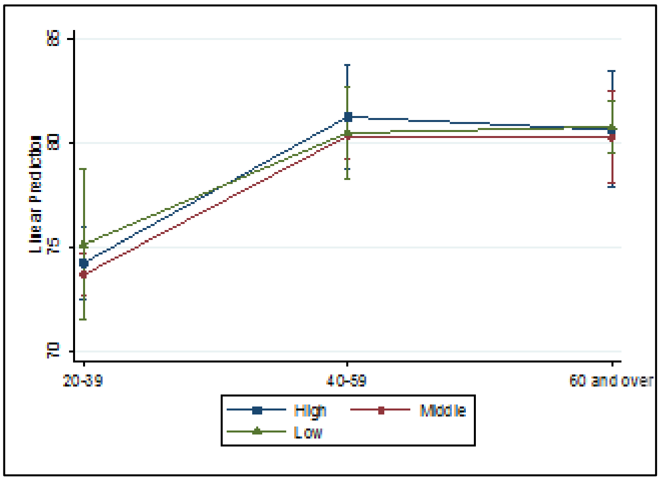
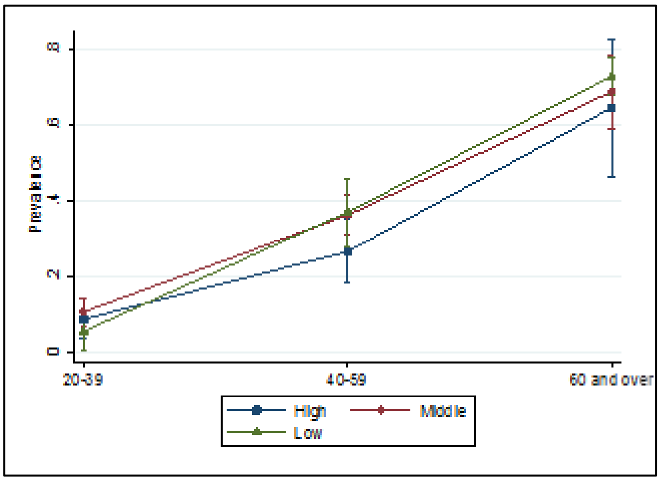


Figure 5-21: Predicted prevalence of hypertension for interaction between age as categorical variable and education, adjusted for sex. NHS 2010.



Modifying effect of sex on the association between blood pressure and education

Effect of sex on the association between blood pressure and education after adjusting for age was also studied by including interactions terms and the results are shown in Table 5-21 and Figures 5-22 to 5-24. Unlike to that observed in the National Health Survey 2003, sex did not act as an effect modifier for any of the three outcomes associations with education (p> 0.05 for the three outcomes).

Although interactions between education and sex were not significant for any of three measures of blood pressure, estimations stratified by sex are shown in order to provide an overall view of the association between blood pressure and education in 2010. Table 5-21 shows the estimates for each of the three outcomes by sex. Gradients of SBP across levels of education suggested that people less educated had a higher risk in both genders, however these were not significant (p>0.05). No significant associations were found for DBP and hypertension in both genders (Table 5-21).

Summary and main findings about the role of age and sex in the association between blood pressure and education in 2010

Summarizing, association between blood pressure and education in NHS2010 was affected by age and just was subtly modified by the confounding effect of sex.

In effect, analyses of the effect of age showed that this was acting as an effect modifier on the association between blood pressure and education in some cases. Age categorised into three groups did not have an effect modifier on the association between blood pressure and education for any of the three outcomes. Considering the previous results, subsequent analysis were adjusted for age as a continuous variable and although interaction term between education and age categorised into three groups was not significant, age-stratified analyses using three age groups were carried for comparison purposes.

Table 5-21: Effect of sex on association between blood pressure and education, adjusted for age as a continuous. NHS 2010.

		SBP			**DBP**			**Hypertension**		
	Weighted N	Coef	95% CI	p value	Coef	95% CI	p value	PR	95% CI	p value
Men										
High	1112	Ref	-	-	Ref	-	-	Ref	-	-
Middle	2196	0.69	[-2.55,3.93]	0.67	0.17	[-1.92,2.25]	0.88	1.33	[0.95,1.86]	0.10
Low	748	1.89	[-2.62,6.40]	0.41	-1.53	[-4.27,1.22]	0.28	1.03	[0.72,1.47]	0.88
P-value for trend				*0.45*			*0.39*			*0.99*
Women										
High	1112	Ref	-	-	Ref	-	-	Ref	-	-
Middle	2196	0.42	[-2.44,3.28]	0.77	-1.01	[-3.05,1.02]	0.33	1.14	[0.79,1.65]	0.48
Low	748	4.78	[0.13,9.43]	0.04	-1.07	[-3.60,1.46]	0.41	1.13	[0.79,1.61]	0.51
P-value for trend				*0.06*			*0.40*			*0.47*
P for sex-education interaction			*0.50*			*0.46*			*0.23*	
Age		0.74	[0.68,0.81]	<0.01	0.21	[0.17,0.25]	<0.01	1.05	[1.04,1.05]	<0.01

Figure 5-22: Predictive means of SBP for the interaction of education and sex, adjusted for age as a continuous. NHS 2010.

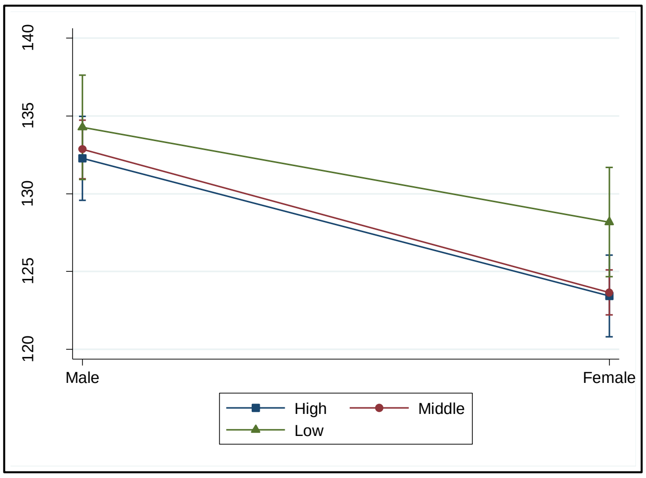


Figure 5-23: Predictive means of DBP for the interaction of education and sex, adjusted for age as a continuous. NHS 2010.

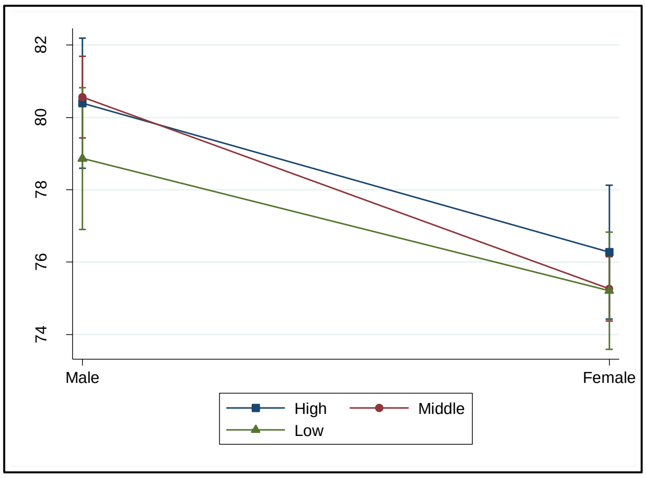
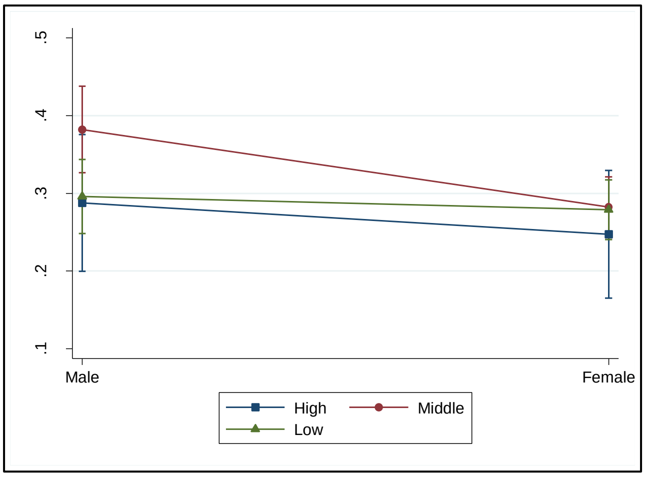


Figure 5-24: Predictive prevalence of hypertension for the interaction of education and sex, adjusted for age as a continuous. NHS 2010.



Moreover, analysis showed that gender acted as confounder of the blood pressure and education association. However, when effect modification by sex was analysed, the results showed that gender was not acting as an effect modifier for any of the three outcomes and their association with education. As a result, further analyses were only adjusted for sex. Also, sex-stratified analysis was carried out.

In addition, stratified analysis by three age groups showed a significant inverse gradient in SBP for people aged 45-59 and 60 and over. In turn, sex-stratified analysis showed no significant association between blood pressure and education for men and women.

The role of age and sex in the association between blood pressure and assets-based SEP.

Crude estimates for the association between blood pressure and assets-based index showed a clear significant inverse gradient across educational levels for SBP ($p<0.01$). In the case of hypertension, people in the highest level of assets-based index had the lowest risk, while those in intermediate and in the lowest groups showed a similar and a higher risk than those most privileged ($p=0.04$). No significant association was found between DBP and SEP based on assets (Appendix 5, Table A5.17).

Adjustments for age and sex

Adjustments for age weakened the association between SBP and education but this remained being significant ($p=0.03$ after adjustment) (Appendix 5, Table A5.17). In the case of hypertension the adjustment for age weakened the association with education until this was no longer significant ($p>0.05$) (Appendix 5, Table A5.17). For DBP, association with assets-based index remained no significant after adjustments (Appendix 5, Table A5.17).

On the other hand, adjustment for gender led to subtle changes in the estimates of three outcomes. In this manner, the inverse gradient observed for SBP and hypertension remained significant after this adjustment and no association remained for DBP.

Modifying effect of age on the association between blood pressure and assets based index

Additional analyses were undertaken to have a whole understanding of the effect of age on the association between blood pressure and assets-based index in NHS 2010.

The effect of age as categorical variable was evaluated by including interaction term between education and age categorised into three groups. Age as categorical variable did not act as an effect modifier for any of the three outcomes included in this research (Table 5-22 and Appendix 5, Table A5.19 and Table A5.20).

Table 5-22 shows the results obtained. An inverse gradient of SBP across levels of assets index was found for 40-59 age group (p=0.05). Among people aged 60 and over, intermediate and the lowest groups of SEP based on assets showed a higher risk than those most privileged (p<0.01). Associations between assets-based SEP and DBP and hypertension were not significant for any of the age group (Table 5-22).

Modifying effect of sex on the association between blood pressure and assets based index

Effects of sex on the association between blood pressure and assets-based index was analysed by including interaction terms in the models for each of the three outcomes. Table 5-23 and Figures 5-25 to 5-27 show the results. Sex did not act as modifier effect of the association between blood pressure and socioeconomic position based on assets for any of the three outcomes included in this research (p>0.05).

Estimations stratified by sex were carried out in order to show the complete picture of the association between blood pressure and assets-based index, even though gender was not acting as modifier effect. Results are shown in Table 5-23. In women association between SBP and assets-based index was significant (p=0.01), and the intermediate group of SEP showed the highest risk. For DBP and hypertension, the associations with SEP based on assets were not significant (Table 5-23). In men, association between blood pressure and assets based index was significant hypertension but not for SBP and DBP (Table 5-23).

Table 5-22: Effect of 3 age groups on association between assets-based index and blood pressure outcomes, adjusted for sex. NHS 2010.

		SBP			DBP			Hypertension		
	N	Coef	95% CI	P value	Coef	95% CI	P value	PR	95% CI	P value
Age 20-39										
High	876	Ref	-	-	Ref	-	-	Ref	-	-
Middle	748	2.40	[0.09,4.71]	0.04	1.23	[-0.70,3.16]	0.21	1.26	[0.66,2.38]	0.48
Low	113	0.32	[-3.65,4.29]	0.87	-0.67	[-3.65,2.31]	0.66	1.20	[0.41,3.52]	0.74
P-value for trend				*0.14*			0.51			*0.50*
Age 40-59										
High	725	Ref	-	-	Ref	-	-	Ref	-	-
Middle	688	3.38	[-0.26,7.01]	0.07	0.19	[-1.74,2.12]	0.85	1.13	[0.90,1.43]	0.29
Low	152	3.74	[-1.64,9.12]	0.17	-0.80	[-3.54,1.94]	0.57	0.99	[0.65,1.50]	0.96
P-value for trend				*0.05*			0.79			*0.61*
Age 60 and over										
High	306	Ref	-	-	Ref	-	-	Ref	-	-
Middle	366	7.20	[1.95,12.45]	0.01	-0.13	[-2.47,2.21]	0.91	1.07	[0.91,1.27]	0.42
Low	81	6.34	[0.38,12.31]	0.04	0.24	[-2.82,3.29]	0.88	0.99	[0.78,1.24]	0.90
P-value for trend				*<0.01*			0.96			*0.75*
P for age-assets interaction			*0.40*			*0.83*			*0.98*	
Sex (ref: men)		-8.85	[-10.79,-6.91]	<0.01	-4.82	[-5.98,-3.65]	<0.01	0.81	[0.70,0.94]	<0.01

Table 5-23: Effect of sex on each level of assets-based index, adjusted for age. NHS 2010.

		SBP			DBP			Hypertension		
	Weighted N	Coef	95% CI	p value	Coef	95% CI	p value	PR	95% CI	p value
Men										
High	1907	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1802	1.60	[-1.26,4.46]	0.27	-0.27	[-2.04,1.50]	0.76	1.02	[0.81,1.28]	0.85
Low	346	2.50	[-2.42,7.41]	0.32	-1.77	[-4.82,1.28]	0.26	1.04	[0.73,1.48]	0.83
P-value for trend				*0.19*			*0.34*			*<0.01*
Women										
High	1907	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1802	3.68	[1.21,6.15]	<0.01	0.75	[-0.80,2.31]	0.34	1.07	[0.86,1.32]	0.53
Low	346	2.25	[-0.72,5.22]	0.14	0.49	[-1.30,2.28]	0.59	0.85	[0.64,1.15]	0.29
P-value for trend				*<0.01*			*0.36*			*0.79*
P for sex-assets interaction			*0.52*			*0.40*			*0.54*	
Age		0.77	[0.72,0.82]	<0.01	0.20	[0.17,0.23]	<0.01	1.04	[1.04,1.05]	<0.01

Figure 5-25: Predictive mean of SBP of the interaction between sex and assets index, adjusted for age. NHS 2010.

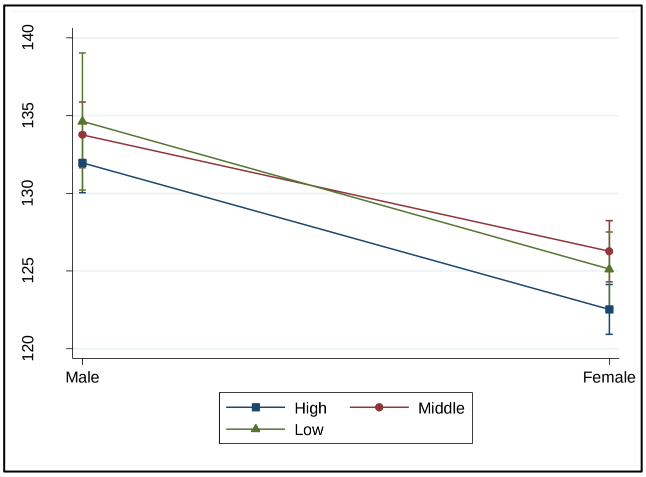


Figure 5-26: Predictive mean of DBP of the interaction between sex and assets index, adjusted for age. NHS 2010.

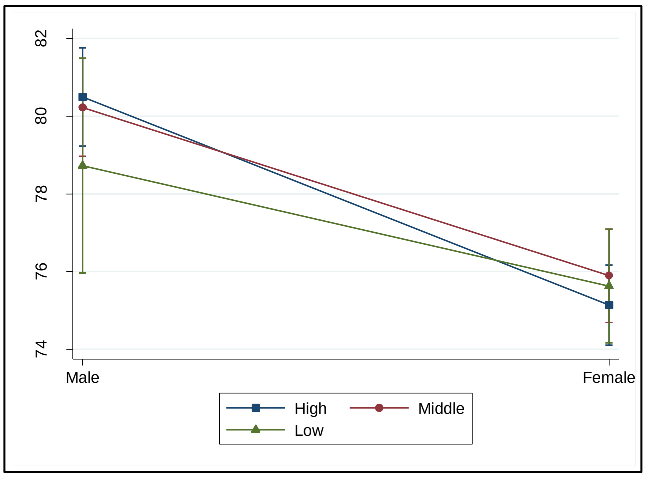
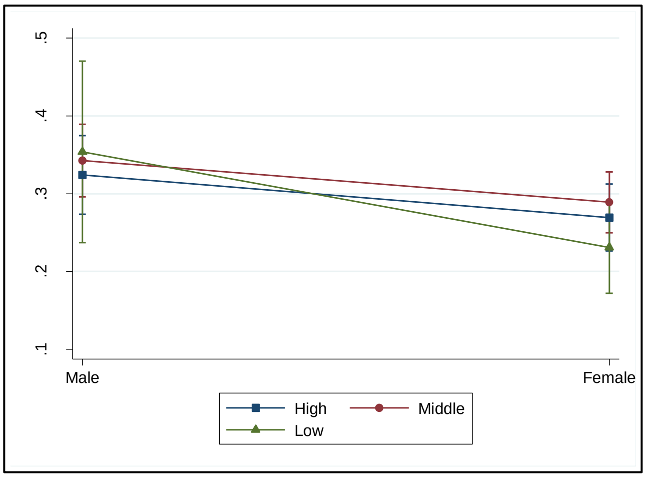


Figure 5-27: Predictive prevalence of hypertension of the interaction between sex and assets index, adjusted for age. NHS 2010.



Summary and main findings about the role of age and sex in the association between blood pressure and assets-based SEP in 2010

In summary, age and sex showed being confounder of the association between blood pressure and assets-based SEP, but not effect modifier.

As mentioned above, age acted as a confounder and this was observed for each of the three outcomes studied in this research. When the effect of age was investigated, results showed that age as categorical variable with three categories, was not effect modifier for the association of any of the three outcomes with assets-based index.

Likewise, gender acted as a confounder of the blood pressure and assets-based SEP association, but no as an effect modifier for any of the three outcomes.

In consequence, further analyses should include adjustments for age and sex. Although interaction between assets-based index and age and between assets-based index and sex were not significant in 2010, subsequent analyses include stratification for these variables. This latter, based on that stratified analysis was undertaken for 2003, given that interaction terms were significant, and therefore it was important to maintain comparability between surveys. Moreover, this decision is based on that from the public health policy point of view it is relevant to draw an accurate picture of the situation in health inequalities by sex.

In addition, age-stratified analysis showed significant associations between SBP and SEP based on assets in people aged 40-59 and 60 and over. Sex-stratified analysis showed a significant association between SBP and assets-based index only in women.

The role of age and sex in the association between blood pressure and occupation.

In this section association between blood pressure and occupation was developed in two subsections. Firstly, occupation was used as exposure with six categories, including workers and non-workers. Secondly, the analysis was focused on workers, and therefore the exposure in this case was used as a hierarchical socioeconomic position measure with three categories, higher worker, intermediate worker and manual and routine worker.

Analysis using occupation with six categories

Analysis of the association between blood pressure and occupation including workers and non-workers was carried out stratified by sex. This was due to the important differences observed in the distribution across categories of occupation by sex (Section 5.3.1, Table 5-1). Crude estimations of the association between blood pressure and occupation showed significant inequalities for SBP in both genders ($p<0.01$) (Appendix 5, Table A5.20). Differences across categories of occupation for DBP were significant only for women ($p<0.01$). In the case of hypertension inequalities were significant for both genders ($p<0.01$) (Appendix 5, Table A5.20).

Adjustments for age

Adjustments for age produced changes in the magnitude of the differences among categories of occupation and in the significance of these inequalities. In the case of SBP inequalities among men were no longer significant. In women inequalities remained significant and the categories with the highest risk of raised SBP changed after adjustments. Retired and homemakers had the highest risks before adjustments. After adjustments, inactive and retired people had the highest probabilities of raised SBP (Appendix 5, Table A5.21). Differences in DBP across categories of occupation after adjustments were significant for both genders. Higher workers had one of the highest risks of raised DBP in both, men and women (Appendix 5, Table A5.21). For hypertension, inequalities among categories of occupation after age adjustments continued being significant only for men and homemakers had the highest risk. However, given the small number of homemakers among men, estimations were less accurate with wide confident intervals. Without considering homemakers manual workers showed the highest risk of hypertension among men (Appendix 5, Table A5.21).

Modifying effect of age on the association between blood pressure and occupation

With the aim of understanding the potential effect of age on the association between blood pressure and occupation, interaction between age and occupation were assessed for each of the three outcomes studied in this research. In this manner interaction terms between age as continuous variable and age as categorical with three and five categories were assessed.

Age as a continuous variable acted as effect modifier of the association between DBP and hypertension with occupation in both genders ($p<0.01$) (Appendix 5, Table A5.22 and A5.23). In addition interactions between age and categorised into three and five groups and occupation were evaluated for each of the three outcomes. Similarly to that observed in 2003, models assessing the interaction effect of age with three and five categories did not reach convergence for hypertension. Therefore, models including interaction term between age with two categories and occupation were fitted, and the results are presented in Tables 5-24 and Table 5-25. Age categorised into two groups resulted being effect modifier of the relationship between DBP and occupation in men and between SBP and occupation in women.

Analysis using occupation with three categories of workers

Crude estimates of the association between blood pressure and occupation, including only workers, showed a significant gradient for SBP in which manual workers had the highest risk. This association remained significant after age adjustment ($p<0.01$) and after sex adjustment ($p=0.01$), and was not significant after age and sex adjustments ($p=0.14$) (Appendix 5, Table A5.24). The associations between DBP and hypertension with occupation were not significant before and after adjustments (Appendix 5, Table A5.24).

Modifying effect of age on the association between blood pressure and occupation focused on workers.

In order to investigate the potential effect of age on the association between SBP and occupation, interactions between occupation, including only workers, and age as a categorical variable were assessed. Results showed that age as categorical variable was not effect modifier of the association between blood pressure and occupation (workers) for any of the three blood pressure measures analysed (Table 5.26 and Appendix 5, Table A5.25 and Table A5.26).

Table 5-24 Effect of 2 age groups on association between occupation and blood pressure outcomes in men. NHS 2010.

		SBP			DBP			Hypertension		
	Weighted N	Coef	CI 95%	p-value	Coef	CI 95%	p-value	Coef	CI 95%	p-value
20-44										
Higher worker	92	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	310	-2.61	[-8.01,2.80]	0.34	-1.79	[-5.39,1.82]	0.33	0.84	[0.28,2.51]	0.76
Routine worker	485	0.32	[-4.82,5.46]	0.90	-2.47	[-5.80,0.85]	0.15	0.91	[0.34,2.47]	0.85
Homemaker	18	-2.51	[-9.49,4.48]	0.48	2.45	[-6.43,11.33]	0.59	2.37	[0.46,12.11]	0.30
Inactive	187	-2.89	[-8.48,2.69]	0.31	-4.85	[-8.57,-1.12]	0.01	0.22	[0.06,0.84]	0.03
Retired	4	-6.01	[-19.91,7.90]	0.40	1.75	[-4.95,8.45]	0.61	0.62	[0.05,7.05]	0.70
Test for homogeneity				*0.30*			*0.06*			*0.09*
45 and over										
Higher worker	68	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	157	4.05	[-5.51,13.61]	0.41	2.47	[-1.97,6.92]	0.28	1.21	[0.70,2.10]	0.49
Routine worker	310	8.36	[-1.26,17.98]	0.09	1.27	[-3.13,5.67]	0.57	1.20	[0.72,2.01]	0.48
Homemaker	16	8.57	[-6.81,23.95]	0.27	-5.70	[-11.51,0.12]	0.05	1.35	[0.70,2.59]	0.37
Inactive	59	9.39	[-4.00,22.78]	0.17	0.76	[-5.76,7.28]	0.82	1.38	[0.77,2.50]	0.28
Retired	183	16.20	[6.64,25.82]	0.00	-3.22	[-7.46,1.02]	0.14	1.53	[0.92,2.54]	0.10
Test for homogeneity				*<0.01*			*0.01*			*0.12*
P for age-occupation interaction			*0.17*			*0.01*			*0.05*	

Table 5-25: Effect of 2 age groups on association between occupation and blood pressure outcomes in women. NHS 2010

		SBP			DBP			Hypertension		
	Weighted N	Coef	CI 95%	p-value	Coef	CI 95%	p-value	Coef	CI 95%	p-value
20-44										
Higher worker	157	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	282	-3.31	[-11.37,4.75]	0.42	-2.59	[-8.38,3.19]	0.38	0.86	[0.22,3.39]	0.83
Routine worker	158	-1.47	[-9.76,6.82]	0.73	-0.52	[-6.40,5.36]	0.86	0.68	[0.19,2.48]	0.56
Homemaker	393	-1.03	[-8.92,6.86]	0.80	-1.93	[-7.42,3.56]	0.49	0.71	[0.21,2.43]	0.59
Inactive	175	-4.18	[-12.26,3.90]	0.31	-3.65	[-9.34,2.04]	0.21	0.19	[0.04,0.93]	0.04
Retired	7	4.38	[-12.79,21.55]	0.62	-4.02	[-10.21,2.18]	0.20	2.83	[0.47,16.87]	0.25
Test for homogeneity				*0.49*			*0.24*			*0.04*
45 and over										
Higher worker	46	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	123	-4.34	[-12.71,4.03]	0.31	-4.11	[-8.54,0.31]	0.07	0.79	[0.40,1.56]	0.49
Routine worker	126	-0.18	[-9.50,9.15]	0.97	-1.95	[-7.12,3.23]	0.46	0.77	[0.40,1.50]	0.44
Homemaker	439	6.72	[-1.31,14.75]	0.10	-0.87	[-5.23,3.49]	0.70	1.12	[0.62,2.03]	0.71
Inactive	29	7.82	[-4.33,19.97]	0.21	5.73	[-2.50,13.97]	0.17	1.05	[0.50,2.21]	0.90
Retired	231	16.30	[8.02,24.60]	0.00	-3.20	[-7.65,1.25]	0.16	1.62	[0.90,2.92]	0.11
Test for homogeneity				*<0.01*			*0.04*			*<0.01*
P for age-occupation interaction		*0.04*			*0.11*			*0.11*		

Results for analysis stratified into three age groups, showed a significant inverse gradient of SBP across occupation levels only in people aged 40-59 years (p-value for trend=0.02). DBP and hypertension had no significant associations with occupation (Table 5-26).

Modifying effect of sex on the association between blood pressure and occupation (workers)

Also effect of sex on the association between blood pressure and occupation was assessed by including interactions terms in the models for each of the three outcomes. Results are shown in Table 5-27 and Figures 5-28 to 5-30. Sex did not act as an effect modifier of the association between blood pressure and occupation for any of the three outcomes studied.

With regard to the analysis of the association between occupation and blood pressure; estimations stratified by sex showed an inverse and significant gradient of SBP across occupational socioeconomic status in men (p=0.04) (Table 5-27). For DBP and hypertension associations with occupation were not significant for both genders.

Summary and main findings about the role of age and sex in the association between blood pressure and occupation in 2010

Similarly to that for NHS2003, analysis of the effect of age and sex on the association between blood pressure and occupation in 2010 was undertaken. The first part of this analysis included the occupation variable with six categories, including workers and non-workers. The second part was focused on workers, namely included only three categories.

Effect modification by age as categorical variable (two groups) was found for the association between DBP and occupation in men and for the association between SBP and occupation in women.

Table 5-26: Effect of 3 age groups on association between occupation (workers) and blood pressure outcomes. NHS 2010

		SBP			DBP			Hypertension		
	N	Coef	95% CI	P value	Coef	95% CI	P value	PR	95% CI	P value
Age 20-39										
Higher worker	199	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	461	-4.87	[-11.34,1.59]	0.14	-3.25	[-7.84,1.34]	0.17	0.67	[0.23,1.93]	0.46
Routine worker	457	-2.62	[-8.97,3.74]	0.42	-3.49	[-7.95,0.97]	0.12	0.50	[0.19,1.28]	0.15
P-value for trend				*0.63*			*0.15*			*0.15*
Age 40-59										
Higher worker	126	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	353	3.48	[-2.04,9.00]	0.22	-0.54	[-4.10,3.02]	0.76	1.31	[0.75,2.27]	0.34
Routine worker	517	6.99	[1.26,12.72]	0.02	-0.58	[-4.22,3.06]	0.76	1.43	[0.85,2.41]	0.18
P-value for trend				*0.02*			*0.80*			*0.19*
Age 60 and over										
Higher worker	38	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	58	0.21	[-9.56,9.97]	0.97	2.11	[-2.26,6.47]	0.34	1.00	[0.59,1.70]	0.99
Routine worker	106	1.95	[-9.70,13.61]	0.74	2.49	[-2.87,7.86]	0.36	0.85	[0.51,1.41]	0.53
P-value for trend				*0.73*			*0.45*			*0.45*
P for age-occupation interaction			*0.31*			*0.50*			*0.31*	
Sex (ref: men)		-10.4	[-12.79,-7.93]	<0.01	-5.68	[-7.34,-4.03]	<0.01	0.69	[0.52,0.91]	0.01

Table 5-27: Effect of sex on the association between blood pressure and occupation. Estimates adjusted for age as a continuous variable. NHS 2010.

		SBP			DBP			Hypertension		
	Weighted N	Coef	95% CI	p value	Coef	95% CI	p value	PR	95% CI	p value
Men										
Higher worker	363	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	872	0.89	[-3.98,5.76]	0.72	0.14	[-2.70,2.98]	0.92	1.07	[0.66,1.74]	0.77
Routine worker	1079	3.89	[-0.91,8.69]	0.11	-0.84	[-3.54,1.86]	0.54	1.09	[0.70,1.68]	0.70
P-value for trend				*0.04*			*0.37*			*0.73*
Women										
Higher worker	363	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	872	-1.82	[-7.89,4.26]	0.56	-2.34	[-6.84,2.15]	0.31	1.04	[0.49,2.19]	0.92
Routine worker	1079	-0.01	[-6.52,6.50]	0.99	-0.98	[-5.64,3.67]	0.68	0.95	[0.47,1.91]	0.89
P-value for trend				*0.94*			*0.76*			*0.86*
P for sex-occupation interaction			*0.64*			*0.35*			*0.91*	
Age		0.74	[0.64,0.83]	<0.01	0.32	[0.26,0.38]	<0.01	1.05	[1.04,1.06]	<0.01

Figure 5-28: Predictive mean of SBP for interaction between sex and occupation, adjusted for age. NHS 2010.

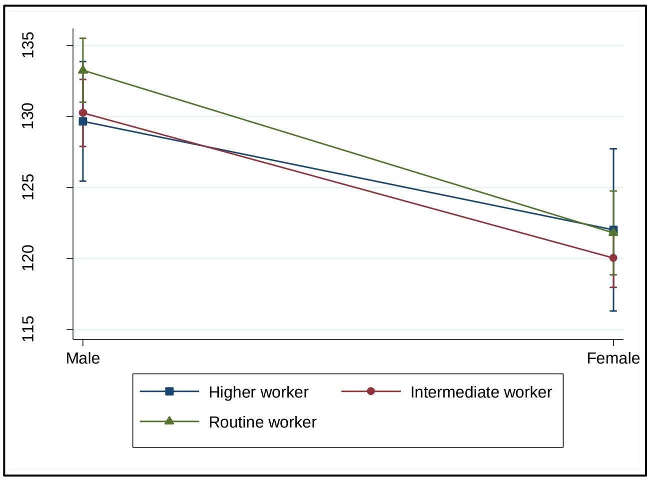


Figure 5-29: Predictive mean of DBP for interaction between sex and occupation, adjusted for age. NHS 2010.

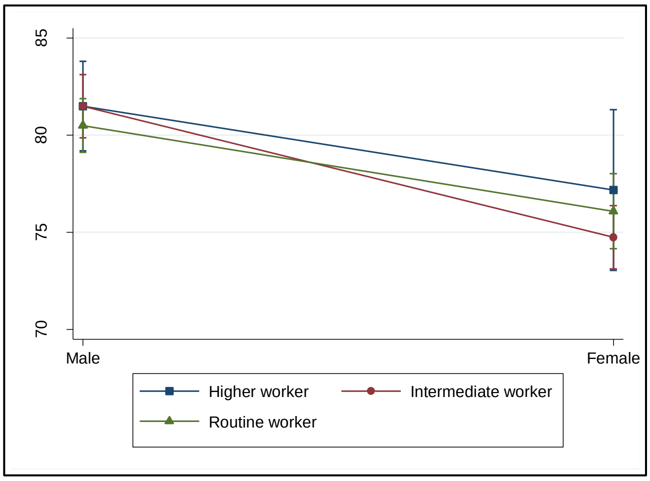
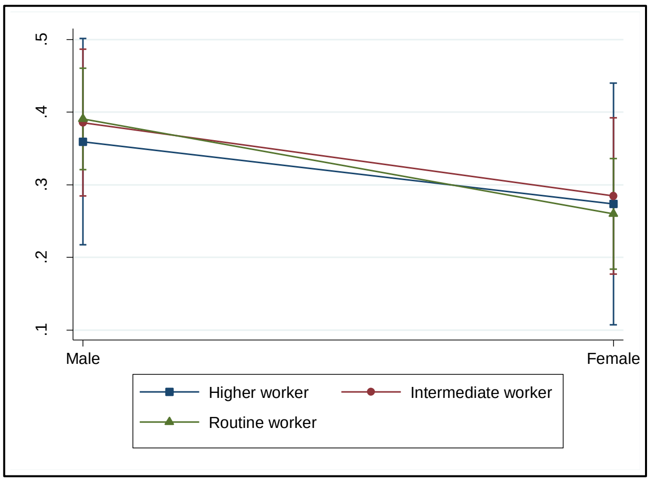


Figure 5-30: Predictive prevalence of hypertension for interaction between sex and occupation, adjusted for age. NHS 2010.



Sex-stratified analysis of the association between blood pressure and occupation showed significant differences between the six categories of occupation in women for SBP and DBP, while in men significant inequalities were found for DBP and hypertension.

Analyses showed that age as categorical variable did not show effect modification on the association between blood pressure and occupation (workers).

In turn sex did not act as an effect modifier on the association between blood pressure and occupation (workers). Stratified analyses of the association between blood pressure and occupation (workers) showed significant inverse gradients for SBP across occupation levels in people aged 40-59 years and for SBP across occupation in men.

Based on these results, subsequent analyses of the association between blood pressure and occupation should consider the inclusion of adjustments for age and sex. Although age did not act as an effect modifier age-stratified analyses were carried out for comparison purposes.

Summary of role of age and sex in the association between blood pressure and three SEP in 2010.

The results obtained for the effect of age and sex on the association between blood pressure and SEP, showed different patterns according the outcome and the socioeconomic position measure. In this way, association between blood pressure and SEP varied according the blood pressure measure and SEP measure used.

Table 5-28 summarises the results for each of the three outcomes and for each of the three SEP measures. In general, there was not interaction effect of age as categorical variable. The exception was for the association between the three outcomes and occupation.

Assessment of the effect of sex on the association between blood pressure and SEP showed that this acted as a confounder in all the cases. There was not gender interaction for any of the three SEP measures and for any of the three outcomes.

Stratified analyses by age group and by sex showed that association between blood pressure and socioeconomic position did not have an unique pattern in 2010. These associations were different according the measure of social class, the outcome, the group of age and gender. Table 5-29 summarises the associations between each measure of blood pressure and each socioeconomic position measure in NHS 2010.

Inverse gradients were most commonly observed when the outcome was SBP and in people aged over 40. These inverse gradients were observed across education and assets-based index in women, and across occupational class (workers) in men.

Table 5-28: Effect of age and sex on the association between blood pressure and SEP. NHS 2010

<table>
<tr><th>Education</th><th colspan="2">SBP</th><th colspan="2">DBP</th><th colspan="2">Hypertension</th></tr>
<tr><td>Education and age 3 categories</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">-</td></tr>
<tr><td>Education and sex</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">-</td></tr>
<tr><td>Assets-based SEP</td><td colspan="2">SBP</td><td colspan="2">DBP</td><td colspan="2">Hypertension</td></tr>
<tr><td>Assets-based SEP and age 3 categories</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">-</td></tr>
<tr><td>Assets-based SEP and sex</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">-</td></tr>
<tr><td>Occupation 6 categories</td><td colspan="2">SBP</td><td colspan="2">DBP</td><td colspan="2">Hypertension</td></tr>
<tr><td></td><td>Men</td><td>Women</td><td>Men</td><td>Women</td><td>Men</td><td>Women</td></tr>
<tr><td>Occupation and age 2 categories</td><td>-</td><td>✓</td><td>✓</td><td>-</td><td>✓</td><td></td></tr>
<tr><td>Occupation (workers)</td><td colspan="2">SBP</td><td colspan="2">DBP</td><td colspan="2">Hypertension</td></tr>
<tr><td>Occupation and age 3 categories</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">-</td></tr>
<tr><td>Occupation and sex</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">-</td></tr>
</table>

Notes: ✓: significant interaction term. (-): no significant interaction term. N/A not assessed due to convergence issue. Models assessing interaction terms between SEP and age as categorical variable were adjusted for sex. Models assessing interactions terms between SEP and sex were adjusted for age as a continuous.

Significant inequalities among the six categories of occupation were observed for the three outcomes, and these were most commonly observed in women.

Based on above results, subsequent analysis of the association between blood pressure and SEP in NHS2010 includes adjustments for age and sex in the three SEP measures and in the three outcomes. In addition, interaction terms between age and each of the three SEP measures and sex and the three exposures were included in order to show stratified analysis allowing comparison with results in 2003.

Table 5-29: Summary of the association between blood pressure and SEP NHS2010

	Education	**Assets index**	**Occupation**	**Occupation (workers)**
SBP	Inverse gradient in people aged 40 and over Inverse gradient in women	Inverse gradient in 40-59 and in 60 + age groups Inverse gradient in men (2 mmHg and 3 mmHg higher in middle and in the lowest level than the highest level respect.) and in women	Significant differences in men and women aged 45 and over	Inverse gradient in men and in 40-59 age group. In 20-39 age group higher risk in higher workers (5 and 3 mmHg lower in intermediate and in routine workers than higher workers).
DBP	No association	No association	Significant differences in men aged 20-44 and 45 and over, and in women aged 45 and over	In 20-39 age group higher risk in higher workers (3 mmHg lower in intermediate and in routine workers than higher workers).
Hypertension	In 40-59 age group middle and the lowest level had 37% and 39% higher PR than the highest level.	In 20-39 age group middle and the lowest level had 26% and 20% higher PR than the highest level Inverse gradient in men	Significant differences in women aged 20-44 and 45 and over	In people aged 60 and over higher risk in intermediate and in the lowest levels (31% and 43% higher PR than higher workers respectively)

Note: When differences in mmHg or PR are given analyses correspond to effect size. When differences are not mentioned, results are based on p-values.

Summary of role of age and sex in the association between blood pressure and three SEP: comparison between 2003 and 2010.

The effect of age and sex on the association between blood pressure and socioeconomic position showed different pattern. Effects varied according the outcomes and exposures utilised and also varied between 2003 and 2010 surveys.

- Interaction effect of age on the association between blood pressure and education was weaker in 2010 than in 2003. In general effect modification of age as categorical variable disappeared between two years. Similarly, effect of sex on the association between blood pressure and education disappeared over time. In this way, in 2010, gender acted as a confounder.
- The effect of age on the association between blood pressure and assets-based index was significant only in 2003, with age as categorical variable. Gender acted as a confounder but not as an effect modifier in both surveys.
- Age acted as an effect modifier of the association between blood pressure and occupation with six categories only in women in 2003 and in both genders in 2010.
- Interaction effects of age and gender on the association between blood pressure and occupation with three categories were in general not significant in both years.
- Social gradients of blood pressure were observed in both, 2003 and 2010 (Table 5-30).
- Inverse gradients were most commonly observed in women and in people aged 40-59 (Table 5-30).
- In men, inverse social gradients were observed only in 2010 and only across assets-based index and occupation (Table 5-30).

Table 5-30: Summary of the association between blood pressure and SEP NHS 2003 and NHS2010

		Health outcome					
		SBP		DBP		Hypertension	
		2003	2010	2003	2010	2003	2010
Pattern of means and prevalence rates by SEP levels	Education	Inverse gradient in women and in 20-39 and 40-59 age groups. Inverted j-shaped in 60+ age group (SBP about 20 and 17 mm Hg higher in lower SEP levels).	Inverse gradient in women and in 40-59 and 60 + age groups.	Inverse gradient in women and 40-59 age group. Inverted j-shaped in 60+ age group (DBP about 11 and 8 mm Hg higher in lower SEP levels).	-	Inverse gradient in women and in 20-39 age group (PR 62% higher in intermediate level and 86% higher in the lowest level); in 40-59 age group, and in women aged 60 + .	In 40-59 age group middle and the lowest level had 37% and 39% higher PR than the highest level.
	Assets-based index	Inverse gradient in women; in 20-39 and in 40-59 age groups. U-shaped in 60+ age group Inverse gradient in men (SBP 1.3 and 3.1 higher in intermediate and in the lowest level respectively than reference group).	Inverse gradient in men (2 mmHg and 3 mmHg higher in middle and in the lowest level than the highest level respect.); in women, in 40-59 and in 60 + age groups.	Inverse gradient in 40-59 age group (DBP 4.2 and 3.2 mm Hg higher in intermediate and in the lowest level respectively than reference). Inverse gradient in women (SBP 3 mmHg higher in intermediate and in the lowest level than reference group).	-	Inverse gradient in 20-39 age group (PR 90% and 200% higher in intermediate and in the lowest level resp.). Inverse gradient in 40-59 and 60+ age groups. Higher PR in intermediate and lower levels of SEP in women (PR 43% higher than reference group).	In 20-39 age group middle and the lowest level had 26% and 20% higher PR than the highest level Inverse gradient in men.
	Occupation (6 categories)	Significant differences in 45 and over age group in men and in women in two age groups.	Significant differences in men and women aged 45 and over.	Significant differences in women in two age groups.	Significant differences in men aged 20-44 and 45 and over, and in women aged 45 and over	Significant differences in women in 45 and over age group.	Significant differences in women aged 20-44 and 45 and over.

Table 5-30 (cont): Summary of the association between blood pressure and SEP NHS 2003 and NHS2010

		Health outcome					
		SBP		DBP		Hypertension	
		2003	2010	2003	2010	2003	2010
	Occupation (workers)	In 20-39 age group Intermediate workers had 6 mmHg lower SBP than higher workers. In 60+ age group routine workers had SBP 8mmHg lower than higher workers. In men and women, intermediate workers had 3 mmHg and 5 mmHg lower SBP than higher workers respectively	Inverse gradient in men and in 40-59 age group. In 20-39 age group higher risk in higher workers (5 and 3 mmHg lower in intermediate and in routine workers than higher workers).	In 20-39 age group Intermediate workers had 5 mmHg lower DBP than higher workers. Inverted J-shaped curve in 60 plus age group (Routine worker had 9 mmHg lower DBP than higher workers). In men and women, intermediate workers had 3 mmHg and 5 mmHg lower SBP than higher workers respectively.	In 20-39 age group higher risk in higher workers (3 mmHg lower in intermediate and in routine workers than higher workers). In 40-59 age group higher DBP in intermediate and in routine workers (2 mmHg higher than higher workers).	In 20-39 and 40-59 age groups intermediate workers had lower PR than higher workers.	Inverse gradient in 40-59 age group (31% and 43% higher PR in intermediate and in routine workers than higher workers respectively).

Note: When differences in mmHg or PR are given analyses correspond to effect size. When differences are not mentioned, results are based on p-values.

5.3.3 Multivariable analysis of the association between blood pressure and socio-economic position

The next section examines the role of different covariates on the association between the measures of blood pressure (SBP, DBP and hypertension) and the three SEP measures studied: education, assets-based SEP and occupation. Two versions of occupation were used, one including workers and non-workers, and the other only workers.

The covariates included in this stage of analysis were sex, age, place of residence, marital status, body mass index (BMI), diabetes mellitus (DM), family history of hypertension, smoking habit and physical activity. These covariates are described in section 4.3.3.

These covariates were added one at a time in order to observe the effect of each on the gradient of the blood pressure across the SEP after adjustment for sex and age. The statistical significance of the gradient across socioeconomic position was tested by using p-value for trend for each model. Wald test for homogeneity was used for testing differences between the categories of occupation when six categories of workers and non-workers were included.

Multiple regression models included interaction terms between SEP and sex and between SEP and age (categorised into three age groups). In the previous section, interactions between age group and SEP were shown to be significant for the three outcomes in 2003 and not significant in 2010. With the aim of comparing both periods, the regressions models for both surveys included the interaction terms, and therefore, stratified analyses were undertaken for both years. In addition, in order to study the socioeconomic inequalities in blood pressure in a format useful to public health planning, analyses were also stratified by sex.

This section was divided into three subsections corresponding to the association of blood pressure with each of the three SEP measures (education, assets-based SEP and occupation). Within each subsection, the results were organised by the outcome, being firstly presented the results for SBP, followed by DBP, and finally results for hypertension are showed.

5.3.3.1 Multivariable analysis of the association between blood pressure and education

This section presents the results for the association between blood pressure and education by sex and age groups in both 2003 and 2010.

Multivariable analysis of the association between SBP and education 2003 and 2010

SBP and education analysis by sex in 2003 and 2010

Estimates by sex of the association between SBP and education in 2003 and 2010 after full adjustment model are shown in Table 5-31. Models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.1.

In men inverse association between SBP and education was found for men (Appendix 6, Table A6.1). Adding variables to adjust the models did not change the association between SBP and education (Appendix 6, Table A6.1).

In 2003 inverse gradients between SBP and education were observed in women for all the models and these remained significant after full adjustment (Appendix 6, Table A6.1). The inverse gradient in women was subtly changed by the place of residence, marital status, diabetes mellitus, family history of hypertension and physical activity and the level of significance did not change (Appendix 6, Table A6.1). BMI, in turn, produced a more important change, which affected both the intermediate and low level of education but the gradient of SBP across educational levels remained significant after this adjustment. In the final model coefficients of SBP declined roughly by 20% and 30% in the intermediate and in the lowest level of education respectively, and even so, the social gradients were significant (Appendix 6, Table A6.1).

In 2010, the group with the lowest level of education had consistently higher coefficient for SBP than the group most educated. Differences between the extreme levels of education in women were no longer significant after adjustment for place of residence, BMI, DM, smoking habit, and after full adjustment. Similar to that observed in 2003, BMI had an important impact on the association between SBP and education in women in 2010. After adjusting for this covariate the coefficient for the lowest educational level declined by about 30%, and after full adjustment, this estimate decreased about 34%.

Therefore, the lack of educational inequalities in the fully adjusted model was given almost entirely by BMI (Appendix 6, Table A6.1). The exceptions were the models adjusted for marital status, family history of hypertension and physical activity, where differences between extreme socioeconomic groups remained significant and even increased (Appendix 6, Table A6.1).

Assessment of the differences between the second and the third level of education in women in 2010 showed that these were significant for all the models, with the exception of the model after adjusting for BMI and the fully adjusted model (Appendix 6, Table A6.2). Analysis using education with two categories (combining the highest and the intermediate levels in one) showed significant differences in all models, with the only exception of the model adjusted for BMI (Appendix 6, Table A6.3). This additional analysis demonstrated that least educated women in 2010 had consistently worse SBP parameters than women in the intermediate and in the highest levels of education. Additionally it can be seen that BMI decreased these differences, which were no longer significant.

In this manner there was a change in association between SBP and education among women between 2003 and 2010. In 2003 higher education was protective against SBP, whereas high and middle levels in 2010, although these latter were not significant after full adjustment.

The effect of each covariate on blood pressure can be observed in Table 5-31. Age, was related to increase of SBP. For each additional year of age there was 0.74 mmHg increased in systolic blood pressure in 2003 and 0.71 in 2010. Marital status, in turn had a significant effect on SBP. Being single in 2003 and being divorced/separated/widowed in 2010, had the highest risks of raised SBP. Being married had the lowest risk of raised SBP in both surveys. BMI was directly related to SBP, so for each additional point of BMI was 0.90 mmHg and 0.78 increased in systolic blood pressure in 2003 and 2010 respectively. In addition, having family history of hypertension was associated with increase of the levels of SBP in both, 2003 and 2010. Having diabetes mellitus was associated to increase of SBP in 2003, but the in 2010 this variable was not significant. Similarly, smoking habit had significant effect on SBP in 2003 but not in 2010. In this case, being current or past smoker in 2003 had a lower risk of raised SBP than those who never smoked. However, this effect was reduced in 2010 and was no longer significant. The place of residence and physical activity were not significant in both, 2003 and 2010.

SBP and education analysis by age group in 2003 and 2010

Table 5-32 presents the results of multivariable analysis for the association between SBP and education by age group in fully adjusted model in 2003 and 2010. Models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.4.

In 2003, models performed for people aged 20-39 and 40-59 showed significant inverse associations after adjustment for BMI and for family history of hypertension (Appendix 6, Table A6.4). The gradients of the models adjusted for diabetes mellitus and smoking habit were significant (p=0.05) (Appendix 6, Table A6.4). Place of residence, marital status and physical activity weakened the association between SBP and education in the youngest people in 2003, so much so that it was no longer significant. In 2010, associations between SBP and education were not significant in this age group in any of the models (Appendix 6, Table A6.4).

Education was significantly inversely related to SBP in people aged 20-39 and 40-59 and an inverted u-shaped association was found in people aged 60 and over in 2003. All the covariates, with the exception of BMI, only had a slight effect on the association between SBP and education and the gradient remained significant (p-value for trend <0.01). BMI affected mainly the lowest level of education, where coefficient diminished around 17%, decreasing the difference with the most educated, but the gradient remained significant (p-value for trend <0.01) (Appendix 6, Table A6.4). In 2010, inverse gradients of SBP across educational levels were observed in all the models in people aged 40-59 years (Appendix 6, Table A6.4). As previously, BMI seems to be the most important covariate in the way it affects association between SBP and education.

Table 5-31: Multivariable analysis of the association between SBP and education, by sex. Fully adjusted models 2003 and 2010.

		2003			2010		
Education	**N**	**Coef**	**95% CI**	**p value**	**Coef**	**95% CI**	**p value**
Men							
High	570	Ref	-	-	Ref	-	-
Middle	1636	0.82	[-2.29,3.92]	0.61	1.76	[-1.39,4.91]	0.27
Low	836	0.10	[-3.79,3.99]	0.96	2.59	[-1.86,7.03]	0.25
P-value for trend				*0.91*			*0.22*
Women							
High	570	Ref	-	-	Ref	-	-
Middle	1636	5.31	[2.03,8.59]	<0.01	-0.05	[-2.38,2.29]	0.97
Low	836	6.90	[3.10,10.71]	<0.01	3.15	[-1.51,7.81]	0.19
P-value for trend				<0.01			*0.20*
Age[1]		0.74	[0.65,0.82]	<0.01	0.71	[0.64,0.78]	<0.01
Place of residence (Ref: Urban)		1.74	[-0.65,4.13]	0.15	0.62	[-1.76,3.00]	0.61
Marital status							
Married/cohabiting		Ref	-	-	Ref	-	-
Single		3.38	[1.02,5.74]	0.01	2.94	[1.09,4.78]	<0.01
Divorced/Separated/Widowed		2.49	[-0.65,5.63]	0.12	3.40	[0.18,6.63]	0.04
Body Mass Index[2]		0.90	[0.71,1.09]	<0.01	0.78	[0.64,0.91]	<0.01
Diabetes Mellitus[3]		4.58	[0.44,8.72]	0.03	1.84	[-1.20,4.89]	0.23
Family history of hypertension[4]		2.18	[0.44,3.91]	0.01	3.80	[2.11,5.48]	<0.01
Smoking							
Never		Ref	-	-	Ref	-	-
Past		-3.48	[-6.25,-0.72]	0.01	-2.42	[-4.95,0.11]	0.06
Current		-3.01	[-5.04,-0.99]	<0.01	-1.90	[-3.96,0.17]	0.07
Physical Activity							
3 or more times		Ref	-	-	Ref	-	-
Less than 3 times		2.01	[-0.84,4.87]	0.17	-2.98	[-6.19,0.23]	0.07
None		2.11	[-0.48,4.70]	0.11	-2.28	[-5.35,0.80]	0.15

(1)Age: as a continuous variable. (2) Body Mass Index: as a continuous variable. (3) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (4) Family history of hypertension (as binary variable).

Table 5-32: Multivariable analysis of the association between SBP and education by age group, fully adjusted models. 2003 and 2010.

		2003			2010		
Education	**Weighted N**	**Coef**	**95% CI**	**p value**	**Coef**	**95% CI**	**p value**
20-39							
High	570	Ref	-	-	Ref	-	-
Middle	1636	2.14	[-0.28,4.57]	0.08	0.40	[-1.58,2.38]	0.69
Low	836	2.57	[-1.71,6.86]	0.24	1.03	[-2.74,4.79]	0.59
P-value for trend				*0.13*			*0.58*
40-59							
High		Ref	-	-	Ref	-	-
Middle		4.48	[-0.11,9.06]	0.06	2.56	[-1.64,6.76]	0.23
Low		8.27	[3.63,12.92]	<0.01	5.97	[-0.77,12.71]	0.08
P-value for trend				*<0.01*			*0.08*
60 and over							
High		Ref	-	-	Ref	-	-
Middle		18.50	[7.10,29.84]	<0.01	2.72	[-6.60,12.05]	0.57
Low		14.40	[4.09,24.75]	0.01	5.33	[-3.21,13.86]	0.22
P-value for trend				*0.73*			*0.15*
Sex (Ref: Male)		-8.41	[-10.04,-6.78]	<0.01	-10.40	[-12.37,-8.45]	<0.01
Place of residence (Ref:Urban)		1.62	[-0.83,4.06]	0.20	0.79	[-1.66,3.24]	0.53
Marital status							
Married/cohabiting		Ref	-	-	Ref	-	-
Single		0.28	[-1.92,2.49]	0.80	0.50	[-1.40,2.40]	0.60
Divorced/Separated/Widowed		4.64	[1.41,7.86]	<0.01	3.89	[0.61,7.16]	0.02
Body Mass Index[1]		0.98	[0.79,1.16]	<0.01	0.87	[0.75,1.00]	<0.01
Diabetes Mellitus[2]		5.47	[1.15,9.78]	0.01	1.13	[-1.96,4.22]	0.47
Family history of hypertension[3]		2.19	[0.53,3.85]	0.01	3.82	[2.10,5.54]	<0.01
Smoking							
Never		Ref	-	-	Ref	-	-
Past		-3.36	[-6.08,-0.64]	0.02	-1.88	[-4.52,0.76]	0.16
Current		-3.86	[-5.79,-1.93]	<0.01	-2.13	[-4.19,-0.07]	0.04
Physical Activity							
3 or more times		Ref	-	-	Ref	-	-
Less than 3 times		2.33	[-0.59,5.25]	0.12	-2.20	[-5.41,1.01]	0.18
None		2.95	[0.28,5.63]	0.03	-1.10	[-4.16,1.96]	0.48

(1) Body Mass Index: as a continuous variable. (2) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (3)Family history of hypertension: Having family history of hypertension (as binary variable).

The analysis of the association between SBP and education in people aged 60 and over showed that the intermediate level of education had the highest risk in all the models (Appendix 6, Table A6.4). Differences between most educated and the intermediate and the lowest levels of education were significant. In general the covariates did not have important effects on the coefficients. In 2010, all the models had a significant inverse gradient except the model adjusted for BMI and the fully adjusted model (Appendix 6, Table A6.4). BMI affected mainly the lowest level of education, whereby its coefficient decreased in about 19% causing a reduction of inequalities. Having diabetes mellitus and smoking habit subtly weakened the gradient in older people.

The results of the fully adjusted model of the association between SBP and education stratified by age group in 2003 and 2010 are shown in Table 5-32.

Similar to that observed in the previous analysis stratified by sex, being man and age increased SBP in both surveys. Being Divorced/Separated/Widowed had a higher risk of raised SBP than married people and being single was not significant, in both 2003 and 2010. BMI, in turn, also had a significant effect on SBP, so for each additional point of BMI was 0.98 mmHg and 0.87 mmHg increased in systolic blood pressure in 2003 and 2010 respectively. Having family history of hypertension also was related to increase the risk of raised SBP in both surveys. Being current or past smoker had a lower risk of raised SBP in both surveys. Having diabetes mellitus and physical activity had significant effect on SBP in 2003 but not in 2010. In this manner, having diabetes mellitus increased the risk of raised SBP, and people who did not do exercise had a higher risk than those who did exercise 3 or more times in 2003. The place of residence was not significant.

Multivariable analysis between DBP and education in 2003 and 2010

In this section results of the multivariable regressions model for DBP across education, are presented stratified by sex and age group, for both 2003 and 2010

DBP and education analysis by sex in 2003 and 2010

Sex-stratified analysis of the association between DBP and education after full adjustment is presented in Table 5-33. Models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.5.

Findings showed that in 2003 and 2010 there were no significant associations in men. Adjustment for each of the covariates did not change the association between DBP and education which remained not significant in both 2003 and 2010 (Appendix 6, Table A6.5).

In 2003, in most of the models, women in the intermediate and in the lowest levels of education had higher risks of raised DBP than those most educated. Adjustments for most of the variables did not have important effects, with the exception of BMI. This adjustment weakened the gradient of DBP across educational levels which was no longer significant (p-value for trend = 0.14) (Appendix 6, Table A6.5). BMI caused the coefficient of the intermediate and of the lowest levels of education to decline by around 33% and 43% respectively. In the fully adjusted model women in intermediate level of education had significant higher risk than those most educated (Appendix 6, Table A6.5).

After full adjustment, the coefficients for the intermediate group and for those least educated decreased around 33% and 48%. This provides evidence that changes in the level of significance of the educational gradient in DBP were due to BMI rather than the others covariates (Appendix 6, Table A6.5).

In 2010 the gradient of DBP across education was reversed. In this manner, women in the intermediate and in the lowest levels of education had lower risks than those most educated, although these were significant only after adjustment for BMI and after full adjustment (Appendix 6, Table A6.5).

The fully adjusted parameters of the association between DBP and education for 2003 and 2010 are shown in Table 5-33. Similar to that observed for SBP, being man and age increases the risk of raised DBP in both surveys. BMI was also related to DBP, and the estimations showed that for each additional point of BMI was 0.83 mmHg and 0.57 increased in DBP in 2003 and 2010 respectively. In turn, family history of hypertension showed increasing the risk of raised DBP in 2003 and 2010. The effect of marital status on DBP in 2003 was not significant. In 2010, being single showed a lower risk of raised DBP than being married and being divorced/separated/widowed was not significant. Smoking habit was related to DBP in 2003 but not in 2010. Being current smoker had a lower risk of raised DBP than those never smoked. Finally, the place of residence and physical activity had no significant effects on DBP in both, 2003 and 2010.

DBP and education analysis by age group in 2003 and 2010

Analysis of the associations between DBP and education stratified by age group are shown in Table 5-34. Models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.6.

The association between DBP and education in people aged 20-39 were not significant in both, 2003 and 2010 (Table 5-34).

In adults aged 40-59, those least educated showed a higher risk than those in the highest level of SEP in 2003. Place of residence, marital status, having diabetes mellitus, having family history of hypertension and physical activity had no effect over the coefficients of DBP across levels of education or on its level of significance (Appendix 6, Table A6.6). Unlike, adjustment for BMI attenuated the effect in the lowest level of education, and the inequalities were no longer significant. This provides evidence that changes in the level of significance in the fully adjusted model were caused by BMI rather than the other variables. In 2010, a direct association was found between DBP and education in people aged 40-59 (Table 5-34).

In people aged 60 and over, education was significantly related to DBP in 2003 in all the models and an inverted j-shaped curve was observed in all of them. So that, individuals in the intermediate level of education had the higher risk, while those least educated showed a higher risk than most educated people but lower than those with intermediate level of education. In 2010, none of the models had significant associations between DBP and education.

Table 5-33: Multivariable analysis of the association between DBP and education, by sex. Fully adjusted models 2003 and 2010.

	2003				2010			
Education	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
Men								
High	570	Ref	-	-	1112	Ref	-	-
Middle	1636	-0.18	[-2.42,2.07]	0.88	2196	0.00	[-2.02,2.02]	0.99
Low	836	-0.60	[-3.43,2.22]	0.67	748	-1.72	[-4.53,1.09]	0.23
P-value for trend				*0.73*				*0.32*
Women								
High	570	Ref	-	-	1112	Ref	-	-
Middle	1636	2.63	[0.32,4.95]	0.03	2196	-1.87	[-3.44,-0.30]	0.02
Low	836	2.11	[-0.45,4.68]	0.11	748	-2.39	[-4.56,-0.23]	0.03
P-value for trend				*0.18*				*0.02*
Age[1]		0.26	[0.22,0.31]	<0.01		0.16	[0.12,0.20]	<0.01
Place of residence (Ref: Urban)		0.58	[-1.10,2.26]	0.50		0.34	[-1.17,1.85]	0.66
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		-0.05	[-1.48,1.38]	0.95		-1.20	[-2.38,-0.03]	0.04
Divorced/Separated/Widowed		0.43	[-1.52,2.38]	0.67		0.02	[-1.85,1.89]	0.99
Body Mass Index[2]		0.83	[0.71,0.95]	<0.01		0.57	[0.50,0.65]	<0.01
Diabetes Mellitus[3]		-0.77	[-3.16,1.62]	0.53		0.51	[-1.19,2.21]	0.55
Family history of hypertension[4]		2.31	[1.12,3.51]	<0.01		2.42	[1.44,3.41]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-1.38	[-3.18,0.42]	0.13		-0.54	[-2.04,0.95]	0.48
Current		-1.86	[-3.25,-0.46]	0.01		-0.50	[-1.64,0.65]	0.39
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.41	[-1.72,2.55]	0.70		-1.15	[-3.15,0.86]	0.26
None		0.70	[-1.31,2.70]	0.49		0.60	[-1.22,2.43]	0.52

(1)Age: as a continuous variable. (2) Body Mass Index: as a continuous variable. (3) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (4)Family history of hypertension: Having family history of hypertension (as binary variable).

Table 5-34: Multivariable analysis of the association between DBP and education, by age group. Fully adjusted models 2003 and 2010

	2003				2010			
Education	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
20-39								
High	570	Ref	-	-	1112	Ref	-	-
Middle	1636	0.47	[-1.38,2.32]	0.62	2196	-0.93	[-2.47,0.61]	0.24
Low	836	0.57	[-2.36,3.51]	0.70	748	-0.37	[-4.57,3.82]	0.86
P-value for trend				*0.61*				*0.41*
40-59								
High	570	Ref	-	-	1112	Ref	-	-
Middle	1636	1.72	[-1.16,4.61]	0.24	2196	-1.92	[-4.52,0.67]	0.15
Low	836	2.84	[-0.21,5.89]	0.07	748	-2.29	[-5.51,0.93]	0.16
P-value for trend				*0.07*				*0.15*
60 and over								
High	570	Ref	-	-	1112	Ref	-	-
Middle	1636	10.90	[3.92,17.97]	<0.01	2196	-0.64	[-4.64,3.37]	0.76
Low	836	7.76	[0.96,14.57]	0.03	748	-1.00	[-4.73,2.72]	0.60
P-value for trend				*0.99*				*0.56*
Sex (Ref: men)		-6.94	[-8.05,-5.82]	<0.01		-5.90	[-6.97,-4.82]	<0.01
Place of residence (Ref:urban)		0.49	[-1.17,2.15]	0.56		0.24	[-1.24,1.72]	0.75
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		-0.65	[-2.04,0.74]	0.36		-1.22	[-2.43,-0.00]	0.05
Divorced/Separated/Widowed		1.53	[-0.39,3.45]	0.12		0.88	[-0.97,2.72]	0.35
Body Mass Index[1]		0.82	[0.71,0.94]	<0.01		0.58	[0.51,0.66]	<0.01
Diabetes Mellitus[2]		-0.29	[-2.69,2.10]	0.81		0.56	[-1.10,2.23]	0.51
Family history of hypertension[3]		2.07	[0.92,3.21]	<0.01		2.35	[1.36,3.34]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-1.44	[-3.13,0.25]	0.09		-0.65	[-2.14,0.85]	0.40
Current		-2.42	[-3.78,-1.07]	<0.01		-0.69	[-1.85,0.46]	0.24
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.60	[-1.47,2.68]	0.57		-0.93	[-2.95,1.08]	0.36
None		0.95	[-1.02,2.92]	0.34		0.92	[-0.89,2.73]	0.32

(1) Body Mass Index: as a continuous variable. (2) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (3)Family history of hypertension: Having family history of hypertension (as binary variable).

The fully adjusted model parameters of the association between DBP and education in 2003 and 2010 are shown in Table 5-34. Being man and age increased the risk of raised DBP in both surveys. In turn, BMI was also significant, and for each additional point of BMI was 0.82 mmHg and 0.58 increased in DBP in 2003 and 2010 respectively. Having family history of hypertension had a higher risk of raised DBP in 2003 and 2010. Moreover, in 2003 being current or past smoker had a lower risk of raised DBP than those who never smoked. In 2010 smoking habit was not significant. On the other hand, the place of residence, marital status, diabetes mellitus and physical activity were not significant in both years.

Multivariable analysis of the association between hypertension and education in 2003 and 2010

Results of the multivariable regression models investigating the association between hypertension and education are presented in this section, analyses stratified by sex and age were examined for both 2003 and 2010.

Hypertension and education analysis by sex in 2003 and 2010

Results of the multivariable regression models investigating the association between hypertension by sex are given in Table 5-35. Models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.7.

There was not association between hypertension and education in men in both 2003 and 2010 (Table 5-35).

In 2003, women in the intermediate level and those in the lowest level of education, had higher PRs that their counterpart in the highest in all the models (Table 5-35). This association also remained significant after full adjustment. Place of residence, marital status, having diabetes mellitus, family history of hypertension, smoking habit and physical activity had a marginal effect on the association (Appendix 6, Table A6.7). In turn, BMI attenuated the effect in around 10% and 14% in the intermediate and in the lowest educational levels respectively. Regardless, estimates remained significant. Concordant with previous analysis for SBP and DBP, BMI was the covariate which most affected the association between hypertension and education (Appendix 6, Table A6.7).

In 2010, there was a not association between hypertension and education in any of the models performed for women.

Table 5-35 shows the parameters of the fully adjusted regression models of the association between hypertension and education in 2003 and 2010 by sex. Analyses showed that sex was significant in 2003 but not in 2010, and being man had a higher risk of hypertension than being woman. Age, increased the risk in both 2003 and 2010. BMI was significant in both surveys. For each additional point of BMI was 5% and 4% increased the prevalence of hypertension in 2003 and 2010 respectively. In turn, having family history of hypertension increased the risk of hypertension in about 30% in 2003 and 2010. Multivariable analysis also showed that having diabetes mellitus was not significant in 2003 and significant in 2010. The risk of hypertension was 20% higher in people with diabetes mellitus in 2010. The place of residence, marital status, smoking and physical activity were not significant in both, 2003 and 2010.

Hypertension and education analysis by age group in 2003 and 2010

Multivariable regression analysis for the association between hypertension and education by age is presented in this section, and the results are given in Table 5-36. In Appendix 6, Table A6.8 models in which covariates were added one-at-a-time are shown.

Association between hypertension and education was not significant in people aged 20-39 in both, 2003 and 2010 (Table 5-36).

In the intermediate age group (40-59), education was significantly inversely related to hypertension in most of the models in 2003 (Appendix 6, Table A6.8). The place of residence, marital status and having diabetes mellitus had a minimal effect on the association between hypertension and education, so that; the regression parameters remained similar to those adjusted only for age and sex (Appendix 6, Table A6.8). In turn, adjustments for family history of hypertension subtly strengthened the inverse gradient. Adjustment for BMI, however, weakened the association between hypertension and education by decreasing the PR in the lowest level. Most of the changes observed for the fully adjusted model were given by the effect of BMI on the lowest socioeconomic level.

Table 5-35: Multivariable analysis of the association between hypertension and education, fully adjusted models by sex. 2003 and 2010.

	2003				2010			
Education	**N**	**PR**	**95% CI**	**p value**	**N**	**PR**	**95% CI**	**p value**
Men								
High	570	Ref	-	-	1112	Ref	-	-
Middle	1636	1.01	[0.79,1.30]	0.91	2196	1.33	[0.94,1.88]	0.11
Low	836	0.92	[0.71,1.20]	0.55	748	0.93	[0.64,1.35]	0.70
P-value for trend				*0.49*				*0.58*
Women								
High	570	Ref	-	-	1112	Ref	-	-
Middle	1636	1.91	[1.03,3.54]	0.04	2196	1.13	[0.83,1.52]	0.43
Low	836	1.96	[1.07,3.57]	0.03	748	1.06	[0.78,1.45]	0.69
P-value for trend				*0.02*				*0.64*
Age[1]		1.04	[1.03,1.04]	<0.01		1.04	[1.04,1.05]	<0.01
Place of residence (Ref: Urban)		1.05	[0.90,1.23]	0.54		1.02	[0.80,1.30]	0.86
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.87	[0.69,1.09]	0.22		0.94	[0.79,1.14]	0.55
Divorced/Separated/Widowed		1.01	[0.87,1.16]	0.91		1.04	[0.84,1.28]	0.73
Body Mass Index[2]		1.05	[1.04,1.07]	<0.01		1.04	[1.03,1.05]	<0.01
Diabetes Mellitus[3]		0.97	[0.85,1.12]	0.70		1.20	[1.03,1.41]	0.02
Family history of hypertension[4]		1.33	[1.17,1.51]	<0.01		1.34	[1.17,1.53]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		0.91	[0.79,1.04]	0.17		1.00	[0.84,1.19]	0.97
Current		0.83	[0.70,1.00]	0.05		1.01	[0.85,1.20]	0.90
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.94	[0.71,1.25]	0.69		0.90	[0.58,1.39]	0.63
None		1.03	[0.81,1.32]	0.79		1.23	[0.87,1.75]	0.24

(1)Age: as a continuous variable. (2) Body Mass Index: as a continuous variable. (3) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (4)Family history of hypertension: Having family history of hypertension (as binary variable).

Table 5-36: Multivariable analysis of the association between hypertension and education, fully adjusted models, by age. 2003 y 2010

	2003				2010			
Education	**N**	**PR**	**95% CI**	**p value**	**N**	**PR**	**95% CI**	**p value**
20-39								
High	570	Ref	-	-	1112	Ref	-	-
Middle	1636	1.59	[0.82,3.06]	0.17	2196	1.27	[0.70,2.32]	-0.43
Low	836	1.72	[0.80,3.73]	0.17	748	0.61	[0.22,1.64]	-0.32
P-value for trend				*0.11*				*0.83*
40-59								
High	570	Ref	-	-	1112	Ref	-	-
Middle	1636	1.17	[0.88,1.56]	0.28	2196	1.25	[0.89,1.74]	-0.19
Low	836	1.29	[0.97,1.72]	0.08	748	1.21	[0.82,1.79]	-0.33
P-value for trend				*0.06*				*0.32*
60 and over								
High	570	Ref	-	-	1112	Ref	-	-
Middle	1636	1.02	[0.77,1.34]	0.92	2196	1.07	[0.74,1.55]	-0.73
Low	836	0.93	[0.72,1.22]	0.61	748	1.02	[0.70,1.48]	-0.93
P-value for trend				*0.34*				*0.96*
Sex (Ref: men)		0.69	[0.61,0.78]	<0.01		0.73	[0.63,0.85]	<0.01
Place of residence (Ref:urban)		1.04	[0.90,1.19]	0.61		1.03	[0.82,1.30]	0.79
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.88	[0.70,1.10]	0.26		0.96	[0.78,1.18]	0.71
Divorced/Separated/Widowed		1.19	[1.04,1.36]	0.01		1.18	[0.96,1.45]	0.11
Body Mass Index[1]		1.05	[1.04,1.06]	<0.01		1.04	[1.03,1.05]	<0.01
Diabetes Mellitus[2]		1.03	[0.90,1.18]	0.64		1.11	[0.95,1.30]	0.20
Family history of hypertension[3]		1.23	[1.09,1.39]	<0.01		1.32	[1.15,1.51]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		0.88	[0.77,1.01]	0.07		0.97	[0.81,1.17]	0.75
Current		0.78	[0.66,0.93]	0.01		0.95	[0.81,1.12]	0.55
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.99	[0.74,1.32]	0.94		0.95	[0.62,1.48]	0.84
None		1.07	[0.84,1.36]	0.60		1.33	[0.93,1.91]	0.12

(1) Body Mass Index: as a continuous variable. (2) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (3)Family history of hypertension: Having family history of hypertension (as binary variable).

In 2010, there was not association between hypertension and education in people aged 40-59 in any of the models performed (Appendix 6, Table A6.8).

In older people (60 and over) education was not related to hypertension in any of the models performed, in neither 2003 nor 1010 (Appendix 6, Table A6.8).

The results for the fully adjusted models of the association between hypertension and education for 2003 and 2010 are shown in Table 5-36. These results showed that being man increased the risk of hypertension in both 2003 and 2010. Moreover, the risk of hypertension increased with age. Being 40-59 years old increased the risk of hypertension by about 3-fold, and being 60 and older about 6.6-fold the risk in people aged 20-39, in both surveys. In turn, people with family history of hypertension also showed a higher risk of hypertension than people who did not have it, in both years under study. BMI had significant effects in both surveys, so that, for each additional point of BMI there was a 5% and 4% increase in prevalence of hypertension in 2003 and 2010 respectively. The association between marital status an hypertension was significant only in 2003. Being divorced/separated/widowed had a higher risk of hypertension than married people and the effect of being single was not significant. Being current smoker had a lower risk of hypertension than people who never smoked in 2003. In 2010 smoking habit was not significant. In addition, the place of residence, having diabetes mellitus and physical activity were not significant in both, 2003 and 2010.

Summary of multivariable analysis of the association between blood pressure and education in 2003 and 2010

Association between blood pressure and education varied according to sex, age group, outcome and year. Inverse association was the most common type of association observed and this was found mainly in women, in people aged 40-59 and when the outcome was SBP. A direct association between DBP and education was found in women and in people aged 40-59 in 2010, and u-shaped curves of SBP and DBP across education were observed in people aged 60 and over in 2003. In turn, inverted u-shaped and j-shaped curves were found in people aged 60 and over for SBP and DBP across educational levels respectively in 2003.

In addition, association between blood pressure and education tended to diminish in 2010. In addition, people aged 60 and over in the intermediate level of education tended to show higher levels of SBP and DBP.

Covariates such as gender, age, BMI and family history of hypertension had consistently significant effect on blood pressure. BMI was the covariate which had by far the most substantial effect on the association between blood pressure and SEP. In most of cases, adjustment for BMI caused large changes in the estimates across levels of SEP, affecting the level of significance.

5.3.3.2 Multivariable analysis of the association between blood pressure and assets-based index

In this section the results for the association between blood pressure and assets based index are presented. Estimations were stratified by sex and age groups for both 2003 and 2010.

Multivariable analysis of the association between SBP and assets-based index in 2003 and 2010

SBP and assets-based index analysis by sex in 2003 and 2010

The analyses reported in this section examined the association between SBP and assets-based index using multivariable analysis, and the results are shown in Table 5-37. Results of the models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.9.

In men, inverse gradient were observed in both 2003 and 2010. In this manner, adding covariates to the models did not change the results in the gradient of SBP across assets-based SEP(Table 5-37).

In women, a significant inverse gradient of SBP across assets-based index was observed after adjustment for each of the variables studied in 2003 (Appendix 6, Table A6.9). In general all the variables subtly weakened the association between assets-based index and SBP, except for BMI which had a most important effect. BMI affected more markedly to the lowest level of education group, decreasing the coefficient in 29%. After adjusting for this covariate, the gradient weakened although remained statistically significant

(Appendix 6, Table A6.9). In 2010, an inverted u-shaped association was observed between SBP and assets-based index in all the models, but only differences between the intermediate and the highest level were significant (Appendix 6, Table A6.10). In general all covariates affected subtly the coefficients, and the level of significance remained. BMI weakened the association between SBP and education, but differences between the two most privileged groups remained significant (p-value for trend=0.04) (Appendix 6, Table A6.9).

The regression parameters resulting from the fully adjusted model of the association between SBP and assets-based index are shown in Table 5-37. These results showed that being man and age increased the risk of raised SBP in both surveys. In turn, being single, had a higher risk than married people. Similar that observed in the previous analysis BMI was significant in both surveys. For each additional point of BMI there were 0.92 mmHg and 0.77 mmHg increase in risk of raised SBP in 2003 and 2010, respectively. Having family history of hypertension incremented SBP in both years under study. In both surveys, past and current smokers had lower SBP than people who never smoked. Having diabetes mellitus increased the risk of raised SBP, but this was significant only in 2003. The place of residence and physical activity were not significant in both surveys.

SBP and assets-based index analysis by age group in 2003 and 2010

Results of the multivariable analysis of the association between SBP and assets-based index by age group are presented in Table 5-38, while results of the models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.11.

In 2003, inverse association was found between assets-based SEP and SBP in people aged 20-39 in most of the models (Appendix 6, Table A6.11). However, only differences between the two extreme levels of assets index were significant. These inequalities were no longer found after adjustment for place of residence, BMI, physical activity and after full adjustments (Appendix 6, Table A6.11). In 2010, assets-based SEP was not related to SBP in people aged 20-39 (Appendix 6, Table A6.11).

Table 5-37: Multivariable analysis of the association between SBP and assets-based SEP, by sex. Fully adjusted models 2003 and 2010

	2003				2010			
Assets-based SEP	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
Men								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	0.88	[-2.89,4.66]	0.65	1802	2.23	[-0.46,4.93]	0.10
Low	741	3.19	[-0.99,7.38]	0.13	346	3.18	[-1.75,8.10]	0.21
P-value for trend				*0.09*				*0.07*
Women								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	3.70	[-0.70,8.10]	0.10	1802	2.43	[0.07,4.79]	0.04
Low	741	4.05	[-0.78,8.88]	0.10	346	1.56	[-1.34,4.45]	0.29
P-value for trend				*0.13*				*0.06*
Age[1]		0.76	[0.68,0.83]	<0.01		0.73	[0.66,0.79]	<0.01
Place of residence (Ref: Urban)		1.39	[-0.90,3.67]	0.23		0.39	[-1.99,2.76]	0.75
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		3.26	[0.89,5.63]	0.01		2.86	[1.07,4.64]	<0.01
Divorced/Separated/Widowed		2.56	[-0.58,5.69]	0.11		3.31	[0.07,6.56]	0.05
Body Mass Index[2]		0.92	[0.73,1.10]	<0.01		0.77	[0.63,0.91]	<0.01
Diabetes Mellitus[3]		4.64	[0.45,8.83]	0.03		2.01	[-1.02,5.03]	0.19
Family history of hypertension[4]		2.06	[0.35,3.77]	0.02		3.80	[2.10,5.50]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-3.74	[-6.47,-1.00]	0.01		-2.57	[-5.11,-0.03]	0.05
Current		-3.16	[-5.19,-1.13]	<0.01		-2.00	[-4.00,-0.00]	0.05
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		2.26	[-0.58,5.09]	0.12		-3.06	[-6.27,0.16]	0.06
None		2.15	[-0.45,4.75]	0.10		-2.24	[-5.27,0.79]	0.15

(1)Age: as a continuous variable. (2) Body Mass Index: as a continuous variable. (3) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (4)Family history of hypertension: Having family history of hypertension (as binary variable).

Table 5-38: Multivariable analysis of the association between SBP and assets-based SEP, by age group. Fully adjusted models. 2003 and 2010.

Assets-based SEP	2003				2010			
	N	Coef	95% CI	p value	N	Coef	95% CI	p value
20-39								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	0.95	[-2.69,4.60]	0.61	1802	1.54	[-0.29,3.37]	0.10
Low	741	2.67	[-1.24,6.58]	0.18	346	-0.21	[-3.72,3.29]	0.90
P-value for trend				*0.14*				*0.33*
40-59								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	6.80	[2.51,11.08]	<0.01	1802	3.05	[-0.44,6.55]	0.09
Low	741	6.54	[1.57,11.51]	0.01	346	4.17	[-1.58,9.92]	0.16
P-value for trend				*0.03*				*0.05*
60 and over								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	-8.71	[-23.59,6.18]	0.25	1802	5.96	[0.79,11.14]	0.02
Low	741	-3.44	[-18.67,11.78]	0.66	346	5.76	[-0.29,11.82]	0.06
P-value for trend				*0.99*				*0.02*
Sex (Ref: men)		-7.95	[-9.61,-6.29]	<0.01		-10.50	[-12.47,-8.54]	<0.01
Place of residence (Ref:urban)		1.59	[-0.73,3.92]	0.18		0.56	[-1.95,3.08]	0.66
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.20	[-1.96,2.36]	0.86		0.28	[-1.53,2.09]	0.76
Divorced/Separated/Widowed		4.42	[1.15,7.69]	0.01		3.57	[0.20,6.94]	0.04
Body Mass Index[1]		1.00	[0.82,1.18]	<0.01		0.88	[0.75,1.00]	<0.01
Diabetes Mellitus[2]		5.88	[1.47,10.29]	0.01		1.34	[-1.75,4.42]	0.40
Family history of hypertension[3]		1.82	[0.08,3.57]	0.04		3.88	[2.15,5.62]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-3.74	[-6.64,-0.83]	0.01		-2.03	[-4.64,0.59]	0.13
Current		-3.96	[-5.90,-2.02]	<0.01		-2.22	[-4.23,-0.22]	0.03
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		2.37	[-0.62,5.36]	0.12		-2.35	[-5.52,0.82]	0.15
None		2.90	[0.15,5.65]	0.04		-1.04	[-4.02,1.94]	0.49

(1) Body Mass Index: as a continuous variable. (2) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (3)Family history of hypertension: Having family history of hypertension (as binary variable).

In addition, assets-based index was significantly inversely related to SBP in people aged 40-59 in both 2003 and 2010. In 2003, differences between levels of assets index and the gradients across SEP were significant in all the models (Appendix 6, Table A6.11). After full adjustment, the gradient weakened but remained significant (p-value for trend = 0.03). In 2010, individuals in the intermediate and in the lowest socioeconomic levels had higher SBP than their counterpart in the most privileged group. Unlike to that observed in the previous sections, BMI increased the effect in the lowest socioeconomic level (increase 30%).

Analyses in people aged 60 and over showed a j-shaped association between SBP and assets-based SEP in 2003. In 2010, the highest risk was observed in the intermediate group, and differences between the lowest socioeconomic groups with respect to the highest group were also significant before full adjustment (Appendix 6, Table A6.11). Recoding the intermediate and the lowest level of assets SEP in one, showed a significant higher risk in this new category of least privileged than those most privileged (Appendix 6, Table A6.12).

The regression parameters resulting from the fully adjusted models of the association between SBP and assets-based SEP in 2003 and 2010 are shown in Table 5-38, and the effects of each variable on SBP are summarised below.

Like in sex-adjusted analysis, being man and age increased SBP in both surveys. Also, being divorced/separated/widowed and having family history of hypertension increased the risk of raised SBP in 2003 and 2010. In turn, for each additional point of BMI there was 1.00 mmHg and 0.88 mmHg increase in risk of raised SBP in 2003 and 2010, respectively. Having diabetes mellitus increased SBP in 2003 but was not significant in 2010. In 2003, past and current smoker had a lower risk of raised SBP than who never had smoked, while in 2010, the coefficient was only significant for current smokers. Physical activity had a significant effect in 2003, but not in 2010. So, people who did not do physical activity had a higher SBP than who did exercise 3 times per week. The place of residence was not significant.

Multivariable analysis of DBP and assets-based index in2003 and 2010

DBP and assets-based index analysis by sex in 2003 and 2010

Table 5-39 presents the results of multivariable analysis of DBP and assets-based index stratified by sex. In Appendix 6, Table A6.13, models in which covariates were added one-at-a-time are shown.

No association was found between DBP and assets-base SEP in men in both 2003 and 2010. In 2003, women in the intermediate socioeconomic group showed the highest significant risk of raised DBP in most of the models (Table 5-39). The model adjusted for family history of hypertension showed an inverse gradient which was near to reach statistical significance (p-value for trend =0.06) (Appendix 6, Table A6.13). There was not association between DBP and assets index in women in 2010.

The results from the fully adjusted model of the association between DBP and assets-based SEP in both 2003 and 2010 are shown in Table 5-39. The effects on DBP of each covariate included in the model can be summarised as follow. Being man, age, having family history of hypertension and an increment in BMI, increased the risk of raised DBP in the both surveys. For each additional point of BMI there was 0.84 mmHg and 0.57 mmHg increase in risk of raised DBP. Current smoker in 2003, had lower risk of raised DBP than people who never had smoked, while in 2010 smoking habit was not significant. On the other hand, the place of residence, marital status, having diabetes mellitus and physical activity were no significant in both, 2003 and 2010.

DBP and assets-based index analysis by age group in 2003 and 2010

Table 5-40 presents the results of the multivariable analysis of DBP and assets-based index stratified by age group for both 2003 and 2010. There was not association between DBP and assets-based SEP in people aged 20-39 in both 2003 and 2010 (Table 5-40).

Table 5-39: Multivariable analysis of the association between DBP and assets-based SEP, by sex. Fully adjusted models 2003 and 2010

	2003				2010			
Assets-based SEP	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
Men								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	0.40	[-1.89,2.68]	0.73	1802	-0.27	[-1.93,1.39]	0.75
Low	741	1.15	[-1.57,3.86]	0.41	346	-0.85	[-3.93,2.23]	0.59
P-value for trend				*0.36*				*0.57*
Women								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	1.39	[-1.18,3.96]	0.29	1802	-0.03	[-1.38,1.32]	0.96
Low	741	0.49	[-2.42,3.39]	0.74	346	0.13	[-1.59,1.84]	0.89
P-value for trend				*0.92*				*0.96*
Age[1]		0.26	[0.22,0.30]	<0.01		0.14	[0.11,0.18]	<0.01
Place of residence (Ref: Urban)		0.53	[-1.11,2.16]	0.53		-0.04	[-1.53,1.44]	0.95
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		-0.17	[-1.59,1.26]	0.82		-1.12	[-2.29,0.05]	0.06
Divorced/Separated/Widowed		0.45	[-1.46,2.36]	0.65		0.06	[-1.82,1.95]	0.95
Body Mass Index[2]		0.84	[0.73,0.96]	<0.01		0.57	[0.49,0.64]	<0.01
Diabetes Mellitus[3]		-0.78	[-3.16,1.60]	0.52		0.46	[-1.24,2.16]	0.60
Family history of hypertension[4]		2.26	[1.07,3.46]	<0.01		2.43	[1.43,3.42]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-1.49	[-3.26,0.29]	0.10		-0.37	[-1.86,1.13]	0.63
Current		-1.90	[-3.29,-0.51]	0.01		-0.39	[-1.53,0.74]	0.50
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.49	[-1.61,2.59]	0.65		-1.11	[-3.15,0.93]	0.29
None		0.73	[-1.27,2.74]	0.47		0.51	[-1.31,2.33]	0.58

(1)Age: as a continuous variable. (2) Body Mass Index: as a continuous variable. (3) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (4)Family history of hypertension: Having family history of hypertension (as binary variable).

Table 5-40: Multivariable analysis of the association between DBP and assets-based SEP, by age group. Fully adjusted models. 2003 and 2010.

	2003				2010			
Assets-based SEP	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
20-39								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	-0.13	[-2.71,2.44]	0.92	1802	0.42	[-1.07,1.92]	0.58
Low	741	0.43	[-2.38,3.25]	0.76	346	-1.21	[-4.07,1.65]	0.41
P-value for trend				*0.67*				*0.87*
40-59								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	3.18	[0.68,5.68]	0.01	1802	-0.05	[-1.93,1.84]	0.96
Low	741	2.04	[-0.98,5.05]	0.18	346	-0.12	[-2.92,2.67]	0.93
P-value for trend				*0.32*				*0.93*
60 and over								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	-1.36	[-7.80,5.09]	0.68	1802	-0.72	[-3.08,1.65]	0.55
Low	741	-0.50	[-7.31,6.32]	0.89	346	0.28	[-2.80,3.36]	0.86
P-value for trend				*0.98*				*0.85*
Sex (Ref: men)		-6.76	[-7.89,-5.62]	<0.01		-5.86	[-6.95,-4.76]	<0.01
Place of residence (Ref:urban)		0.57	[-1.04,2.19]	0.49		0.01	[-1.46,1.48]	0.99
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		-0.62	[-2.02,0.78]	0.38		-1.05	[-2.26,0.17]	0.09
Divorced/Separated/Widowed		1.46	[-0.44,3.36]	0.13		0.95	[-0.91,2.81]	0.32
Body Mass Index[1]		0.83	[0.71,0.95]	<0.01		0.58	[0.50,0.66]	<0.01
Diabetes Mellitus[2]		-0.20	[-2.63,2.23]	0.87		0.51	[-1.17,2.18]	0.55
Family history of hypertension[3]		1.93	[0.75,3.12]	<0.01		2.35	[1.35,3.35]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-1.63	[-3.39,0.14]	0.07		-0.53	[-2.03,0.97]	0.49
Current		-2.44	[-3.80,-1.08]	<0.01		-0.64	[-1.79,0.51]	0.28
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.59	[-1.53,2.72]	0.58		-1.00	[-3.03,1.03]	0.33
None		0.93	[-1.13,2.99]	0.37		0.74	[-1.08,2.56]	0.43

(1) Body Mass Index: as a continuous variable. (2) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (3)Family history of hypertension: Having family history of hypertension (as binary variable).

The association between DBP and assets-based SEP in people in middle age (40-59) tended to have an inverted j-shaped in 2003. Differences between the intermediate group of SEP with respect to the highest, were significant in all the models adding covariates one-at-a-time (Appendix 6, Table A6.14). Models after adjusting for marital status and family history of hypertension showed an inverted j-shaped where all the coefficients were significant (Appendix 6, Table A6.14). In the fully adjusted model, the coefficient for the lowest level of SEP was no longer significant. However, analysis using only two levels of SEP (recoding the intermediate and the lowest level as one category) showed a higher risk of raised DBP in the least privileged people (p=0.02 if fully adjusted model) (Appendix 6, Table A6.15). In 2010, no association was found between DBP and assets-based SEP for this age group (Table 5-40). In people aged 60 and over, assets-based SEP was not related to DBP in both, 2003 and 2010 (Table 5-40).

Table 5-40 shows the results of fully adjusted models of the association between DBP and assets-based SEP stratified by three age groups. Sex, age, BMI and family history of hypertension had significant effects on DBP in both surveys. Being woman had lower risk of raised DBP than being man. Alike, people in older age groups and having family history of hypertension had a higher DBP. As observed for other associations between blood pressure and SEP, the higher BMI the higher the risk. For each additional point of BMI there was 0.83mmHg and 0.58 mmHg increase in DBP in 2003 and 2010, respectively. In addition, in 2003, being current smoker had a lower risk than those who never smoked.

Hypertension and assets-based index in 2003 and 2010

This section examines the association between hypertension and assets-based index in both 2003 and 2010. Multivariable regression analysis was undertaken, stratified by sex and age, and the results are shown below.

Hypertension and assets-based index analysis by sex in 2003 and 2010

PRs of hypertension across level of assets-based index, stratified by sex, are provided in Table 5-41. Results of the models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.16.

Sex-stratified analysis of the association between hypertension and assets-based SEP showed that, in men hypertension was not associated with this SEP measure in any of the two surveys analysed. Similarly, the gradients were all not significant (Table 5-41). In women, participants in the intermediate and in the lowest socioeconomic levels had almost identical PRs, and at the same time, they had higher risk than their counterpart in the highest socioeconomic level. These associations were significant in all the models with the exception of the model adjusted for BMI and the fully adjusted model (Appendix 6, Table A6.16). Changes in the fully adjusted model were given almost entirely by BMI. So, once more, BMI demonstrated an important effect on the social gradient of blood pressure (Appendix 6, Table A6.16).

The results of the fully adjusted models of the association between hypertension and assets based index by sex, are shown in Table 5-41. Being man, age and family history of hypertension increased the risk of hypertension in both, 2003 and 2010. In addition, for each additional point of BMI there was a 5% and 4% increase in PR in 2003 and 2010 respectively. People who were current smokers had a lower risk of hypertension in 2003 and people having diabetes mellitus had a higher risk of hypertension in 2010 (Table 5-41).

Hypertension and assets-based index analysis by age group in 2003 and 2010

Table 5-42 presents the results of the multivariable analysis of hypertension across assets-based index levels stratified by age group. In Appendix 6, Table A6.17 models in which covariates were added one-at-a-time are shown.

Age-stratified analysis showed that this SEP measure was not related to hypertension in people aged 20-39 in both surveys (Table 5-42). Neither the models adjusted for the covariates nor the fully adjusted model showed significant association of hypertension with assets-based SEP (Appendix 6, Table A6.17).

Table 5-41: Multivariable analysis of the association between hypertension and assets-based SEP, by sex. Fully adjusted models. 2003 and 2010.

	2003				2010			
Assets-based SEP	**N**	**PR**	**95% CI**	**p value**	**N**	**PR**	**95% CI**	**p value**
Men								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	1.00	[0.78,1.28]	0.98	1802	0.99	[0.79,1.24]	0.95
Low	741	1.07	[0.81,1.42]	0.64	346	1.12	[0.77,1.63]	0.57
P-value for trend				*0.57*				*0.70*
Women								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	1.27	[0.93,1.72]	0.13	1802	1.01	[0.84,1.23]	0.89
Low	741	1.23	[0.87,1.73]	0.24	346	0.84	[0.63,1.13]	0.26
P-value for trend				*0.35*				*0.53*
Age[1]		1.04	[1.03,1.04]	<0.01		1.04	[1.04,1.05]	<0.01
Place of residence (Ref: Urban)		1.03	[0.89,1.20]	0.67		0.99	[0.77,1.26]	0.91
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.87	[0.69,1.09]	0.21		0.91	[0.76,1.09]	0.29
Divorced/Separated/Widowed		1.01	[0.88,1.17]	0.87		1.02	[0.82,1.26]	0.86
Body Mass Index[2]		1.05	[1.04,1.07]	<0.01		1.04	[1.03,1.05]	<0.01
Diabetes Mellitus[3]		0.97	[0.84,1.12]	0.64		1.18	[1.01,1.38]	0.04
Family history of hypertension[4]		1.33	[1.17,1.51]	<0.01		1.34	[1.17,1.53]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		0.90	[0.78,1.04]	0.14		1.00	[0.84,1.19]	0.99
Current		0.83	[0.70,1.00]	0.04		1.01	[0.86,1.20]	0.87
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.95	[0.72,1.26]	0.74		0.92	[0.60,1.42]	0.72
None		1.03	[0.81,1.30]	0.82		1.25	[0.88,1.77]	0.21

(1)Age: as a continuous variable. (2) Body Mass Index: as a continuous variable. (3) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (4)Family history of hypertension: Having family history of hypertension (as binary variable).

Table 5-42: Multivariable analysis of the association between hypertension and assets-based SEP by age group. Fully adjusted models. 2003 and 2010.

	2003				2010			
Assets-based SEP	**N**	**PR**	**95% CI**	**p value**	**N**	**PR**	**95% CI**	**p value**
20-39								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	1.80	[0.83,3.92]	0.14	1802	1.10	[0.62,1.95]	0.75
Low	741	1.81	[0.80,4.09]	0.15	346	1.12	[0.38,3.29]	0.84
P-value for trend				*0.18*				*0.75*
40-59								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	1.28	[0.92,1.76]	0.14	1802	1.10	[0.88,1.38]	0.38
Low	741	1.30	[0.93,1.83]	0.13	346	1.05	[0.68,1.63]	0.83
P-value for trend				*0.14*				*0.55*
60 and over								
High	444	Ref	-	-	1907	Ref	-	-
Middle	1857	0.69	[0.58,0.81]	<0.01	1802	1.01	[0.83,1.21]	0.95
Low	741	0.75	[0.64,0.89]	<0.01	346	0.97	[0.75,1.24]	0.79
P-value for trend				*0.06*				*0.90*
Sex (Ref: men)		0.70	[0.62,0.79]	<0.01		0.73	[0.62,0.85]	<0.01
Place of residence (Ref:urban)		1.05	[0.92,1.21]	0.47		1.02	[0.81,1.30]	0.85
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.86	[0.69,1.07]	0.18		0.95	[0.78,1.15]	0.58
Divorced/Separated/Widowed		1.18	[1.04,1.35]	0.01		1.17	[0.95,1.44]	0.15
Body Mass Index[1]		1.05	[1.04,1.06]	<0.01		1.04	[1.03,1.05]	<0.01
Diabetes Mellitus[2]		1.04	[0.91,1.19]	0.57		1.11	[0.95,1.30]	0.20
Family history of hypertension[3]		1.21	[1.07,1.37]	<0.01		1.32	[1.15,1.51]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		0.87	[0.76,1.00]	0.05		0.96	[0.81,1.16]	0.69
Current		0.78	[0.66,0.93]	<0.01		0.94	[0.80,1.11]	0.49
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.98	[0.73,1.31]	0.90		0.95	[0.62,1.47]	0.82
None		1.06	[0.83,1.35]	0.64		1.33	[0.94,1.90]	0.11

(1) Body Mass Index: as a continuous variable. (2) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (3)Family history of hypertension: Having family history of hypertension (as binary variable).

In people aged 40-59, in general there was not association between hypertension and assets index. With the only exception of the models adjusted for marital status and family history of hypertension, where individuals in the lowest socioeconomic level showed higher risk than those in the highest level. In 2010 no association between hypertension and assets-based SEP was found in all the models (Appendix 6, Table A6.17).

In people aged 60 and over, in 2003, people in the intermediate and in the lowest levels of assets-based index, had consistent and significantly lower risk than their counterpart in the highest level, in 2003. This association was observed in all the models. In 2010, there was no association between hypertension and assets-based SEP (Appendix 6, Table A6.17).

Results of the fully adjusted models of the association between hypertension and assets-based SEP are shown in Table 5-42. Being man, age and having family history of hypertension increased the risk of hypertension in both 2003 and 2010. In turn, for each additional point of BMI there was a 5% and 4% increase risk of hypertension in 2003 and 2010 respectively. Moreover, in 2003 being Divorced/Separated/Widowed increased the risk of hypertension and being current smoker decreased it. Physical activity and diabetes mellitus were not significant (Table 5-42).

Summary of multivariable analysis of the association between blood pressure and assets-based in 2003 and 2010

Results of the association between blood pressure and assets-based SEP showed a relatively similar pattern to that observed for education. In this manner inverse social gradients were observed most frequently in people in the intermediate age group (40-59) and for SBP. Other types of association between blood pressure and assets-based SEP were also found. A j-shaped curve was found for people aged 60 and over in 2003, and an inverted u-shaped curve in women in 2010. In these latter cases those in intermediate group of assets index had the highest levels of SBP. In turn, in people aged 60 and over, those most privileged had the highest levels of SBP in 2003 (direct association).

For this SEP, a direct association with hypertension was found in people aged 60 and over. Whereby people in the lower levels of SEP showed lower risk of hypertension.

Similar to that observed for education, BMI was the covariate with the most important effect on the association between blood pressure and assets-based SEP.

The effects of covariates on blood pressure were consistent with those found in the previous section. So that, sex, age, BMI and family history of hypertension were significant in the models in 2003 and 2010.

5.3.3.3 Multivariable analysis of the association between blood pressure and occupation

In this section multivariable analysis of the association between blood pressure and occupation are shown. Two versions of occupational class were used, one including workers and non-workers, and the other only workers.

Analyses are shown for each type of occupational class and are presented stratified by sex and age for both surveys.

Blood pressure and occupation including both non-workers and workers

SBP and occupation analysis by sex in 2003 and 2010

Results for the multivariable analysis of the association between SBP and occupational class including worker and non-workers are presented in Table 5-43. Results of the models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.18 and Table A6.19.

Analysis showed that differences of SBP among categories of occupation were not significant in all the models in men, in both surveys (Appendix 6, Table A6.18 and Table A6.19). The fully adjusted model was also not significant in both, 2003 and 2010 (Table 5-43).

In women, significant differences of SBP were found in most of the models in 2003. The exception was the model adjusted for BMI, smoking habit and the fully adjusted model (p= 0.05; 0.06 and 0.6 respectively). The highest risk was observed in retired people and the lowest in intermediate workers. In 2010, differences of SBP among categories of occupation in women were significant in all the models (p<0.01). The highest risk was observed in inactive people and the lowest in the intermediate workers. (Appendix 6, Table A6.18 and Table A6.19).

The results for the fully adjusted models are shown in Table 5-43. Being man, age, and having and family history of hypertension increased the risk of raised SBP in both years. Moreover, a significant direct association was found between BMI and SBP in 2003 and 2010. In 2003, in addition, being single, having diabetes mellitus and people who do not do exercise had a higher risk of raised SBP, while current and past smokers had a lower risk.

SBP and occupation analysis by age in 2003 and 2010

This section presents the multivariable analysis of SBP and occupation stratified by age group. The results are provided in Table 5-44 and Appendix 6, Tables A6.20 and Table A6.21.

In people aged 20-39, differences of SBP among categories of occupation in 2003 were significant except after adjustment for BMI and after full adjustment (Appendix 6, Tables A6.20 and Table A6.21). BMI mainly increased the coefficients for intermediate workers and for inactive people, which were no longer significant. In this manner, changes in the fully adjusted model were given importantly by BMI. In 2010, inequalities were not significant in all the models (Appendix 6, Tables A6.20 and Table A6.21.

People in middle age (40-59) had significant inequalities of SBP among categories of occupation in all the models including the fully adjusted model in 2003. The highest risk was found in retired people followed by home-makers (Table 5-44). In 2010, inequalities of SBP across occupations were also found (Appendix 6, Tables A6.20 and Table A6.21). Routine workers and home-makers had significant higher risks than higher workers. BMI weakened the differences of SBP among categories of occupation, and these were not significant in the model adjusted for BMI and in the fully adjusted model (p=0.08 and 0.16 respectively) (Appendix 6, Tables A6.20 and Table A6.21).

People aged 60 and over did not have significant inequalities of SBP among categories of occupation in both surveys.

Table 5-43: Multivariable analysis of the association between SBP and occupation by sex. Fully adjusted model. 2003 and 2010.

	2003				2010			
Occupation	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
Men								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	-2.19	[-8.08,3.71]	0.47	328	0.85	[-3.49,5.19]	0.70
Routine and manual	837	-0.07	[-3.10,2.97]	0.97	837	4.19	[-0.10,8.49]	0.06
Home-maker	810	3.50	[-2.23,9.24]	0.23	810	6.54	[-0.87,13.95]	0.08
Inactive	507	-0.44	[-4.19,3.31]	0.82	507	3.51	[-1.82,8.83]	0.20
Retired	224	-2.88	[-7.36,1.59]	0.21	224	1.18	[-5.11,7.46]	0.71
Wald test of homogeneity				*0.61*				*0.14*
Women								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	-2.06	[-8.88,4.77]	0.55	328	-0.30	[-3.70,3.09]	0.86
Routine and manual	837	-0.12	[-6.59,6.36]	0.97	837	0.74	[-3.32,4.79]	0.72
Home-maker	810	3.50	[-2.23,9.24]	0.23	810	3.55	[-0.04,7.13]	0.05
Inactive	507	0.76	[-5.48,7.01]	0.81	507	6.65	[2.47,10.82]	<0.01
Retired	224	8.28	[-0.50,17.07]	0.06	224	5.09	[-0.35,10.52]	0.07
Wald test of homogeneity				*0.06*				*<0.01*
Age[1]		0.74	[0.67,0.81]	<0.01		0.73	[0.66,0.80]	<0.01
Place of residence (Ref: Urban)		1.77	[-0.60,4.15]	0.14		0.43	[-1.95,2.81]	0.72
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		3.67	[1.46,5.88]	<0.01		2.68	[0.87,4.49]	<0.01
Divorced/Separated/Widowed		2.38	[-0.76,5.52]	0.14		3.11	[-0.16,6.38]	0.06
Body Mass Index[2]		0.92	[0.74,1.10]	<0.01		0.80	[0.67,0.94]	<0.01
Diabetes Mellitus[3]		5.03	[0.93,9.13]	0.02		1.69	[-1.31,4.69]	0.27
Family history of hypertension[4]		2.14	[0.42,3.86]	0.01		3.78	[2.10,5.47]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-3.54	[-6.24,-0.84]	0.01		-2.25	[-4.78,0.28]	0.08
Current		-2.96	[-4.98,-0.94]	<0.01		-1.71	[-3.70,0.28]	0.09
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		2.36	[-0.41,5.14]	0.10		-2.98	[-6.16,0.19]	0.07
None		2.75	[0.29,5.21]	0.03		-2.10	[-5.15,0.94]	0.17

(1)Age: as a continuous variable. (2) Body Mass Index: as a continuous variable. (3) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (4)Family history of hypertension: Having family history of hypertension (as binary variable).

Table 5-44: Multivariable analysis of the association between SBP and occupation, by age group. Fully adjusted models. 2003 and 2010.

	2003				2010			
Occupation	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
20-39								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	-4.11	[-8.87,0.66]	0.09	328	-1.78	[-5.30,1.74]	0.32
Routine and manual	837	0.32	[-3.63,4.26]	0.87	837	0.80	[-2.76,4.36]	0.66
Home-maker	810	-3.40	[-8.00,1.21]	0.15	810	0.43	[-3.58,4.44]	0.83
Inactive	507	-3.03	[-7.00,0.93]	0.13	507	0.12	[-3.66,3.90]	0.95
Retired	224	-6.05	[-15.31,3.21]	0.20	224	-2.50	[-9.27,4.27]	0.47
Wald test of homogeneity				*0.10*				*0.32*
40-59								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	-2.80	[-10.49,4.89]	0.48	328	2.56	[-2.31,7.42]	0.30
Routine and manual	837	-0.03	[-5.03,4.97]	0.99	837	5.72	[0.59,10.85]	0.03
Home-maker	810	6.19	[0.87,11.52]	0.02	810	6.01	[0.52,11.49]	0.03
Inactive	507	0.97	[-5.77,7.71]	0.78	507	6.87	[-1.84,15.59]	0.12
Retired	224	8.42	[0.17,16.67]	0.05	224	7.17	[-2.07,16.41]	0.13
Wald test of homogeneity				*<0.01*				*0.16*
60 and over								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	4.59	[-14.53,23.71]	0.64	328	-1.87	[-11.99,8.25]	0.72
Routine and manual	837	-5.88	[-16.93,5.17]	0.30	837	0.94	[-10.59,12.46]	0.87
Home-maker	810	1.44	[-8.22,11.09]	0.77	810	5.64	[-4.19,15.47]	0.26
Inactive	507	-3.97	[-16.95,9.00]	0.55	507	6.70	[-7.82,21.23]	0.37
Retired	224	0.31	[-10.28,10.89]	0.95	224	4.64	[-4.49,13.78]	0.32
Wald test of homogeneity				*0.49*				*0.31*
Sex		-8.70	[-10.89,-6.51]	<0.01		-10.70	[-12.62,-8.75]	<0.01
Place of residence		1.94	[-0.46,4.33]	0.11		0.89	[-1.62,3.40]	0.49

Table 5-44 (cont.): Multivariable analysis of the association between SBP and occupation, by age group. Fully adjusted models. 2003 and 2010.

	2003				2010			
Occupation	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.60	[-1.67,2.88]	0.60		0.54	[-1.37,2.46]	0.58
Divorced/Separated/Widowed		4.47	[1.27,7.67]	0.01		3.47	[0.18,6.77]	0.04
Body Mass Index[1]		0.96	[0.78,1.14]	<0.01		0.88	[0.75,1.00]	<0.01
Diabetes Mellitus[2]		5.82	[1.49,10.16]	0.01		1.08	[-2.02,4.18]	0.49
Family history of hypertension[3]		1.69	[-0.02,3.40]	0.05		3.83	[2.09,5.58]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-3.57	[-6.43,-0.71]	0.01		-1.73	[-4.27,0.81]	0.18
Current		-3.98	[-5.86,-2.09]	<0.01		-2.03	[-4.03,-0.02]	0.05
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		2.15	[-0.66,4.96]	0.13		-2.05	[-5.25,1.14]	0.21
None		3.66	[1.16,6.17]	<0.01		-0.77	[-3.77,2.23]	0.62

(1) Body Mass Index: as a continuous variable. (2) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (3)Family history of hypertension: Having family history of hypertension (as binary variable).

In addition, the results of the fully adjusted models by age are shown in Table 5-44. Among the variables which increased the risk of raised SBP in the two surveys were: being man, age, being divorced, and increase in BMI. In 2003, having diabetes mellitus and no exercising, also increased SBP. In 2010, having family history of hypertension had a significant effect in SBP, increasing the risk. The place of residence was not significant in both, 2003 and 2010.

DBP and occupation analysis by sex in 2003 and 2010

This section examines multivariable analysis of the association between DBP and occupation stratified by sex and the results are shown in Table 5-45. Results of the models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.22 and Table A6.23.

Inequalities in DBP among occupational status in men were significant in all the models performed and in both surveys. In 2003, BMI had an important role weakening the differences; however, these remained significant after adjustment for this covariate and after full adjustment (Appendix 6, Table A6.22 and Table A6.23). In 2010, all the models resulted with significant inequalities of DBP among categories of occupation ($p<0.01$) (Appendix 6, Table A6.22 and Table A6.23). Retired men had significant lower risks than higher workers in both, 2003 and 2010 (Appendix 6, Table A6.22 and Table A6.23).

In women, inequalities in DBP were not significant in 2003 in the fully adjusted model and in most of the models. Adjustment for family history of hypertension strengthened the differences reaching statistical significance ($p=0.04$) (Appendix 6, Table A6.22 and Table A6.23). In 2010, differences in DBP in women across occupations were significant after adjustments for each variable and after full adjustment. Similar to that observed in men, retired women in 2010 had a significant lower risk of raised DBP than higher workers (Table 5-45).

Results of the fully adjusted models in 2003 and 2010 showed that, like previous analyses, age, being man, increase in BMI and having family history of hypertension increased DBP in both surveys (Table 5-46). Additionally, in 2003, current smoker had a lower risk of raised DBP than non-smokers. On the other hand, the place of residence, marital status, diabetes mellitus and physical activity were not significant (Table 5-45).

Table 5-45: Multivariable analysis of the association between DBP and occupation by sex. Fully adjusted model. 2003 and 2010.

	2003				2010			
Occupation	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
Men								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	-2.22	[-6.72,2.28]	0.33	328	0.35	[-2.39,3.09]	0.80
Routine and manual	837	-0.99	[-3.08,1.11]	0.36	837	-0.46	[-3.07,2.16]	0.73
Home-maker	810	-0.25	[-4.10,3.59]	0.90	810	0.68	[-6.50,7.86]	0.85
Inactive	507	-1.96	[-4.62,0.70]	0.15	507	-1.47	[-4.58,1.63]	0.35
Retired	224	-4.80	[-7.75,-1.85]	<0.01	224	-6.57	[-10.02,-3.13]	<0.01
Wald test of homogeneity				*0.03*				*<0.01*
Women								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	-3.10	[-7.70,1.50]	0.19	328	-1.47	[-4.09,1.15]	0.27
Routine and manual	837	-0.98	[-5.35,3.40]	0.66	837	-0.23	[-3.09,2.63]	0.87
Home-maker	810	-0.25	[-4.10,3.59]	0.90	810	-1.29	[-3.73,1.14]	0.30
Inactive	507	-1.03	[-5.53,3.47]	0.65	507	2.33	[-0.77,5.43]	0.14
Retired	224	1.21	[-3.70,6.11]	0.63	224	-5.61	[-8.66,-2.56]	<0.01
Wald test of homogeneity				*0.45*				*<0.01*
Age[1]		0.27	[0.23,0.31]	<0.01		0.21	[0.17,0.25]	<0.01
Place of residence (Ref: Urban)		0.46	[-1.18,2.11]	0.58		0.03	[-1.41,1.46]	0.97

Table 5-45 (cont.): Multivariable analysis of the association between DBP and occupation by sex. Fully adjusted model. 2003 and 2010.

	2003				2010			
Occupation	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.12	[-1.29,1.54]	0.87		-0.92	[-2.12,0.29]	0.14
Divorced/Separated/Widowed		0.13	[-1.80,2.06]	0.90		0.62	[-1.20,2.44]	0.50
Body Mass Index[2]		0.83	[0.71,0.94]	<0.01		0.57	[0.50,0.65]	<0.01
Diabetes Mellitus[3]		-0.47	[-2.76,1.82]	0.69		0.49	[-1.21,2.20]	0.57
Family history of hypertension[4]		2.31	[1.12,3.50]	<0.01		2.35	[1.38,3.33]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-1.36	[-3.13,0.41]	0.13		-0.55	[-2.03,0.94]	0.47
Current		-1.84	[-3.21,-0.46]	0.01		-0.49	[-1.61,0.63]	0.39
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.55	[-1.52,2.61]	0.60		-1.56	[-3.52,0.41]	0.12
None		1.01	[-0.89,2.92]	0.30		0.21	[-1.57,1.98]	0.82

(1)Age: as a continuous variable. (2) Body Mass Index: as a continuous variable. (3) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (4)Family history of hypertension: Having family history of hypertension (as binary variable).

DBP and occupation analysis by age group in 2003 and 2010

Table 5-46 shows the results for the multivariable analysis of the association between DBP and occupation by age group in the fully adjusted model. Results of the models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.24 and Table A6.25.

People aged 20-39 had significant inequalities in DBP across occupations in 2003 after adjustments for each of the covariates, with the exception of BMI and the full adjustment (Appendix 6, Table A6.24). In 2010, differences were not significant in all the models Appendix 6, Table A6.25).

Similar to that observed in younger people (20-39), those aged 40-59 had significant inequalities among occupational status in 2003 in all the models, except in that adjusted for BMI and in fully adjusted model (Table 5-46). In 2010, inequalities were not significant in all the models carried out (Table 5-46).

Unlike, in people aged 60 and over, inequalities in 2003 were significant after adjustment for BMI, smoking habit and after full adjustment. In this age group, BMI had an opposite effect to that observed in younger people, and this strengthened inequalities across occupations. Intermediate workers had the highest risk of raised DBP (Appendix 6, Table A6.24). In 2010, with the exception of the model adjusted for diabetes mellitus, all the models resulted with significant inequalities in DBP among occupational categories Inactive people had the highest risk of raised DBP (Appendix 6, Table A6.25).

The results of the fully adjusted models for the association between DBP and occupation, for both surveys 2003 and 2010, are shown in Table 5-46. Findings showed that being man, age, increase in BMI and having family history of hypertension increased DBP in both, 2003 and 2010. In addition, current smokers had a higher risk of raised DBP than people who never smoked in 2003. On the other hand, the place of residence, marital status, diabetes mellitus and physical activity were not significant (Table 5-46).

Table 5-46: Multivariable analysis of the association between DBP and occupation by age group. Fully adjusted model 2003 and 2010.

	2003				2010			
Occupation	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
20-39								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	-3.13	[-6.87,0.62]	0.10	328	-1.01	[-3.60,1.57]	0.44
Routine and manual	837	-0.12	[-3.23,2.99]	0.94	837	-1.09	[-3.66,1.47]	0.40
Home-maker	810	-2.37	[-5.90,1.16]	0.19	810	-0.52	[-3.28,2.24]	0.71
Inactive	507	-2.59	[-5.80,0.62]	0.11	507	-0.98	[-3.67,1.71]	0.47
Retired	224	-4.89	[-12.94,3.15]	0.23	224	0.89	[-3.67,5.46]	0.70
Wald test of homogeneity				*0.09*				*0.90*
40-59								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	-3.73	[-9.08,1.62]	0.17	328	-1.12	[-4.34,2.09]	0.49
Routine and manual	837	-1.73	[-4.62,1.17]	0.24	837	-1.28	[-4.53,1.97]	0.44
Home-maker	810	1.38	[-1.62,4.39]	0.37	810	-2.14	[-5.32,1.05]	0.19
Inactive	507	0.85	[-3.35,5.06]	0.69	507	-0.55	[-5.34,4.24]	0.82
Retired	224	1.39	[-3.36,6.13]	0.57	224	-5.15	[-9.38,-0.92]	0.02
Wald test of homogeneity				*0.10*				*0.21*
60 and over								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	8.00	[-0.95,16.95]	0.08	328	0.58	[-4.52,5.68]	0.82
Routine and manual	837	-4.91	[-11.39,1.58]	0.14	837	1.54	[-3.89,6.97]	0.58
Home-maker	810	-1.85	[-8.14,4.43]	0.56	810	-0.32	[-4.95,4.30]	0.89
Inactive	507	-3.47	[-11.48,4.54]	0.40	507	8.31	[0.90,15.72]	0.03
Retired	224	-2.09	[-8.65,4.46]	0.53	224	-2.11	[-6.51,2.28]	0.35
Wald test of homogeneity				*0.01*				*0.02*
Sex		-6.83	[-8.32,-5.34]	<0.01		-5.72	[-6.93,-4.51]	<0.01
Place of residence		0.48	[-1.13,2.09]	0.56		0.05	[-1.40,1.50]	0.95
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		-0.34	[-1.80,1.13]	0.65		-1.05	[-2.33,0.23]	0.11
Divorced/Separated/Widowed		1.41	[-0.50,3.33]	0.15		1.25	[-0.58,3.07]	0.18
Body Mass Index[1]		0.80	[0.69,0.92]	<0.01		0.58	[0.51,0.66]	<0.01

Table 5-46 (cont.): Multivariable analysis of the association between DBP and occupation by age group. Fully adjusted model 2003 and 2010.

	2003				2010			
Occupation	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
Diabetes Mellitus[2]		-0.18	[-2.55,2.19]	0.88		0.50	[-1.16,2.16]	0.56
Family history of hypertension[3]		1.88	[0.72,3.05]	<0.01		2.29	[1.30,3.28]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-1.62	[-3.38,0.15]	0.07		-0.62	[-2.10,0.86]	0.41
Current		-2.41	[-3.69,-1.12]	<0.01		-0.71	[-1.84,0.43]	0.22
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.44	[-1.58,2.46]	0.67		-1.00	[-2.99,0.99]	0.33
None		1.21	[-0.64,3.07]	0.20		0.69	[-1.09,2.46]	0.45

(1) Body Mass Index: as a continuous variable. (2) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (3)Family history of hypertension: Having family history of hypertension (as binary variable).

Hypertension and occupation, analysis by sex in 2003 and 2010

Multivariable analysis of hypertension and occupation stratified by sex are presented in Table 5-47. In Appendix 6, Table A6.26 and Table A6.27 results of the models in which covariates were added one-at-a-time are shown.

In men, hypertension was associated to occupation, in both 2003 and 2010. Inequalities among categories of occupation were more marked in 2003, although in 2010 differences were also significant for all the models. In 2003, it is worth noting that adjustment for BMI strengthened the inequalities among occupation status. Retired people had the lowest risk of hypertension in both surveys (Appendix 6, Table A6.26 and Table A6.27).

In women, there were no inequalities among occupations in 2003 and 2010 (Table 5-47).

Results of the fully adjusted models in 2003 and 2010 are shown in Table 5-47. Similar to that observed for the association of occupation with the other outcomes, being man, age, increase in BMI and having history of hypertension increased the risk of hypertension in the two surveys analysed. In addition, in 2010, having diabetes mellitus increased also the risk of having hypertension. In turn, the place of residence, marital status, smoking and physical activity were not significant.

Hypertension and occupation, analysis by age group in 2003 and 2010

Results of multivariable regression for the association between hypertension and occupation, stratified by age group, are shown in Table 5-48. Results of the models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.28 and Table A6.29.

Age-stratified analysis of the association between hypertension and occupation was done by using age with two categories (20-44 and 45 and over). This due to the models including age categorised into three groups did not reach convergence.

Table 5-47: Multivariable analysis of the association between hypertension and occupation by sex. Fully adjusted models. 2003 and 2010.

	2003				2010			
Occupation	**N**	**PR**	**95% CI**	**p value**	**N**	**PR**	**95% CI**	**p value**
Men								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	0.76	[0.47,1.23]	0.26	328	1.05	[0.67,1.64]	0.84
Routine and manual	837	0.89	[0.70,1.13]	0.33	837	1.07	[0.71,1.61]	0.75
Home-maker	810	1.23	[0.72,2.09]	0.45	810	1.52	[0.64,3.60]	0.34
Inactive	507	0.84	[0.61,1.15]	0.28	507	0.86	[0.50,1.50]	0.60
Retired	224	0.56	[0.43,0.72]	<0.01	224	0.68	[0.44,1.04]	0.08
Wald test of homogeneity				*< 0.01*				*<0.01*
Women								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	0.96	[0.46,2.04]	0.92	328	1.21	[0.75,1.97]	0.43
Routine and manual	837	1.12	[0.58,2.14]	0.74	837	1.06	[0.69,1.63]	0.79
Home-maker	810	1.23	[0.72,2.09]	0.45	810	1.24	[0.87,1.78]	0.24
Inactive	507	0.95	[0.51,1.75]	0.87	507	0.94	[0.51,1.74]	0.85
Retired	224	1.24	[0.73,2.12]	0.43	224	1.16	[0.80,1.68]	0.44
Wald test of homogeneity				*0.55*				*0.74*
Age[1]		1.04	[1.03,1.04]	<0.01		1.05	[1.04,1.05]	<0.01
Place of residence (Ref: Urban)		1.05	[0.90,1.22]	0.55		0.98	[0.78,1.25]	0.89

Table 5-47 (cont.): Multivariable analysis of the association between hypertension and occupation by sex. Fully adjusted models. 2003 and 2010.

	2003				2010			
Occupation	**N**	**PR**	**95% CI**	**p value**	**N**	**PR**	**95% CI**	**p value**
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.89	[0.71,1.11]	0.30		0.96	[0.80,1.16]	0.70
Divorced/Separated/Widowed		0.99	[0.85,1.15]	0.89		1.06	[0.85,1.31]	0.62
Body Mass Index[2]		1.05	[1.04,1.07]	<0.01		1.04	[1.03,1.05]	<0.01
Diabetes Mellitus[3]		1.01	[0.89,1.16]	0.86		1.19	[1.02,1.39]	0.03
Family history of hypertension[4]		1.32	[1.17,1.50]	<0.01		1.34	[1.17,1.53]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		0.92	[0.80,1.05]	0.22		1.00	[0.84,1.18]	0.99
Current		0.84	[0.70,1.00]	0.05		1.01	[0.85,1.20]	0.89
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.95	[0.73,1.25]	0.74		0.87	[0.57,1.33]	0.52
None		1.06	[0.84,1.34]	0.62		1.21	[0.86,1.70]	0.27

(1)Age: as a continuous variable. (2) Body Mass Index: as a continuous variable. (3) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (4)Family history of hypertension: Having family history of hypertension (as binary variable).

Table 5-48: Multivariable analysis of the association between hypertension and occupation by age group. Fully adjusted models. 2003 and 2010.

	2003				2010			
Occupation	**N**	**PR**	**95% CI**	**p value**	**N**	**PR**	**95% CI**	**p value**
20-44								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	0.68	[0.36,1.30]	0.25	328	1.09	[0.56,2.12]	0.79
Routine and manual	837	0.90	[0.56,1.43]	0.64	837	1.04	[0.58,1.84]	0.90
Home-maker	810	0.66	[0.38,1.16]	0.15	810	0.97	[0.49,1.90]	0.92
Inactive	507	0.63	[0.34,1.13]	0.12	507	0.29	[0.12,0.69]	<0.01
Retired	224	0.95	[0.23,3.96]	0.94	224	2.08	[0.64,6.73]	0.22
Wald test of homogeneity				*0.44*				*0.01*
45 and over								
Higher worker	336	Ref	-	-	336	Ref	-	-
Intermediate worker	328	0.88	[0.57,1.36]	0.56	328	0.95	[0.64,1.41]	0.79
Routine and manual	837	1.03	[0.78,1.35]	0.84	837	0.98	[0.67,1.43]	0.90
Home-maker	810	1.34	[1.02,1.77]	0.03	810	1.14	[0.77,1.68]	0.51
Inactive	507	1.18	[0.87,1.61]	0.28	507	1.11	[0.70,1.77]	0.66
Retired	224	1.28	[0.99,1.65]	0.06	224	1.35	[0.93,1.96]	0.12
Wald test of homogeneity				*0.01*				<0.01
Sex		0.67	[0.55,0.81]	<0.01		0.70	[0.58,0.85]	<0.01
Age		1.75	[1.11,2.75]	0.02		3.49	[1.92,6.35]	<0.01
Place of residence		1.06	[0.92,1.22]	0.43		1.03	[0.83,1.27]	0.82

Table 5-48 (cont.): Multivariable analysis of the association between hypertension and occupation by age group. Fully adjusted models. 2003 and 2010.

	2003				2010			
Occupation	**N**	**PR**	**95% CI**	**p value**	**N**	**PR**	**95% CI**	**p value**
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.80	[0.63,1.02]	0.07		1.01	[0.83,1.23]	0.91
Divorced/Separated/Widowed		1.27	[1.10,1.46]	<0.01		1.25	[1.02,1.53]	0.03
Body Mass Index[1]		1.05	[1.04,1.06]	<0.01		1.04	[1.03,1.05]	<0.01
Diabetes Mellitus[2]		1.07	[0.94,1.21]	0.33		1.15	[0.99,1.35]	0.07
Family history of hypertension[3]		1.21	[1.07,1.36]	<0.01		1.35	[1.17,1.54]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		0.90	[0.78,1.04]	0.16		0.93	[0.78,1.10]	0.41
Current		0.76	[0.64,0.91]	<0.01		0.90	[0.77,1.05]	0.18
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.95	[0.72,1.26]	0.73		0.91	[0.60,1.37]	0.65
None		1.18	[0.94,1.50]	0.16		1.33	[0.96,1.83]	0.09

(1) Body Mass Index: as a continuous variable. (2) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (3)Family history of hypertension: Having family history of hypertension (as binary variable).

In people aged 20-44, inequalities among occupations were not significant in 2003. In 2010, however, differences were significant after adjustments for each of the covariates and after full adjustment. Inactive people had the lowest risk and retired people, the highest (Table 5-48 and Appendix 6, Table A6.28 and Table A6.29).

In people aged 45 and over, there were inequalities among occupational status in both 2003 and 2010. Retired people and home-maker had the highest risks of hypertension in both surveys (Table 5-48 and Appendix 6, Table A6.28 and Table A6.29).

Results of the fully adjusted models in 2003 and 2010 are presented in Table 5-48. Findings showed that being man, age, being single or divorced/separated/widowed, increase in BMI and having family history of hypertension increased the risk of hypertension in 2003 and 2010. Moreover, current smokers in 2003 had a lower risk of hypertension than who never smoked (Table 5-48). The place of residence and physical activity were not significant in both years under study.

Multivariable analysis of blood pressure and occupational class based on workers

This section presents multivariable analysis of blood pressure and occupational class including only workers. This analysis was undertaken in order to assess social gradients of blood pressure across occupation. Given that this version of occupation corresponds to an ordered variable, and therefore allows testing for gradients.

SBP and occupation analysis by sex in 2003 and 2010

Results of the multivariable analysis of occupation and SBP are given in Table 5-49. Analysis of the association between SBP and occupation (workers) showed that in 2003 occupation was related to SBP in men, and a u-shaped curve was observed. In 2010 a significant inverse socioeconomic gradient was observed after adjustment for most of the covariates and after full adjustment. In contrast to that observed in the association between blood pressure and other socioeconomic position measures, BMI strengthened the inverse gradient of SBP across occupations. On the other hand, smoking habit weakened the association between SBP and occupation, so much so that after adjustment this was no longer significant (Table 5-49 and Appendix 6, Table A6.30).

In women, also a u-shaped curve was observed for the association between SBP and occupation in 2003. No association was found in 2010 (Table 5-49).

Results of the full adjusted models stratified by sex for both surveys are presented in Table 5-49. This estimates showed that being man, age and increment in BMI increased the risk of raised SBP in the two surveys. On the contrary, being past smoker decreased the risk of raised SBP in both, 2003 and 2010. In addition, being single and being divorced/separated/widowed, increased the risk of raised SBP in 2003 and 2010 respectively. Having family history of hypertension had a significant effect in increasing the risk of raised SBP only in 2010 (Table 5-49). The place of residence, having diabetes mellitus and physical activity were not significant.

SBP and occupation analysis by age group in 2003 and 2010

Table 5-50 shows multivariable analysis in fully adjusted model of the association between SBP and occupation stratified by sex in both 2003 and 2010. The covariates were added one-at-a-time and these results are shown in Appendix 6, Table A6.31.

In the age-stratified analysis of the association between SBP and occupation (workers) no association was found in people aged 20-39 in all the models adjusted for the covariates and after full adjustment, in both, 2003 and 2010 (Table 5-50 and Appendix 6, Table A6.31).

In people aged 40-59, a u-shaped curve was observed for the association between SBP and occupation in 2003. In 2010 a significant inverse gradient was observed in each of the models adjusted for the covariates. After full adjustment, this gradient was significant (p=0.05) (Table 5-50 and Appendix 6, Table A6.31).

In people aged 60 and over, an inverted j-shaped curve was found for the association between SBP and occupation in 2003. No association was found in in 2010 (Appendix 6, Table A6.31).

The effects of each variable on SBP resulting from the fully adjusted model can be observed in Table 5-50. Being man, age and increment in BMI increased the risk of SBP in the two years studied. Being divorced/separated/widowed and having family history of hypertension increased the risk only in 2010. Moreover, being past smoker decreased the risk of raised SBP in 2003 and being current smoker decreased this risk in 2010 (Table 5-50). The place of residence, having diabetes mellitus and physical activity were not significant in 2003 and 2010.

DBP and occupation analysis by sex in 2003 and 2010

Results for Multivariable analysis of the association between DBP and occupation fully adjusted can be observed in Table 5-51. Models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.32).

Findings showed a u-shaped curve for the association between DBP and occupation in men and in women in 2003. DBP was not related to occupation in 2010, both in men and in women (Table 5-51).

The results of the fully adjusted model showed that the factors which increased the risk of raised DBP in both surveys were, being man, age and increment in BMI. Family history of hypertension also increased the risk of raised SBP but only in 2010 (Table 5-51). Place of residence, marital status, having diabetes mellitus, smoking and physical activity were not significant in both, 2003 and 2010.

DBP and occupation analysis by age group in 2003 and 2010

Table 5-52 shows the multivariable analysis stratified by age group of the association between DBP and occupation in fully adjusted model. Results of the models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.33).

No association was found between DBP and occupation in all the models in people aged 20-39 in both, 2003 and 2010 (Table 5-52 and Appendix 6, Table A6.33). In people aged 40-59 a u-shaped curve was observed for the association between DBP and occupation in 2003. In 2010, DBP was not related to occupation in 40-59 age group.

In people aged 60 and over, an inverted j-shape was found for the association between DBP and occupation in 2003 in all the models carried out. These associations were all significant, except for those after adjustment for BMI and after full adjustment (Appendix 6, Table A6.33).

Table 5-49: Multivariable analysis of the association between SBP and occupation by sex. Fully adjusted models. 2003 and 2010.

	2003				2010			
Occupation (workers)	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
Men								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	-2.60	[-8.35,3.15]	0.38	872	0.89	[-3.34,5.12]	0.68
Low	837	0.08	[-3.01,3.17]	0.96	1079	4.27	[0.05,8.48]	0.05
P-value for trend				*0.78*				*0.01*
Women								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	-2.96	[-9.52,3.59]	0.37	872	-0.21	[-3.76,3.33]	0.91
Low	837	-0.65	[-6.68,5.39]	0.83	1079	0.88	[-3.28,5.05]	0.68
P-value for trend				*0.99*				*0.65*
Age[1]		0.64	[0.52,0.76]	<0.01		0.66	[0.56,0.76]	<0.01
Place of residence (Ref: Urban)		1.51	[-1.59,4.62]	0.34		-0.19	[-3.31,2.93]	0.90
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		3.28	[0.56,6.00]	0.02		2.12	[-0.00,4.24]	0.05
Divorced/Separated/Widowed		0.50	[-4.69,5.68]	0.85		5.73	[1.68,9.78]	0.01
Body Mass Index[2]		1.05	[0.72,1.37]	<0.01		0.91	[0.75,1.07]	<0.01
Diabetes Mellitus[3]		6.78	[-2.63,16.18]	0.16		3.48	[-0.40,7.36]	0.08
Family history of hypertension[4]		1.71	[-0.82,4.24]	0.18		4.40	[2.35,6.45]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-5.37	[-8.93,-1.82]	<0.01		-3.25	[-6.33,-0.16]	0.04
Current		-1.24	[-4.04,1.55]	0.38		-2.72	[-4.96,-0.47]	0.02
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		1.47	[-2.01,4.96]	0.41		-2.37	[-5.82,1.09]	0.18
None		1.46	[-1.94,4.85]	0.40		-1.29	[-4.52,1.93]	0.43

(1)Age: as a continuous variable. (2) Body Mass Index: as a continuous variable. (3) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (4)Family history of hypertension: Having family history of hypertension (as binary variable).

Table 5-50: Multivariable analysis of the association between SBP and occupation by age group. Fully adjusted models. 2003 and 2010.

	2003				2010			
Occupation (workers)	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
20-39								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	-2.82	[-7.34,1.69]	0.22	872	-1.36	[-4.89,2.17]	0.45
Low	837	0.63	[-3.26,4.51]	0.75	1079	0.89	[-2.71,4.49]	0.63
P-value for trend				*0.49*				*0.38*
40-59								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	-3.37	[-10.91,4.17]	0.38	872	2.29	[-2.53,7.11]	0.35
Low	837	-0.58	[-5.31,4.14]	0.81	1079	5.04	[-0.04,10.11]	0.05
P-value for trend				*0.93*				*0.05*
60 and over								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	3.56	[-17.15,24.27]	0.74	872	-2.91	[-13.30,7.49]	0.58
Low	837	-6.52	[-17.71,4.67]	0.25	1079	0.25	[-11.30,11.79]	0.97
P-value for trend				*0.18*				*0.84*
Sex (Ref: men)		-10.20	[-12.79,-7.52]	<0.01		-12.30	[-14.45,-10.17]	<0.01
Place of residence (Ref:urban)		1.63	[-1.48,4.73]	0.30		0.50	[-2.69,3.68]	0.76
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.85	[-1.85,3.55]	0.54		0.14	[-2.01,2.29]	0.90
Divorced/Separated/Widowed		0.87	[-4.49,6.22]	0.75		6.11	[2.09,10.13]	<0.01
Body Mass Index[1]		1.13	[0.82,1.44]	<0.01		1.00	[0.84,1.16]	<0.01
Diabetes Mellitus[2]		7.60	[-2.15,17.36]	0.13		3.79	[-0.02,7.61]	0.05
Family history of hypertension[3]		1.70	[-0.75,4.14]	0.17		4.40	[2.29,6.50]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-5.25	[-8.77,-1.73]	<0.01		-2.78	[-5.94,0.37]	0.08
Current		-2.18	[-4.75,0.40]	0.10		-2.84	[-5.12,-0.57]	0.01
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		1.18	[-2.42,4.78]	0.52		-2.01	[-5.44,1.41]	0.25
None		2.01	[-1.41,5.43]	0.25		-0.27	[-3.40,2.87]	0.87

(1) Body Mass Index: as a continuous variable. (2) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (3)Family history of hypertension: Having family history of hypertension (as binary variable).

Table 5-51: Multivariable analysis of the association between DBP and occupation, by sex. Fully adjusted models. 2003 and 2010.

	2003				2010			
Occupation (workers)	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
Men								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	-2.46	[-6.91,2.00]	0.28	872	0.41	[-2.30,3.12]	0.77
Low	837	-0.98	[-3.17,1.21]	0.38	1079	-0.35	[-2.95,2.25]	0.79
P-value for trend				*0.53*				*0.59*
Women								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	-3.22	[-7.62,1.18]	0.15	872	-1.34	[-3.96,1.28]	0.32
Low	837	-1.04	[-5.23,3.15]	0.63	1079	-0.31	[-3.18,2.56]	0.83
P-value for trend				*0.88*				*0.94*
Age[1]		0.27	[0.20,0.35]	<0.01		0.24	[0.18,0.30]	<0.01
Place of residence (Ref: Urban)		-0.20	[-2.22,1.82]	0.85		-0.80	[-2.92,1.33]	0.46
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.79	[-1.21,2.78]	0.44		0.03	[-1.48,1.55]	0.97
Divorced/Separated/Widowed		-0.65	[-4.00,2.69]	0.70		2.38	[-0.20,4.97]	0.07
Body Mass Index[2]		0.90	[0.69,1.10]	<0.01		0.63	[0.52,0.73]	<0.01
Diabetes Mellitus[3]		-0.18	[-5.40,5.04]	0.95		0.85	[-1.84,3.55]	0.53
Family history of hypertension[4]		1.75	[-0.09,3.59]	0.06		2.61	[1.30,3.92]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		-1.73	[-4.01,0.55]	0.14		-0.49	[-2.49,1.51]	0.63
Current		-0.50	[-2.40,1.41]	0.61		-1.18	[-2.68,0.32]	0.12
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.37	[-2.77,3.51]	0.82		-0.48	[-2.64,1.69]	0.67
None		0.39	[-2.64,3.43]	0.80		1.34	[-0.71,3.39]	0.20

(1)Age: as a continuous variable. (2) Body Mass Index: as a continuous variable. (3) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (4)Family history of hypertension: Having family history of hypertension (as binary variable).

Table 5-52: Multivariable analysis of the association between DBP and occupation, by age group. Fully adjusted models. 2003 and 2010.

	2003				2010			
Occupation (workers)	**N**	**Coef**	**95% CI**	**p value**	**N**	**Coef**	**95% CI**	**p value**
20-39								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	-2.28	[-5.90,1.33]	0.22	872	-0.75	[-3.31,1.81]	0.56
Low	837	0.11	[-2.89,3.10]	0.94	1079	-0.95	[-3.48,1.57]	0.46
P-value for trend				*0.66*				*0.49*
40-59								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	-4.04	[-9.27,1.20]	0.13	872	-1.38	[-4.54,1.77]	0.39
Low	837	-2.08	[-4.82,0.65]	0.14	1079	-1.67	[-4.88,1.53]	0.31
P-value for trend				*0.21*				*0.38*
60 and over								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	7.23	[-2.61,17.06]	0.15	872	0.23	[-4.90,5.36]	0.93
Low	837	-5.37	[-12.09,1.35]	0.12	1079	1.46	[-4.07,6.99]	0.61
P-value for trend				*0.06*				*0.57*
Sex (Ref: men)		-7.87	[-9.80,-5.95]	<0.01		-6.92	[-8.33,-5.50]	<0.01
Place of residence (Ref:urban)		-0.11	[-2.13,1.91]	0.91		-0.78	[-2.96,1.40]	0.48
Marital status								
Married/cohabiting		Ref	-	-				
Single		0.20	[-1.68,2.09]	0.83		-0.51	[-2.11,1.08]	0.53
Divorced/Separated/Widowed		-0.56	[-3.87,2.75]	0.74		3.28	[0.79,5.77]	0.01
Body Mass Index[1]		0.94	[0.74,1.13]	<0.01		0.66	[0.56,0.77]	<0.01
Diabetes Mellitus[2]		0.08	[-5.27,5.43]	0.98		1.23	[-1.33,3.80]	0.35
Family history of hypertension[3]		1.68	[-0.05,3.41]	0.06		2.61	[1.29,3.94]	<0.01
Smoking								
Never		Ref	-	-				
Past		-1.94	[-4.23,0.36]	0.10		-0.31	[-2.24,1.63]	0.76
Current		-0.98	[-2.73,0.77]	0.27		-1.35	[-2.86,0.16]	0.08
Physical Activity								
3 or more times		Ref	-	-				
Less than 3 times		0.15	[-2.88,3.19]	0.92		-0.36	[-2.62,1.89]	0.75
None		0.47	[-2.46,3.41]	0.75		1.68	[-0.39,3.75]	0.11

(1) Body Mass Index: as a continuous variable. (2) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (3)Family history of hypertension: Having family history of hypertension (as binary variable).

Table 5-52 provides the results of the full adjusted models stratified by age and for two surveys. Similar to that observed in the previous sections, being man, age and increment in BMI increased DBP in the two years studied. Having family history of hypertension also increased the risk of raised DBP but only in 2010. Place of residence, marital status, having diabetes mellitus, smoking and physical activity were not significant in 2003 and 2010 (Table 5-52).

Hypertension and occupation analysis by sex in 2003 and 2010

Multivariable analysis was undertaken for the association between hypertension and occupation and the results are shown in Table 5-53. Regression Models were fitted adding covariates one-at-a-time and these results are shown in Appendix 6, Table A6.34.

Analysis stratified by sex of the association between hypertension and occupation showed that there was no association in men, in all the models adjusting for the covariates. In women an inverted j-shaped curve was observed in 2010 (Table 5-53 and Appendix 6, Table A6.34).

Findings from the fully adjusted model showed that being man, age, increment in BMI and having family history of hypertension increased the risk of hypertension in both, 2003 and 2010 (Table 5-53). People who do not exercise almost doubled the risk of hypertension of people who exercise 3 times per week. Place of residence, marital status, having diabetes mellitus and smoking were not significant in 2003 and 2010.

Hypertension and occupation analysis by age group in 2003 and 2010

Table 5-54 shows the results obtained in the analysis of the association between hypertension and occupation stratified by age group for both surveys. Results of the models in which covariates were added one-at-a-time are presented in Appendix 6, Table A6.35.

No association between hypertension and occupation (workers) was found, in all the models adjusted for each of the covariates, in people aged 20-39 and 40-59. In people aged 60 and over, those in the lower levels of SEP had lower risk than those in the highest level in 2010. (Table 5-54 and Appendix 6, Table A6.35).

Table 5-53: Multivariable analysis of the association between hypertension and occupation (workers), by sex. Fully adjusted models 2003 and 2010.

	2003				2010			
Occupation (workers)	**N**	**PR**	**95% CI**	**p value**	**N**	**PR**	**95% CI**	**p value**
Men								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	0.76	[0.48,1.22]	0.26	872	1.04	[0.66,1.62]	0.88
Low	837	0.90	[0.70,1.14]	0.37	1079	1.05	[0.70,1.58]	0.80
P-value for trend				*0.48*				*0.82*
Women								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	0.96	[0.46,2.01]	0.89	872	1.34	[0.79,2.26]	0.28
Low	837	1.07	[0.56,2.04]	0.84	1079	1.14	[0.70,1.86]	0.59
P-value for trend				*0.80*				*0.74*
Age[1]		1.04	[1.03,1.05]	<0.01		1.05	[1.04,1.06]	<0.01
Place of residence (Ref: Urban)		1.02	[0.78,1.34]	0.89		0.95	[0.69,1.31]	0.76
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.91	[0.67,1.23]	0.54		1.04	[0.77,1.41]	0.79
Divorced/Separated/Widowed		0.90	[0.64,1.26]	0.54		1.35	[0.88,2.08]	0.17
Body Mass Index[2]		1.07	[1.05,1.10]	<0.01		1.05	[1.04,1.06]	<0.01
Diabetes Mellitus[3]		1.01	[0.76,1.35]	0.94		1.13	[0.87,1.46]	0.38
Family history of hypertension[4]		1.26	[1.01,1.57]	0.04		1.58	[1.27,1.95]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		0.86	[0.66,1.10]	0.23		0.87	[0.64,1.18]	0.36
Current		0.99	[0.77,1.29]	0.96		0.85	[0.67,1.07]	0.17
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.90	[0.61,1.33]	0.60		1.39	[0.75,2.57]	0.29
None		0.89	[0.63,1.27]	0.52		1.92	[1.11,3.31]	0.02

(1)Age: as a continuous variable. (2) Body Mass Index: as a continuous variable. (3) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (4)Family history of hypertension: Having family history of hypertension (as binary variable).

Table 5-54: Multivariable analysis of the association between hypertension and occupation (workers) by age group. 2003 and 2010.

	2003				2010			
Occupation (workers)	**N**	**PR**	**95% CI**	**p value**	**N**	**PR**	**95% CI**	**p value**
20-39								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	0.78	[0.32,1.89]	0.58	872	1.24	[0.53,2.88]	0.62
Low	837	0.97	[0.53,1.80]	0.93	1079	0.86	[0.40,1.85]	0.70
P-value for trend				*0.98*				*0.52*
40-59								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	0.73	[0.48,1.11]	0.14	872	1.19	[0.74,1.91]	0.48
Low	837	0.90	[0.68,1.18]	0.44	1079	1.18	[0.74,1.87]	0.48
P-value for trend				*0.58*				*0.60*
60 and over								
High	336	Ref	-	-	363	Ref	-	-
Middle	328	1.34	[0.95,1.89]	0.09	872	0.74	[0.42,1.32]	0.31
Low	837	0.93	[0.68,1.29]	0.68	1079	0.71	[0.43,1.17]	0.18
P-value for trend				*0.46*				*0.24*
Sex (Ref: men)		0.56	[0.42,0.74]	<0.01		0.54	[0.40,0.72]	<0.01
Place of residence (Ref:urban)		1.05	[0.81,1.37]	0.70		1.02	[0.74,1.40]	0.92
Marital status								
Married/cohabiting		Ref	-	-		Ref	-	-
Single		0.83	[0.62,1.12]	0.22		0.97	[0.70,1.34]	0.85
Divorced/Separated/Widowed		0.95	[0.67,1.35]	0.76		1.49	[0.99,2.24]	0.05
Body Mass Index[1]		1.08	[1.05,1.10]	<0.01		1.05	[1.04,1.07]	<0.01
Diabetes Mellitus[2]		1.07	[0.80,1.45]	0.64		1.13	[0.85,1.49]	0.39
Family history of hypertension[3]		1.20	[0.97,1.49]	0.09		1.56	[1.26,1.94]	<0.01
Smoking								
Never		Ref	-	-		Ref	-	-
Past		0.83	[0.64,1.07]	0.15		0.88	[0.65,1.20]	0.42
Current		0.92	[0.73,1.17]	0.51		0.84	[0.67,1.07]	0.16
Physical Activity								
3 or more times		Ref	-	-		Ref	-	-
Less than 3 times		0.90	[0.61,1.33]	0.60		1.47	[0.79,2.70]	0.22
None		0.91	[0.65,1.28]	0.59		2.17	[1.25,3.76]	0.01

(1) Body Mass Index: as a continuous variable. (2) Diabetes Mellitus: Having Diabetes Mellitus (binary variable). (3)Family history of hypertension: Having family history of hypertension (as binary variable).

The effects on hypertension of the covariates after full adjustment are provided in Table 5-54. Being man, age, increment in BMI and having family history of hypertension increased the risk of hypertension in both, 2003 and 2010 (Table 5-54). Risk of hypertension was two-fold higher in people who did not do exercise than those who did it 3 times per week. Place of residence, marital status, having diabetes mellitus and smoking were not significant in 2003 and 2010.

Summary of multivariable analysis of the association between blood pressure and occupation

Analysis of the association between blood pressure and occupation was carried out by using occupation with six non-hierarchical categories and three ordered categories.

Significant inequalities across occupations were found in DBP and hypertension in men in 2003 and 2010 and in SBP and DBP in women in 2010.

Age-stratified analysis showed significant differences among occupation categories in SBP in people aged 40-59 in 2003. Differences were also found in DBP in people aged 60 and over in both 2003 and 2010. The risk of hypertension was significantly different in people aged 45 and over in 2003 and 2010, and in people aged 20-44 in 2010.

However, given that occupation with six categories is not a hierarchical SEP measure, it is not possible to determine if there were social gradients of blood pressure across occupations.

Analysis of the association between blood pressure and categories of workers showed different types of association. An inverse gradient was observed in men and in people aged 40-59 in 2010 but not in 2003, suggesting that occupational inequalities may have increased over time in these groups. U-shaped curves, whereby intermediate workers had the lowest levels of blood pressure, were found for men, women and in people aged 40-59 only in 2003. In turn, j-shaped curves were found in people aged 60 and over in 2003 and in women in 2010.

5.3.3.4 Summary of the main findings in the multivariable analysis of the association between blood pressure and SEP

Association between blood pressure and socioeconomic status was different according the outcome and the socioeconomic position measure used. In this manner, significant associations were more frequently found when the outcome was SBP, followed for DBP. Among the hierarchical SEP measures used, education was more commonly related to blood pressure (Table 5-55).

Different types of associations between blood pressure and socioeconomic position were found. Inverse gradient was the shape of association most commonly observed and this was found most frequently for SBP. In four cases a direct association was found when the outcomes were DBP or hypertension. Moreover inverted j-shaped and inverted u-shaped curves, whereby intermediate level of SEP had the highest levels of BP, were observed in people aged 60 an over in 2003 and in women in 2010. In turn, u-shaped curves, whereby people in intermediate levels of SEP had the lowest levels of BP, were observed in 2003 when occupation (workers) was the exposure (Table 5-55).

Analysis of the association between blood pressure and occupation including non-workers showed that inequalities were more commonly observed in men and in older people, in both 2003 and 2010 (Table 5-55).

Comparing both surveys, it is possible to note that inequalities of blood pressure across educational levels in women in 2010 decreased with respect to 2003. Unlike, inequalities across education and occupation increased in men.

Regarding the role of the covariates in drawing the association between blood pressure and SEP, it is worth noting that BMI was the covariate that more strongly affected these associations, and after adjustment for this variable, most of them were no longer significant.

After analysing the models combining different outcomes, exposures and stratifications, it is possible to conclude that the best model to analyse the association between education and blood pressure is that using SBP as outcome and stratifications by age group and gender. In the case of assets-based index the model which better captured inequalities in blood pressure was that using SBP as outcome and stratification by age group. In turn, analyses showed that occupation may be more sensitive in capturing inequalities in blood pressure in men, when SBP was used as outcome. Therefore, association between occupation and blood pressure should include sex-stratification. Since BMI was the covariate which most affected the association between blood pressure and SEP, models examining social inequalities in blood pressure in Chile should include adjustment for this covariate.

Table 5-55: Summary of the multivariable analysis of the association between blood pressure and socio-economic position NHS 2003 and 2010 (Results of fully adjusted models).

<table>
<tr><th rowspan="2"></th><th colspan="2">Men</th><th colspan="2">Women</th><th colspan="2">20-39</th><th colspan="2">40-59</th><th colspan="2">60 and over</th></tr>
<tr><th>2003</th><th>2010</th><th>2003</th><th>2010</th><th>2003</th><th>2010</th><th>2003</th><th>2010</th><th>2003</th><th>2010</th></tr>
<tr><td>Education</td><td colspan="10"></td></tr>
<tr><td>Education/SBP</td><td>-</td><td>Inverse*</td><td>Inverse</td><td>Inverse*</td><td>Inverse*</td><td>-</td><td>Inverse</td><td>Inverse*</td><td>Inverted u-shaped</td><td>Inverse*</td></tr>
<tr><td>Education/DBP</td><td>-</td><td>-</td><td>Inverse[1]</td><td>Direct</td><td>-</td><td>-</td><td>Inverse*</td><td>Direct*</td><td>Inverted j-shaped</td><td>-</td></tr>
<tr><td>Education/Hyp.</td><td>-</td><td>-</td><td>Inverse</td><td>-</td><td>-</td><td>-</td><td>Inverse*</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Assets-based SEP</td><td colspan="10"></td></tr>
<tr><td>Assets-based SEP/SBP</td><td>Inverse*</td><td>Inverse*</td><td>Inverse*</td><td>Inverted u-shaped*</td><td>-</td><td>-</td><td>Inverse[2]</td><td>Inverse</td><td>J-shaped*</td><td>Inverse[2]</td></tr>
<tr><td>Assets-based SEP/DBP</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>Inverse[1]</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Assets-based SEP/Hyp.</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>Inverse</td><td>-</td><td>Direct</td><td>-</td></tr>
<tr><td>Occupation (workers)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Occupation/SBP</td><td>U-shaped*</td><td>Inverse</td><td>U-shaped*</td><td>-</td><td>-</td><td>-</td><td>U-shaped*</td><td>Inverse</td><td>Inverted j-shaped*</td><td>-</td></tr>
<tr><td>Occupation/DBP</td><td>U-shaped*</td><td>-</td><td>U-shaped*</td><td>-</td><td>-</td><td>-</td><td>U-shaped*</td><td>-</td><td>Inverted j-shaped*</td><td>-</td></tr>
<tr><td>Occupation/Hyp.</td><td>-</td><td>-</td><td>-</td><td>Inverted j-shaped*</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>Direct*</td></tr>
<tr><td>Occupation 6 categories</td><td colspan="10"></td></tr>
<tr><td>Occupation/SBP</td><td>-</td><td>-</td><td>Significant differences</td><td>Significant differences</td><td>-</td><td>-</td><td>Significant differences</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Occupation/DBP</td><td>Significant differences</td><td>Significant differences</td><td>-</td><td>Significant differences</td><td>-</td><td>-</td><td>-</td><td>-</td><td>Significant inequalities</td><td>Significant inequalities</td></tr>
<tr><td rowspan="2"></td><td colspan="4" rowspan="2"></td><td colspan="3">20-44</td><td colspan="3">45 and over</td></tr>
<tr><td>2003</td><td colspan="2">2010</td><td colspan="2">2003</td><td>2010</td></tr>
<tr><td>Occupation/Hyp.</td><td>Significant differences</td><td>Significant differences</td><td>-</td><td>-</td><td>-</td><td colspan="2">Significant differences</td><td colspan="2">Significant differences</td><td>Significant differences</td></tr>
</table>

1: intermediate and the lowest level of education recoded as one category. 2: the intermediate and the lowest level of SEP had similar coefficients and these were higher than that for the highest level of SEP. * Results based on effect size analysis.

5.3.4 Relative and absolute socioeconomic inequalities in blood pressure in 2003 and 2010

In this section, the magnitude of socioeconomic inequalities in blood pressure was examined by using RII and SII, and results for 2003 and 2010 were compared. The indices were obtained by regression analyses. For SBP and DBP, indices were estimated using generalised linear models specifying a Gaussian family distribution with the log link function for RII and with the identity link function for SII. For hypertension, due to convergence issues, Poisson models and linear regression models were used to estimate, RII and SII respectively (See chapter 5, section 5.2.4). All the models estimating these indices were adjusted for age, sex, marital status and place of residence.

The results for RII and SII summarise the relative and the absolute effect on blood pressure of moving from the lowest to the highest level of the social hierarchy. Values larger than one of RII and larger than zero of SII indicate relative and absolute disadvantages in people in the lowest levels of SEP respectively. A larger index indicates a larger magnitude of the health differences. A positive SII indicates that coefficients or prevalence increased with lower levels of SEP (see Chapter 5, section 5.2.4).

Models that did not meet the assumption of linearity were excluded from the evaluation of the relative and absolute inequalities in blood pressure.

5.3.4.1 Overall analysis of relative and absolute socioeconomic inequalities in blood pressure

The RII and SII estimated to analyse relative and absolute socioeconomic inequalities in blood pressure in 2003 and 2010 are shown in Table 5-56 and 5-57. In addition, potential interaction effect between survey year and SEP were examined in order to assess changes of inequalities over time.

Significant relative inequalities were found for SBP across education and assets-based SEP in 2003 and 2010, although the magnitude of these was low, with values just above one (Table 5.56).

In the case of education, RII for SBP was 1.04 (95%CI: 1.01, 1.07) in 2003 and 1.03 (95%CI: 1.01, 1.07) in 2010 suggesting that relative educational inequalities in SBP did not change between the two years. Concordant with this, interaction term between education and survey year was not significant (p-value >0.05). Relative inequalities across education were also found for DBP. RII in 2003 was over one and significant (p-value = 0.07), while in 2010 this index was significant and under one. The results for the interaction term between education and year confirmed the change in educational relative inequalities in DBP from 2003 to 2010, since this was significant with a p-value <0.01 (Table 5-56).

Analysis of relative inequalities across assets-based SEP, showed that the value of the RII for SBP in both years was 1.04, but the level of significance decreased from p<0.01 in 2003 to p=0.01 in 2010 (Table 5.56). This may indicate a trend for these inequalities to decrease, however, the interaction term assessing changes over time was not significant (p-value>0.05). RII for DBP and hypertension and assets-based SEP were not significant.

RII of blood pressure for occupation was not significant in either of the two years analysed. However, it is worth noting that in 2010 RII was over 1 for SBP, and the p value bordered on a statistically significant value (p-value=0.07). This suggests that possibly occupational relative inequalities for SBP were increasing between the two years. However, interaction terms evaluating changes in relative inequalities across occupation over time, were not significant (Table 5-56).

In turn, results for SII showed significant educational inequalities for the outcomes SBP and DBP and inequalities across assets-based SEP for SBP (Table 5-57).

Estimates of SII for SBP by education decreased from 6.37 in 2003 to 3.57 in 2010, although this was not significant. In this way, absolute educational inequalities observed in 2003 disappeared in 2010. Nonetheless, the interaction term evaluating changes of the educational inequalities over time showed that the difference between the two years was not significant. Similar to that observed for RII, educational absolute inequalities for DBP increased over time, and the gradient also changed the direction. This was confirmed by the interaction term SEP by survey year, which was significant with a p-value <0.01 (Table 5-57).

Table 5-56 Relative socioeconomic inequalities in SBP, DBP and hypertension 2003 and 2010

		Socioeconomic position measure		
	Survey year	Education	Assets based SEP	Occupational class
Relative inequalities		RII (95% CI)	RII (95% CI)	RII (95% CI)
SBP	2003	1.04 (1.01, 1.07)**	1.04 (1.01, 1.07)**	0.99 (0.93, 1.05)
	2010	1.03 (1.01, 1.07)*	1.04 (1.01, 1.07)*	1.04 (0.99, 1.08)*
Year-SEP interaction p-value		*0.46*	*0.70*	*0.21*
DBP	2003	1.03 (0.99, 1.06)*	1.02 (0.97, 1.02)	N/A
	2010	0.97 (0.95, 1.01)*	0.99 (0.97, 1.03)	0.98 (0.94, 1.02)
Year-SEP interaction p-value		*<0.01*	*0.20*	*0.75*
Hypertension	2003	1.07 (0.82, 1.40)	1.21 (0.94, 1.55)	0.83 (0.44, 1.57)
	2010	1.20 (0.89, 1.62)	1.08 (0.82, 1.44)	1.00 (0.63, 1.60)
Year-SEP interaction p-value		*0.55*	*0.53*	*0.62*

RII: Relative Index of Inequality. * p<0.07, **p<0.01 . Not assessed because of non-linearity (Appendix 7).

Table 5-57: Absolute socioeconomic inequalities in SBP, DBP and hypertension, 2003 and 2010

		Socioeconomic position measure		
	Survey year	Education	Assets based SEP	Occupational class
Absolute inequalities		SII (95% CI)	SII (95% CI)	SII (95% CI)
SBP	2003	6.37 (2.61, 10.14)**	5.67 (1.69, 9.66)**	-0.75 (-8.08, 6.60)
	2010	3.57 (-0.59, 8.24)	4.27 (0.91, 7.63)*	4.17 (-0.80, 9.13)
Year-SEP interaction p-value		*0.28*	*0.59*	*0.27*
DBP	2003	2.62 (0.01, 5.24)*	1.72 (-0.93, 4.36)	N/A
	2010	-3.02 (-5.51, 0.53)*	-0.40 (-2.47, 1.67)	-1.59 (-4.87, 1.70)
Year-SEP interaction p-value		*<0.01*	*0.21*	*0.86*
Hypertension	2003	0.07 (-0.02, 0.16)	0.07 (-0.02, 0.15)	-0.05 (-0.27, 0.16)
	2010	0.03 (-0.06, 0.13)	0.01 (-0.07, 0.10)	0.03 (-0.06, 0.13)
Year-SEP interaction p-value		*0.45*	*0.36*	*0.82*

SII: Slope Index of Inequality. * p<0.07, **p<0.01. N/A: Not assessed because of non-linearity (Appendix 7).

In the case of assets-based SEP, the value of the SII of 5.67 (95%CI: 1.69, 9.66) in 2003 decreased to 4.27 (95%CI: 0.91, 7.63) in 2010, however the confident intervals overlapped suggesting that absolute socioeconomic inequalities remained stable over time. A non-significant year interaction confirmed that there were not differences in absolute inequalities between the two surveys.

All the indices estimated to analyse occupational absolute inequalities were not significant in both years.

5.3.4.2 Relative and absolute socioeconomic inequalities in blood pressure, differences by gender

Inequalities in blood pressure were also tested for gender interaction. Significant effect of gender was found on the association between education and the three outcomes in 2003, but not in 2010 (Table 5-58 and Table 5-59). Interaction effect of gender on inequalities across assets-based SEP and across occupational class, were not significant.

Consequently sex-stratified estimations were carried out for educational inequalities in 2003, and in order to have a complete picture of these educational inequalities, the indices were also estimated for 2010 (Table 5-58 and Table 5-59). Moreover, with the aim to evaluate changes in the inequalities over time, interaction effect between education and survey year were examined for each gender.

Consistent with findings showed in previous section (Section 5.4) about multivariable analysis of socioeconomic inequalities in blood pressure, educational inequalities were found in women but not in men. When the outcome of interest was SBP, RII in 2010 for women had a value over 1 and significant, indicating that SBP was higher at each consecutives lower level of education (Table 5-58). Changes over time were not assessed due to RII was not estimated for 2003 for non-linearity of the association between education and SBP.

Table 5-58 Relative educational inequalities in SBP, DBP and hypertension by sex, 2003 and 2010.

		Women	Men	*Gender-SEP interaction p-value*
Relative inequalities		RII (95% CI)	RII (95% CI)	
SBP	2003	N/A	0.99 [0.95,1.03]	<0.01
	2010	1.05* [1.01,1.10]	1.02 [0.97,1.06]	0.20
Year-SEP interaction p-value		N/A	0.56	
DBP	2003	N/A	0.97 [0.93,1.02]	<0.01
	2010	0.98 [0.94,1.02]	0.97 [0.93,1.02]	0.80
Year-SEP interaction p-value		N/A	0.35	
Hypertension	2003	1.80** [1.21,2.69]	0.87 [0.62,1.21]	<0.01
	2010	1.18 [0.78,1.78]	N/A	0.64
Year-SEP interaction p-value		0.52	0.20	

RII: Relative Index of Inequality. * p<0.05,**p<0.01. N/A: Not assessed because of non-linearity (Appendix 7).

Table 5-59 Absolute educational inequalities in SBP, DBP and hypertension by sex, 2003 and 2010

		Women	Men	*Gender-SEP interaction p-value*
Absolute inequalities		SII (95% CI)	SII (95% CI)	
SBP	2003	11.30** [5.94,16.74]	-1.27 [-6.54,3.99]	<0.01
	2010	5.73 [-0.02,11.49]	2.59 [-3.17,8.36]	0.40
Year-SEP interaction p-value		0.06	0.61	
DBP	2003	N/A	-2.20 [-6.14,1.75]	0.01
	2010	-1.80 [-5.09,1.49]	-1.90 [-5.51,1.72]	0.97
Year-SEP interaction p-value		N/A	0.33	
Hypertension	2003	0.14* [0.02,0.26]	-0.02 [-0.15,0.12]	0.05
	2010	0.02 [-0.10,0.13]	0.06 [-0.07,0.19]	0.59
Year-SEP interaction p-value		0.08	0.56	

SII: Slope Index of Inequality. * p<0.05, **p<0.01. N/A: Not assessed because of non-linearity (Appendix 7).

In the case of DBP, RII across education in women was estimated only for 2010 due to non-linearity of the association between education and DBP in 2003. There were not relative inequalities in DBP in 2010 in women. Relative educational inequalities were found for hypertension in women in 2003 but not in 2010. These results suggested a decrease of the inequalities in hypertension over time; however the survey year interactions term was not significant (Table 5-58). In men relative inequalities were not significant in either year (Table 5-58).

Similarly to findings for RII, absolute educational inequalities were observed in women but not in men. In 2003 there were educational absolute inequalities for SBP and hypertension in women but these were not found in 2010 (Table 5-59). Considering that interaction terms between survey year and SEP for SBP and hypertension had p-values of 0.06 and 0.08, it is possible to suggest that absolute inequalities in women diminished between 2003 and 2010 (Table 5-59). Absolute educational inequalities for DBP were not evaluated for 2003, since test of linearity showed that the association between DBP and education was non-linear (Appendix 7).

5.3.4.3 Relative and absolute socioeconomic inequalities in blood pressure, differences by age group

Considering that inequalities in blood pressure may vary by age, the potential effect of age on relative and absolute inequalities was assessed by including interaction terms between age and the three measures of SEP for both surveys.

Significant effect modification by age was found for education and for assets-based SEP, in particular when hypertension was the outcome of interest (Table 5-60 and Table 5-61). In concordance with these results, age-stratified estimations of RII and SII were undertaken for education and assets-based scores. Moreover, with the aim to evaluate changes over time of these relative and absolute, potential interaction effect between survey year and SEP were examined for each age group and each outcome and are presented in Tables 5-60 and Table 5-61.

RII and SII for education by age group are presented in Table 5-60 and Table 5-61 respectively. Findings showed that RII varied among age groups and were different according to the outcome. There were not significant inequalities in people aged 20-39 in both surveys. In people aged 40-59, RII were significant for the three outcomes in 2003, but in 2010, it was significant only for SBP. The RIIs for SBP in this age group diminished from 1.11 in 2003 (95%CI: (1.06, 1.16) and 1.08 in 2010 (95%CI: 1.02, 1.15]. These results suggested that relative inequalities in blood pressure decreased over time in people aged 40-59. However, this resulted effective only for DBP where year interaction was significant. In addition, findings showed there was a significant RII for SBP in people aged 60 and over (1.07 95%CI1.01, 1.14) in 2010 (Table 5-60). However, changes over time were not assessed due to association between education and SBP in people aged 60 and over in 2003 was non-linear (Appendix 7). RII for DBP and hypertension in 60 plus age group were not significant.

In turn, absolute educational inequalities showed the same pattern observed for relative inequalities (Table 5-61). In younger people (20-39) there were not absolute inequalities. In people in the intermediate age group, SII had significant positive values in 2003, indicating that there were inverse social gradients for the three outcomes. Comparison of the indices between the two surveys suggested that absolute inequalities between 2003 and 2010 diminished in people aged 40-59. In fact, SII for SBP decreased from 13.9 to 10.4 between the two surveys. Indices for DBP and hypertension were no longer significant in 2010, suggesting that inequalities disappeared over time for these two outcomes. On the other hand, SII in people aged 60 and over was significant only for SBP in 2010. There were not absolute inequalities for DBP and hypertension in either 2003 or 2010 (Table 5-61). Changes over time were not evaluated because of non-linearity of the association between education and SBP and DBP in 2003 (Appendix 7).

RII and SII for assets-based SEP by age group are shown in Table 5-62 and Table 5-63 respectively.

Findings for relative inequalities (RII) and absolute inequalities (SII) showed that there were not relative socioeconomic inequalities in blood pressure in people aged 20-39 and 40-59 for any of the three outcomes (Table 5-62 and Table 5-63). In people aged 60 and over RII and SII were significant for SBP in 2010, but not in 2003. These differences RII and SII for SBP between survey years may indicate that inequalities increased over time in 60 plus age group. However, findings showed non-significant interaction effects between the SEP score and survey year (Table 5-62 and Table 5-63).

Table 5-60: Relative educational inequalities in SBP, DBP and hypertension by age group, 2003 and 2010.

		20-39	40-59	60 and over	Age-SEP interaction p-value
Relative inequalities		RII (95% CI)	RII (95% CI)	RII (95% CI)	
SBP	2003	1.04 [0.99,1.09]	1.11** [1.06,1.16]	N/A	0.08
	2010	1.01 [0.97,1.05]	1.08* [1.02,1.15]	1.07* [1.01,1.14]	0.11
Year-SEP interaction p-value		0.14	0.43	N/A	
DBP	2003	1.01 [0.96,1.07]	1.07** [1.02,1.12]	N/A	0.26
	2010	0.98 [0.92,1.04]	0.99 [0.93,1.04]	1.01 [0.96,1.05]	0.74
Year-SEP interaction p-value		0.39	0.02	N/A	
Hypertension	2003	2.10 [0.83,5.32]	1.58** [1.12,2.22]	0.88 [0.67,1.14]	0.01
	2010	1.05 [0.29,3.82]	1.53 [0.95,2.47]	1.19 [0.85,1.67]	0.66
Year-SEP interaction p-value		0.33	0.86	0.12	

* p<0.05, **p<0.01. RII: Relative Index of Inequality. N/A: Not assessed because of non-linearity (Appendix 7).

Table 5-61 Absolute educational inequalities in SBP, DBP and hypertension by age group, 2003 and 2010.

		20-39	40-59	60 and over	Age-SEP interaction p-value
Absolute inequalities		SII (95% CI)	SII (95% CI)	SII (95% CI)	
SBP	2003	4.44 [-1.23,10.10]	13.9** [7.88,19.87]	N/A	0.05
	2010	0.60 [-4.47,5.67]	10.4* [2.12,18.59]	9.49* [0.50,18.47]	0.06
Year-SEP interaction p-value		0.13	0.36	0.51	
DBP	2003	0.96 [-3.33,5.26]	5.66** [1.86,9.46]	N/A	0.20
	2010	-1.62 [-5.90,2.67]	-1.17 [-5.40,3.06]	0.47 [-3.28,4.21]	0.74
Year-SEP interaction p-value		0.38	0.01	0.92	
Hypertension	2003	0.10 [-0.03,0.23]	0.21** [0.05,0.36]	-0.11 [-0.32,0.09]	0.04
	2010	-0.01 [-0.14,0.12]	0.14 [-0.02,0.30]	0.11 [-0.10,0.32]	0.29
Year-SEP interaction p-value		0.20	0.50	0.11	

* p<0.05, **p<0.01. SII: Slope Index of Inequality. N/A: Not assessed because of non-linearity (Appendix 7).

Table 5-62 Relative inequalities in SBP, DBP and hypertension across assets-based SEP by age group, 2003 and 2010

		20-39	40-59	60 and over	*Age-SEP interaction p-value*
Relative inequalities		**RII (95% CI)**	**RII (95% CI)**	**RII (95% CI)**	
SBP	2003	1.04 [1.00,1.08]	N/A	1.01 [0.92,1.11]	0.51
	2010	1.03 [0.99,1.07]	1.05 [1.00,1.10]	1.09** [1.02,1.16]	0.27
Year-SEP interaction p-value		0.43	N/A	0.31	
DBP	2003	1.02 [0.97,1.07]	N/A	1.01 [0.93,1.09]	0.79
	2010	1.01 [0.96,1.06]	1.00 [0.96,1.04]	1.01 [0.96,1.06]	0.95
Year-SEP interaction p-value		0.70	N/A	0.71	
Hypertension	2003	1.68 [0.81,3.49]	1.41 [0.98,2.02]	N/A	0.01
	2010	1.44 [0.44,4.69]	1.16 [0.75,1.79]	1.08 [0.78,1.50]	0.89
Year-SEP interaction p-value		0.76	0.54	N/A	

*p<0.05, **p<0.01. RII: Relative Index of Inequality, SII: Slope Index of Inequality. N/A: Not assessed because of non-linearity (Appendix 7).

Table 5-63 Absolute inequalities in SBP, DBP and hypertension across assets-base SEP by age group, 2003 and 2010.

		20-39	40-59	60 and over	*Age-SEP interaction p-value*
Absolute inequalities		SII (95% CI)	SII (95% CI)	SII (95% CI)	
SBP	2003	4.37 [-0.42,9.17]	N/A	1.96 [-12.61,16.52]	0.45
	2010	3.15 [-1.43,7.72]	6.26 [-0.08,12.61]	12.5** [3.45,21.45]	0.18
Year-SEP interaction p-value		0.45	N/A	0.32	
DBP	2003	1.34 [-2.21,4.90]	N/A	0.82 [-6.11,7.76]	0.73
	2010	0.78 [-2.81,4.37]	-0.03 [-3.39,3.32]	0.44 [-3.56,4.43]	0.95
Year-SEP interaction p-value		0.74	N/A	0.72	
Hypertension	2003	0.07 [-0.04,0.17]	0.16 [-0.01,0.33]	N/A	0.03
	2010	0.03 [-0.09,0.15]	0.045 [-0.10,0.19]	0.04 [-0.17,0.25]	0.99
Year-SEP interaction p-value		0.55	0.36	N/A	

* p<0.05, **p<0.01. RII: Relative Index of Inequality, SII: Slope Index of Inequality. N/A: Not assessed because of non-linearity (Appendix 7).

5.3.4.4 Summary and main findings about relative and absolute socioeconomic inequalities in blood pressure in 2003 and 2010

There was evidence of significant inequalities by education and assets-based SEP in relative (RII) and absolute (SII) terms in both surveys. Inequalities by occupational class did not present the same pattern and were no significant in both surveys.

In general, there were strong associations between SBP and education and assets-based SEP. These associations were on the expected direction whereby adults who were in lower educational and assets-based index levels had larger regression coefficients than those in the highest levels. Relative inequalities in education and assets-based SEP in SBP tended to remain stable between the two surveys. Findings on absolute inequalities in SBP showed that educational inequalities observed in 2003 disappeared in 2010, while absolute inequalities by assets-based SEP remained significant in the two years.

Relative and absolute inequalities were also found for the association between DBP and education. These showed an inverse social gradient in 2003 and a direct gradient in 2010. This change over time was significant.

When significant gender interactions were found in absolute or relative inequalities, there were consistent larger inequalities among women. These inequalities were observed for SBP and hypertension, and tended to decline between 2003 and 2010 for this latter outcome.

Age-stratified analysis for education revealed consistent relative and absolute inequalities in people aged 40-59 in 2003, in particular for SBP. These inequalities tended to decreased in 2010. By contrast, estimates of RII and SII suggested that inequalities in SBP in people aged 60 and over increased over time. However survey year interactions were in general not significant.

5.4 Discussion

5.5 Project summary

This project was intended to address the question of whether and how socioeconomic status is related to blood pressure in Chilean adults and how this association has evolved between 2003 and 2010. The project proposed several hypotheses relating to socioeconomic inequalities, their individual contributing factors and changes over time, which can be summarised as follow:

1. Socioeconomic position is inversely related to blood pressure in Chilean adults, and this can be observed for different outcomes and across different SEP measures.
2. These socioeconomic inequalities are independent from the effects of socio-demographic and health related individual factors.
3. Socioeconomic inequalities in blood pressure are larger in women than men and in younger people than older people.
4. These socioeconomic inequalities in blood pressure can be observed in both, relative and absolute terms.
5. Socio-economic Inequalities in blood pressure in Chilean adults have increased between 2003 and 2010.

The above hypotheses were tested using three outcomes (SBP, DBP and hypertension) and three socioeconomic measures (Education, assets-based index and occupation) in both surveys. Two main methods of analysis were used:

1. Multivariable Regression analysis – Testing the association between each blood pressure outcome and each socioeconomic position measured in both 2003 and 2010.

2. Estimation of Relative and Slope Indices of Inequalities – Testing relative and absolute social inequalities in 2003 and 2010 by fitting multivariable regression models.

Table 5-64 gives an overview of the results of these analyses for the three outcomes and each individual-level socioeconomic indicator and for the two surveys. The overall message of Table 5-64 is that socioeconomic inequalities in blood pressure are stronger in SBP than in other blood pressure measures. The following sections explore these results in more detail, with reference to the project's specific hypotheses. In addition, this chapter discusses strengths and limitations, and implications for policies and future research.

In general, findings were partially consistent with the first hypothesis of this thesis, in that the expected inverse associations between socioeconomic position and blood pressure were observed, however, there were certain differences in results according to the outcome and the socioeconomic position indicator used.

In gender and age-adjusted models and in multivariable analysis, social gradients were found for some of the associations analysed. The inverse associations between these socioeconomic indicators and blood pressure were more commonly observed in 2003 than 2010. Education was stronger in capturing inequalities in blood pressure than assets-based index and occupation. Considering the large number of analyses in this thesis, overall patterns and effect sizes were evaluated to determine the level of significance of associations between blood pressure and SEP. In this way p values between 0.05 and 0.07 were considered as significant rather than borderline. These associations are presented below in Table 5-65.

Estimates of the relative and slope indices of inequality were consistent with multivariable analysis, with significant inequalities in blood pressure were found, and different patterns appearing according to the outcome and SEP indicator. There were consistent significant educational and assets-based index inequalities in blood pressure, in both relative and absolute terms. Relative and absolute inequalities by education were found for the three outcomes in 2003, and for SBP in 2010. Meanwhile RII and SII for assets-based index were significant in both 2003 and 2010, but only for SBP. There were no occupational inequalities detected in either year.

Table 5-64: Summary of findings – socioeconomic inequalities in blood pressure 2003 and 2010

		Health outcome					
		SBP		DBP		Hypertension	
		2003	2010	2003	2010	2003	2010
Pattern of means and prevalence rates by SEP levels[1]	Education	Inverse gradient in women, 20-39 and 40-59 age groups. Inverted j-shaped in 60+ age group*.	Inverse gradient in women and in 40-59 and 60 plus age groups.	Inverse gradient in women and 40-59 age group. Inverted j-shaped in 60+ age group*.	-	Inverse gradient in women and in 20-39*, 40-59 age group and in women aged 60 plus.	Inverse gradient in 40-59 age group*.
	Assets-based index	Inverse gradient in men, women, 20-39 and 40-59 age groups. U-shaped in 60+ age group*.	Inverse gradient in men*, women, in 40-59 and 60 plus age groups.	Inverse gradient in 40-59 age group*.	-	Inverse gradient in 20-39*, 40-59 and 60+ age groups. Higher PR in intermediate and lower levels of SEP in women.	Inverse gradient in men. Higher PR in intermediate and lower levels of SEP in 20-39 age group.
	Occupation	In men, women and in 20-39 age group higher SBP in higher workers*. In 60+ age group routine workers had lower risk than higher workers.	Inverse gradient in men, in 40-59 age group. in 20-39 age group* higher SBP in higher workers.	Inverted j-shaped curve in 60 plus age group. In 20-39 age group* higher DBP in higher workers.	In 20-39 age group* higher DBP in higher workers. Inverse in 40-59 age group*.	In 20-39 and 40-59 age groups* higher PR in higher workers.	Inverse gradient in 40-59 age group*.
Pattern of means and prevalence rates by SEP levels[2]	Education	Inverse gradient in women, in 20-39*, and 40-59 age groups. Inverted u-shaped curve in 60 plus.	Inverse gradient in men*, in women*, in 40-59* age group and in 60+* age group.	Inverse gradient in women and in 40-59* age group. Inverted j-shaped curve in 60 plus.	Direct gradient in women and in 40-59 age group*.	Inverse gradient in women and in 40-59*age group.	-
	Assets-based index	Higher risk in least privileged[3] in 40-59 age group. J-shaped in 60+ age group. Inverse gradient in men* and in women*.	Inverse gradient in men*, in 40-59* and in 60+* age group. Inverted u-shaped in women.	Inverse in 40-59 age group*.	-	Inverse gradient in 40-59 age group. Direct in 60+age group.	-
	Occupation	U-shaped curve in men*, in women* and in 40-59* age group. Inverted j-shaped curve in 60 plus*.	Inverse gradient in men and in 40-59 age group.	U-shaped curve in men*, in women* and in 40-59* age group. Inverted j-shaped curve in 60 plus* age group.	-	-	Inverted j-shaped in women*. In 60+ age group lower PR in intermediate and in routine workers than higher workers*.

Table 5-64 (Cont.): Summary of findings – socioeconomic inequalities in blood pressure 2003 and 2010

		Health outcome					
		SBP		DBP		Hypertension	
		2003	2010	2003	2010	2003	2010
Relative inequalities (RII)	Education	Relative inequalities in whole population and 40-59 age group.	Relative inequalities in women, in 40-59 and 60+ age group.	Relative in 40-59 age group.	Relative inequalities in whole population.	Relative inequalities in women and 40-59 age group.	-
	Assets-based SEP	Relative inequalities in whole population and 40-59 age group.	Relative inequalities in whole population, and 60 plus age group.	-	-	-	-
	Occupation	-	-	-	-	-	-
Absolute inequalities (SII)	Education	Absolute inequalities in whole population, women and 40-59 age group.	Absolute inequalities 40-59 and 60+ age groups.	Absolute inequalities in 40-59 age group.	Absolute inequalities in whole population.	Absolute inequalities in women and 40-59 age group.	-
	Assets-based SEP	Absolute inequalities in whole population and 40-59 age group.	Absolute inequalities in whole population, and 60 plus age group.	-	-	-	-
	Occupation	-	-	-	-	-	-

Empty cells indicate that there was no evidence of inverse social gradients or significant RII or SII. 1. Results showed correspond to those obtained from models stratified by gender adjusted for age and from models stratified by age group adjusted for gender. 2. Results showed correspond to those obtained from the fully adjusted models. * Results based on effect size analysis.

5.6 Socioeconomic inequalities in blood pressure according to the income level of countries

In Chile, inverse gradient was the most common type of association between blood pressure and socioeconomic position observed in 2003 and 2010, when different outcomes, exposures, age groups and genders were used. Although less frequently than inverse, other types of associations were also found. In this manner, the types of association reported in this thesis are, in order of importance, inverse, u-shaped, inverted j-shaped, direct, inverted u-shaped and j-shaped. Considering that Chile is a higher middle income country and the inverse association between blood pressure and SEP was the most commonly observed, the findings of this thesis were consistent with the inverse social gradient reported for high income countries, as opposed to direct gradients which tend to be seen in middle and low income countries. Other countries in Latin America have not consistently reported a similar pattern. [144,145,163,166,167] An overview published in 1998, while reporting inverse socioeconomic gradients in blood pressure in high income countries, found a direct association in undeveloped and developing countries.[2] Another study which compared prevalence of hypertension across socioeconomic position in six countries, revealed varying patterns of social gradient across the countries studied.[133] For example, in China, South Africa and Mexico only the highest level of SES showed a significantly lower risk than those least privileged, in contrast, in Ghana those least privileged showed the lowest risk. In turn, in the Russian Federation an inverse social gradient was observed and in India no association was found. An analysis which evaluated the association between selected cardiovascular risk factors and education in regions at various stages of development, revealed that, as expected, the associations differed among regions.[369] In sub-Saharan African countries cardiovascular risk factors was positively related to educational attainment, while clear inverse gradient was observed in Eastern Europe and a less marked inverse gradient was reported in Latin America. [369] Some authors have posited that inequalities in chronic diseases may be related to nutrition transition.[186,198,199,203] Namely, depending on the stage of the nutrition transition where a population is located, different dietary patterns and life styles can be observed. As a result, differences in prevalence of degenerative diseases can be also found. [186,198,199,203,370] Different stages of nutrition transition can be identified in different countries and in different groups of the population within countries. In high-income countries, the least privileged people tend to have inadequate diet, and therefore, are more likely to suffer obesity and chronic diseases; whereas those most privileged tend to have a healthy diet and show a decreased risk of non-communicable diseases. In contrast, in low income countries, socioeconomic status has a positive association with fat intake and therefore, with the risk of non-communicable diseases.[198,199] According to the World Bank classification, most countries in Latin America correspond to lower-middle or higher-middle income economies. [11] In addition, among Latin American countries there is a high heterogeneity in terms of the stage of the nutrition transition in which different countries are located. This is probably due to some countries having started their nutrition transition earlier than others. [198,370] In this way middle-income countries can be viewed as occupying a transitional place between the positive association between socioeconomic status and blood pressure observed in low-income countries, and the inverse association found in high-income countries. Therefore, varying patterns of association may be found in this transitional stage. Studies carried out in Brazil, Argentine, Mexico and Chile have reported inverse associations between socioeconomic status and blood pressure,[147,149,150,163,265] while studies undertaken in Peru and Cuba reported a direct social gradient in blood pressure.[161,250] No association has also been reported in Brazil. [162,164] It has been suggested that Chile along with Brazil, were the first countries in the region entering the most advanced stage of the nutrition transition. This, is a result of changes in factors contributing to this process such as, urbanization, economic growth, technical change, and culture.[198,199] This may explain why Chile, despite being a middle income country, tends to show an inverse educational gradient in blood pressure.

5.7 Inequalities in blood pressure across different SEP measures

Different patterns of the association between socioeconomic status and blood pressure were observed according to the SEP indicator used, which is consistent with previous studies. [55,114,115,120,123,127,141-143,145-147,152,154,157,176,180] In this thesis, inverse gradient between blood pressure and socioeconomic position was most commonly observed when education was the exposure variable, meanwhile, u-shaped and inverted j-shaped associations were most frequently observed for occupation. The other types of associations did not show a consistent pattern according to the SEP measure used.

One explanation for these differences in results, is that each measure of socioeconomic position may capture different aspects of the social class.[303] Another potential reason for these differences is that the relevance of each measure of socioeconomic position may vary depending of the health outcome which is being analysed.[51] Davey Smith et al., analysed, in a prospective study, the differentials in the profile of mortality associated with two socioeconomic measures. They found that occupation was better predictor of social differences in smoking and in non-cardiovascular mortality, while education was better capturing social gradients in mortality from cardiovascular causes.[56] These findings suggest that there are underlying factors associated with socioeconomic measures, which differentially affect the health.

Education

According to the findings, socioeconomic inequalities in blood pressure in Chilean adults seem to be better captured when education was the measure of socioeconomic status used. These results are consistent with the literature, since several studies from countries with different levels of income have reported significant social gradients in blood pressure across educational levels but not across other socioeconomic indicators.[55,114,115,127] Other studies in Latin America have also reported that education was inversely related to blood pressure, while, no association or other type of association was found for other social class measures.[139,141,142,145-147] For example, Barquera et al., analysed the prevalence of hypertension in Mexican adults and its contributing factors, including education and assets-based SEP. They observed that education was inversely related to hypertension, while no association was found between assets-based SEP and hypertension. [147] Similarly, three studies carried out in different cities of Brazil, reported an inverse gradient for prevalence of hypertension across educational levels, and no association when the SEP measure was income.[141,142,145]

Different mechanisms through which education may be a strong predictor of good health have been hypothesised. Firstly, education is considered an important determinant of individuals' work and economic circumstances. [371] Also, certain skills and knowledge achieved through education may make people more able to receive messages about health, to understand the requirements of good health, and to use properly healthcare resources. [372] Also, education may influence life style behaviours and facilitate acquisition of social and psychological resources.[373] From life course approach, it is considered that education may capture the SEP circumstances of the family of origin, because education is usually completed early in adulthood. [56] Ross et al., have classified in three categories the main factors explaining the association between education and health, 1) socioeconomic conditions and work: compared to the least educated those most educated are more likely to work full time, to have rewarding jobs, and high incomes; 2) social and psychological resources: the well-educated people report a higher sense of control over their lives, and greater levels of social support, and 3) lifestyles: most educated people are more likely to exercise and less likely to adopt risky health behaviours such as smoking and alcohol drinking.[62] This multiplicity of factors through which education affects health, may explain why this indicator of socioeconomic position is stronger in capturing health inequalities than others. Another reason, why in Latin American countries education may capture inequalities better, may be the fact that education can be more accurately collected in the surveys, given that this type of information is easily remembered by the interviewed individuals.

This is also an indicator widely used in different administrative registers, and therefore, it may there be less resistance to provide it.[51] In Chile, educational level is the indicator of socioeconomic position most used in administrative registers, as well as, in national surveys. Therefore, people may be more willing to provide this information, and at the same time, this may be more reliable than other socioeconomic measures.

Assets-based indices

Results in the analysis of the association between blood pressure and assets-based index, are in line with literature reviews, in terms that this socioeconomic indicator was a weaker predictor of inequalities in blood pressure compared with education. Socioeconomic indicators based on assets have been mainly used in low and middle-income countries to analyse social inequalities in health in general and in blood pressure. This, due to information needed to construct this type of indices, has been historically included in surveys, rather than other socioeconomic information such as occupation or income.[303] Several studies carried out in Latin America found no association when an indicator of material circumstances was used, but a significant inverse gradient in blood pressure across education.[141,146,147]

In the first place, given that the comparison of socioeconomic inequalities in blood pressure between the two surveys was one of the objectives of this thesis, an indicator was constructed using variables related to ownership of five assets, which were available in the two surveys. Results obtained for the assets index, based on five assets, showed that inequalities were only evidenced when this index was used with two categories, instead of the original three categories. Moreover, unlike that observed for education, there were no significant gradients in the analysis stratified by gender. This may indicate a limitation of this indicator in capturing social gradients in blood pressure.

Using socioeconomic measures based on household assets implicitly assumes that these resources are equally shared by all the household members. However, research on this subject suggests that the access to these resources can be higher for men than for the other family members. [303,374,375] Some factors such as the income level of the family, financial power and the employment status of wives may affect the way that the resources are distributed within a family. [375,376] In Chile, an important percentage of women reported being a home maker (52% in 2003 and 38% in 2010) and according the evidence, this status may impact their access to the household resources.[376] In this way, socio-economic indicators based on household assets or wealth, may be overestimating the individual social class of women in Chile, since women may be assigned a level of SEP according the resources in the household, but they may do not have access to these in the same way as men do.

This might be a reason why assets-based indices resulted weaker in capturing inequalities in women than other individual socioeconomic measures such as education. Despite this further research is needed to clarify the adequacy of using this type of indicator in the analysis of inequalities in blood pressure in Chile.

Occupation

For the purposes of this project, two versions of occupational class were used, one including workers and non-workers, and the other, including only workers. Although significant differences were observed across the first occupational indicator, the non-hierarchical nature of this does not allow evaluation of social gradients. Therefore, the focus of the discussion is on the hierarchical measure of occupation that included only workers. Results for the association of and blood pressure are consistent with previous analyses in Latin America suggesting there are no social gradients for this measure. [143,165] However, the two studies carried out in Latin American may not be comparable with those of this thesis, since one of them was carried out in rural areas and only in women, while the other one was focused on ethnic differences. In high income countries, inverse gradients, as well as, no association between blood pressure and occupational class have been reported in several studies (Appendix 1, Table A1.11). Among the studies which reported no association between occupation and blood pressure, there were some which found significant social gradients across other socioeconomic indicators.[55,120,123,143,157,176,180] As aforementioned, a prospective study found that occupation was better predictor of social gradients in non-cardiovascular mortality, while education was better predictor of social differences in cardiovascular mortality.[56] This may supports the findings that occupation may be a weaker predictor of inequalities in blood pressure than others.

In this thesis, the socioeconomic measure based on occupation had an important disadvantage due to the proportion of women participating in labour force in Chile. In the 2003 survey, 31% of women declared being a worker, and 41% in 2010. Consequently the analyses using occupational social class as exposure left out more than a half of women, who, at the same time, have shown higher levels of socioeconomic inequalities in blood pressure than men. This may explain why no occupational gradients were found in women in either survey. In addition, it is worth mentioning that inverse social inequalities in blood pressure in men were observed, only when occupation was the socioeconomic indicator used. Most of the studies reporting occupational inequalities in blood pressure have found social gradients for the whole sample, and only one found an inverse gradient in men and not in women (Appendix 1, Table A1.9). [214] This latter study was a prospective study of British civil servants, where social gradients were found for both SBP and DBP only in men. It was posited that occupational classifications may have limitations to capture adequately the hierarchy of women's occupation, as these systems are based on the occupations dominated by men. [63,377] Therefore, occupational class may be weak in capturing inequalities in women, but at the same time, may be a good measure to analyse inequalities in men.

5.8 Differences in the results according to the outcome

Findings of this thesis showed differences in the social gradient of blood pressure according the outcome used. The results suggest that socioeconomic inequalities may be better captured by SBP than DBP and hypertension. Moreover, inequalities in SBP were mainly found in women and those in middle age. These results are consistent with previous studies which analysed the association between blood pressure and socioeconomic status using more than one measure of blood pressure as outcome. Cois et al., who analysed the socioeconomic determinants of hypertension in South Africa, found different patterns in the association between socioeconomic indicators and blood pressure according to the outcome and gender. [138] The results suggest that SES was more strongly associated with SBP than DBP in women, while the opposite was observed in men. Another study carried out in Czech Republic showed that education was inversely related to SBP but not to DBP in both women and men[102]. Differences in the effect of socioeconomic variables on SBP and DBP may be explained by the fact that some psychological and dietary factors may be more associated with SBP than DBP and vice versa. [378,379] A longitudinal study in Italian women analysed the anthropometric and nutritional determinants of BP values, and showed that some nutrients had different effects on SBP and DBP. In this manner, consumption of vegetables, yoghurt, eggs, among others, were inversely related to SBP, while olive oil and monounsaturated fatty acids showed an inverse association with DBP.[379] Another study, which examined the cardiodynamic response to psychological stress, showed that changes in levels of SBP were proportionally higher than DBP.[378] Although these investigations were not focused on socioeconomic inequalities in blood pressure and its differences according the outcome, the results suggest that behavioural as well as stressor factors may differentially affect SBP and DBP. Therefore, different dietary patterns and different levels of stressor across the social hierarchy may be playing a role in shaping socioeconomic inequalities in blood pressure.

5.9 Effect of covariates on socioeconomic inequalities in blood pressure

The analysis of the association between socio-economic position and blood pressure also included adjustments for relevant covariates. Results of this analysis provide support to the hypothesis stating that socioeconomic inequalities in blood pressure are independent from the effects of socio-demographic and health related individual factors.

Significant associations between socio-economic status and blood pressure were found after adjustment for covariates. In general, significant associations observed in gender and age adjusted models weakened after full adjustment, and some were no longer significant after adjustment for covariates. The weakening of the association between socio-economic position and blood pressure was mainly and consistently caused by the inclusion of the body mass index variable.

The inclusion of body mass index variable in the models analysing socioeconomic inequalities of blood pressure in women had an important impacts on the gradients, and this was observed for different outcomes and in both surveys years. In general, in those associations between education and blood pressure where inverse gradients were observed, adjustment for BMI decreased the coefficients and the prevalence ratios in the lower social levels by about 20-30%. Similarly, when BMI was included in the models analysing the association between assets-based index and blood pressure, the social gradients found in age and gender adjusted models weakened after adjusting for BMI. This was observed mainly for SBP in women in 2003. However, when an inverse gradient was observed in blood pressure across occupational classes in men, the inclusion of BMI had an opposite effect. In this case the gradient was steeper after adjustment for BMI. The rest of the covariates had a more modest impact on the blood pressure-socioeconomic status associations, and in general, did not change the level of significance of the gradients after their inclusion in the models.

These findings of this thesis are in line with previous studies reporting an important effect of BMI in shaping social gradients. In a study carried out in France, Chaix et al., reported direct and indirect effects of some risk factors in the associations between socioeconomic class and SBP by using path analysis.[116] That study reported that a decrease in both individual education and neighbourhood education was independently associated with an increase in SBP. Also, low individual and neighbourhood education were associated with a higher body mass index. In turn, body mass index was the most significant confounder of the associations between education and SBP. The indirect effects of BMI represented 28% of the individual education-SBP association and 51% of the neighbourhood education-SBP association.[116] Another study undertaken in South Africa, examined the role of a set of bio-behavioural risk factors in explaining the association between social class and blood pressure. In that South African study BMI was related directly to socio-economic status, and was the strongest confounder of the harmful effect of SES on blood pressure. Results showed that the effects of BMI accounted for a significant increase in blood pressure per level of education, both in men and women.[138] Findings also showed that the confounder effect of BMI on the association between socioeconomic status and blood pressure varied according gender. Adjustment for BMI contributed to reduce the harmful effect of lower socioeconomic levels on blood pressure, found in women, weakening the inverse social gradient. This suggests that BMI was inversely related to socioeconomic status in women, and therefore, contributed to the higher blood pressure observed in women in low-socioeconomic levels. On the other hand, the only significant social gradient of blood pressure found in men became steeper after adjustment for BMI, suggesting a direct association between BMI and socioeconomic status in men.

The causal association of body mass index with blood pressure, has been quite well established. [380] It has also been reported that BMI is associated with socioeconomic position, and this in turn, is associated to the economic level of the countries. [198,199] An overview including 144 studies revealed that there was a strong inverse social gradient of obesity among women and an inconsistent association in developed countries. Meanwhile, in developing societies a strong direct association between SES and obesity was reported in men and women.[300] In this manner, findings of this thesis confirm the results of the previous studies in which BMI is an important confounder of the association between socioeconomic status and blood pressure.

5.10 Effect of covariates on blood pressure

In general, findings of the analysis were consistent with the expected association between covariates and blood pressure, and this was observed for the different outcomes and in both years. [88,381,382] Analysis of the impact of socio-demographic variables on blood pressure showed that, being man and older increased the risk of raised blood pressure. The literature shows that blood pressure tends to be higher in men and increase with age. [383,384] Gender differences in risk of hypertension have been widely studied, and it has been suggested that the higher blood pressure in men may relate to the influence of some hormones and genes. [384-387] In turn, increase in blood pressure over the life course has been explained by an age-related increase in arterial stiffness. [388]

Findings in this thesis showed that unmarried individuals (Single /divorced / separated/ widowed) tended to show higher risk of raised blood pressure than those married. Literature analysing the association between health and marital status has consistently identified that married people generally report better health and have lower mortality rates than their unmarried counterparts.[389,390] Two main theories explaining the excess risk for unmarried people have been suggested: 1) 'marriage selection', referring to that healthier individuals are selected for marriage, while those less healthy remained single, or have a higher probability of becoming separated, divorced or widowed, and 2) 'protective effect' of being married and the adverse impact on health of transition from being married into being unmarried.[389,391]

The place of residence of people was not related to blood pressure in 2003 nor in 2010. In the literature reviewed, results are not consistent. No association has been reported [114] and also higher risk of raised blood pressure in rural areas has also found in women. [151]

Of the biomedical risk factors examined BMI and heart rate were significantly directly related to blood pressure. Likewise, having family history of hypertension and having diabetes mellitus increased the risk of raised blood pressure. The direct association between BMI and blood pressure has been well established in literature. [380,392,393] However, the precise mechanism by which weight gain produces increase in blood pressure is not fully understood. Considerable evidence supports the idea that weight gain stimulates the sympathetic system activation, which is responsible of regulation of blood pressure.[394,395] In turn, it has been reported that elevated heart rate is associated with elevated blood pressure. [396-398] Evidence suggests that central nervous mechanisms play a primary role in the production of these phenomena.[399] In addition, findings of this thesis showing that having family history of hypertension and having diabetes mellitus, increase the risk of raised blood pressure are consistent with literature examining risk factors of hypertension. There is a large body of evidence about the higher risk of hypertension in people with family history. [400] [401,402] It has been also reported that diabetes mellitus and hypertension frequently coexist, and this may be explained by common contributing factors such as obesity. There are some pathophysiological mechanisms by which diabetes mellitus may increase levels of blood pressure. [403] Also, it has been suggested that the pathways of both diseases may interact and influence each other. [404]

Results on the association between behavioural risk factors and blood pressure were varied. In the case of smoking, the impact on blood pressure was not in the expected direction. People who reported being current or past smokers tended to have lower risk than those who had never smoked, and this was most consistently observed in 2003. However, several studies have reported that blood pressure levels among smokers were lower than those of non-smokers.[405-408] The reduction in blood pressure in smokers may be related to decreased body weight and to the vasodilator effect of a derivative of nicotine. [409-411] Results of this thesis showed no association between physical activity and blood pressure which disagrees with literature. The effect of aerobic physical activity in lowering blood pressure is supported by a wide body of evidence.[387] Given that these studies correspond to trials assessing the effectiveness of physical activity programmes on blood pressure, bias introduced through self-report of physical activity in the health surveys may explain the results obtained in this thesis. It is worth mentioning that in both surveys analysed in this thesis, physical activity corresponds to self-report which may lack accuracy.

5.11 Changes between 2003 and 2010

In general, the comparison of inequalities in blood pressure between 2003 and 2010 showed different patterns according age, gender, outcome and SEP measure used. These heterogeneous findings thus do not support the hypothesis that socio-economic inequalities in blood pressure in Chilean adults have increased between the two surveys.

The analysis of inequalities across education and across assets-based index, showed that social gradients observed in SBP in 2003 had tendency to remain similar in 2010, while inequalities in DBP and hypertension found in 2003 had tendency to reduce or even disappear in 2010. This was observed mainly in women and in people aged 40-59. Findings also suggest that educational inequalities in blood pressure may be increasing over time in people aged 60, given that, absolute and relative educational inequalities were observed for SBP in 2010 but not in 2003. In men there were no socioeconomic inequalities either in 2003 or in 2010.

In turn, when occupational inequalities in blood pressure were examined, results of gender and age-adjusted models and multivariable analysis showed that there were social gradients in men and in people aged 40-59 in 2010 but not in 2003. There were occupational inequalities neither in women, nor in other age groups in 2003 or 2010.

In this way, comparing both surveys, it is possible to suggest that the trend of socioeconomic inequalities in blood pressure over time tends to be stable or to decrease in women and in people aged 40-59, according the outcome used, while may be increasing in people aged 60 and over. This can be observed across educational and assets-based index levels. Findings also suggest that occupational inequalities may be increasing in men and in people aged 40-59. These results are in line with previous studies assessing the trend of inequalities in blood pressure which have shown different results according to gender, SEP indicator, outcome measure and method of evaluation used. [97,121,130-132,206,207,228,289-294,361] Among these studies, three found that social inequalities, using education and neighbourhood index as SEP measure, had increased over time in women but not in men. [97,121,290] In a study carried out in the United Kingdom increasing relative inequalities in DBP and no change in SBP were observed.[228] Another study in Norway reported an increase in relative inequalities in both genders and a decrease in absolute inequalities in women and no change in men.[294] In an analysis of health inequalities over time for some OECD countries, Bleich et al.,[131] reported an increasing trend of educational inequalities in hypertension in the United States and a decreasing occupational trend in England. The lack of consistency in the results of studies assessing the trend of inequalities in blood pressure may be explained by the fact that changes in blood pressure arise mainly from the implementation of primary prevention strategies, and in turn, the impact of these strategies may be different in different population groups. In other words, some changes of behavioural factors may be reflected in improvement of health and eventually these improvements in risk factors may lead to reduction of socioeconomic differences. [228,294,412] Besides prevention and promotion strategies, other types of policies may have impact on health inequalities, and therefore, on the social gradients in blood pressure.

In Chile, results comparing inequalities in blood pressure in 2003 and 2010 suggest that vulnerability in women and in people aged 40-59 might have diminished after seven years, since some social gradients across education and assets-based index observed in 2003 were no longer significant in 2010. Some public policies focused on women have been implemented in the last decades in Chile and these may explain the decrease in women's health inequalities. These policies are focused on female headship, women worker, and bonus per children.[413,414] Although these strategies clearly have been aimed at improving the conditions of most vulnerable women in Chile, it is difficult to know how and how much these policies may contribute to reduce health inequalities in women. Furthermore, in Chile, universal prevention and promotion strategies have also been implemented such as the smoking law and norms about salt reduction in bread which may have differential impacts across social gradient. Considering that the trend of inequalities in blood pressure was differential by gender, age group, outcome and SEP measure, it would be important to monitor changes over time using these subpopulations.

5.12 Conclusions

Results presented in this chapter of the thesis suggested that there are socioeconomic inequalities in blood pressure and these are different according to gender and age group.

1. Inverse social gradient was the type of association between blood pressure and socioeconomic position most commonly found, although other types of associations such as u-shaped, inverted j-shaped, direct, among others, were also observed, but less frequently than inverse.
2. Inequalities in blood pressure were most commonly observed in women and in people aged 40-59.
3. Social gradient in women and in 40-59 age group were better captured when SBP was the outcome and education was the SEP measure used.
4. Inequalities in blood pressure in women and in people aged 40-59 were observed both in relative and in absolute terms.
5. In men, inequalities were found only across occupational class in 2010.
6. Social inequalities in blood pressure were found even after adjustment for range of covariates.
7. BMI was by far the most important covariate affecting the association between SES and blood pressure in 2003 and 2010.
8. In general, the effect of covariates on blood pressure was as expected; age, gender, BMI, heart rate and family history of hypertension were consistently significantly associated with different blood pressure outcomes, different SEP measures and for both survey years.
9. Comparison of inequalities in blood pressure in Chile between 2003 and 2010 showed that inequalities observed in women and people aged 40-59 for DBP and hypertension in 2003 tended to diminish in 2010, while inequalities in SBP in these same groups were still present in 2010. On the other hand, findings also suggest that inequalities in blood pressure may be increasing in men and in people aged 60 and over.
10. Further studies are needed to explain these findings and gain further understanding on the potential mechanisms linking socioeconomic position with individual factors and patterns of inequalities in blood pressure.

Chapter 6. Area-level socioeconomic characteristics and blood pressure

6.1 Methodology:

6.1.1 Introduction

This chapter aims to assess the role of the community socioeconomic context characteristics on the variation in blood pressure among districts. Similar to the previous sections of this thesis, three health outcomes were included in these analyses these were SBP, DBP as continuous variables and hypertension as a binary variable.

Objective 3 of the thesis focusing on area-level socioeconomic circumstances was addressed by including districts socioeconomic variables and an index of deprivation in the models using multilevel approach.

Socioeconomic inequalities in blood pressure have been analysed at different levels, from individual to neighbourhood, cities and regions. Studies analysing contextual effects on blood pressure are based in the premise that socio-economic characteristics in the areas where people live, have an influence on blood pressure independently of the individual socioeconomic status.[83,113,116,120,126,128,144,176,211,238,255,270-272,415-417]

In this thesis, besides investigating the influence of the individual socioeconomic status on blood pressure, the role of contextual factors on blood pressure was also examined. Contextual factors refer to group differences attributable to the effects of group level properties, after adjusting for individual factors (compositional factors). Compositional factors are defined as inter-group differences in an outcome attributable to differences in group composition, namely, the characteristics of the individuals of which the groups are comprised.[418,419]

In order to assess the influence of socioeconomic characteristics at district level on the variation in blood pressure among districts in Chile, multilevel modelling (MLM) were carried out.

6.1.2 Multilevel modelling methodology

Multilevel regression models are particularly appropriate to analyse data organised in more than one level, since these recognise the hierarchical or clustered structure of the data. Clustering refers to the fact that individuals selected from the same area may be more similar to each other (in relation to the study outcome) than are people chosen at random from the population at large, and from different districts. In other words, from the point of view of health, the health status of individuals with similar characteristics may be different according the cultural, economic, political, or geographical context of the place where they live. [278,279,420] In this manner, the measured units of nested data are not independent and therefore, given that the independency assumption is not met, single-level multiple regression is not appropriate to analyse this type of data. Using traditional regression models to analyse hierarchical data may lead to underestimating standard errors and consequently to high risk of Type I errors. [278-280]

In addition, multilevel modelling allows studying the nature and sources of variation within and across clusters, and the effects on individual outcomes. In a two-level model, this technique permits splitting the residuals of the model into two parts corresponding to the two levels in the data structure. In this manner, the total variance is partitioned into two components: the within group variance and the between-group variance. In terms of the present analysis, the models partition the variance in the outcome under study into a first component corresponding to differences among individuals and a second one corresponding to differences between districts. [278,279]

The equation 1 represents a 2-levels model including one individual-level predictor and one district-level predictor. Where y_{ij} is the value of the outcome y for the *i* th individual in the *j* th district. β_0 is the overall intercept; β_1 and β_2 are the coefficients of the association between the predictor and the outcome; x_{1ij} and x_{2ij} are the individual-level and the district-level explanatory variables respectively. u_j is the district-level residuals and e_{ij} represents the individual residuals. In this model two components can be identified, a fixed part given for $\beta_0 + \beta_1 x_{1ij} + \beta_2 x_{2j}$ and a random part given for $u_j + e_{ij}$

$$y_{ij} = \beta_0 + \beta_1 x_{1ij} + \beta_2 x_{2j} + u_j + e_{ij} \tag{1}$$

This model (1) is also called a random intercept model, since the intercept of the group is allowed to vary randomly across districts. This can be represented by replacing β_0 by β_{0j}, where the intercept (β) for a given district *j*, (β_{0j}) is the overall intercept (β_0) plus the district-level residuals (u_j).

Although the equation *(1)* is the representation of a MLM for continuous outcomes, this can also be generalised for binary responses, but considering some specifications. In the case of binary outcomes the distribution of the individual residuals e_{ij} needs to be specified (link function) and the most common distribution utilised is the logistic. Whatever the specified distribution, the variance at individual level is fixed and in the case of logistic distribution this is fixed at 3.29, given that $\pi^2/3$ is the variance of the logistic distribution ($\pi^2/3$ = 3.29). In turn, the residuals at level 2 (district-level) (uj) are assumed to be normally distributed and the variance is estimated by fitting the model. These modified models are called multilevel logistic regression models and can be represented as follow:

$$\log\left[\frac{\pi_{ij}}{1-\pi_{ij}}\right] = \beta_0 + \beta_1 x_{1ij} + \beta_2 x_{2j} + u_j \qquad (2)$$

For this research, the role of district socioeconomic characteristics on blood pressure was investigated by using multilevel linear regression when the outcomes were SBP and DBP, and by using multilevel logistic regression models when the outcome was hypertension.

6.1.3 Scaling weights in multilevel models

Moreover, additional considerations must be taken into account when MLM is used to analyse complex survey data. Complex survey design regularly involves unequal selection probabilities either of clusters and /or individuals within the clusters. So, in order to account for those unequal probabilities design (sampling) weights are incorporated to the data. Failing to account the unequal selection probabilities in MLM analysis may lead to biased parameters estimates.[280,421] Consequently, it has been developed procedures to incorporate design weights to MLM through including this in the likelihood function, producing pseudolikelihood. However, the inclusion of the design weights in multilevel modelling requires scaling weights. [280,421-423] The scaling modification methods are a type of standardization consisting of multiplying the weights by a scaling constant so that the total weight of the cluster is equal to some cluster characteristic. Two methods of scaling are the most commonly used and described. In Method 1 (scale size) *(3)* weights are scaled to sum to the cluster size (n_j), and Method 2 *(4)* (scale effective) scales the weights so that the new weights sum to the effective cluster size.[280,422,424] Equations for both methods are shown below.

Where, $\omega*_{i/j}$ represents the scaled weight for individual i in cluster j, $\omega_{i/j}$ the unscaled

Method 1: Scale-size

$$\omega *_{i/j=} n_j \omega_{i/j} \left\{ \sum_{i=1}^{nj} \omega_{i/j} \right\}^{-1} \tag{3}$$

Method 2: Scale effective

$$\omega *_{i/j=} \omega_{i/j=} \left\{ \sum_{i=1}^{nj} \omega_{i/j} \right\} \left\{ \sum_{i=1}^{nj} \omega_{i/j}^2 \right\}^{-1} \tag{4}$$

weight for individual i in cluster j, and nj the number of sample units in cluster j. In turn, the sample design weight $\omega_{i/j}$ is the inverse of the conditional probability of selection of individual i given the selection of cluster j.

It has been reported that method 1 (scale-size) generally achieves the most accurate results in most cases. In addition, analyses comparing both methods have found that as cluster sizes increase (n>20), method 1 may be the best choice for decreasing bias. [280,422] For this research, considering that the 58% of the clusters in 2003 and 78% of the clusters in 2010 were composed of more than 20 individuals, method 1 was chosen to perform the MLM. However, as recommended in the literature, sensitivity analyses were carried out (see section 6.1.6 for details) by performing the MLM using the scaling method 2 and unweighted sample.[280] In addition, MLM allows including weights for each level, however for this research because of the two surveys only had one survey weight, and there was not information to estimate the weight for the second level, the models were performed using the scaled weight in the first level, and equal probability sampling was assumed at the second level (weight=1).[280,424]

Analyses were performed using multilevel mixed-effects linear regression models (mixed commands) in Stata for SBP and DBP. Models were fitted for unweighted data and for scaled weight by two methods, using special commands (pwscale(size) and pwscale(effective)). Models using scale-size scaling method are shown in the results section in this chapter, and results from unweighted models and models using scale-effective method are shown in Appendix 8.

In the case of hypertension, multilevel mixed-effects logistic regressions were performed (melogit) in Stata for unweighted models. However, given that weights are not allowed in this command, generalised linear latent and mixed model procedure (GLLAM commands) was performed in Stata. With the objective to obtain PRs, a log link function was initially used, but given that the design weight is also not allowed for this function, a logit function was used. In this manner OR estimations for hypertension were obtained. In addition, because of GLLAM does not include automatic weight scaling, new weights were estimated according the formulas described above. New scaled-weights using scale-size method were used for the analysis presented in this section, and new weights using scale-effective method were used for sensitivity analyses (Appendix 8).

6.1.4 Multi-level model development

In the multilevel models were included both, individual-level and district-level variables. The individual-level explanatory variables included in the models were demographic characteristics, SEP measures and health related variables. Socio-demographic variables were: 1) Age in years, treated as continuous and centred at the sample mean of 50 in 2003 and 48 in 2010; 2) Gender, a binary variable with men as reference category; 3) Marital status categorized as married/cohabiting (reference category), single and divorced/separated/widowed and 4) Place of residence, as binary with urban as reference category. In addition, three individual SEP measures were included: education, assets-based SEP and occupational social class as described in section 4.3.2. Health-related variables included: BMI, as a continuous variable and centred at the sample mean of 27.8 in 2003 and 28.2 in 2010; diabetes mellitus, as a binary variable; family history of hypertension, as a binary variable; smoking, as a categorical variable with three categories (never, past smoker and current smoker) and physical activity, as a categorical variable with three categories (3 or more times, less than 3 times, and none). The district-level explanatory variables included were schooling, overcrowding index, unemployment rate, household income and a deprivation index (Section 4.7).

For each outcome under study, a sequence of multilevel regression models were performed in the order described below:

1. Null or empty model (model 1): As first step of the analysis a two-level random intercept model without using any explanatory variables was fitted. By fitting this model it was possible to obtain the baseline estimation of the district-level variance in blood pressure and what proportion this is of the total variance (VPC: variance partition coefficient). This percentage indicates the proportion of the variance in blood pressure that can be attributable to differences between districts.
2. Model with socio-demographic individual-level variables (model 2): This is the second step in which a two-level random intercept model was fitted including socio-demographic individual-level explanatory variables. These individual explanatory variables were demographic characteristics (age, gender, marital status and place of residence) and SEP measures (education, assets based SEP and occupational social class). This model provides information about the proportion of the variance in blood pressure across districts (district-level variance) being explained by socio-demographic individual-levels variables.
3. Model with socio-demographic individual-level and health-related individual level variables (model 3): The new individual-level variables included were BMI, diabetes mellitus, smoking habit and physical activity. This model showed how much health-related individual level variables contribute to explaining the variation in blood pressure across districts.
4. Model with individual, and socio-economic district-level variable added one at a time (model 4a to model 4e): The socio-economic district-level variables incorporated in the models were, years of schooling, unemployment rate, overcrowding index, mean of household income and deprivation index. These models provide information about the proportion of the district-level variance explained by each district-level socio-economic factor when individual characteristics, including individual socioeconomic variables, are accounted for, and is the main focus of this analysis.

The proportion of variance attributable to each level was calculated for each model according the type of model (linear or logit) and by using the formulas described below, where σ^2_e is the individual-level variance and σ^2_u is the district-level variance.

For multilevel mixed-effects linear regression models: SBP and DBP:

% of total variance attributable to individual level

$$= \left[\frac{\sigma^2_e}{(\sigma^2_e + \sigma^2_u)}\right] \times 100 \tag{6}$$

% of total variance attributable to district level (the variance partition coefficient VPC)

$$= \left[\frac{\sigma^2_u}{(\sigma^2_e + \sigma^2_u)}\right] \times 100 \tag{7}$$

For multilevel mixed-effects logistic regression models: hypertension:

% of total variance attributable to individual level $= \left[\frac{3.29}{(3.29 + \sigma^2_u)}\right] \times 100$ *(8)*

% of total variance attributable to district level (VPC)

$$= \left[\frac{\sigma^2_u}{(3.29 + \sigma^2_u)}\right] \times 100 \tag{9}$$

Wald criterion was used to estimate the degree of significance of the variance at district level, considering that an estimate is significant at the 5 percent level (p=0.05), if it exceeds 1.96 times its associated standard error[425]. Moreover, p-value for trend was estimated for deprivation index variable.

In addition, Wald test was used to compare the goodness-of-fit of each weighted model, and likelihood ratio test was used to compare the goodness-of-fit for unweighted models. Moreover, Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were reported, since it has been advised to consider several fit measures to assess the fit of models, in addition to the chi-square index(6). The AIC and BIC indices can be used to compare models since these include measures of the ‘fit’ and ‘complexity’ of each model. In addition, AIC and BIC values are directly comparable, so that lower values indicate a better fit and so the model with the lowest AIC or BIC is the best fitting model [426].

6.1.5 Sensitivity analysis – different scaling methods of sampling weights

As mentioned in section 6.1.3 multilevel analysis of complex survey data with sampling weights requires scaling the weights. [280,421-423] Given that there are more than one method to scale the design weights and according to has been recommended, diverse estimations were made for each outcome and each year using different scaling procedures[427]. In this manner, the models above described (section 6.1.5) were fitted by using two methods of scaling (scale size and scale effective) and for unweighted data in order to test the sensitivity of analysis to different methods (Appendix 8).

Comparison of the estimates between the two scaling methods showed that the models for the three outcomes achieved nearly identical weighted results in fixed effects. In this manner regression coefficients and odds ratios resulting from models using scale-size and scale-effective methods were consistently similar and led to similar inferential conclusions.

Unlike to observed for fixed effects, larger differences were observed in the results for random effects between models with different methods of scaling weights. In the case of SBP and DBP the variances estimated for district-level were larger in the models using scale size method and unweighted models than those using scale-effective method. Moreover, district-level variances for SBP and DBP resulted significant in models using scale size and unweighted models, but not in models using scale-effective method. The opposite was observed for hypertension, since district-level variances were significant and larger in the models which used scale-effective method than those obtained from unweighted models and from the models using scale size method. In this case, results for unweighted models were closer to those resulted from models with weights standardised with scale size method.

The results shown in the next section (Section 6.2) correspond to those obtained from fitting weighted models using scale size method (Method 1) which is the preferred according the size of the clusters in the surveys. [423,427] Based on the above, estimates may be considered less biased than those obtained by using scale-effective method to scale the sampling weights.

The results from the models using scale effective method (method 2) and unweighted data are shown in Appendix 8, Tables A8.3 to A13.21.

6.2 Results

6.2.1 Multilevel analyses of district's socioeconomic context and systolic blood pressure

In this section the results obtained from the multilevel linear regression models for the outcome of systolic blood pressure in 2003 and 2010 surveys are reported.

6.2.1.1 Analysis 2003

Between-district differences 2003

Tables 6-1 and 6-2 show the estimates from fitting multilevel linear regression models for SBP in 2003 (Models 1 to 4). The Model 1, corresponding to the empty model and which provided the baseline estimate of the district-level variance, showed a significant variation of SBP across districts in 2003. The variance at the district-level was 24.91 with a standard error of 8.46. The variance partition coefficient (VPC) was near 5 which means that 5% of the variation in SBP in 2003 may be attributable to differences between districts. In this manner, the highest proportion of the variance was explained by between-individual differences (Table 6-1).

Inclusion of individual-level variables

In Model 2, adding individual-level variables related to socio-demographic characteristics, it can be observed that the district-level variance remained significant but decreased to 18.73 (SE 7.38) and represented 6% of the total variance. This indicates that 6% of the total variation in SBP was attributable to differences between districts after adjusting for socio-demographic individual-level characteristics. The Wald test carried out to assess the goodness of fit of the model was significant ($p<0.01$) meaning that including socio-demographic variables created a statistically significant improvement in the fit of the model (Table 6-1). In addition, as age was centred at mean of the sample, the district-level variance corresponded to that variance at age=50.

Estimates obtained after taking into account individual-level variables related to health (Model 3) showed a further reduction of the district-level variance from 18.73 to 16.81 (Table 6-1). The proportion of the total variance attributable to differences between districts after adjusting for individual-level variables, including socio-demographic and health-related characteristics, remained around 6%. The reduction in the total variance indicates that the proportion of the original total variance of SBP (empty model) explained by individual-level characteristics was around 42%. This proportion was obtained by estimating the proportion of change in total variance (district-level variance + individual-level variance) between empty model and Model 3 (including all individual-level variables). Adding health-related variables improved significantly the fit of the model ($p<0.01$) with respect to Model 2 (Table 6-1).

Model 3 including individual-level variables (Table 6-1) showed that SBP was significantly associated with sex, age, being single, assets-based SEP, BMI, having diabetes mellitus, having family history of hypertension, and smoking habit. It worth noting that when the three individual SEP measures were added to the model only assets-based SEP showed a significant association with SBP with a significant inverse gradient (p-value for trend =0.02). When the SEP variables were added to the model one at a time, people with intermediate level of education showed a higher risk than those most educated, however this was no longer significant after including assets-based SEP and occupational social class (Appendix 8, Table 8.1).

Inclusion of the district-level variables

The results of the model including district-level variables are shown in Table 6-1 (Model 4a) and Table 6-2 (Models 4b to 4e). The results obtained after separately including overcrowding index, schooling, unemployment rate and deprivation index (Models 4a to 4c and 4e) showed there were no significant associations between these district socioeconomic variables and SBP. In fact, the inclusion of these variables did not significantly improve the fit of the model compared with Model 3 (Wald test > 0.05) (Table 6-1 and Table 6-2).

Table 6-1: Two-level random intercept model for SBP with predictor variables 2003. Models 1 to 4a.

	Model 1	Model 2	Model 3	Model 4a
	Coef (95% CI)			
Individual-level variables				
Sex				
Male		Ref	Ref	Ref
Female		-7.72 [-9.41,-6.03] ***	-9.11 [-10.76,-7.47] ***	-9.11 [-10.75,-7.47] ***
Age (centred on 50)		0.84 [0.76,0.91] ***	0.75 [0.68,0.83] ***	0.75 [0.68,0.83] ***
Marital status				
Married/cohabiting		Ref	Ref	Ref
Single		2.35 [0.55,4.16] *	4.08 [2.34,5.82] ***	4.09 [2.35,5.83] ***
Divorced/separated/widowed		1.11 [-1.74,3.96]	2.41 [-0.34,5.17]	2.42 [-0.34,5.18]
Place of residence				
Urban		Ref	Ref	Ref
Rural		1.91 [-0.78,4.61]	1.88 [-0.77,4.53]	1.84 [-0.85,4.53]
Education				
Higher		Ref	Ref	Ref
Intermediate		1.99* [0.02,3.96]	1.76 [-0.18,3.69]	1.74 [-0.18,3.66]
Low		2.02 [-0.86,4.91]	0.84 [-2.03,3.71]	0.82 [-2.04,3.67]
Assets-based SEP				
High		Ref	Ref	Ref
Middle		2.98 [0.83,5.12]**	2.69 [0.67,4.72]**	2.66 [0.63,4.68]*
Low		4.19 [1.33,7.05]**	3.95 [1.10,6.80]**	3.89 [1.02,6.77]**
Occupational social class				
Higher worker		Ref	Ref	Ref
Intermediate		-3.95 [-7.36,-0.54]*	-2.90 [-6.19,0.40]	-2.90 [-6.20,0.39]
Routine and manual		-3.63 [-6.59,-0.67]*	-2.22 [-5.04,0.61]	-2.22 [-5.05,0.60]
Homemaker		-0.96 [-4.22,2.30]	-0.57 [-3.73,2.58]	-0.58 [-3.74,2.57]
Inactive		-1.78 [-4.71,1.16]	-0.26 [-2.95,2.42]	-0.27 [-2.95,2.42]
Retired		-3.13 [-7.17,0.91]	-1.46 [-5.27,2.35]	-1.46 [-5.26,2.35]

Table 6-1 (cont.): Two-level random intercept model for SBP with predictor variables 2003. Models 1 to 4a.

	Model 1	Model 2	Model 3	Model 4a
			Coef (95% CI)	
Individual-level variables				
BMI (centred on 27.8)			0.87 [0.71,1.02]***	0.87 [0.71,1.02]***
Diabetes Mellitus (ref: yes)			4.99 [1.47,8.52]**	4.99 [1.46,8.51]**
Family history of hypertension (ref: yes)			1.91 [0.48,3.33]**	1.91 [0.49,3.34]**
Smoking				
Never			Ref	Ref
Past			-3.29 [-5.57,-1.01]**	-3.29 [-5.57,-1.01]**
Current			-3.91 [-5.39,-2.43]***	-3.91 [-5.39,-2.43]***
Physical Activity				
3 or more times			Ref	Ref
Less than 3 times			0.45 [-2.15,3.05]	0.45 [-2.15,3.06]
None			1.40 [-0.80,3.61]	1.41 [-0.79,3.61]
District Level variables				
Overcrowding index[1]				2.21 [-9.02,13.45]
District-level variance (SE)	24.91 (8.46)	18.73 (7.38)	16.81 (7.73)	16.83 (7.60)
Individual-level variance (SE)	478.05 (17.62)	294.52 (11.42)	271.93 (10.81)	271.91 (10.81)
% of total variance (partition)				
Individual level (%)	95.05	94.00	94.18	94.17
District level (%)	4.95	6.00	5.82	5.83
% change in district-level var	-	-24.81	-10.25	0.12
Wald test p-value	-	< 0.01	< 0.01	0.70

* p<0.05, ** p<0.01, *** p<0.001. (1) Overcrowding: as a continuous variable.

Table 6-2: Two-level random intercept model for SBP with predictor variables 2003. Models 4b to 4e.

Individual-level variables	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Sex				
Male	Ref	Ref	Ref	Ref
Female	-9.10 [-10.74,-7.46]***	-9.07 [-10.72,-7.43]***	-9.09 [-10.73,-7.45]***	-9.07 [-10.71,-7.43]***
Age (centred on 50)	0.75 [0.68,0.83]***	0.75 [0.68,0.83]***	0.75 [0.68,0.83]***	0.75 [0.68,0.83]***
Marital status				
Married/cohabiting	Ref	Ref	Ref	Ref
Single	4.10 [2.36,5.83]***	4.09 [2.35,5.83]***	4.12 [2.38,5.86]*	4.09 [2.35,5.83]***
Divorced/separated/widowed	2.41 [-0.35,5.17]	2.42 [-0.34,5.18]	2.43 [-0.33,5.18]	2.44 [-0.33,5.20]
Place of residence				
Urban	Ref	Ref	Ref	Ref
Rural	1.63 [-1.31,4.57]	1.94 [-0.70,4.57]	1.63 [-1.05,4.32]	1.60 [-1.18,4.38]
Education				
Higher	Ref	Ref	Ref	Ref
Intermediate	1.72 [-0.19,3.64]	1.75 [-0.19,3.68]	1.71 [-0.22,3.63]	1.73 [-0.19,3.65]
Low	0.78 [-2.07,3.62]	0.85 [-2.02,3.73]	0.79 [-2.07,3.65]	0.80 [-2.05,3.66]
Assets-based SEP				
High	Ref	Ref	Ref	Ref
Middle	2.63 [0.61,4.65]*	2.67 [0.65,4.70]**	2.52 [0.50,4.54]*	2.66 [0.62,4.69]*
Low	3.83 [0.97,6.69]**	3.91 [1.05,6.77]**	3.70 [0.84,6.56]*	3.80 [0.93,6.68]**
Occupational social class				
Higher worker	Ref	Ref	Ref	Ref
Intermediate	-2.90 [-6.19,0.38]	-2.90 [-6.19,0.40]	-2.92 [-6.21,0.37]	-2.89 [-6.19,0.41]
Routine and manual	-2.23 [-5.05,0.58]	-2.21 [-5.03,0.60]	-2.26 [-5.07,0.56]	-2.22 [-5.04,0.60]
Homemaker	-0.59 [-3.74,2.56]	-0.61 [-3.76,2.55]	-0.60 [-3.75,2.55]	-0.6 [-3.74,2.54]
Inactive	-0.26 [-2.94,2.42]	-0.30 [-2.98,2.38]	-0.30 [-2.97,2.37]	-0.29 [-2.98,2.40]
Retired	-1.46 [-5.27,2.35]	-1.51 [-5.31,2.30]	-1.54 [-5.35,2.28]	-1.42 [-5.24,2.39]

Table 6-2 (cont.): Two-level random intercept model for SBP with predictor variables 2003. Models 4b to 4e.

	Model 4b	**Model 4c**	**Model 4d**	**Model 4e**
Individual-level variables	Coef (95% CI)			
BMI (centred on 27.8)	0.87 [0.71,1.02]***	0.87 [0.71,1.02]***	0.87 [0.71,1.02]***	0.87 [0.71,1.02]***
Diabetes Mellitus	4.97 [1.45,8.50]**	5.03 [1.52,8.55]**	4.96 [1.44,8.48]**	4.98 [1.45,8.51]**
Family history of hypertension	1.92 [0.49,3.34]**	1.84 [0.41,3.28]*	1.89 [0.47,3.31]**	1.91 [0.48,3.33]**
Smoking				
Never	Ref	Ref	Ref	Ref
Past	-3.27 [-5.54,-1.00]**	-3.29 [-5.57,-1.01]**	-3.27 [-5.55,-1.00]**	-3.23 [-5.51,-0.95]**
Current	-3.89 [-5.37,-2.41]***	-3.92 [-5.40,-2.44]***	-3.92 [-5.40,-2.45]***	-3.89 [-5.36,-2.42]***
Physical Activity				
3 or more times	Ref	Ref	Ref	Ref
Less than 3 times	0.44 [-2.16,3.04]	0.48 [-2.13,3.08]	0.42 [-2.19,3.02]	0.46 [-2.16,3.07]
None	1.39 [-0.81,3.59]	1.42 [-0.79,3.62]	1.39 [-0.82,3.59]	1.39 [-0.83,3.61]
District Level variables				
Schooling (in years)[1]	-0.20 [-0.85,0.46]			
Unemployment[2]		0.16 [-0.09,0.42]		
Income (mean)[3]			-0.21* [-0.39,-0.03]	
Deprivation index				
Least deprived				Ref
2 quintile				-0.65 [-3.33,2.04]
3 quintile				-0.57 [-3.69,2.56]
4 quintile				0.52 [-2.67,3.71]
Most deprived				0.66 [-2.33,3.65]
Deprivation index p-value for trend				*0.39*
District-level variance (SE)	16.40 (7.75)	17.17 (7.65)	16.00 (7.54)	16.32 (7.69)
Individual-level variance (SE)	272.07 (10.82)	271.66 (10.81)	272.02 (10.83)	272.03 (10.84)
% of total variance (partition)				
Individual level (%)	94.31	94.05	94.45	94.34
District level (%)	5.69	5.95	5.55	5.66
% change in district-level var	-2.44 (from model 3)	2.14(from model 3)	-4.82(from model 3)	-2.92(from model 3)
Wald test p-value	0.56	0.21	0.02	0.39

* p<0.05, ** p<0.01, *** p<0.001. (1) Schooling: in years as as an ordinal variable; (2) Unemployment: rate as a continuous variable; (3) Income: mean as a continuous variable.

Inclusion of the mean district income in the model (Model 4d), results showed that there was an inverse and significant association with SBP ($p < 0.05$). This indicates that after adjusting for individual-level characteristics, an individual will, on average, have higher risk of raised SBP if he or she lives in a district with a lower mean income. In this model the district-level variance decreased about 5% compared to model 3. This indicates that the mean district income explained 5% of the variation in SBP among districts. Moreover, the goodness of fit test determined a substantial improvement in model fit compared with Model 3 ($p=0.02$) (Table 6-2).

Associations between the outcome and individual-level characteristics did not change substantially after including district-level variables. Both the direction of the association and the level of significance remained similar to those before adjustment for level-2 variables (Table 6.1 and Table 6-2).

6.2.1.2 Analysis 2010

Between-district differences 2010

The results of multilevel analysis for SBP in 2010 are presented in Tables 6-3 and 6-4. The empty model showed that 3% of the variance in SBP is due to differences between districts. The district-level variance was 15.63 with a standard error of 3.99 which gives evidence that SBP varies significantly across districts. Although the district-level variance was significant, the larger proportion of the variation in SBP was found at level 1 (Table 6-3). Comparison with the results in 2003 showed a decrease in the proportion of the variation in SBP attributable to differences between districts (5% in 2003 and 3% in 2010).

Inclusion of individual-level variables

The model with socio-demographic individual-level variables (Model 2) showed that SBP was significantly associated with gender, age, being single and being divorced/separated/widowed compared with being married (Table 6-3). When the three individual socio-economic measures were included at the same time into the model, none of them were significantly related to SBP. However, when these predictors were separately added to the model, differences in SBP among assets index levels and among occupational levels were significant or were near to statistical significance (Appendix 8,

Table A8.2). This can be explained by the fact that these different SEP measures are reflecting the same underlying phenomenon related to the position of people in the social hierarchy. After accounting for socio-demographic characteristics, the district-level variance diminished from 15.63 in Model 1 to 10.56 in Model 2. The proportion of total variance attributable to differences between districts remained around 3%, as in Model 1 (Table 6-3).

In Model 3, including individual-level variables related to health, it can be observed that after accounting for all individual-level variables, the district-level variance remained significant and was 8.7 with standard error of 3.1 (Table 6-3). The total variance decreased from 496.8 in the empty Model to 300.4 in Model 3, indicating that around 40% of the total variance in SBP can be explained by the individual-level characteristics. The proportion of the district-level over the total variance decreased slightly to 3%. The inclusion of the individual-level variables significantly improved the overall fit of the model ($p < 0.01$).

Inclusion of the district-level variables

Estimates for the models including district-level variables are presented in Table 6-3 (Model 4a) and Table 6-4 (Models 4b to 4e). Findings showed that overcrowding was related to SBP in unexpected direction, namely, the higher overcrowding index the lower the mean of SBP, but this association was not significant (Model 4a).The association between SBP and income, although in the expected direction, was also not significant (Model 4d). In the models where overcrowding index and income index were included, district-level variance was slightly reduced (0.6% and 4.6%) indicating that these variables explain a low proportion of the variation in SBP among districts (Models 4a and 4d). In addition, adding overcrowding and income variables to the model did not improve the fit of the model.

Table 6-3: Two-level random intercept model for SBP with predictor variables 2010. Models 1 to 4a.(weighted with scale-method size)

	Model 1	Model 2	Model 3	Model 4a
	Coef (95% CI)			
Individual-level variables				
Sex				
Male		Ref	Ref	Ref
Female		-8.87 [-10.52,-7.21]***	-9.83 [-11.41,-8.25]***	-9.83 [-11.42,-8.25]***
Age (centred on 48)		0.75 [0.69,0.81]***	0.70 [0.64,0.76]***	0.70 [0.64,0.76]***
Marital status				
Married/cohabiting		Ref	Ref	Ref
Single		2.54 [0.77,4.31]**	3.19 [1.66,4.73]***	3.19 [1.66,4.72]***
Divorced/separated/widowed		3.07 [0.56,5.58]*	3.56 [1.24,5.88]**	3.56 [1.24,5.88]**
Place of residence				
Urban		Ref	Ref	Ref
Rural		-0.66 [-3.09,1.76]	-0.45 [-2.80,1.89]	-0.46 [-2.77,1.85]
Education				
Higher		Ref	Ref	Ref
Intermediate		0.53 [-1.23,2.28]	0.01 [-1.67,1.69]	0.02 [-1.68,1.71]
Low		1.63 [-1.45,4.70]	0.79 [-2.23,3.82]	0.80 [-2.22,3.82]
Assets-based SEP				
High		Ref	Ref	Ref
Middle		1.59 [-0.22,3.40]	1.11 [-0.26,2.48]	1.11 [-0.26,2.47]
Low		0.71 [-1.85,3.27]	0.70 [-1.60,3.01]	0.71 [-1.58,3.00]
Occupational social class				
Higher worker		Ref	Ref	Ref
Intermediate		-1.71 [-5.25,1.82]	-0.25 [-2.72,2.22]	-0.24 [-2.72,2.24]
Routine and manual		0.39 [-3.39,4.17]	1.99 [-0.71,4.69]	2.00 [-0.70,4.70]
Homemaker		0.66 [-2.88,4.20]	1.71 [-0.61,4.03]	1.72 [-0.60,4.03]
Inactive		0.62 [-2.98,4.22]	2.37 [-0.08,4.82]	2.38 [-0.07,4.82]
Retired		-0.57 [-5.26,4.13]	1.63 [-1.99,5.25]	1.64 [-1.97,5.25]

Table 6-3 (cont.): Two-level random intercept model for SBP with predictor variables 2010. Models 1 to 4a.(weighted with scale-method size)

BMI (centred on 28.2)			0.79 [0.69,0.89]***	0.79 [0.69,0.89]***
Diabetes Mellitus			3.58 [0.88,6.27]**	3.58 [0.88,6.27]**
Family history of hypertension			3.38 [2.03,4.74]***	3.39 [2.03,4.74]***
Smoking				
Never			Ref	Ref
Past			-3.11 [-4.69,-1.54]***	-3.12 [-4.69,-1.54]***
Current			-2.50 [-3.86,-1.15]***	-2.51 [-3.86,-1.15]***
Physical Activity				
3 or more times			Ref	Ref
Less than 3 times			-0.46 [-3.28,2.35]	-0.46 [-3.29,2.36]
None			-0.62 [-3.10,1.86]	-0.62 [-3.11,1.87]
District Level variables				
Overcrowding index[1]				-0.65 [-10.02,8.71]
District-level variance (SE)	15.63 (3.99)	10.56 (3.32)	8.66 (3.12)	8.61 (3.17)
Individual-level variance (SE)	481.15 (18.71)	316.54 (14.89)	291.70 (13.86)	291.72 (13.87)
% of total variance (partition)				
Individual level (%)	96.85	96.77	97.12	97.13
District level (%)	3.15	3.23	2.88	2.87
% change in district-level var	-	-32.44	-17.99	-0.58 (from model 3)
Wald test p value	-	< 0.01	< 0.01	0.89

* p<0.05, ** p<0.01, *** p<0.001. (1) Overcrowding: as a continuous variable.

Table 6-4: Two-level random intercept model for SBP with predictor variables 2010. Models 4b to 4e.

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Individual-level variables				
Sex				
Male	Ref	Ref	Ref	Ref
Female	-9.81 [-11.39,-8.22]***	-9.80 [-11.38,-8.22]***	-9.80 [-11.38,-8.21]***	-9.81 [-11.40,-8.22]***
Age (centred on 48)	0.70 [0.65,0.76]***	0.70 [0.64,0.76]***	0.70 [0.64,0.76]***	0.71 [0.65,0.76]***
Marital status				
Married/cohabiting	Ref	Ref	Ref	Ref
Single	3.26 [1.72,4.80]***	3.20 [1.67,4.73]***	3.24 [1.70,4.78]***	3.27 [1.74,4.80]***
Divorced/separated/widowed	3.62 [1.29,5.95]**	3.51 [1.18,5.84]**	3.59 [1.26,5.92]**	3.56 [1.23,5.89]**
Place of residence				
Urban	Ref	Ref	Ref	Ref
Rural	-1.09 [-3.37,1.19]	-0.34 [-2.63,1.96]	-0.63 [-2.97,1.71]	-0.80 [-3.06,1.46]
Education				
Higher	Ref	Ref	Ref	Ref
Intermediate	-0.17 [-1.87,1.54]	-0.03 [-1.70,1.65]	-0.09 [-1.78,1.61]	-0.17 [-1.88,1.53]
Low	0.46 [-2.63,3.54]	0.81 [-2.20,3.83]	0.65 [-2.40,3.69]	0.55 [-2.50,3.60]
Assets-based SEP				
High	Ref	Ref	Ref	Ref
Middle	1.03 [-0.33,2.39]	1.07 [-0.29,2.44]	1.05 [-0.31,2.41]	1.02 [-0.35,2.39]
Low	0.56 [-1.77,2.89]	0.64 [-1.67,2.94]	0.63 [-1.68,2.95]	0.47 [-1.87,2.80]
Occupational social class				
Higher worker	Ref	Ref	Ref	Ref
Intermediate	-0.30 [-2.76,2.15]	-0.28 [-2.74,2.19]	-0.39 [-2.87,2.10]	-0.27 [-2.73,2.19]
Routine and manual	1.83 [-0.88,4.53]	1.99 [-0.71,4.69]	1.84 [-0.88,4.55]	1.90 [-0.78,4.58]
Homemaker	1.55 [-0.76,3.86]	1.70 [-0.62,4.03]	1.53 [-0.79,3.86]	1.60 [-0.70,3.90]
Inactive	2.27 [-0.20,4.74]	2.37 [-0.07,4.80]	2.27 [-0.19,4.73]	2.24 [-0.19,4.66]
Retired	1.54 [-2.08,5.16]	1.58 [-2.04,5.19]	1.48 [-2.14,5.10]	1.49 [-2.12,5.09]
BMI (centred on 28.2)	0.78 [0.68,0.89]***	0.79 [0.68,0.89]***	0.79 [0.68,0.89]***	0.79 [0.69,0.89]***

Table 6-4 (cont.): Two-level random intercept model for SBP with predictor variables 2010. Models 4b to 4e.

	Model 4b	**Model 4c**	**Model 4d**	**Model 4e**
Individual-level variables		Coef (95% CI)		
Diabetes Mellitus	3.59 [0.89,6.28]**	3.57 [0.88,6.25]**	3.57 [0.88,6.27]**	3.59 [0.89,6.29]**
Family history of hypertension	3.38 [2.02,4.73]***	3.31 [1.94,4.69]***	3.38 [2.02,4.73]***	3.32 [1.97,4.67]***
Smoking				
Never	Ref	Ref	Ref	Ref
Past	-3.07 [-4.64,-1.49]***	-3.11 [-4.69,-1.53]***	-3.09 [-4.66,-1.51]***	-3.10 [-4.68,-1.53]***
Current	-2.43 [-3.78,-1.07]***	-2.50 [-3.86,-1.14]***	-2.47 [-3.83,-1.11]***	-2.43 [-3.79,-1.07]***
Physical Activity				
3 or more times	Ref	Ref	Ref	Ref
Less than 3 times	-0.54 [-3.38,2.29]	-0.40 [-3.20,2.41]	-0.51 [-3.34,2.33]	-0.48 [-3.30,2.34]
None	-0.66 [-3.15,1.84]	-0.58 [-3.06,1.90]	-0.66 [-3.15,1.83]	-0.61 [-3.10,1.89]
District Level variables				
Schooling (in years)[1]	-0.64 [-1.18,-0.09]*			
Unemployment[2]		0.24 [0.00,0.49]*		
Income (mean)[3]			-0.14 [-0.32,0.04]	
Deprivation index				
Less deprived				Ref
2 quintile				0.71 [-1.65,3.07]
3 quintile				2.15 [-0.10,4.40]
4 quintile				2.48 [0.34,4.62]*
Most deprived				3.55 [1.19,5.91]**
Deprivation index p-value for trend				*<0.01*
District-level variance (SE)	7.48 (3.05)	7.77 (3.00)	8.26 (3.10)	7.07 (2.91)
% of total variance (partition)	291.80 (13.83)	291.77 (13.83)	291.70 (13.86)	291.67 (13.75)
Individual level (%)	97.50	97.41	97.25	97.63
District level (%)	2.50	2.59	2.75	2.37
% change in district-level var	-13.62(from model 3)	-10.28(from model 3)	-4.62(from model 3)	-18.24(from model 3)
Wald test p value	0.02	0.05	0.12	<0.01

* p<0.05, ** p<0.01, *** p<0.001. (1) Schooling: in years as as an ordinal variable; (2) Unemployment: rate as a continuous variable; (3) Income: mean as a continuous variable.

Schooling and unemployment indices were significantly related to SBP (Models 4b and 4c). Higher schooling level was associated with lower SBP, and an increment in the unemployment rate was associated with an increase in SBP. Inclusion of these district-level variables (Models 4b and 4c), significantly improved the fit of the model (according to Wald test p-value) although the district-level variance decreased (Table 6-4). These reductions of the district-level variance suggest that schooling and unemployment rate helps to explain the variation in SBP among districts. The percentages of change in district level variance with respect Model 3 were -13% for schooling and -10% for unemployment rate (Table 6-4).

Model 4e was adjusted for all individual variables and for the deprivation index. Adding the deprivation index resulted in a reduction of the country-level variance from 8.66 in Model 3 to 7.07 in Model 4e. This decrease suggests that the index including the four dimensions: overcrowding, schooling, unemployment and income, helps to explain the variation in SBP between districts. The proportional variation at district level remained around 2-3 %. Adjusting for the deprivation index caused a significant improvement of the fit of the model from Model 3 (p-value < 0.01). Estimates for the association between SBP and deprivation index showed an statistically significant social gradient, whereby adults living in most deprived districts had higher risk of raised SBP than those in the least deprived districts (Table 6-4).

Finally, the associations between individual-level variables and SBP in Model 3 remained almost identical after the addition of district-level variables in Models 4a to 4e.

6.2.2 Multilevel analyses of district socioeconomic context and diastolic blood pressure

This section examines the results obtained from the multilevel linear regression models for the outcome of diastolic blood pressure in 2003 and 2010 surveys.

6.2.2.1 2003 Survey

Between-district differences 2003

Results of multilevel analyses (Models 1 to 4) for the outcome of diastolic blood pressure in 2003 are presented in Tables 6-5 and 6-6. The empty model showed that roughly 7% of the variance in this outcome was due to differences between districts. The estimate of the district-level variance was 11.40 with a standard error of 3.50, providing evidence of a significant variation in DBP across districts (Table 6-5). These findings showed that most of the variation in DBP was at level 1, which is concordant with findings for SBP.

Inclusion of individual-level variables

Similar to findings for SBP, although more modest in magnitude, adding individual-level variables (Model 2 and Model 3) caused the district-level variance to decline. In this case, the variance at district-level declined by 10% after adjusting for socio-demographic variables (Model 2) and by 7% after adjustment for health-related variables (Model 3). Compared to Model 1 (empty model), Model 3 showed a decline in the district-level variance (from 11.40 to 9.47) and a decrease of the total variance from 172.8 to 120.5. The total variation in DBP explained for individual-level characteristics can be obtained by estimating the proportion of change in total variance (district-level variance + individual-level variance) between empty model and Model 3 (including all individual-level variables), and this resulted around -30%. This reduction indicates that roughly a third of the total variation in DBP can be explained for individual-level characteristics. In addition, adding individual-level variables significantly improved the fit of the model with a Wald test p-value <0.01 (Model 2 and model 3)(Table 6-5).

The model with all individual-level variables (Model 3) showed that DBP was significantly associated with age, gender, BMI, having family history of hypertension, some categories of occupational class and being current smoker (Table 6-5). Regarding demographic characteristics, older participants and men were more likely to have raised DBP compared to their younger counterparts and women. The association with assets-based SEP was in the expected direction. Those most deprived had a higher risk of raised DBP than those most privileged, however this association did not achieve statistical significance. Estimates of DBP across educational levels showed minimal differences. In turn, manual workers, inactive and retired people had significantly lower risk of raised DBP than higher workers (Table 6-5).

Inclusion of the district-level variables

Adding the district-level variables to the model (Models 4a to 4e), showed that the direction of the associations between overcrowding, unemployment rate and income were in the expected direction, where people in most deprived districts tended to have higher risk of raised DBP (Tables 6-5 and Table 6-6). However, none of the associations between DBP and contextual socioeconomic characteristics were significant. After adjusting for the single contextual socio-economic variables, the district-level variance remained almost identical to that in Model 3, this indicates that these socio-economic variables did not explain the district-level variance observed in Model 4a to 4d. When the model was adjusted for the deprivation index, the variance was reduced from 4%, indicating that this index explain around 4% of inequalities between districts. Nonetheless, the inclusion of the district-level variables did not improve the fit of the model (Wald test p-value >0.05) (Tables 6-5 and Table 6-6).

Estimates of Models 4a to 4e revealed that including the district-level variables did not affect the direction or size of the associations between DBP and individual-level variables. Findings showed that gender, age, some categories of occupational class, BMI, family history of hypertension and being current smoker were significantly related to DBP (Tables 6-5 and Table 6-6).

6.2.2.2 2010 Survey

Between-district differences 2010

There was a significant variation in DBP across districts (Table 6-7). Specifically, the district-level variance was 3.15 with a standard error of 1.01 (Model 1) which is evidence that the between-district variation was non-zero. In this empty model, 2% of the total variance in DBP was at the district level. This suggests that the variation of DBP is mainly caused by individual factors, as 97% of the total variation is located at the individual level.

Table 6-5: Two-level random intercept model for DBP with predictor variables 2003. Models 1 to 4a (weighted with scale-method size)

	Model 1	Model 2	Model 3	Model 4a
	Coef (95% CI)			
Individual-level variables				
Sex				
Male		Ref	Ref	Ref
Female		-6.34 [-7.49,-5.18]***	-7.57 [-8.59,-6.55]***	-7.57 [-8.59,-6.55]***
Age (centred on 50)		0.34 [0.29,0.38]***	0.29 [0.25,0.33]***	0.29 [0.25,0.33]***
Marital status				
Married/cohabiting		Ref	Ref	Ref
Single		-0.77 [-2.07,0.54]	0.90 [-0.29,2.09]	0.90 [-0.29,2.09]
Divorced/separated/widowed		-0.85 [-2.68,0.99]	0.32 [-1.42,2.07]	0.32 [-1.43,2.06]
Place of residence				
Urban		Ref	Ref	Ref
Rural		1.08 [-0.93,3.09]	1.16 [-0.79,3.11]	1.17 [-0.81,3.15]
Education				
Higher		Ref	Ref	Ref
Intermediate		0.85 [-0.82,2.52]	0.74 [-0.79,2.26]	0.74 [-0.78,2.27]
Low		0.46 [-1.53,2.45]	-0.33 [-2.24,1.58]	-0.32 [-2.23,1.59]
Assets-based SEP				
High		Ref	Ref	Ref
Middle		1.38 [-0.00,2.77]	1.27 [-0.04,2.58]	1.28 [-0.03,2.59]
Low		1.83* [0.02,3.65]	1.73 [-0.03,3.50]	1.75 [-0.03,3.52]
Occupational social class				
Higher worker		Ref	Ref	Ref
Intermediate		-3.19 [-5.66,-0.71]*	-2.25 [-4.57,0.07]	-2.25 [-4.57,0.07]
Routine and manual		-3.28 [-5.28,-1.27]**	-2.26 [-4.20,-0.32]*	-2.26 [-4.20,-0.32]*
Homemaker		-2.04 [-4.13,0.04]	-1.62 [-3.60,0.35]	-1.62 [-3.59,0.35]
Inactive		-3.64 [-5.82,-1.45]**	-2.27 [-4.37,-0.17]*	-2.26 [-4.36,-0.16]*
Retired		-5.76 [-8.27,-3.25]***	-4.19 [-6.49,-1.89]***	-4.19 [-6.49,-1.89]***

Table 6-5 (cont.): Two-level random intercept model for DBP with predictor variables 2003. Models 1 to 4a (weighted with scale-method size)

	Model 1	Model 2	Model 3	Model 4a
Individual-level variables			Coef (95% CI)	
BMI (centred on 27.8)			0.78 [0.68,0.88]***	0.78 [0.68,0.88]***
Diabetes Mellitus			0.38 [-1.61,2.37]	0.38 [-1.61,2.38]
Family history of hypertension			2.10 [1.10,3.11]***	2.10 [1.10,3.11]***
Smoking				
Never			Ref	Ref
Past			-1.36 [-2.86,0.13]	-1.36 [-2.86,0.13]
Current			-2.41 [-3.35,-1.46]***	-2.41 [-3.35,-1.46]***
Physical Activity				
3 or more times			Ref	Ref
Less than 3 times			-1.06 [-3.06,0.95]	-1.06 [-3.06,0.94]
None			0.17 [-1.50,1.84]	0.17 [-1.50,1.84]
District Level variables				
Overcrowding index[1]				-0.66 [-8.35,7.02]
District-level variance (SE)	11.40 (3.50)	10.28 (3.60)	9.47 (3.74)	9.46 (3.76)
Individual-level variance (SE)	161.40 (5.84)	126.40 (4.98)	110.98 (4.29)	110.99 (4.29)
% of total variance (partition)				
Individual level (%)	93.39	92.50	92.14	92.15
District level (%)	6.61	7.50	7.86	7.85
% change in district-level var	-	-9.82	-16.93 from Model 1 -7.88 from Model 2	-0.11
Wald test p value	-	< 0.01	< 0.01	0.87

* p<0.05, ** p<0.01, *** p<0.001. (1) Overcrowding: as a continuous variable.

Table 6-6: Two-level random intercept model for DBP with predictor variables 2003. Models 4b to 4e (weighted with scale-method size)

	Model 4b	Model 4c	Model 4d	Model 4e
Individual-level variables	Coef (95% CI)			
Sex				
Male	Ref	Ref	Ref	Ref
Female	-7.59 [-8.62,-6.56]***	-7.56 [-8.58,-6.54]***	-7.57 [-8.59,-6.54]***	-7.58 [-8.60,-6.56]***
Age (centred on 50)	0.29 [0.24,0.33]***	0.29 [0.25,0.33]***	0.29 [0.25,0.33]***	0.29 [0.24,0.33]***
Marital status				
Married/cohabiting	Ref	Ref	Ref	Ref
Single	0.89 [-0.30,2.07]	0.90 [-0.28,2.09]	0.91 [-0.28,2.10]	0.88 [-0.31,2.07]
Divorced/separated/widowed	0.33 [-1.42,2.07]	0.32 [-1.42,2.07]	0.32 [-1.42,2.07]	0.33 [-1.42,2.07]
Place of residence				
Urban	Ref	Ref	Ref	Ref
Rural	1.45 [-0.73,3.62]	1.18 [-0.77,3.12]	1.09 [-0.89,3.07]	1.23 [-0.81,3.26]
Education				
Higher	Ref	Ref	Ref	Ref
Intermediate	0.77 [-0.76,2.31]	0.74 [-0.79,2.26]	0.72 [-0.80,2.25]	0.75 [-0.77,2.28]
Low	-0.26 [-2.18,1.66]	-0.33 [-2.24,1.59]	-0.34 [-2.25,1.57]	-0.29 [-2.21,1.62]
Assets-based SEP				
High	Ref	Ref	Ref	Ref
Middle	1.34 [0.04,2.64]*	1.26 [-0.04,2.57]	1.22 [-0.08,2.53]	1.29 [-0.02,2.59]
Low	1.86 [0.09,3.64]*	1.72 [-0.05,3.49]	1.66 [-0.11,3.44]	1.75 [-0.02,3.52]
Individual-level variables				
Occupational social class				
Higher worker	Ref	Ref	Ref	Ref
Intermediate	-2.24 [-4.57,0.08]	-2.25 [-4.57,0.07]	-2.26 [-4.58,0.07]	-2.25 [-4.58,0.07]
Routine and manual	-2.25 [-4.19,-0.30]*	-2.26 [-4.20,-0.32]*	-2.27 [-4.21,-0.33]*	-2.27 [-4.21,-0.32]*
Homemaker	-1.62 [-3.59,0.36]	-1.63 [-3.61,0.34]	-1.63 [-3.60,0.34]	-1.61 [-3.58,0.36]
Inactive	-2.27 [-4.38,-0.17]*	-2.28 [-4.37,-0.18]*	-2.27 [-4.37,-0.17]*	-2.27 [-4.37,-0.17]*
Retired	-4.19 [-6.50,-1.89]***	-4.20 [-6.51,-1.90]***	-4.21 [-6.52,-1.90]***	-4.19 [-6.51,-1.87]***
BMI (centred on 27.8)	0.78 [0.68,0.88]***	0.78 [0.68,0.88]***	0.78 [0.68,0.88]***	0.78 [0.68,0.88]***

Table 6-6 (cont.): Two-level random intercept model for DBP with predictor variables 2003. Models 4b to 4e (weighted with scale-method size)

	Model 4b	**Model 4c**	**Model 4d**	**Model 4e**
Individual-level variables		Coef (95% CI)		
Diabetes Mellitus	0.40 [-1.59,2.39]	0.39 [-1.59,2.38]	0.38 [-1.61,2.37]	0.37 [-1.63,2.36]
Family history of hypertension	2.09 [1.09,3.10]***	2.09 [1.07,3.10]***	2.10 [1.09,3.11]***	2.12 [1.11,3.12]***
Smoking				
Never	Ref	Ref	Ref	Ref
Past	-1.39 [-2.88,0.09]	-1.36 [-2.86,0.13]	-1.36 [-2.85,0.14]	-1.35 [-2.84,0.14]
Current	-2.43 [-3.38,-1.48]***	-2.41 [-3.36,-1.47]***	-2.41 [-3.35,-1.47]***	-2.41 [-3.35,-1.47]***
Physical Activity				
3 or more times	Ref	Ref	Ref	Ref
Less than 3 times	-1.05 [-3.05,0.95]	-1.05 [-3.05,0.96]	-1.06 [-3.07,0.94]	-1.06 [-3.07,0.94]
None	0.19 [-1.49,1.86]	0.17 [-1.50,1.85]	0.17 [-1.51,1.84]	0.17 [-1.51,1.84]
District Level variables				
Schooling (in years)[1]	0.24 [-0.26,0.74]			
Unemployment[2]		0.05 [-0.13,0.23]		
Income (mean)[3]			-0.06 [-0.21,0.09]	
Deprivation index				
Least deprived				Ref
2 quintile				-0.80 [-2.76,1.16]
3 quintile				-0.29 [-2.59,2.02]
4 quintile				0.01 [-2.14,2.15]
Most deprived				-0.90 [-3.00,1.20]
Deprivation index p-value for trend index				*0.65*
District-level variance (SE)	9.52 (3.77)	9.52 (3.72)	9.39 (3.71)	9.07 (3.88)
Individual-level variance (SE)	110.92 (4.27)	110.96 (4.29)	111.00	111.08 (4.29)
% of total variance (partition)				
Individual level (%)	92.10	92.10	92.20	92.45
District level (%)	7.90	7.90	7.80	7.55
% change in district-level var	0.53	0.53	-0.85	-4.22
Wald test p value	0.34	0.59	0.40	0.65

* p<0.05, ** p<0.01, *** p<0.001. (1) Schooling: in years as an ordinal variable; (2) Unemployment: rate as a continuous variable; (3) Income: mean as a continuous variable.

Table 6-7: Two-level random intercept model for DBP with predictor variables 2010. Models 1 to 4a. (weighted with scale-method size)

	Model 1	Model 2	Model 3	Model 4a
Individual-level variables		Coef (95% CI)		
Sex				
Male		Ref	Ref	Ref
Female		-4.61 [-5.65,-3.56]***	-5.44 [-6.43,-4.45]***	-5.44 [-6.43,-4.45]***
Age (centred on 48)		0.25 [0.21,0.29]***	0.21 [0.18,0.25]***	0.21 [0.18,0.25]***
Marital status				
Married/cohabiting		Ref	Ref	Ref
Single		-0.63 [-1.81,0.55]	-0.08 [-1.05,0.89]	-0.091 [-1.06,0.87]
Divorced/separated/widowed		-0.36 [-1.65,0.92]	0.07 [-1.15,1.29]	0.07 [-1.15,1.28]
Place of residence				
Urban		Ref	Ref	Ref
Rural		-0.63 [-1.87,0.62]	-0.53 [-1.70,0.64]	-0.55 [-1.72,0.62]
Education				
Higher		Ref	Ref	Ref
Intermediate		0.22 [-0.85,1.30]	-0.17 [-1.25,0.92]	-0.14 [-1.23,0.94]
Low		-0.56 [-2.06,0.95]	-1.09 [-2.58,0.39]	-1.07 [-2.55,0.41]
Assets-based SEP				
High		Ref	Ref	Ref
Middle		0.24 [-0.91,1.38]	-0.19 [-1.07,0.68]	-0.19 [-1.06,0.69]
Low		-0.67 [-2.16,0.83]	-0.79 [-2.15,0.58]	-0.77 [-2.14,0.60]
Occupational social class				
Higher worker		Ref	Ref	Ref
Intermediate		-1.94 [-4.45,0.56]	-0.92 [-2.53,0.69]	-0.90 [-2.51,0.71]
Routine and manual		-1.40 [-4.00,1.20]	-0.27 [-2.02,1.49]	-0.25 [-2.00,1.51]
Homemaker		-1.90 [-4.48,0.69]	-1.10 [-2.75,0.56]	-1.07 [-2.73,0.58]
Inactive		-2.41 [-4.94,0.12]	-0.98 [-2.68,0.72]	-0.97 [-2.67,0.73]
Retired		-7.10 [-10.13,-4.06]***	-5.39 [-7.57,-3.21]***	-5.37 [-7.55,-3.19]***
BMI (centred on 28.2)			0.58 [0.51,0.65]***	0.58 [0.51,0.65]***
Diabetes Mellitus			1.07 [-0.38,2.51]	1.07 [-0.37,2.52]

Table 6-7 (cont.): Two-level random intercept model for DBP with predictor variables 2010. Models 1 to 4a. (weighted with scale-method

	Model 1	Model 2	Model 3	Model 4a
		Coef (95% CI)		
Family history of hypertension			2.75 [1.95,3.55]***	2.75 [1.95,3.55]***
Smoking				
Never			Ref	Ref
Past			-0.96 [-1.91,-0.01]*	-0.96 [-1.91,-0.01]*
Current			-1.00 [-1.82,-0.17]*	-1.00 [-1.83,-0.18]*
Physical Activity				
3 or more times			Ref	Ref
Less than 3 times			-0.13 [-2.13,1.88]	-0.12 [-2.12,1.89]
None			0.74 [-0.86,2.33]	0.75 [-0.85,2.34]
District Level variables				
Overcrowding index[1]				-1.74 [-7.28,3.81]
District-level variance (SE)	3.15 (1.01)	3.21 (1.05)	2.87 (1.06)	2.82 (1.06)
% of total variance (partition)	130.50 (4.92)	112.53 (4.76)	99.65 (3.77)	99.67 (3.78)
Individual level (%)	97.64	97.23	97.2	97.26
District level (%)	2.36	2.77	2.80	2.74
% change in district-level var	-	1.91	-8.88 (from model 1) -10.59 (from model 2)	-1.74 (from model 3)
Wald test p value	-	< 0.01	< 0.01	0.54

* p<0.05, ** p<0.01, *** p<0.001. (1) Overcrowding: as a continuous variable.

Table 6-8: Two-level random intercept model for DBP with predictor variables 2010. Models 4b to 4e. (weighted with scale-method size)

	Model 4b	Model 4c	Model 4d	Model 4e
Individual-level variables	Coef (95% CI)			
Sex				
Male	Ref	Ref	Ref	Ref
Female	-5.43 [-6.42,-4.44]***	-5.43 [-6.42,-4.44]***	-5.42 [-6.42,-4.43]***	-5.44 [-6.43,-4.44]***
Age (centred on 48)	0.21 [0.18,0.25]***	0.21 [0.18,0.25]***	0.21 [0.18,0.25]***	0.21 [0.18,0.25]***
Marital status				
Married/cohabiting	Ref	Ref	Ref	Ref
Single	-0.06 [-1.03,0.92]	-0.08 [-1.05,0.90]	-0.06 [-1.03,0.92]	-0.06 [-1.04,0.91]
Divorced/separated/widowed	0.09 [-1.14,1.31]	0.05 [-1.17,1.27]	0.08 [-1.14,1.31]	0.09 [-1.12,1.31]
Place of residence				
Urban	Ref	Ref	Ref	Ref
Rural	-0.74 [-1.89,0.41]	-0.50 [-1.67,0.67]	-0.61 [-1.78,0.56]	-0.60 [-1.73,0.53]
Education				
Higher	Ref	Ref	Ref	Ref
Intermediate	-0.22 [-1.32,0.87]	-0.18 [-1.25,0.90]	-0.21 [-1.30,0.88]	-0.22 [-1.31,0.86]
Low	-1.20 [-2.73,0.32]	-1.09 [-2.57,0.39]	-1.16 [-2.66,0.33]	-1.17 [-2.67,0.33]
Assets-based SEP				
High	Ref	Ref	Ref	Ref
Middle	-0.22 [-1.10,0.66]	-0.2 [-1.08,0.67]	-0.22 [-1.10,0.66]	-0.20 [-1.08,0.68]
Low	-0.84 [-2.22,0.53]	-0.81 [-2.18,0.55]	-0.83 [-2.20,0.55]	-0.82 [-2.20,0.56]
Occupational social class				
Higher worker	Ref	Ref	Ref	Ref
Intermediate	-0.94 [-2.55,0.67]	-0.93 [-2.54,0.68]	-0.99 [-2.62,0.65]	-0.94 [-2.55,0.66]
Routine and manual	-0.32 [-2.08,1.43]	-0.27 [-2.03,1.48]	-0.34 [-2.11,1.43]	-0.32 [-2.07,1.43]
Homemaker	-1.15 [-2.81,0.50]	-1.10 [-2.76,0.55]	-1.18 [-2.85,0.49]	-1.14 [-2.79,0.51]
Inactive	-1.02 [-2.72,0.69]	-0.99 [-2.68,0.71]	-1.03 [-2.73,0.67]	-1.01 [-2.71,0.69]
Retired	-5.42 [-7.61,-3.24]***	-5.41 [-7.58,-3.23]***	-5.46 [-7.66,-3.26]***	-5.45 [-7.63,-3.28]***
BMI (centred on 28.2)	0.57 [0.50,0.64]***	0.58 [0.51,0.65]***	0.57 [0.50,0.65]***	0.58 [0.51,0.65]***
Diabetes Mellitus	1.07 [-0.38,2.52]	1.07 [-0.38,2.51]	1.07 [-0.38,2.51]	1.06 [-0.39,2.51]

Table 6-8 (cont.): Two-level random intercept model for DBP with predictor variables 2010. Models 4b to 4e. (weighted with scale-method

	Model 4b	Model 4c	Model 4d	Model 4e
		Coef (95% CI)		
Family history of hypertension	2.74 [1.94,3.55]***	2.73 [1.92,3.54]***	2.74 [1.94,3.55]***	2.74 [1.93,3.54]***
Smoking				
Never	Ref	Ref	Ref	Ref
Past	-0.94 [-1.90,0.01]	-0.96 [-1.91,-0.01]*	-0.95 [-1.90,0.00]	-0.95 [-1.91,0.00]
Current	-0.97 [-1.80,-0.15]*	-1.00 [-1.82,-0.17]*	-0.98 [-1.81,-0.16]*	-0.98 [-1.81,-0.15]*
Physical Activity				
3 or more times	Ref	Ref	Ref	Ref
Less than 3 times	-0.15 [-2.17,1.86]	-0.11 [-2.11,1.90]	-0.15 [-2.16,1.87]	-0.11 [-2.12,1.90]
None	0.72 [-0.87,2.32]	0.75 [-0.85,2.34]	0.72 [-0.88,2.32]	0.76 [-0.84,2.35]
District Level variables				
Schooling (in years)[1]	-0.21 [-0.53,0.12]			
Unemployment[2]		0.07 [-0.06,0.20]		
Income (mean)[3]			-0.07 [-0.18,0.05]	
Deprivation index				
Least deprived quintile				Ref
2 quintile				0.49 [-0.98,1.97]
3 quintile				0.57 [-0.82,1.97]
4 quintile				1.26 [-0.19,2.71]
Most deprived				0.78 [-0.57,2.13]
Deprivation index p-value for trend				*0.16*
District-level variance (SE)	2.68 (1.07)	2.74 (1.04)	2.72 (1.06)	2.66 (1.02)
% of total variance (partition)	99.69 (3.78)	99.68 (3.77)	99.68 (3.78)	99.67 (3.75)
Individual level (%)	97.38	97.32	97.34	97.40
District level (%)	2.62	2.68	2.66	2.60
% change in district-level var	-6.62	-4.53	-5.22	-7.32
Wald test p value	0.22	0.29	0.27	0.17

* p<0.05, ** p<0.01, *** p<0.001. (1) Schooling: in years as an ordinal variable; (2) Unemployment: rate as a continuous variable; (3) Income: mean as a continuous variable.

Inclusion of individual-level variables

Firstly, socioeconomic individual-level variables were included in model 2 (Table 6-7). Results in this model showed that 3% of the total variation in DBP was attributable to differences between districts after adjusting for these individual-level characteristics. When socio-economic variables were included (Model 2), the fit of the model improved (according to the Wald test) but the district-level variance remained almost the same. This suggests that socioeconomic characteristics at the individual level did not explain the variance in DBP at the district level. Second, health-related variables were added to model 3. The inclusion of these individual-level variables caused the country-level variance to decline from 3.21 in model 1 to 2.87 in model 3. This reduction indicates that health related factors explained around 10% of the variation in DBP among districts. The proportion of the variation in DBP, explained by differences between districts, remained in 3% after adjusting for all individual-level characteristics. The fit of the model significantly improved after adjustments for socioeconomic and health-related variables (Model 2 and model 3) (Table 6-7).

Adding individual-level variables to the model 2 and 3 showed that DBP was significantly associated with being woman, older, being retired (compared to being higher worker), BMI, having family history of hypertension and being past or current smoker (compared to being never smoker). Moreover, the regression coefficients for education and assets-based social class suggested a pattern of social gradients with the lowest risk of raised DBP at the lowest SEP level, but these estimates were not significant.

Between-district differences 2010

When district-level variables were included in the model (Model 4a to model 4e) (Table 6-7 and Table 6-8), results showed that three of the four contextual factors were in the expected direction. Whereby, the higher the mean of schooling and income, the lower the risk of raised DBP, and the greater the unemployment rate the higher the risk of raised DBP. Overcrowding showed being related to DBP in unexpected direction, where those in worse living condition had lower risk. In turn, DBP tended to be subtly higher in districts in quintiles 2 to 5 of deprivation index, than those in quintile 1. However, all these associations with district-level variables did not achieve statistical significance. The addition of level-2 variables reduced the variance at this level between 2% and 7% (Model 4a to 4e). The most important reductions were observed after adjusting for schooling and for deprivation index, which explained 7% of the between-district variance. Nonetheless, the inclusion of district-level variables did not improve the fit of the model (Wald test p-value >0.05).

Associations between the outcome and individual-level characteristics did not have important changes from those in Models 3, and so the magnitude and the significance levels were almost the same for all of them (Table 6-7 and Table 6-8).

6.2.3 Hypertension

Results of multilevel analyses for the outcome of hypertension are presented in Table 6-9. The empty models showed that level-2 variance was not significant in both surveys. Estimates of the variances and their respective standard errors did not provide evidence to set up that the between-districts variance was not zero. As a result, it was not worth fitting multilevel models for the outcome of hypertension since there were not significant amount of differences in hypertension across districts.

Table 6-9: Two-level random intercept model for hypertension. Empty models 2003 and 2010 (weighted with scale-method size.

	Empty Model	
	2003	**2010**
District-level variance (SE)	0.017 (0.04)	0.02 (0.02)
% of total variance (partition)		
Individual level (%)	99.49	99.4
District level (%)	0.51	0.60

6.2.4 Summary and main findings about area-level socioeconomic characteristics and blood pressure

Using a multilevel approach, analysis of the influence of the contextual socioeconomic factors on inequalities in blood pressure showed that district-level characteristics accounted for up 7 percent of the observed variation in blood pressure outcomes. The variation at district level was significant for SBP and DBP, but not for hypertension.

The proportion of variation for district-level decreased between 2003 and 2010 for both, SBP and DBP. In the case of SBP, the district-level variation explained around 5 percent of differences of this outcome between districts in 2003, and in 2010 this proportion declined to about 2 percent. In turn, the proportion of the variation in DBP which was attributable to differences between countries diminished from about 7 percent in 2003 to around 2 percent in 2010.

Associations between blood pressure and district socioeconomic factors were stronger for SBP than DBP. After adjustment for individual characteristics, only the district income mean was significant in 2003, whereby, the higher the mean district income, the lower the risk of raised SBP in 2003. In 2010, schooling, unemployment rate and deprivation index were significantly related to SBP. These associations were in the expected direction, so that, people living in districts with lower level of schooling or higher unemployment rate, had a greater risk of raised SBP.

6.3 Discussion

This chapter aimed to assess the influence of area-level socioeconomic position (a district-level characteristic) on the variation in blood pressure between districts in Chile, using a multilevel approach. It was hypothesised that district-level socioeconomic characteristics would contribute to explaining some of the observed variation in blood pressure in Chile.

In order to test this hypothesis, a multilevel analysis was conducted using three measures of blood pressure as outcomes (SBP, DBP and hypertension) and including both individual- and area-level factors. Among the individual covariates added to the models were demographic, socioeconomic, behavioural and health-related variables. In turn, area-level SES exposures included overcrowding, schooling, unemployment, income, and a deprivation index. The socioeconomic index was built using the four area-level socioeconomic measures and similar weights were assigned to each measure.

Table 6.10 gives the summary results for the three outcomes and for the two surveys. The main conclusion of Table 6-10 is that inequalities in blood pressure across area-level SEP differed according to the outcome, the socioeconomic position indicator used and the year analysed. The following paragraphs examine these results in more detail, and attempt to link them with the project's hypothesis related to area-level SEP, and its effect on blood pressure.

In general, findings support, at least partly, the hypothesis of this thesis related to the role of area-level factors in explaining variations in blood pressure. Results of the multilevel analysis revealed that the variation of blood pressure at district-level was significant for SBP and DBP, but not for hypertension. About 5% and 3% of the variation in systolic blood pressure, respectively, was attributable to differences between districts in Chile in 2003 and 2010. For diastolic blood pressure, this proportion of variation explained at the district-level was 7% in 2003 and 2% in 2010. The remaining proportion (over 90% of the total variation in each outcome) was related to individual-level factors. Adding individual-level variables to the models showed that being older, being man, having family history of hypertension and the increment in BMI were consistently related to higher risk of raised blood pressure. When the individual SEP measures were included to the models at the same time, in general, these individual SEP indicators were not significantly associated to blood pressure.

Consistent with the hypothesis (e), the variation at district-level reduced in general when the area-level variables were introduced into models of SBP and DBP. This indicates that some district-level characteristics studied contributed to explaining some of the district variation in blood pressure in Chile, and suggest compositional rather than contextual role of area-based socioeconomic characteristics. Associations between blood pressure and area-level factors were significant only for SBP. After adjustment for individual characteristics (compositional factors), only mean district income was significant in 2003, whereby, the higher the mean district income, the lower SBP. Meanwhile in 2010, schooling, unemployment rate and deprivation index were significantly related to SBP and these associations were in the expected direction. So that, people living in districts with lower level of schooling, higher unemployment rate or higher deprivation, had higher levels of SBP.

These results showed that district-level characteristics accounted for up to 7% of the variation in blood pressure. Previous analyses of health outcomes using a multilevel approach with individuals nested in local areas have shown modest contextual area effects compared to individual-level effects.[419 428] For example, an analysis of 5,121 residents of 22 areas of Amsterdam found that the variation of poor health explained by area deprivation was small, although significant association of poor health with area deprivation was observed. In that study, self-rated health, physical complaints, long-term physical limitations, obesity and smoking were used as health outcomes and on average only 4% of variation was explained by area level (range 3-5%). This study in Amsterdam also reported that introduction of area deprivation measures into the models reduced the proportion of variation at area level by a half, indicating that those indicators explained half the variation in health outcomes between areas.[429] In similar analyses, district level characteristics have accounted for 5% to 10% of the variation in self-report of long term illness[430] and 3% of the variation in mental disorders.[431] Another study analysing geographical differences in diastolic blood pressure in Swedish women reported that individual characteristics accounted for most of the variation in DBP, while area-level characteristics accounted for less than one percent of the variation. [125] Results from the studies above mentioned, suggest that aggregate characteristics of individuals in small areas contribute more importantly in variation in health outcomes.

Effect of the different district-level SEP measures on blood pressure

Consistent with literature, results of the current study showed differences in the associations between each district-level socioeconomic indicator evaluated (including the deprivation index) and blood pressure measures. In this thesis the effect of each area-level socioeconomic indicator was analysed separately, as well as assessing the effect of the area deprivation index. In previous studies, however, when deprivation indices were used to analyse area-level inequalities in blood pressure, the effect of the individual components of the indices were usually not reported.[120,176,255,417]

Overcrowding

Findings of this thesis showed that overcrowding was not related to blood pressure, and did not have a role explaining differences in blood pressure across districts. This agrees with previous studies on area-level inequalities in blood pressure including overcrowding index as district socioeconomic position.[176,274,417] A study analysing the association between neighbourhood socioeconomic status and cardiovascular risk factors in two European countries also revealed no association between overcrowding index and hypertension in both countries.[126] However, the same study in European countries reported that overcrowding index tended to be significantly related to smoking and obesity.[274] Other studies have reported differences in the results according to the outcome and area-level indicator used.[419] This suggests that some characteristics of area or neighbourhood may be more or less related to health outcomes than others, and this may be explained by the possible underlying pathways present in each case.

Table 6-10 Summary of findings – socioeconomic inequalities in blood pressure 2003 and 2010

		Health outcome					
		SBP		DBP		Hypertension	
		2003	2010	2003	2010	2003	2010
% of total variance explained by district-level (empty model)		4.95%	3.15%	6.61%	2.36%	N/S	N/S
Inequalities across districts	Overcrowding	-	-	-	-	N/E	N/E
	Schooling	-	Social gradient	-	-	N/E	N/E
	Unemployment	-	Social gradient	-	-	N/E	N/E
	Income	Social gradient	-	-	-	N/E	N/E
	Deprivation index	-	Social gradient	-	-	N/E	N/E

Empty cells indicate that there was no evidence of social gradients. N/S: Not significant. N/E: Not evaluated.

Unemployment

The direct association observed in 2010, whereby the higher the unemployment rate the higher the level of SBP was not consistent with previous studies. The same research which analysed overcrowding as area-level SEP also used unemployment rate to study the role of neighbourhood socioeconomic status on cardiovascular risk factors. [274] No association was found between unemployment and hypertension neither in Germany nor in Czech Republic. However, inverse gradients were observed for obesity and physical activity in Germany and for smoking in both these countries. Findings of this thesis suggest that inequalities captured by unemployment at area-level may be increasing, since these were observed in 2010 but not in 2003. However, further comparison is not possible because there are no other studies analysing changes over the time in area-level inequalities in blood pressure by unemployment level. Further research including analyses of trend in area-level socioeconomic inequalities in blood pressure could help to understand how these inequalities evolve over time.

Schooling

Inequalities across area-level schooling showed a significant association, after adjusting for individual factors, only for SBP and only in 2010. Districts with lower levels of schooling showed higher levels of SBP. This is partially consistent with previous literature. A longitudinal study of the association between DBP and area of residence in Swedish women found that area educational level had a contextual effect on diastolic blood pressure, which was not captured by individual educational level.[125] Two studies analysing neighbourhood factors and its association with systolic blood pressure in France in 2008 and 2010, both studies used path analysis to assess the mediating role of different risk factors of hypertension. [116,128] An inverse gradient was reported in both studies, whereby, systolic blood pressure increased with decreasing neighbourhood educational level. Path analysis indicated that nutritional indicators and resting heart rate were the most important intermediate variables contributing to the association between area-level education and blood pressure. In contrast, a study carried out in Buenos Aires, Argentina investigating the association of individual- and area-based SEP with chronic disease risk factors, reported no association between hypertension and area-level education.[144] However, this Argentinian study did not use MLM to analyse the 2-level socioeconomic measure, therefore these results may not be comparable with those using MLM approach. Although there still are a few previous studies investigating the association between education at area-level and blood pressure, all suggest a consistent pattern in which people living in areas with lower education level tend to have higher blood pressure than those in most privileged areas. [125,114,126]

Income

Only a few studies have examined the association between area-level income and blood pressure and the results were not consistent.[116,211,273] A Chinese study found a direct association between community income and blood pressure in rural areas, whereas no association was observed in urban areas.[211] Meanwhile, a French study reported that area-level income was not related to blood pressure, although an inverse gradient of blood pressure across area-level education was reported. [116] Research in Colorado, USA analysed the prevalence of various cardiovascular disease risk factors across categories of community affluence, but no significant differences were found.[273] Other studies analysing socioeconomic area-level inequalities in blood pressure, have measured income, but it is only included in deprivation indices, no results are reported for just income.[120,176,271]

Deprivation index

Area-level deprivation index was significantly inversely related to blood pressure but only for SBP and only in 2010. Inverse gradients in blood pressure have been reported across deprivation index levels, while other studies have found no association. Chaix et al., reported significant inverse association between SBP and area-level index in France using MLM to account for hierarchical structure of data.[128] Two indicators were used to construct this area-level index, education and population density.[128] Another study in Philadelphia, USA, analysing the associations of prevalence of hypertension with SEP at the neighbourhood level using multilevel regression analysis found that area-based index was inversely related to hypertension.[135] Other studies have also reported an inverse association between deprivation index and blood pressure. However, these did not use multilevel regression modelling in their analysis, and therefore, the results may be less robust.[83,120,176,270,271] Unlike, in a Swedish cross-sectional study no association was found between hypertension and neighbourhood-level deprivation index. This study in Switzerland did not use MLM approach to analyse hierarchical data, therefore is less comparable with findings of this thesis. [255]

Area-based composite deprivation indices have been used in public health, as well as in social sciences.[432] Deprivation indices are usually based on aggregated personal information and can include a wide varying of combination of variables.[60,419] This implies that there may be also a wide range of different composite indices. One advantage of this type of index includes the possibility to present the results using a single underlying concept of area socioeconomic status, integrating economic, cultural and structural characteristics of areas.[419] These indices also allow inclusion of highly correlated area-level variables, which may otherwise lead to collinearity in models. However, indices may mask variation in that some areas may have the same score but the constituent variables may have contributed with different values to that score.[419] In this thesis, multilevel analyses were separately performed using each of the components of the area-level SEP index, and finally the index including these indicators was used in the models. In this way, the effect of each socioeconomic dimension on blood pressure was assessed, as well as, the combined effect of all of them.

Changes between 2003 and 2010

In Chile three of the socioeconomic indices included in multilevel analysis showed an improvement between 2003 and 2010. Overcrowding index in whole country decreased from 0.87 in 2003 to 0.80 in 2010, whereby there were less people per room. The number of years of schooling increased from 9.8 to 10.3 between the two years, while income mean (in 100.000 Chilean pesos) in whole country showed an important raise from 6.0 to 7.8. The unemployment index remained equal between the two years. Comparison between districts with the best and the worst indices in both, 2003 and 2010, shows that inequalities may have diminished in overcrowding, may have remained stable in schooling and in unemployment, and may have increased in income mean (Table 6-11).

Table 6-11: Descriptive characteristics of socioeconomic indices at district level

	2003			2010		
	Best district	Worst district	Difference	Best district	Worst district	Difference
Overcrowding	0.54	1.18	0.64	0.53	1.08	0.55
Schooling	14.94	5.31	9.63	15.67	6.03	9.64
Unemployment	1.87	20.11	18.24	1.94	20.29	18.35
Income	34.45	1.48	32.97	37.32	2.89	34.43
Index of deprivation	0.15	3.73	3.58	0.08	3.53	3.45

In this thesis, the proportion of variation in blood pressure at the district-level was higher in 2003 than 2010 for SBP and DBP. This suggests that blood pressure outcomes may be less sensitive to contextual characteristics and individual characteristics possibly played a more important role in 2010. However, in 2003 only area-income was associated with blood pressure, while in 2010 area-schooling, unemployment, and the deprivation index were each significantly related to blood pressure. Previously, a longitudinal study in China reported a direct association between hypertension and community income in rural areas. Additional analysis of time trend in the Chinese study showed that the association between income and hypertension weakened over time.[211] Changes over time in the association between socioeconomic area-level factors and blood pressure, may reflect the development of compensatory mechanisms at area level, and these in turn, would be related to the pathways through which characteristics at area level affect blood pressure. In the case of Chile, figures suggest that income inequalities may have increased over time; however in 2010 this indicator was not significant. Therefore, other factors compensating for changes in blood pressure may explain the results observed. On the other hand, considering that descriptive analysis suggests that inequalities in unemployment, schooling and deprivation index have remained stable or decreased over time, the increased effect of these indicators on blood pressure between 2003 and 2010, may be associated to other social conditions (related to these indicators) which may have deteriorated over time. However, there are no studies or reports that analyse these factors at district level over time in Chile. Further research may help to elucidate how and why inequalities at district level evolve over time.

Mechanisms explaining place differences in chronic diseases

There is an important body of evidence supporting the idea that health outcomes depend not only on individual characteristics but also on the surrounding environment in which individuals live and work.[419] Several potential causal pathways have been suggested to explain how social context translates into biological conditions and disease. Five mechanisms have been identified and these concern the physical environment, the cultural milieu, place deprivation, selective mobility and segregation. [433,434] Physical environment refers to people living in the same place, for example, share water supplies and suffer similar level of pollution. These area-level characteristics may interact with household or individual-level variables and the combination of these effects could increase or decrease the risk for a particular disease or health condition.[433] In Chile, a study analyzing cancer mortality reported geographic inequalities which may be related to regional differentials in environmental exposures. [435]

The second mechanism, cultural milieu, refers to individual interactions with specific local cultures. This relates to social processes occurring over geographic space. People create local cultures with routines, practices and structures defining the local context. In turn, this context conditions people, through providing the setting in which people learn and respond to societal demands. In this way, the setting or social norms and culture influence personal habits and as a result, attitudes and behaviours are socially patterned by area-level characteristics.[436] In Chile, inequalities at district level in cancer mortality may be related to dietary patterns. [435] In the case of blood pressure, patterns of behaviour may affect the behavioural determinants of high blood pressure, such as physical activity, dietary pattern and smoking.

Differences in health across areas may be also related to processes associated with place deprivation. Place-based deprivation refers to meagre access to local goods and services such as transportation play areas, healthy food among others.[83,135] This mechanism may be related to area-level differences in blood pressure, since local context may influence cardiovascular health behaviours such as smoking, physical inactivity and dietary habits. [255,428] In Chile, access to goods and services varies across districts. In general, more affluent districts have higher amount and quality of good and services. For example, a report about availability of green spaces and recreation places in the metropolitan area in

Chile, showed high inequalities between districts. Therefore have different access levels to these types of spaces according the district where they live, and this may affect the chance to make physical activity.[437]

A fourth mechanism contributing to area-level differences has been identified and is related to selective mobility.[433,438] This phenomenon refers to the fact that people, according their health status, tend to move from most deprived areas to less deprived and vice versa. A study analyzing the contribution of migration in place-specific rates of illness in England and Wales found that in twenty years (1971-1991) health inequalities between areas increased, and migration, rather than changes in the deprivation of the area, accounted for the majority of change.[438] In Chile, there are no studies about selective mobility, but considering some districts and health care provider characteristics, it is possible to conjecture that this phenomenon may occur in two situations. First, people with chronic diseases may have a decrease in their income and therefore may tend to move from affluent districts (with high cost of living) toward less affluent or poor districts, in order to have more affordable costs of living. Moreover, due to geographical characteristics of Chile, some districts are very isolated, thus people living in these places need to travel several hours to go to the regional hospitals, so that, it is likely that patients with complex health care needs, tend to move to districts where the hospitals are located.

The fifth factor associated with differences between areas is residential segregation. This refers to spatial separation of population groups along racial and/or economic lines.[434,439] Although most evidence about segregation refers to racial residential segregation, the processes would apply equally to other subgroups as well as to economic segregation.[434,440] Evidence suggests that poor people living isolated in poor areas have worse living conditions, leading to poorer health, lower education, and higher criminality rates than those poor living in more heterogeneous areas.[434,441-443] It is hypothesized that segregation may affect health through quality of contextual environment, concentration of poverty, lack of positive models or shaping socioeconomic attainment.[434,443,444] In Chile, high economic residential segregation by districts has been reported, in particular in the largest cities.[443,444] In this manner, there are districts where most affluent people live and others where poorer people settle, so determining differentials in health risks.[443] This mechanism, as well as the previous described may determine differences in blood pressure at district level in Chile. However, variables related to these mechanisms were not available in the datasets used in this thesis. Considering the limited evidence about area-level health inequalities in Latin America and in Chile, further research is needed to enhance knowledge in this topic and to contribute to the design of effective public policies.

6.4 Conclusions

Analyses presented in this chapter suggest that socioeconomic district-level factors have significant associations with blood pressure in Chile.

1. Using a multilevel approach, results showed that district-level socioeconomic factors contributed to explaining some of the variation in blood pressure among districts in Chile. In this way, districts clustering according to socioeconomic characteristics have a role in explaining differences in blood pressure.
2. Variations at district level were significant for SBP and DBP, but not for hypertension. The proportion of variation in blood pressure explained by differences among districts was higher for SBP than DBP in 2003 and vice versa in 2010.
3. In 2003 people living in districts with lower income mean tended to have higher risk of raised SBP. Overcrowding, schooling, unemployment and deprivation index were not related to SBP in 2003.
4. In 2010 individuals living in districts with lower schooling, higher unemployment and higher level of deprivation showed higher risk of raised SBP. Overcrowding and income were not associated to SBP in 2010.
5. Although analysis showed significant variation of DBP at district level, area-level socioeconomic measures were not associated to DBP in 2003 or 2010.
6. Although there is variation of SBP and DBP by area, area-level SEP indicators seem to be less important than individual level characteristics in explaining district-level variations.
7. Pattern of inequalities at district level may be changing over time. Further studies are needed to explain these findings and gain further understanding on the potential mechanisms linking area-level socioeconomic factors and blood pressure.

Chapter 7.Discussion

In this chapter the findings of chapter 5 and 6 are discussed and factors contributing to changes in inequalities in blood pressure between 2003 and 2010 are also considered (section 7.1). In addition, explanations for the differences in blood pressure inequalities by gender (section 7.2) and by age group (section 7.3) are examined. The methodological issues that might have affected the findings both in positive and negative way are also considered (section 7.4). The next section presents suggestions for future research in areas relevant for this thesis (section 7.5) and the chapter concludes by discussing the potential policy implications of the results of this thesis (section 7.6).

7.1 Inequalities in blood pressure at individual and at district level in Chile in 2003 and 2010.

Findings of this thesis support the hypothesis that there were inequalities in blood pressure in Chilean adults in both 2003 and 2010 at both individual and district level. Also consistent with the hypothesis of this thesis, results at individual level suggest that inequalities in blood pressure tended to diminish between 2003 and 2010, unlike socioeconomic inequalities at district level which seemed to increase over time.

Results of this thesis are consistent with previous studies showing that health inequalities are explained mainly by socioeconomic factors at individual level. In the case of Chile individual factors accounted for 93% or over of the variation of blood pressure, while district-level characteristics accounted for up to 7% of this variation. In previous analyses, individual characteristics account for most of the variation in health, while district-level characteristics account for no more than 10% of that variation.[419,428,430,445] For example, a study carried out in the United Kingdom, analysing individual and area characteristics, reported the proportion of total variation attributable to the individual level was greater than district level variation. In this British study the "district effect" corresponded to around 5% and 10% of the total variation for men and women respectively.[430]

Considering the results of this thesis, where inequalities in blood pressure were explained by individual and district-level factors, public health strategies should consider interventions at both individual and area level in order to reduce disparities in blood pressure. While, conceptual frameworks for social determinants of health consider that area-level factors are also relevant when designing public health policies, although inequalities are explained in a higher proportion by individual characteristics.[39-41,48,238,274]

Inequalities in blood pressure across individual socioeconomic status found in this thesis are consistent with literature (Appendix 1). Inverse gradients of blood pressure across SEP have been more commonly reported than other types of associations (Appendix 1). However, evidence has shown that the type of association between blood pressure and social status may be related to the level of nutrition transition of a society, and therefore, with the level of development of the country.[198,199,311,312] Chile, although a middle income country, can be considered in an advanced stage of nutrition transition, and therefore higher risks are observed in those less privileged. [198,199]

Findings showing inequalities in blood pressure at district level are consistent with previous studies[113,116,120,125,135] which found significant variation of blood pressure across area level socioeconomic indicators, and at the same time, reported higher level of blood pressure in most deprived areas. All the studies reporting inequalities in blood pressure across area level socioeconomic measures used indices as area-level SEP, with only one exception which used mean educational level.[125]

Changes over time of inequalities in blood pressure at individual and district level

Results of this thesis suggest that inequalities at individual levels may have diminished at both, individual and district level between 2003 and 2010. Inverse gradients of blood pressure across individual SEP measures were more commonly observed in 2003 than 2010. In turn, the proportion of variation of blood pressure attributable to differences between districts decreased over time for the two outcomes analysed (SBP and DBP). However, multilevel analysis showed significant association between blood pressure and area-level SEP only for SBP, and this was observed only for income in 2003 and for schooling, unemployment rate and deprivation index in 2010.

Changes over time in inequalities in blood pressure in Chile at individual and at district level, are consistent with socioeconomic circumstances in Chile at these two levels of analysis. According to official statistics, the proportion of people living in poverty has decreased between 2000 and 2010, and at the same time, the Gini index has diminished between these two years showing a decrease in income concentration in Chile. [26] In addition, descriptive analysis of three of the four SEP measures included in multilevel analysis of this thesis, suggest that socioeconomic circumstances of people in Chile have increased between 2003 and 2010 (Section 6.3, page 297). However, it is not possible know whether socioeconomic inequalities between districts have decreased, since there are no studies comparing SEP measures at district level between 2003 and 2010 in Chile, and descriptive analysis of differences between districts of SEP measures included in multilevel analysis is not conclusive (Section 6.3, page 298).

In 2005 in Chile, an important public health policy was implemented named Regime of Explicit Health Guarantees (Plan AUGE). This program establishes an explicit sub-set of guarantees to access, quality, opportunity, and financial protection. The group of health conditions guaranteed were prioritised based on epidemiological criteria. This Regime guarantees access to health care to whole population and defines a maximum waiting period for receiving services at each stage (opportunity); the set of procedures necessary for treating the medical condition (quality); and the maximum that a family can spend per year on health (financial protection). In 2005 hypertension was included in this regime due to its high prevalence, therefore since that year everybody who suffers from hypertension in Chile receives health care with the four guarantees mentioned. [446,447] Some studies analysing the trend of inequalities in health care and health coverage in Chile between 2000 and 2009 have suggested that the Chilean health system has become more equitable and responsive to need. Although changes cannot be directly attributed to the Regime of Explicit Health Guarantees (AUGE), they were coincident with the AUGE reforms.[448,449] Therefore, it is possible that socioeconomic inequalities in access to care and in quality of treatment of hypertension have diminished between 2003 and 2010.

7.2 Gender differences in the association between individual SEP and blood pressure

Gender stratified analysis provides support for the hypothesis that social inequalities in blood pressure are higher in women than men. Although, patterns of inequalities were different according the socioeconomic measure used, inverse social gradients were most commonly found in women.

In 2003, women with lower levels of education showed consistently higher risks than those most educated, and this was observed for the three outcomes before full adjustment. After adjustment, inverse gradients were also observed for the three outcomes. Social gradients were also found for SBP and hypertension across assets-based index in women in 2003 before full adjustment, but estimates for hypertension were no longer significant in the fully adjusted models. U-shaped curves of SBP and DBP across occupations were observed in women in 2003 after adjustments, whereby those in the intermediate level of SEP showed the lowest levels of blood pressure.

In 2010, inverse gradients across education and assets-based index were found in women in the age-adjusted models and in the fully adjusted models only for SBP. Meanwhile, a direct educational gradient was observed for DBP in women in 2010 before and after full adjustment.

In men, inverse gradients were found for SBP across assets-based index in both, 2003 and 2010, before and after adjustment. Inverse gradient were also observed for SBP across education and occupation but only in 2010. (Table 5-65).

Gender stratified analysis of relative and absolute inequalities across educational levels were consistent with findings in multivariable analysis, with significant differences only found only in women. In 2003, RII and SII in women were significant for each of the three outcomes, while in 2010, there were only relative inequalities in women for SBP.

Overall, analyses stratified by sex showed that social gradients in blood pressure were most commonly observed in women, in particular in 2003, and when the exposure was education. This is consistent with several studies showing an inverse gradient between SES an blood pressure in women but not in men.[55,98,99,102,103,105,106,111,118] In Latin America, some studies found a different pattern of social inequalities by gender.[10,149,165,193,450] One study carried out in the city of Buenos Aires, Argentina, reported inverse gradients in the prevalence of high blood pressure across education and income in women, and no association either of these socioeconomic indicators in men. [193] Other studies undertaken in Mexico, Panama and Brazil, observed that education was inversely related to blood pressure only in women. [148,149,152] Findings of this thesis for survey in 2003 suggest that women might be more vulnerable to the effects of low education on blood pressure than men. Studies about the effect of socioeconomic inequality on women's health have suggested that a comprehensive approach should be used for understanding the socio-economic pattern in the outcomes of women's health.[301] From this point of view, factors such as political environment, culture and norms, women's roles and health-related mediators should be considered when examining socioeconomic inequalities in health in women. [301] Other authors who analysed differences in the association between education level and blood pressure by gender, have observed that women with low SEP have higher risk of co-occurring psychosocial determinants of poor health than men in the same socioeconomic group. In this manner, single-parenting, low income, stress outside work, and depression, may affect most importantly to women, leading a poorer health.[118,200] Considering this approach, it seems relevant to analyse the role of some factors of vulnerability on inequalities in blood pressure in Chilean women.

Single parenting

In Chile there is an important proportion of single women heads of households, and this has increased from 25% in 2003 to 28% in 2011. [332,451,452] This proportion is higher in the households in the poorest quintile of income (32% in 2003 and 37% in 2011), than those in the most affluent quintile (18% in 2003 and 2011).[453,454] The relation between female headship and poverty has been reasonably well studied.[413] McLanahan et al., have identified three determinants of low income in mother-only families; these are (1) the low earning capacity of the mother, (2) the lack of support from the father, and (3) the deficient benefits provided by the state.[455] The earning capacity of women is influenced by the fact that the main earners of these households, are by definition women who have, on average, lower earnings than men. Gaps between men and women's wages have been widely reported. Some authors have estimated that women receive on average 30% less than men in monthly wage and 20% less than men in hourly wage.[301] In Chile, official figures showed that in 2012 the average monthly income in women was 32% less than men. [456] In the United States it has been estimated that only about 58% of single mothers with children had financial father's support, and among these, only 50% receive the full payment. [455] In Chile, it has also been estimated that around 60% of non-resident fathers do not pay the child support.[457] According to McLanahan et al., the support from the state plays a role in financial vulnerability of female-headed families. In Chile, it has been reported in 1992 that female heads of household had significantly less access to government subsidies than men. [458] In this way, single female heads of households in Chile have a higher burden compared to male heads of household or other women, and this is more marked in the lowest levels of the social hierarchy. Therefore this may explain the higher health vulnerability in least privileged women compared with men in the same socioeconomic levels.

Employment

Another factor described as contributing to vulnerability in least privileged women, is that women in general receive less income than men. Firstly, women have consistently lower rates of participation in labour force and higher unemployment rates than men, particularly in middle and low income countries. The participation of women in labour market in Chile in 2012 was 55%. This rate can be considered low compared with high income countries (e.g., 71% in United Kingdom and 69% in Spain) and with other Latin American countries (e.g., 58% Colombia or 61% in Brazil).[459] The unemployment rate in 2011 in women was 50% higher than men (10% vs 6%). Second, as mentioned previously there is a difference between women and men's earnings. Finally, female workers in Chile tend to have more precarious jobs than men, and these are concentrated in domestic work which have lower average level of wages.[460] The level of participation in labour market and the lower wages in women may lead to women, not only to have less access to material resources, but also to have less power in making decisions, and less social networks. [461]All this in turn may shape the vulnerability of least privileged women.

Women's "double burden"

The concept "double burden" is used to describe the workload of people who have a paid work outside home, but at the same time, are responsible for significant amounts of unpaid domestic labour.[462] Some studies have reported that the "double burden" may determine higher stress levels, and therefore may impact in health status.[462-465] Gender differences in the time dedicated to face the double burden of paid and domestic work have been reported[463,466] Several studies have reported that women are more vulnerable to psychological distress and poorer health status than men as a result of this double burden. [462-465,467] In Chile, the double burden faced by women may be exacerbated due to the society being considered very conservative compared with those in developed countries. Chilean women, despite have increased their participation in labour market, continue in charge of domestic chores. A study carried out among Chilean female workers found high rates of depression and anxiety syndrome, which may be related to this double burden that they face.[468] Although the double burden crosses socioeconomic levels, most privileged women can lessen it with hired help in the house, which cannot be afforded by the least privileged women.

7.3 Age differences in the association between individual socioeconomic position and blood pressure

Age stratified analysis of the association between socioeconomic position and blood pressure were partially supported the hypothesis that there were greater social inequalities in blood pressure in younger people. Results indicated inverse social gradients were more commonly observed in people in middle age (40-59), than younger (20-39) and older groups (60 and over).

In people aged 20-39 inverse gradients were observed for SBP and hypertension across education and assets-based index in gender-adjusted models in 2003, and after full adjustment only the gradient of SBP across education remained.

In 40-59 age group, SBP was inversely related to education and assets-based index before and after full adjustment in 2003. Inverse gradients were also found in this age group for DBP across education and assets-based index before and after full adjustment in 2003. There was also an inverse association between education and hypertension in 2003. In 2010, social gradients were observed for SBP across education, assets-based index and occupation before and after full adjustment. There was a direct gradient between DBP and education in 2010 in people aged 40-59.

When inequalities were examined in people aged 60 and over, inverted j-shaped curves were found for SBP and DBP across education and across occupation in 2003. A j-shaped curve was also found for DBP across occupation in 2003. Moreover, an inverse gradient was observed for hypertension across assets-based index in the fully adjusted model in 2003. Meanwhile, in 2010 inverse gradients were found for SBP across education and assets based index before and after adjustment for covariates. There were no inequalities in DBP across any socio-economic indicator in 60 plus age group in 2010. In turn, a direct association was found between hypertension and occupation in people 60 plus in 2010.

Meanwhile, age stratified estimates of RII and SII, showed different patterns of the association between SEP and blood pressure and different levels of significance by age group according to the outcome and SEP indicator. In people aged 20-39 years RII and SII by education and assets-based index were not significant in 2003. In 40-59 age group, relative and absolute inequalities by education were consistently significant for all three outcomes in 2003. In this age group, relative and absolute inequalities were also found for SBP across assets-based index in 2003. In people aged 60 and over, RII and SII by education and assets-based index were not significant in 2003. In 2010, analysis in 20-39 age group showed no significant association for RII and SII with any of the SEP indicators assessed. In people aged 40-59 only absolute inequalities were found by education in 2010. In older people (60 plus) RII and SII by education and assets-based index were significant in 2010.

These findings showing differences in socioeconomic inequalities in blood pressure according the age group are consistent with previous studies. A comparison of educational inequalities of selected diseases between different age groups was reported by Dalstra et al. using national survey data from eight European countries differences of prevalence rates between educational levels were estimated. Higher inequalities in hypertension were found in people aged 25-59 than those aged 60 and over.[98] In turn, a cross sectional study carried out by Addor et al., in Switzerland, reported differences in social gradients according to outcome and age group. In people aged 15-35 those most educated had higher levels of DBP than those least educated. In middle age (35-55) these inequalities tended to vanish and emerge again in older adults (over 55). In younger people (15-34) those most privileged had higher level of SBP than those in the lowest social level. However, in people aged over 35 those least educated had consistently higher levels of SBP and the differences increased with age.[108]

Different authors have tried to explain how and why socioeconomic inequalities change across the life course. Some authors have proposed that socioeconomic disadvantages deepen and accumulate across life course, therefore, health inequalities grow as people age. Living environment, unhealthy work conditions, economic deprivation, and high levels of stress are among factors that would be detrimental to the health of the most deprived leading to increasing inequalities.[302-304] In addition, some studies have shown that socio-economic inequalities in health may expand until middle age and start to narrow again in old age. Two explanations have been suggested. These correspond to (1) mortality selection and (2) social security and medical care. [305,306] Mortality selection refers to that the most deprived people may accumulate disadvantages over time leading them to have a higher probability of dying at younger ages than those most privileged. Meanwhile, social security and medical care explanations, refer to that extensive welfare policies for old people may lead to reduce disadvantages in most deprived old individuals, and therefore, to a reduction in health inequalities.[304,306]

Findings of this thesis suggest that in Chile, the aforementioned theories may be acting in shaping social inequalities in blood pressure by age group. In the first place, the approach based on the effect on health of accumulative disadvantages, may explain why, in general, no association was found between socioeconomic status and blood pressure in the youngest age group (20-39), but at the same time, social gradients were commonly observed in people in middle age (40-59). Namely, early social disadvantages in Chilean people may be manifesting on blood pressure after four decades of accumulation of health damage. Secondly, in Chile, mortality selection may be acting in shaping the trajectory of blood pressure over life course. Differences in life expectancy at age 20 between the least and most educated groups were 12 years in men and 9 years in women in the period 2003-2006.[19] Finally, several policies focused on people aged 60 and more have been implemented in Chile in recent years. For instance, in 1996, the Ministry of Health set up the free access to medical care in the public health system for all people aged 60 plus. Additionally, in 2002, Chile created the National Service for Older Persons, developing policies in different areas such as, housing, leisure and physical activity, transport, health, among others. In this way, findings on social inequalities in blood pressure in Chile by age are concordant with these postulated theories, which identify factors that are shaping the trajectory over time of inequalities in health.

7.4 Strengths and limitations of the thesis

This section discusses the strengths and limitations of this thesis. It focuses first on generic limitations and strengths derived from sampling designs and handling missing data in both surveys. The next two subsections present the strengths and limitations of the analyses of individual socioeconomic position and its association with on blood pressure and the role of area-level socioeconomic characteristics in shaping inequalities in blood pressure in Chile.

7.4.1 Sampling designs and handling missing data

This section discusses issues about the potential bias related to sampling design, and missing data in 2003 and 2010 surveys.

Sampling design

The Chilean National Health Surveys (NHS) are the most important sources of information on health for the adult population in Chile. These surveys were designed to be nationally representative with the aim to be an official source to design and evaluate public policies in health in Chile. Prevalence of disease estimates based on the NHS surveys have been used systematically as official national and international statistics on health indicators, since design of these surveys allow inferring the results to the whole Chilean adult population.[16,18]

One strength of these surveys is the sampling procedures and selection processes (Appendix 2) and large number of variables being similar in both surveys, conferring comparability between 2003 and 2010.

The NHS surveys were designed using sophisticated sampling procedures and selection processes.[16,18] The first step in selection of the participants was made by the NHS technical team who updated all sampling maps in the field, before conducting the surveys. This work on maps allowed construction of updated sampling frames for both surveys.[16,18] The additional steps for selecting participants were based on methods to reduce sampling bias, so that households and respondents within the households were randomly selected.

In addition, the response rates in the Chilean surveys were high, 90% in NHS2003 and 85% in NHS2010, [16,18]compared with those for Health Surveys in other countries. For example, NHANES 2013-2014 in the United States and Health Survey for England 2012 had response rates of 67% and 64%, respectively.[469,470] The high response rates obtained in Chilean surveys, along the randomised sampling procedures used in both years, minimised selection bias in the two surveys.

Missing data

In both surveys relatively low levels of missing data were found (between 0% and 6% in single variables), although overall missingness for the set of variables included in the analyses of this thesis were 11% in 2003 and 16% in 2010. Ignoring missing data in analysis, may lead to biased results. Different methods have been proposed to dealing with missing data, from using complete cases approach to sophisticated procedures of imputation.[333,336] Including only complete cases in the analysis may introduce bias if there are systematic differences between complete and incomplete cases. . [323,325] In this thesis two methods to handling missing data were compared, complete cases approach and multiple imputations. Evidence suggests that multiple imputations may produce less biased parameter estimates than other techniques. [341,344 355,471355,471355,471355,471355,471]Comparisons showed no significant differences between results from analysis using complete cases approach and Multiple Imputations. Thus, complete cases approach was used, since potential bias may be considered similar for the both methods compared, and moreover, using complete cases approach has the additional advantage that allows a wider range of statistical methods to analyse the data than multiple imputation.

7.4.2 Analyses of individual level socioeconomic factors and its association with blood pressure

One of the strengths of this thesis is that it is the first study aimed to analyse association between socioeconomic position and blood pressure in Chile using multivariable regression models. In addition, it is one of the few studies analysing inequalities in blood pressure in Latin America that uses a variety of blood pressure measures, several individual socioeconomic indicators, demographic, behavioural and health-related covariates, and an estimation of both, relative and absolute inequalities. Also, it is the first study to analyse changes of inequalities in blood pressure over time in Chile, and in Latin America. In this way, the thesis makes a valuable contribution to the limited literature on inequalities in blood pressure and the factors associated with these inequalities in Latin American countries.

In addition, the outcomes used in both surveys were based on objective measures of blood pressure. In health research, it has been documented that objectives measurements avoid reporting bias observed in self-reports of disease, which can be influenced by the socioeconomic status (or other characteristics) of the people. Some studies have reported that educational level may influence the level of understanding of health information; therefore, people with less education may have less knowledge and awareness about their diseases.[55,56,62] The socioeconomic effect in self-reporting could lead to underestimating health problems in the most disadvantaged groups, and therefore social gradients could also be underestimated (or even reversed).[472-474] Although objective measures of blood pressure were available in both surveys, there was a limitation which is worth mentioning. The blood pressure measurement procedures were not identical in both surveys, so that, it was necessary to make an adjustment in order to have comparable outcomes for the both years. In 2003 two blood pressure readings were taken, while in 2010 three readings were made. Therefore, in order to provide comparability between 2003 and 2010 only first two measurements of blood pressure were used to estimate the average of both, SBP and DBP, which in turn, were used to construct the three outcomes used in this thesis (Section 4.3.1)(Appendix 2). This particularity in the blood pressure measures may limit the comparability of this study with other studies using the average of three measures of blood pressure to estimate their outcomes.

Other limitations of the analyses of socioeconomic inequalities in blood pressure should be noted. First, in 2003 there was a more limited number of variables related to socioeconomic status and risk factors of hypertension available. In this way, comparison of inequalities in blood pressure between 2003 and 2010 was limited to the exposures and covariates available in both surveys. In particular, in the case of material circumstances, only variables related to assets were included in the questionnaire 2003, whereas in 2010, besides assets, characteristics of the household were also included. For comparative purposes, an asset-based index was created using five asset variables available in both surveys. Therefore, restrictions in terms of data availability may be considered as a weakness of the asset-based index. Some covariates considered in previous literature to be risk factors for hypertension were also not asked in 2003. These were problem drinking, heart rate and family history of heart attack. They were included in additional analysis using only data from analyses 2010. Although estimations were undertaken using the additional variables available in 2010, it was not possible to evaluate how these estimates had evolved over time.

Second, some measures of socioeconomic position used have certain limitations; that is occupation, income and the two assets indices. In the case of occupation, and as was mentioned in section 5.8.1, two versions of occupation were used, one including both working and non-working individuals (divided into six categories), and the other including only workers (divided into three categories). The indicator with six categories has the advantage of including the whole sample. This is particularly important for women, since roughly 50% and 40% of women, respectively, declared being homemakers in 2003 and 2010 respectively. However, using this index, with six categories, has the limitation that, given its non-hierarchical nature, it does not allow evaluating social gradients in blood pressure. On the other hand, using occupational class including only workers (occupation variable with three categories) has the advantage of being a hierarchical measure, but it leaves out of the analysis practically half of the women. This issue is relevant considering that the findings showed inequalities in blood pressure were present mainly in women. An additional limitation of occupational socioeconomic status indicator is that in general, occupational classifications may fail in capturing hierarchy of women's occupations because these classifications are based on occupations dominated by men. [63,377]

In the case of income and assets based indices, it has been described in the literature that their limitations are related to the method of collecting the information and the fact that these correspond to household indicators.[303] The Chilean survey data was collected from a single household member, thus the respondent may be unaware of some household income or expenditures. Furthermore, household income or expenditure may not be representative of income or expenditure for individual members of the family since it is likely that these could be unequally distributed across household members. There was evidence that access to economic resources in households would be higher for men than women or children within a household.[374-376] This is particularly relevant for this research given that using these indicators may mis-estimate socioeconomic position of women, who, according to the findings, are the most exposed to inequalities in blood pressure.

Third, some covariates used in the analyses could have some limitations. First, physical activity was self-reported and based only on one question about frequency. It is not a validated measure, and therefore, may be less accurate than using a standardised instrument and it may affect comparability with studies using other instruments. Currently there are several standardised instruments to assess physical activity[475,476] which are recommended to use in population studies. Despite this limitation the same question about physical activity was used in both surveys, therefore allowing comparisons between 2003 and 2010. Considering that the incorporation of these standardised instruments do not require additional costs, it would be advisable to include these in future surveys, which may contribute to improving future research in physical activity in Chile. Second, alcohol consumption was not measured in accurate way. It has been measured by the AUDIT score in this thesis.[477] This is a standardised instrument used as a proxy of alcohol consumption, due to the lack of other, more objective measures. However, this instrument was designed to identify alcohol-related problems; therefore, this may have less sensitivity to detect low but potentially risky levels of drinking. [477] Furthermore, as it has been reported that women are less likely to have drinking problems[478,479] this instrument may fail in capturing alcohol consumption particularly in women.

Some other methodological considerations are also worth mentioning. Even though this project was not intended to establish causation, but rather to identify associations, the cross-sectional nature of the design makes results particularly prone to reverse causality. Reverse causation is particularly important when analysing socioeconomic inequalities, since social gradients may be the result of a process through which sickness lead to income loss and/or lower educational achievement, and not vice versa.[480]

Another methodological limitation is related to estimations of RII and SII. In some cases it was not possible to derive RII and SII using log-binomial regression models due to non-convergence issues and robust Poisson and linear regression models were used instead. However, sensitivity analysis undertaken in cases where convergence was achieved with log-binomial regression showed that estimates obtained from alternative regressions were very similar.

7.4.3 Analyses of area-level socioeconomic characteristics and its association with blood pressure

This analysis, as far as I am aware, is the first analytical study t to analyse how the area-level socioeconomics characteristics influence inequalities in blood pressure in Chile, and at the same time, to assess how this role has evolved over the time.

Socioeconomic Characterisation Surveys (CASEN) was used to estimate the area-level socioeconomic indicators.[331,332] CASEN surveys are undertaken by the Ministry of Social Planning and are used to develop and evaluate public policy in a wide range of subjects. These surveys are carried out periodically and their samples allow analysis at national, regional and district levels. Given that these surveys have been designed to evaluate public policies, they include a substantial number of socioeconomic variables which allow construction of area-level indicators.

In addition, it is worth mentioning further two methodological considerations related to using sampling weights in multilevel analysis. First, as mentioned in section 6.1, when MLM is used to analyse complex survey data, it is advisable to include design weights into the models to account for the unequal selection probabilities. In this project, due to only one survey weight being available for each survey, and no information to estimate the weight for the district level being available, equal probability sampling was assumed at this level (Level-2 weight=1).[280,424] The second methodological issue is related to the scaling method of weights. The inclusion of sampling weights to multilevel analysis requires scaling weights. [280,421] There are two methods to scale weights and the choice of the appropriate technique is based on the size of clusters. For this project the method used was scale-size method, since this has been recommended when the clusters size is higher than 20, and in both surveys most clusters (districts) had more than 20 individuals (58% in 2003 and 78% in 2010). [280,421] However, considering that there were two other additional alternatives to carry out multilevel analysis with sampling weights, using unweighted data and using scale effective method,[303,478,480] sensitivity analysis were performed using these two methods. Results of sensitivity analysis showed that estimates using scale-size method and unweighted data were very similar unlike estimates using scale-effective method that showed different results in particular in significance of district-level variance.

7.5 Future research

Some research opportunities have arisen from this thesis. First, the possibility of using relevant statistical methods to analyse inequalities across individual and contextual socioeconomic circumstances could encourage researchers and enhance research of health inequalities in low and middle income countries. Replicating these methods of analysis to other health outcomes or diseases with high burden of morbidity or mortality can prove valuable for monitoring health inequalities and help to build public understanding of these from a social determinants perspective.

Second, additional research could be carried out applying this approach to examine the role of other individual factors and contextual dimensions potentially influencing inequalities in blood pressure such as, stress factors,[243,244] social support[481], or work conditions[482-484] among others. This would allow advancing understanding of social determinants of health which is neglected in current research in Latin America.

This research has shown that there were socioeconomic inequalities in blood pressure in Chilean adults and this was more marked when systolic blood pressure was the outcome. Analysis using multilevel approach also showed that inequalities in blood pressure across districts were more evident when systolic blood pressure was used as outcome. Some explanation has been proposed to explain patterns of social gradients in blood pressure, in particular those related to gender, age and the SEP measure, but to date, scarce research exists examining differences in patterns of socioeconomic inequalities according the blood pressure measure. Future research should explore the mechanisms leading to these differentials on socioeconomic inequalities in blood pressure and the factors operating in shaping these social gradients. The knowledge and understanding of these elements would shed light on determinants of blood pressure inequalities and its monitoring.

Findings on blood pressure inequalities across individual and district level socioeconomic position, showed changes over time from 2003 to 2010 with no consistent patterns for the different socioeconomic indicators. Different trends have been reported in studies carried out in high income countries. [83,113,116,126,128,135,144,176,211,255,271,272] Assessing the trend of inequalities in blood pressure including more time points would help to gain further understanding on this area. In addition, the study of time trends for specific subpopulation groups (by gender or age-group) would allow testing some of the hypothesised explanations for findings of this thesis.

7.6 Policy implications of Findings

Several policy implications emerge from this project. In the first place, the study of socioeconomic inequalities in blood pressure at different levels enhances understanding of factors producing them and helps to identify vulnerable groups of population. Therefore, this also enhances capacity to appropriately guide national and local strategies to tackle inequalities in blood pressure.

Different areas of interventions have been described to address inequalities in health and these include interventions directed to structural factors, such as policies on taxation; intervention on behavioural and life styles; actions improving health care access, programmes strengthening disadvantaged communities and interventions targeting specific groups of population.[485] The results of this thesis identifying more vulnerable groups of population of having socioeconomic inequalities in blood pressure such as women, people aged 40-59 and the most deprived districts are valuable steps that will advance the design of programmes focused on reducing these inequalities.

Findings also revealed that obesity was the most important individual factor influencing inequalities in blood pressure. There is an extensive body of evidence showing the influence of body mass index on blood pressure and reporting socioeconomic inequalities in overweight and obesity. Given the relevance of this health problem and the observed social gradient, even in high income countries, several guidelines and recommendations have been developed to address it. [486,487] The role of nutritional status on inequalities in blood pressure and the relevance of inequalities in overweight and obesity itself, provides support for including strategies to address inequalities in overweight and obesity as part of policies tackling inequalities in blood pressure. These policies in turn, involve the design of strategies related to behavioural and life style factors such as healthy diet and physical activity.

This study also allowed identifying more vulnerable districts with respect to blood pressure and provides information about what are the district-level factors influencing inequalities in blood pressure. Considering that there is some evidence that area-based interventions contribute to reduce health inequalities, the results obtained in this project provide valuable insights for policy development in local areas.[485,488]

Results of this thesis allowed comparing socioeconomic inequalities in blood pressure between 2003 and 2010 and at individual and area levels. The persistence of blood pressure inequalities over time suggests that strategies implemented to date have not been completely successful in tackling important determinants, and therefore revisions of these policies are advisable. The World Health Organisation has identified four intervention areas of policies which may impact on social determinants of health and these are 1) interventions to reduce inequalities in the distribution of the socioeconomic factors (structural determinants) such income or education, 2) programmes related to the specific intermediary determinants mediating the effect of social status on health, such as smoking or working conditions, 3) policies to address the adverse effect of health status on socioeconomic position. This implies to avoid the worsening in socioeconomic position in ill people by strategies to maintain people with chronic diseases within the workforce, and 4) strategies to deliver curative healthcare with focus on people in lower socioeconomic position. In Chile, some policies focused on women and implemented during the last decades, may have impacted in reducing health inequalities. In 1991, the Government of Chile created the Women's National Service (Servicio Nacional de la Mujer-SERNAM) with the objective to design and coordinate policies to improve the women situation. In 1996 a program targeting female headship was chosen as priority in order to contribute to increase incomes, improve welfare, and fight gender discrimination.[413] Another strategy implemented in 1996, focused on women who work, was implemented and was aimed to improve their conditions by providing them child care and by extending the hours of operation of health clinics to accommodate the time of working women. [414] In addition, in 2008 two subsidies were created to support to women, such as bonus for female head of household, and bonus to women per children.[489,490]

The design of new policies, as well as evaluation of those policies implemented in the past, require a monitoring system. It has been recommended that countries should identify a small number of health indicators to be included in systems to monitor inequalities in health. These indicators should be tracked over time and across local or regional areas. Tracking trends in key health indicators and between areas will enable policymakers to evaluate health inequalities over time and identify areas in need of intervention.[491,492] Findings of this thesis showing indicators being better capturing health inequalities in blood pressure represent an important contribution to monitoring in health inequalities.

Chapter 8.Conclusions

Analyses presented in this thesis suggested that there are socioeconomic inequalities in blood pressure and these are present mainly in women and in people in middle age (40-59 years). These inequalities in women and in people aged 40-59, although decreased over time, still persisted in 2010.

Findings also showed that there are area-level socioeconomic factors influencing the variation of blood pressure across districts.

Education was the socioeconomic position measure that better captured inequalities in blood pressure at individual level and SBP was the outcome most sensitive to socioeconomic inequalities at both, individual and district levels.

Further studies analysing the potential mechanisms shaping socioeconomic inequalities in blood pressure in Chile may contribute to the understanding of this phenomenon and to tackling these unjust social differences.

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Appendix 1. Summary tables of the literature review

Table A1. 1: Characteristics of reviewed studies on the inverse association between education and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
1	Dyer AR *[2]	1976	USA	Cross Sectional	27,033	Both	25 - 64	Age, heart rate, relative weight	I	I	I	1
2	HDFP *[2]	1977	USA	Cross Sectional	158,906	Both	30 - 69	Age, weight ratio, sex and race	N/R	N/R	I	1
3	Tuomilheto J *[2]	1978	Finland	Cross Sectional	10,951	Both	25 - 58	not reported	N/R	N/R	I	3
4	Keil JE *[2]	1981	USA	Longitudinal	455	Female	35 and over	Age, skin color.	I	I	N/A	1
5	Liu K *[2]	1982	USA	Longitudinal	11,027	Both	40 - 59	Age, heart rate, relative weight	I	N/R	N/R	3
6	Sear M[101]	1982	USA	Cross Sectional	5,465	Both	18 and over	NR	N/R	N/R	I	1
7	Mulcahy R *[2]	1984	Ireland	Cross Sectional	1,560	Male	N/R	Age	I	I	N/R	1
8	Jacobsen BK *[2]	1988	Norway	Cross Sectional	12,368	Both	30 - 54	Age, BMI, PA, smoking, alcohol consumption, bread consumption	I	I	N/R	1
9	Millar J *[2]	1986	Canada	Cross Sectional	13,846	Both	20 - 69	Age	N/R	N/R	I	1
10	Lang T *[2]	1988	Senegal	Cross Sectional	1,315	Male	16 - 64	Age, BMI, ethnicity	N/A	I	I	1
11	Matthews KA *[2]	1989	USA	Cross Sectional	541	Female	42-50	Age, LDL, HDL, glucose, BMI	I	I	N/R	1
12	Dressler WW *[2]	1990	USA	Cross Sectional	186	Both	25-55	Age, BMI, style of life	I	I	I	1
13	Rossouw JE *[2]	1990	South Africa	Cross Sectional	5,620	Both	20-60	Age	N/R	N/R	I	3
14	Winkleby M *[2]	1990	USA	Cross Sectional	3,349	Both	25-74	Age, time of survey	N/R	N/R	I	1
15	Ford E[493]	1991	USA	Longitudinal	7,073	Both	25 - 74	Age, heart rate, cholesterol, BMI, alcohol consumption, Physical activity, magnesium level	N/R	N/R	I	1
16	Klag MJ *[494]	1991	USA	Cross Sectional	457	Both	35-74	Age, BMI, serum urea, glucose, urine sodium, potassium,	I	I	N/R	1
17	Shewry MC *[2]	1992	Scotland	Cross Sectional	10,359	Both	40-59	Age	I	N/R	I	1
18	Sorel JE *[2]	1992	USA	Cross Sectional	11,554	Both	25 - 74	Age, BMI	I	I	I	1
19	Stamler R *[2]	1992	52 countries	Cross Sectional	10,079	Both	20 - 59	Age, BMI, alcohol consumption, sodium, potassium, smoking	I	I	N/R	1

Table A1. 1 (cont.): Characteristics of reviewed studies on the inverse association between education and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
20	Winkleby M [55]	1992	USA	Cross Sectional	2,380	Both	25 - 64	Age, time of survey	I	I	N/R	1
21	Colhoun H *[2]	1993	England	Cross Sectional	1,994	Both	N/R	Age, BMI	N/A	I	I	1
22	Garrison RJ *[2]	1993	USA	Longitudinal	2,846	Both	25 - 64	Age, BMI, smoking, alcohol consumption	N/R	I	N/R	1
23	Luepker RV *[2]	1993	USA	Cross Sectional	3,243	Both	2 - 74	Age	N/R	I	N/R	1
24	Reynes JF *[2]	1993	USA	Cross Sectional	3,765	Both	25 - 64	time of survey, ethnicity	N/R	N/R	I	1
25	Svetkey LP *[2]	1993	USA	Cross Sectional	4,163	Both	65 and over	Age, BMI, race, diabetes, salt intake, Physician visits, smoking	N/R	N/R	I	1
26	Gupta R *[2]	1994	India	Cross Sectional	3,148	Both	20 - 69	Age	I	I	I	1
27	Jaglal SB *[2]	1994	Canada	Cross Sectional	2,532	Both	30 - 74	Age	N/R	N/R	I	3
28	Piccini R[139]	1994	Brazil	Cross Sectional	1,657	Both	20-69	Sex, age, skin colour	N/R	N/R	I	1
29	Bennet S[121]	1995	Australia	Cross Sectional	19,315	Both	25 - 64	Age, survey year, survey centre, birthplace	I	I	N/R	1
30	Hoeymans N*[2]	1996	Netherlands	Cross Sectional	36,000	Both	20 - 59	Age, BMI, Smoking, alcohol consumption, PA.	N/R	N/R	I	1
31	Bobak M[102]	1999	Czech Republic	Cross Sectional	2,353	Both	25 - 64	Age, district	N/A	I	I	1
32	Dyer A[106]	1999	USA	Longitudinal	5,115	Both	18 - 30	Age, waist circumference, physical activity, alcohol consumption, smoking, SBP and Sy X variables (one to the time)	N/R	N/R	I	1
33	Choinière R[99]	2000	Canada	Cross Sectional	23,129	Both	18 - 74	Age	N/R	N/R	I	1
34	Vargas M[107]	2000	USA	Longitudinal	5,861	Both	25 - 74	Age, BMI, region, SBP,	N/R	N/R	I	1
35	Merlo J[125]	2001	Sweden	Cross Sectional	15,569	Female	45-73	Age	I	N/R	N/R	1
36	Freitas OC[140]	2001	Brazil	Cross Sectional	688	Both	18 and over	None	N/R	N/R	I	1
37	Diez-Roux A [120]	2002	USA	Longitudinal	8,187	Both	45 - 64	Age, centre, sex, medication use, time since baseline, interactions between time and sex and baseline age	N/R	N/R	I	1
38	Gaudemaris R[122]	2002	France	Cross Sectional	29,626	Both	18-50	Obesity, PA, alcohol consumption, smoking, single living	N/R	N/R	I	1
39	Addor V[108]	2003	Switzerland	Cross Sectional	6,935	Both	9 -74	None	D	I	N/A	1

Table A1. 1 (cont.): Characteristics of reviewed studies on the inverse association between education and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
40	Galobardes B[83]	2003	Switzerland	Cross Sectional	588	Both	35 - 74	Age, gender and living in subsidised building. For neighbourhood, the above and education and occupation.	N/R	N/R	I	1
41	Mauny F[123]	2003	Madagascar	Cross Sectional	773	Both	adults	None	N/R	N/R	I	1
42	Kivimaki M[124]	2004	Finland	Longitudinal	206	Both	8 years (27, 36, 42)	Sex, childhood BP, Birth weight, smoking, alcohol consumption, BMI, medication, parental SES.	N/R	I	N/R	1
43	Wang Y[103]	2004	USA	Cross Sectional	4,805	Both	18 and over	Not adjusted	N/R	N/R	I	1
44	Gulliford MC[10]	2004	Trinidad y Tobago	Cross Sectional	461	Both	25 and over	Age, sex, ethnic group, BMI, PA, WHR, diabetes, smoking, salt consumption	I	I	I	1
45	Dalstra J[98]	2005	Finland, Denmark Great Britain, The Netherlands, Belgium, France, Italy and Spain	Cross Sectional	7,385; 3,717; 12,756; 19,102; 6,960; 12,569; 41,240; 4,943	Both	25-79	Age. Interaction effect education/country	N/R	N/R	I	3
46	Mensah G[95]	2005	USA	Cross Sectional	264,684	Both	18 and over	Not adjusted	N/R	N/R	I	1
47	Kanjilal S[361]	2006	USA	Cross Sectional	NHANES I, 10, 900; NHANES II, 12,939; NHANES III, 12, 870; NHANES 1999-2002, 6,997.	Both	25 - 74	Age, sex, survey, interaction terms survey *PIR quartile or education.	N/R	N/R	I	1

Table A1. 1 (cont.): Characteristics of reviewed studies on the inverse association between education and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
48	Regidor E[104]	2006	Spain	Cross Sectional	4,009	Both	60 and over	Age, obesity, physical activity, alcohol consumption, height, father social class, intake cured meat.	N/R	N/R	I	1
49	Strand B[97]	2006	Norway	Longitudinal	48,422	Both	35 - 49	Age, year of birth, interaction term age*education	N/R	I	N/R	1
50	Wang Y[110]	2006	China	Cross Sectional	42,751	Both	20 - 74	Age, sex, physical activity, smoking, alcohol consumption, BMI, income, urban/rural, Waist circumference	I	I	N/R	1
51	Zaitune MP[141]	2006	Brazil	Cross Sectional	426	Both	60 and over	Sex, BMI, Smoking, alcohol	N/R	N/R	I	2
52	Dragano N[126]	2007	Germany and Czech Republic	Cross Sectional	11,554	Both	45-69	Age, sex. Covariates: economic activity and social isolation	N/R	N/R	I	1
53	Pilav A[111]	2007	Bosnia	Cross Sectional	2,750	Both	25 - 64	None	I	I	N/R	1
54	Duda R[127]	2007	Ghana	Cross Sectional	1,328	Female	18 and over	Age, BMI, menopause, FBG, cholesterol, family history of hypertension, stroke or myocardial infarction, PA.	N/R	N/R	I	1
55	Morenoff J[113]	2007	USA	Cross Sectional	3,105	Both	18 and over	Age, sex, physical activity, smoking, alcohol consumption, marital status, number of children, health insurance, BMI	N/R	N/R	I	1
56	Perez – Fernandez R[112]	2007	Spain	Cross Sectional	2,884	Both	18 and over	Age	N/R	N/R	I	1
57	Hartmann M[142]	2007	Brazil	Cross Sectional	1,020	Female	20 - 60	Age, marital status, race, family history of hypertension	N/R	N/R	I	1
58	Chaix B[128]	2008	France	Cross Sectional	7,850	Male	50-60	Age, BMI	N/R	I	N/R	1

Table A1. 1 (cont.): Characteristics of reviewed studies on the inverse association between education and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
59	Fernald L[143]	2008	Mexico	Cross Sectional	9,362	Female	over 18 years old	Age, community ladder, country ladder, BMI, marital status	N/R	I	N/R	1
60	Fleischer N[193]	2008	Argentina	Cross Sectional	1,510	Both	19 and over	Age, gender	N/R	N/R	I	2
61	Chrestani MA[145]	2009	Brazil	Cross Sectional	2,949	Both	20 and over	None	N/R	N/R	I	2
62	Cipullo J[146]	2010	Brazil	Cross Sectional	1,717	Both	18 and over	Age	N/R	N/R	I	1
63	Barquera S[147]	2010	Mexico	Cross Sectional	33,366	Both	20 and over	Age, sex	I	I	I	1
64	Chaix B[116]	2010	France	Longitudinal	5,941	Both	30 - 79	Age, sex, antihypertensive medication use and family history of hypertension, smoking, PA, alcohol, BMI, waist circumference, resting heart, family history, employment status, HDI country of birth.	N/R	N/R	I	1
65	Ebrahimi M[114]	2010	Iran	Cross Sectional	29,972	Both	15 - 64	Age, sex, area (rural/urban), race, HDI provinces, smoking, PA, diabetes, overweight or obesity.	N/R	N/R	I	1
66	Grebla R[115]	2010	USA	Cross Sectional	5,685	Both	18 - 39	Age, sex, race, smoking, PA, diabetes, BMI, health insurance, family history.	I	N/R	N/R	1
67	Brummet B[117]	2011	USA	Cross Sectional	14,299	Both	24 - 32	Age, sex, cardiac medication. Full model: financial strain, built environment, alcohol consumption, smoking, BMI, resting HR, waist circumference, marital status, PA,	N/R	I	N/R	1

Table A1. 1 (cont.): Characteristics of reviewed studies on the inverse association between education and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
68	Harris J[129]	2011	USA	Cross Sectional	196,709	Both	18 - 64	Age, gender, marital status, language used for survey, Access. Risk factors: obesity, PA, smoking, use of preventive services	N/R	N/R	I	2
69	Levine D[119]	2011	USA	Longitudinal	3,436	Both	18 - 30	Age, race, sex, smoking, history of hypertension, height, weight, BMI, heart rate, alcohol, PA, insulin, urine sodium/potassium, dietary pattern.	N/R	N/R	I	1
70	Loucks E[118]	2011	USA	Longitudinal	3,890	Both	28 or over	Age, sex, baseline age, baseline blood pressure. Covariates: smoking, alcohol consumption, BMI, Antihypertensive medication.	N/A	I	N/R	1
71	Redondo A[130]	2011	Spain	Cross Sectional	9,646	Both	35 - 74	Age, sex.	N/R	N/R	I	1
72	Beltrán-Sanchez H[148]	2011	Mexico	Cross Sectional	14,280	Both	20 and over	Age, early life experiences, obesity	N/R	N/R	I	1
73	Malta D[149]	2011	Brazil	Cross Sectional	54,000	Both	18 and over	Age	N/R	N/R	I	2
74	Fleischer N[150]	2011	Argentina	Cross Sectional	41,392	Both	18 and over	Age, gender	N/R	N/R	I	2
75	Vathesatogkit P[137]	2012	Thailand	Longitudinal	3499		35-54	age, sex, BMI, smoking status, alcohol consumption, physical activity and diabetes	I	I	I	1
76	Bleich S[131]	2012	USA and England.	Cross Sectional	N/R	Both	20 and over	Age	N/R	N/R	I	1
77	Liu L[135]	2013	USA	Cross Sectional	17,314	Both	19 and over	Age	N/R	N/R	I	2

Table A1. 1 (cont.): Characteristics of reviewed studies on the inverse association between education and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
78	Mosca I[136]	2013	Ireland	Cross Sectional	4,179	Both	50 and over	Age, sex, marital status, place of residence, smoking, alcohol consumption, calories burnt, DM, other CVD, cholesterol, health insurance	N/R	N/R	I	1
79	Cois A[138]	2014	South Africa	Cross Sectional	15,574	Both	15 and over	BMI, smoking, alcohol consumption, physical exercise and resting heart rate	I	I	N/R	1
80	Eggen AE[132]	2014	Norway	Cross Sectional	22,108 and 11,565	Both	30-74	Age	N/R	I	N/R	1
81	Lloyd-Sherlock P[133]	2014	Albania, Armenia and Azerbaijan	Cross Sectional	27,376	Both	50 and over	Age, BMI, smoking, Physical activity, alcohol consumption, place of residence, health insurance	N/R	N/R	I	1
82	Wang Z[134]	2014	China	Cross Sectional	7,037	Both	20-79	Age, sex, marital status, BMI, smoking, alcohol consumption, DM, hyperlipidaemia	N/R	N/R	I	1

* Information taken from overview published by Colhoun et al.[2] N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report and (3) Not reported.

Table A1. 2: Characteristics of reviewed studies on the direct association between education and blood pressure

	Author/Study	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
1	Kim IS[159]	1982	Korea	Cross Sectional	9,790	Both	30 and over	None	D	D	N/R	1
2	Poulter NR *[2]	1984	Kenia	Cross Sectional	1,737	Male	N/R	age, weight, urinary electrolytes	D	D	N/R	1
3	Hutchinson J *[2]	1986	St Vincent Caribbean	N/R	N/R	Both	N/R	NR	D	N/R	N/R	1
4	Gunther H[161]	1988	Cuba	Cross Sectional	1,179	Both	30 - 50	None	N/R	N/R	D	1
5	Tsai A[160]	2007	China	Cross Sectional	4,440	Both	53 or over	Age, sex, physical activity, smoking, alcohol consumption, BMI, dietary factors	N/R	N/R	D	1
6	Razzaque A[155]	2011	Banglades h	Cross Sectional	2,800	Both	25 - 64	Age, occupation, religion.	N/R	N/R	D	1
7	Hosey G[157]	2014	FS Micronesi a	Cross Sectional	1638	Both	25-64	Sex and age.	N/R	N/R	D	1
8	Minicuci N[156]	2014	Ghana	Cross Sectional	4724	Both	50-plus years	Tobacco, alcohol consumption	N/R	N/R	D	1
9	Moser KA[158]	2014	India	Cross Sectional	10671	Both	≥18	Age, place of residence, religion, BMI, alcohol consumption. Hypertension	N/R	N/A	D	1

* Information taken from overview published by Colhoun et al.[2] N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report and (3) Not reported.

Table A1. 3: Characteristics of reviewed studies with no association between education and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
1	Sive PH *[2]	1971	Israel	Cross Sectional	10,000	Male	40-60	Age, BMI, smoking, diabetes, alcohol	N/R	N/A	N/R	1
2	Haynes SG *[2]	1978	USA	Longitudinal	1,652	Both	N/R	Age, relative weight	N/A	N/A	N/A	1
3	Khoury PR *[2]	1981	USA	N/R	N/R	Both	N/R	race, age	N/R	N/A	N/R	1
4	Haglund B *[2]	1985	Sweden	N/R	7,986	Both	25-75	Age, sex, weight index, smoking, HT treatment	N/A	N/A	N/A	1
5	Custodi J[181]	1989	Spain	Cross Sectional	628	Both	N/R	Age, obesity, alcohol, history of hypertension or cardiovascular disease	N/R	N/R	N/A	3

Table A1. 3 (cont.): Characteristics of reviewed studies with no association between education and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
6	Siegrist J *[2]	1990	China	N/R	1169	Male	45 - 65	Age, BMI, alcohol, smoking	N/R	N/A	N/R	1
7	Kalimo R[182]	1993	Finland	Longitudinal	150	Both	31-42	Age, BMI	N/A	N/A	N/R	1
8	Joshi P *[2]	1993	India	N/R	448	Both	15 and over	Age, BMI, alcohol, smoking, diet	N/R	N/R	N/A	3
9	Brannstrom I *[2]	1994	Sweden	Cross Sectional	N/R	Both	N/R	Age	N/R	N/R	N/A	1
10	Lai SW[172]	2001	Taiwan	Cross Sectional	1,093	Both	65 and over	Not adjusted	N/R	N/R	N/A	1
11	Mendez M[166]	2003	Jamaica	Cross Sectional	2,082	Both	25-74	Age, overweight, year of exam	N/A	N/A	N/A	1
12	Schröder H[173]	2004	Spain	Cross Sectional	1,748	Both	25 - 74	Age, physical activity, smoking, alcohol, BMI, diet,	N/A	N/A	N/R	1
13	Ordunez P[165]	2005	Cuba	Cross Sectional	1,667	Both	15-74	Age	N/R	N/R	N/A	1
14	Kivimaki M[174]	2006	Finland	Longitudinal	1,807	Both	24 - 39	Birth weight, breast feeding, BMI, smoking, alcohol	N/R	N/A	N/R	1
15	Ezeamama A[186]	2006	Samoa	Longitudinal	1,289	Both	25 - 58	Sex, location	N/R	N/R	N/A	1
16	Niakara A[175]	2007	Ouagadou gu (Africa)	Cross Sectional	2,087	Both	35 and over	Sex, age	N/R	N/R	N/A	1
17	Jardim PC[164]	2007	Brazil	Cross Sectional	1,739	Both	18 and over	Age, gender, dietary habits, smoking, alcohol, PA	N/R	N/R	N/A	1
18	Da Costa J[163]	2007	Brazil	Cross Sectional	1,968	Both	20-69	Age, skin color, gender, family history of hypertension, extra salt intake, diabetes mellitus, smoking, alcohol	N/R	N/R	N/A	1
19	Metcalf P[176]	2008	New Zealand	Cross Sectional	4,020	Both	35 - 74	Age, gender and ethnicity	N/A	N/A	N/A	1
20	Addo J[183]	2009	Ghana	Cross Sectional	1,015	Both	25 and over	Age, sex	N/R	N/R	N/A	1
21	Longo G[162]	2009	Brazil	Cross Sectional	2,022	Both	20-59	Age, sex, BMI, waist circumference, smoking, alcohol, PA, DM.	N/R	N/R	N/A	1
22	Kaplan M[205]	2010	Canada and USA	Cross Sectional	1,906	Both	65 and over	Age, sex, marital status, race, educational level, smoking, BMI, PA.	N/R	N/R	N/A	2
23	Pang W[178]	2010	China	Cross Sectional	10,065	Both	60 and over	Age, sex, race, smoking, BMI, Alcohol.	N/R	N/R	N/A	1
24	Hamano T[272]	2011	Japan	Cross Sectional	335	Both	Adults (not specified)	Age, sex. Medication use, diabetes, dyslipidaemia, smoking, alcohol, BMI, PA, contextual factors (lack of fairness, mistrust, lack of helpfulness).	N/R	N/A	N/R	1

Table A1. 3 (cont.): Characteristics of reviewed studies with no association between education and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
25	Schumann B[180]	2011	Germany	Longitudinal	1,779	Both	45 - 83	Age, Abdominal obesity and smoking	N/R	N/A	N/R	1
26	Samuel P[184]	2012	India	Longitudinal	2,218	Both	26-32	Age	N/R	N/R	N/A	1
27	Vellakkal S[188]	2013	India	Cross Sectional	12,198	Both	18-plus years	Age, sex	N/R	N/R	N/A	1

* Information taken from overview published by Colhoun et al.[2] N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report and (3) Not reported.

Table A1. 4: Characteristics of reviewed studies on another type of association between education and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
1	Wu X[191]	1995	China	Cross Sectional	950,356	Both	15 and more	NR	N/R	N/R	U- shaped	3
2	Bell C[203]	2004	USA and China	Cross Sectional	5,080	Female	30 - 65	Age, obesity, physical activity, alcohol, smoking,	N/R	N/R	In China U- shaped	1
3	Gus I[192]	2004	Brazil	Cross Sectional	918	Both	20 and more	None	Comparison between healthy and hypertensive individuals lower educational level showed significant association			1
4	Najafipour H[190]	2014	Iran	Cross Sectional	5895	Both	15-75	Age, sex, opium, depression, anxiety, PA, obesity, Family history of hypertension	N/R	N/R	Inverted J- shaped	1

N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report and (3) Not reported.

Table A1. 5: Characteristics of reviewed studies on the inverse association between income and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
1	Tuomilheto J[194]	1978	Finland	Cross Sectional	10.951	Both	25 - 58	N/R	N/R	N/R	I	3
2	Sear M[101]	1982	USA	Cross Sectional	5,465	Both	18 and over	N/R	N/R	N/R	I	1
3	Ford E[105]	1991	USA	Longitudinal	7,073	Both	25 - 74	Age, heart rate, cholesterol, BMI, Alcohol, Physical activity, magnesium level	N/R	N/R	I	1
4	Luepker RV[195]	1993	USA	Cross Sectional	3,243	Both		Age	N/R	I	N/R	1
5	Svetkey LP[208]	1993	USA	Cross Sectional	4,163	Both	65 and over	Age, BMI, race, diabetes, salt intake, Physician visits smoking	N/R	N/R	I	1
6	Hasab A[202]	1999	Oman	Cross Sectional	4,732	Both	18 and over	Age, occupation, physical activity, material status, literacy, obesity.	N/A	I	N/R	1
7	Choinière R[99]	2000	Canada	Cross Sectional	23,129	Both	18 - 74	Age	N/R	N/R	I	1
8	Freitas OC[140]	2001	Brazil	Cross Sectional	688	Both	18 and over	none	N/R	N/R	I	1

Table A1. 5 (cont.): Characteristics of reviewed studies on the inverse association between income and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
9	Diez Roux A[120]	2002	USA	Longitudinal	8,187	Both	45 - 64	Age, center, sex, medication use, time since baseline, interactions between time and sex and baseline age	N/R	N/R	I	1
10	Wong J[206]	2002	Canada	Cross Sectional	20,095; 17,276	Female	20 and over	BMI, PA, DM, smoking, age,	N/R	N/R	I	3
11	Mauny F[123]	2003	Madagascar	Cross Sectional	773	Both	adults		N/R	N/R	I	1
12	Bell C[203]	2004	USA and China	Cross Sectional	5,080	Female		Age, obesity, physical activity, alcohol, smoking,	N/R	N/R	I in USA	1
13	Gulliford MC[10]	2004	Trinidad y Tobago	Cross Sectional	461	Both	25 and over	Age, sex, ethnic group, BMI, PA, WHR, diabetes, smoking, salt consumption	I	I	I	1
14	Kanjilal S[361]	2006	USA	Cross Sectional	10,900; 12,939; 12,870; 6,997	Both	25 - 74	Age, sex, survey, interaction terms survey *PIR quartile or education. Index of inequality was calculated.	N/R	N/R	I	1
15	Morenoff J[113]	2007	USA	Cross Sectional	3,105	Both	18 and over	Age, sex, physical activity, smoking, alcohol, marital status, number of children, health insurance, BMI	N/R	N/R	I	1
16	Da Costa J[163]	2007	Brazil	Cross Sectional	1,968	Both	20-69	Age, skin color, gender, family history of hypertension, extra salt intake, diabetes mellitus, smoking, alcohol	N/R	N/R	I	1
17	Fleischer N[193]	2008	Argentina	Cross Sectional	1,510	Both	19 and over	Age, gender	N/R	N/R	I	2
18	Lee D[207]	2009	Canada	Cross Sectional	117, 626; 73, 402; 131,535; 135,573;: 132,947	Both	12 and over	Age, sex	N/R	N/R	I	2
19	Kaplan M[205]	2010	Canada and USA	Cross Sectional	1,906	Both	65 and over	Age, sex, marital status, race, educational level, smoking, BMI, PA.	N/R	N/R	I	2
20	Pang W[178]	2010	China	Cross Sectional	10.065	Both	60 and over	Age, sex, race, smoking, BMI, Alcohol.	N/R	N/R	I	1

Table A1. 5 (cont.): Characteristics of reviewed studies on the inverse association between income and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
21	Brummet B[117]	2011	USA	Cross Sectional	14,299	Both	24 - 32	Age, sex, cardiac medication. Full model: financial strain, built environment, alcohol, smoking, BMI, resting HR, waist circumference, marital status, PA,	N/R	I	N/R	1
22	Harris J[129]	2011	USA	Cross Sectional	196,709	Both	18 - 64	Age, gender, marital status, language used for survey, Access (health insurance status and presence of usual provider) Risk factors: obesity, PA, smoking, use of preventive services	N/R	N/R	I	2
23	Vathesatogkit P	2012	Thailand	Longitudinal	3499	Both	35-54	age, sex, BMI, smoking status, alcohol consumption, physical activity and diabetes	I	I	I	1
24	Andersen UO[209]	2013	Denmark	Longitudinal	13,736; 12,385; 9,821; 6,119	Both	20 and over	age, sex, body mass index, DM, cholesterol, myocardial attack, stroke	N/A	I	N/R	1
25	Siegel M[210]	2013	Germany	Cross Sectional	87,601	Both	20 and over	Wagstaff index for hypertension	N/R	N/R	I	2
26	Cois A[138]	2014	South Africa	Cross Sectional	15574	Both	15 and over	BMI, smoking, alcohol use, physical exercise and resting heart rate	I	I	N/R	1
27	Wang Z[134]	2014	China	Cross Sectional	7037	Both	20-79	Age, sex, marital status, BMI, smoking, OH, DM, hyperlipidaemia	N/R	N/R	I	1

N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report and (3) Not reported.

Table A1. 6: Characteristics of reviewed studies on the direct association between income and blood pressure

	Author	Year	Country	Type of study		Gender	Age	Adjustments	DBP	SBP	HT	Measure
1	Kim IS[159]	1982	Korea	Cross Sectional	9,790	Both	30 and over	N/R	D	D	N/R	1
2	Joshi P[167]	1993	India	Cross Sectional	448	Both	15 and over	Age, BMI, alcohol, smoking, diet	N/R	N/R	D	3

Table A1. 6 (cont.): Characteristics of reviewed studies on the direct association between income and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
3	Fernald L[143]	2007	Mexico	Cross Sectional	9,362	Female	18 and over	Age, community ladder, country ladder, BMI, marital status.	N/R	D	N/R	1
4	Chen Z[211]	2008	China	Longitudinal	26,659	Both	20 and over	provincial effects, year fixed effects, gender, marital status, age, mean of age squared	N/R	N/R	D	1

N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report and (3) Not reported.

Table A1. 7: Characteristics of reviewed studies on no association between income and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
1	Srivastava RN[212]	1979	India	Cross Sectional	1,325	Both	15 and over	None	N/A	N/A	N/R	1
2	Winkleby M[55]	1992	USA	Cross Sectional	2,380	Both	25 - 64	Age, time of survey	N/A	N/A	N/R	1
3	Zaitune MP[141]	2006	Brazil	Cross Sectional	426	Both	60 and over	Sex, BMI, Smoking, alcohol,	N/R	N/R	N/A	2
4	Duda R[127]	2007	Ghana	Cross Sectional	1,328	Female	18 and over	Age, BMI, menopause, FBG, cholesterol, family history of Hy, stroke or myocardial infarction, PA,	N/R	N/R	N/A	1
5	Hartmann M[142]	2007	Brazil	Cross Sectional	1,020	Female	20 - 60	Age, marital status, race, family history of Hy	N/R	N/R	N/A	1
6	Jardim PC[164]	2007	Brazil	Cross Sectional	1,739	Both	18 and over	Age, gender, dietary habits, smoking, alcohol, PA	N/R	N/R	N/A	1
7	Metcalf P[176]	2008	New Zealand	Cross Sectional	4,020	Both	35 - 74	Age, gender and ethnicity	N/A	N/A	N/A	1
8	Chrestani MA[145]	2009	Brazil	Cross Sectional	2,949	Both	20 and over	Age	N/R	N/R	N/A	2
9	Ebrahimi M[114]	2010	Iran	Cross Sectional	29,972	Both	15 - 64	Age, sex, area (rural/urban), race, HDI provinces, smoking, PA, diabetes, overweight or obesity.	N/R	N/R	N/A	1
10	Grebla R[115]	2010	USA	Cross Sectional	5,685	Both	18 - 39	Age, sex, race, smoking, PA, diabetes, BMI, health insurance, family history.	N/A	N/R	N/R	1

Table A1. 7 (cont.): Characteristics of reviewed studies on no association between income and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
11	Schumann B[180]	2011	Germany	Longitudinal	1,779	Both	45 - 83	Age, Abdominal obesity and smoking	N/R	N/A	N/R	1
12	Cha S[154]	2012	Korea	Cross Sectional	4275	Both	40-64	Age, marital status, residential area, obesity, smoking, alcohol consumption, and physical activity	N/R	N/R	N/A	1
13	Vellakkal S[188]	2013	India	Cross Sectional	12,198	Both	18 plus years	Age, sex	N/R	N/R	N/A	1
14	Hosey G[157]	2014	FS Micronesia	Cross Sectional	1,638	Both	25-64	Sex and age. Stratified by sex and age group	N/R	N/R	N/A	1
15	Mc Donald AJ[152]	2014	Panama	Cross Sectional	3,590	Both	≥18	Age, sex, obesity, diet, FH of diabetes	N/R	N/R	N/A	1

N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report and (3) Not reported.

Table A1. 8: Characteristics of reviewed studies on another type of association between income and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
1	Mendez M[166]	2003	Jamaica	Cross Sectional	2,082	Both	25-74	Age, overweight, year of exam	J-shaped	J-shaped	J-shaped	1
2	Bell C [203]	2004	USA and China	Cross Sectional	5,080	Female	2	Age, obesity, physical activity, alcohol, smoking,	N/R	N/R	U-shaped in China	1

N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report and (3) Not reported.

Table A1. 9: Characteristics of reviewed studies on the inverse association between occupation-based social class and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
1	Marmot[224]	1978	England	Longitudinal	19,000	Male	45-64	Age	N/R	I	I	1
2	Harlan[221]	1984	USA	Cross Sectional	3,854	Both	25-74	Age, BMI, pulse rate, biochemical factors	I	N/A	N/R	1
3	Fouriaud [222]	1984	France	Cross sectional	6,665	Both	Adults	Age	I	I	N/R	1
4	Opit [223]	1984	Australia	Cross Sectional	-	Male	Adults	Age, obesity, alcohol	I	I	N/R	1
5	Haglund [187]	1985	Sweden	Cross Sectional	7,986	Both	25-75	Age, sex, weight index, smoking, HT treatment	I	I	I	1
6	Lang [218]	1988	Senegal	Cross Sectional	1,315	Male	16-64	Age, BMI, ethnicity	N/A	I	I	1
7	Baker [495]	1988	Wales	Cross Sectional	4,792	Male	45-59	Age, height, smoking	N/A	I	N/R	1
8	Duijkers [225]	1989	Netherlands	Cross Sectional	878	Male	40-59	Age, BMI	N/R	I	N/R	1

Table A1. 9 (cont.): Characteristics of reviewed studies on the inverse association between occupation-based social class and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
9	Siegrist [185]	1990	China	Cross Sectional	1,169	Male	45-65	Age, BMI, alcohol, smoking	N/R	I	N/R	1
10	Marmot [214]	1991	UK	Longitudinal	10,308	Both	35-55	Age	I	I	N/R	1
11	Shewry [219]	1992	Scotland	Cross Sectional	10,359	Both	40-59	Age	I	N/R	I	1
12	Colhoun [220]	1994	England	Cross Sectional	1,994	Both	-	Age, BMI	N/A	I	I	1
13	Kaufman [217]	1996	Nigeria	Cross Sectional	598	Both	45 or over	nr	N/R	N/R	I	1
14	Blane [227] D	1996	Scotland	Longitudinal	5,645	Male	35-64	Age	I	N/R	N/R	1
15	Bartley M [228]	2000	UK	Cross Sectional	1984: 2,181; 1993: 4,724	Both	20-64	Age	I	N/A	N/A	1
16	Diez-Roux [120]A	2002	USA	Longitudinal	8,187	Both	45 - 64	Age, centre, sex, medication use, time since baseline, interactions between time and sex and baseline age	N/R	N/R	I	1
17	Gaudemaris R[122]	2002	France	Cross Sectional	29,626	Both	18-50	Obesity, PA, Alcohol, smoking, single living	N/R	N/R	I	1
18	Galobardes [83]B	2003	Switzerland	Cross Sectional	588	Both	35-74	Age, gender and living in subsidised building. For neighbourhood, the above and education and occupation.	N/R	N/R	I	1
19	Galobardes [109] B	2003	Switzerland	Cross Sectional	8,194	Both	35-74	Age	I	I	N/R	1
20	Ezeamama [186] A	2006	Samoa	Longitudinal	963	Both	25 - 58	Sex, location	N/R	N/R	I	1
21	Power [216]	2008	UK	Longitudinal	7,174	Both	45	nr	N/R	I	I	1
22	Chaix [128] B	2008	France	Cross Sectional	7,850	Male	50-59	Age, BMI	N/R	I	N/R	1
23	Bleich S [131]	2012	US and UK	Cross Sectional	-	Both	20 and over	Age	N/R	N/R	I	1
24	Hogberg L[229]	2012	Sweden	Longitudinal	12,030	Both	54-86	sex height, body mass index, smoking and alcohol consumption birth weight, gestational age, mothers' age and parity	N/R	N/R	I	2
25	Wang Z[134]	2014	China	Cross Sectional	7,037	Both	20-79	Age, sex, marital status, BMI, smoking, alcohol consumption, DM, hyperlipidaemia	N/R	N/R	I	1

N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report and (3) Not reported.

Table A1. 10: Characteristics of reviewed studies on the direct association between occupation-based social class and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
1	Komachi [232]	1971	Japan	Cross Sectional	8,583	Male	40 - 69	nr	N/R	N/R	D	3
2	Kim IS [159]	1982	Korea	Cross Sectional	9,790	Both	30 and over	N/R	D	D	N/R	1
3	Bunker CH[231]	1992	Nigeria	Cross Sectional	559	Both	25-54	Age, BMI, alcohol	N/R	N/R	D	1
4	Agarwal AK[233]	1994	India	Cross Sectional	3,760	Both	-	none	N/R	N/R	D	1
5	Addo J [183]	2009	Ghana	Cross Sectional	1,015	Both	25 and over	Age, sex	N/R	N/R	D	
6	Starr J[230]	2011	Scotland	Longitudinal	549	Both	58 or over at baseline	Sex. History of hypertension, drugs, Diabetes, vascular disease.	D	D	N/R	1
7	Razzaque A [155]	2011	Bangladesh	Cross Sectional	2,000	Both	25 - 64	Age, occupation, religion.	N/R	N/R	D	1

N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) Health examination in survey; (2) self-report and (3) Not reported.

Table A1. 11: Characteristics of reviewed studies on no association between occupation-based social class and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
1	Lee RE [241]	1958	USA	Longitudinal	2,374	Female	-	nr	N/R	N/R	N/A	3
2	Khoury [169]	1981	USA	Cross Sectional	362	Both	Adults	race, age	N/R	N/A	N/R	1
3	Wadsworth [234]	1985	England	Cross Sectional	5362	Both	36 at baseline	BMI, family history, birth weight, smoking,	N/A	N/A	N/A	1
4	Custodi [181]	1989	Spain	Cross Sectional	628	Both	-	Age, obesity, alcohol, history of hypertension or cardiovascular disease	N/R	N/R	N/A	3
5	Gregory J [242]	1990	UK	Cross Sectional	-	Both	19-64	Age, diet, region economic status, household type, alcohol	N/A	N/A	N/R	1
6	Winkleby M [55]	1992	USA	Cross Sectional	2,380	Both	25 - 64	Age, time of survey	N/A	N/A	N/R	1
7	Brannstrom I [168]	1993	Sweden	Cross Sectional	-	Both	-	age	N/R	N/R	N/A	1
8	Chaturvedi N[235]	1993	UK	Cross Sectional	1,166	Both	-	Age	N/R	N/A	N/R	1

Table A1. 11 (cont.): Characteristics of reviewed studies on no association between occupation-based social class and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Adjustments	DBP	SBP	HT	Measure
9	Bunker CH[236]	1996	Nigeria	Cross Sectional	-	Both	25-54	Age	N/R	N/R	N/A	1
10	Starr [237] J	1998	Scotland	Longitudinal	-	Both	70 - 88	-	N/A	N/A	N/R	1
11	Smith GD[238]	1998	Scotland	Longitudinal	14,682	Both	45-64	Age	N/A	N/R	N/R	1
12	Brunner E [239]	1999	UK	Cross Sectional	6,980	both	adults	Age, height weight, BMI, cholesterol, triglycerides, glucose, fibrinogen	N/A	N/R	N/R	1
13	Poulton R [240]	2002	New Zealand	Longitudinal	1,000	Both	26 years	Infant health. SEP	N/A	N/R	N/R	1
14	Mauny F [123]	2003	Madagascar	Cross Sectional	773	Both	adults	-	N/R	N/R	N/A	1
15	Ordunez P [165]	2005	Cuba	Cross Sectional	1,667	Both	15-74	Age	N/R	N/R	N/A	1
16	Regidor E[104]	2006	Spain	Cross Sectional	4,009	Both	60 and over	Age, obesity, physical activity, alcohol, height, father social class, intake cured meat.	N/R	N/R	N/A	1
17	Kivimaki M [189]	2006	Finland	Longitudinal	2,270	Both	24 - 39	Birth weight, breast feeding, BMI, smoking, alcohol	N/R	N/A	N/R	1
18	Fernald L [143]	2007	Mexico	Cross Sectional	9,362	Females	over 18 years old	Age, community ladder, country ladder, BMI, marital status.	N/R	N/A	N/R	1
19	Metcalf P [176]	2008	New Zealand	Cross Sectional	4,020	Both	35 - 74	Age, gender and ethnicity	N/A	N/A	N/A	1
20	Chaix B [116]	2010	France	Longitudinal	5,941	Both	30 - 79	Age, sex, antihypertensive medication use, history of hypertension, smoking, PA, alcohol, BMI, waist circumference, resting heart, family history, employment status, HDI country of birth.	N/R	N/R	N/A	1
21	Schumann B[496]	2011	Germany	Longitudinal	1,779	Both	45 - 83	Age, Abdominal obesity and smoking	N/R	N/A	N/R	1
22	Redondo A [130]	2011	Spain	Cross Sectional	9,646	Both	35 - 74	Age, sex.	N/R	N/R	N/A	1
23	Cha S[154]	2012	Korea	Cross Sectional	4,275	Both	40-64	Age, marital status, residential area, obesity, smoking, alcohol consumption, and physical activity	N/R	N/R	N/A	1

N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) Health examination in survey; (2) self-report and (3) Not reported.

Table A1. 12: Characteristics of reviewed studies on the inverse association between wealth or housing conditions social class and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	SES measure	Adjustments	DBP	SBP	HT	Measure
1	Shewry MC [219]	1992	Scotland	Cross Sectional	10 359	Both	40 - 59	Housing Conditions	age	I	N/R	I	1
2	Avendano M [247]	2009	USA, UK, Sweden, Denmark, Germany, the Netherlands, France, Switzerland, Austria, Italy, Spain, and Greece	Cross Sectional	European countries (n=17481), England (n=6527), and the United States (n=9940).	Both	50 - 74	Wealth	Age, sex, educational level, and US or European country. Covariates: smoking, alcohol, BMI and PA.	N/R	N/R	I	2
3	Mosca I[136]	2013	Ireland	Cross Sectional	4,179	Both	50-plus years	Wealth	Age, sex, marit stat, place of res, smoking, drinking, calories burnt, DM, other CVD, cholesterol, health insurance	N/R	N/R	I	1
4	Harhay MO[153]	2013	Albania, Armenia, Azerbaijan	Cross Sectional	N/R	Both	18-49	Housing Conditions	Age	N/R	N/R	I	1

N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) Health examination in survey; (2) self-report and (3) Not reported.

Table A1. 13: Characteristics of reviewed studies on the direct association between wealth or housing conditions social class and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	SES measure	Adjustments	DBP	SBP	HT	Measure
1	Goldstein J [250]	2005	Peru	Cross Sectional	2,337	Both	18 - 60	Housing Conditions	Age, PA, Education, smoking, hours of TV.	N/R	N/R	D	1
2	Addo J [183]	2009	Ghana	Cross Sectional	1,015	Both	25 and more	Housing Conditions	Age, sex	N/R	N/R	D	1
3	Kinra S [249]	2010	India	Cross Sectional	1,983	Both	20 - 69	Housing Conditions	Age, smoking, PA, alcohol, overweight, cholesterol, Diabetes, short stature	N/R	N/R	D	1
4	Samuel P [184]	2012	India	Longitudinal	2,218	Both	26-32	Housing Conditions	Age	N/R	N/R	D	1
5	Moser KA[158]	2014	India	Cross Sectional	10,671	Both	18 and over	Wealth	Age, place of residence, religion, BMI, alcohol consumption.	N/R	N/R	D	1

N/R: Not reported; N/A: No association; D: Direct association. Measure: type of blood pressure measure: (1) Health examination in survey; (2) self-report and (3) Not reported.

Table A1. 14: Characteristics of reviewed studies on no association between wealth or housing conditions social class and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	SES measure	Adjustments	DBP	SBP	HT	Measure
1	Bobak M[102]	1999	Czech Republic	Cross Sectional	2,353	Both	25 - 64	Housing Conditions	Age, District, Material Circ.	N/A	N/A	N/A	1
2	Ezeamama A [186]	2006	Samoa	Longitudinal	963	Both	25 - 58	Housing Conditions	Sex, location	N/R	N/R	N/A	1
3	Zaitune MP [141]	2006	Brazil	Cross Sectional	426	Both	60 and more	Housing Conditions	Sex, BMI, Smoking, alcohol,	N/R	N/R	N/A	2
4	Niakara A[175]	2007	Ouagadou gu	Cross Sectional	2,087		35 and more	Housing Conditions	Sex, age	N/R	N/R	N/A	1
5	Hajat A [248]	2010	USA	Longitudinal	13,031	Both		Wealth	Age, race, sex, marital status, health insurance status, region of residence, income, education.	N/R	N/R	N/A	2
6	Cipullo J [146]	2010	Brazil	Cross Sectional	1,717	Both	18 and more	Housing Conditions	Age	N/R	N/R	N/A	1

Table A1. 14 (cont.): Characteristics of reviewed studies on no association between wealth or housing conditions social class and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	SES measure	Adjustments	DBP	SBP	HT	Measure
7	Barquera S [147]	2010	Mexico	Cross Sectional	33,366	Both	20 and more	Housing Conditions	Age, sex	N/A	N/A	N/A	1
8	Lloyd-Sherlock P[133]	2014	China Ghana India Mexico Russia South Africa	Cross Sectional	27,376	Both	50 and over	Wealth	Age, BMI, smoking, PA, OH, place of residence, health insurance	N/R	N/R	N/A	1
9	Minicuci N[156]	2014	Ghana	Cross Sectional	4,724	Both	50 and over	Housing conditions	Tobacco, OH	N/R	N/R	N/A	1

N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) Health examination in survey; (2) self-report and (3) Not reported.

Table A1. 15: Characteristics of reviewed studies on inverse association between composite index and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Index	Adjustments	DBP	SBP	HT	Measure
1	Mc Donough [258]J.R [258]	1964	USA	Cross Sectional	3,102	Both	40-74	Index: education, occupation and income	N/R	I	N/R	N/R	1
2	Oakes T.W [259]	1973	USA	Cross Sectional	34,280	Both	20-60	Index: occupation and education	N/R	N/R	N/R	I	1
3	Holme I [260]	1976	Norway	Cross Sectional	14,677	Male	20-49	Index: occupation and income	N/R	I	I	N/R	1
4	Keil J.E [261]	1977	USA	Longitudinal	200	Male	35 and more	Index: education and income	Age, duration of follow-up, skin colour	I	I	I	1
5	Kraus J [262]	1980	USA	Cross Sectional	19,141	Male	35-57	Index: education and occupation	Age	N/R	N/R	I	1
6	Helmert U [251]	1989	Germany	Cross Sectional	16,430	Both	25 - 69	Index: education, income and occupation	Age, region	N/R	N/R	I	1
7	Moller L [252]	1991	Denmark	Longitudinal	504	Male	40 and 51	Index based on: occupation, education and number of subordinates	N/R	N/A	N/A	I	1
8	Helmert U [263]	1992	Germany	Cross Sectional	N = 4794, N = 5315, N = 6125	Both		Index: income, education and occupation	Age, BMI	N/R	N/R	I	1
9	James S[264]	1992	USA	Cross Sectional	1,784	Both	25-50	Index: occupation and education	Age, BMI, waist hip, sex, alcohol, PA	N/A	I	N/A	1
10	Jadue L [266]	1999	Chile	Cross Sectional	3,120	both	25-64	Index: Occupation, income, housing conditions, neighbourhood characteristics, parent's education.	Age, sex	N/R	N/R	I	1

Table A1. 15 (cont.): Characteristics of reviewed studies on inverse association between composite index and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	SES measure	Adjustments	DBP	SBP	HT	Measure
11	Vega J [265]	1999	Chile	Cross Sectional	3,120	both	25-64	Index: Occupation, income, housing conditions, neighbourhood characteristics, parent's education.	Age, sex	N/R	N/R	I	1
12	Reichert F [269]	2003	Brazil	Cross Sectional	1,696	Both	40 and more	Index designed by Brazilian Association of Marketing Research	Age, skin color, smoking, BMI, PA.	N/R	N/R	I	2
13	Cubbin C[255]	2006	Sweden	Cross Sectional	18,081	Both	25-64	Index: Mean of income, educational status, occupational status and parent's occupational status.	Age, gender, marital status, immigration status, urbanization	N/R	N/R	I	2
15	Franks P [257]	2011	USA	Longitudinal	15,495	Both	45-64	Index based on income and education.	Time dependent variables	N/R	I	N/R	1

N/R: Not reported; N/A: No association; I: Inverse association. Measure: type of blood pressure measure: (1) Health examination in survey; (2) self-report and (3) Not reported.

Table A1. 16: Characteristics of reviewed studies on direct association between composite index and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Index	Adjustments	DBP	SBP	HT	Measure
1	Singh RB [253]	1997	India	Cross Sectional	1,806	Both	25-64	Index based on education, land-holding, housing condition, consumer durables, income and number of dependents.	Age, smoking, PA, BMI, energy expenditure, waist hip ratio, salt intake, dietary fat intake, family history, years of education.	N/R	N/R	D	1
2	Singh RB[254]	1997	India	Cross Sectional	1,935	Both	25 and more	Rural area. Index based on education, land-holding, housing condition, consumer durables, income and number of dependents	Age, smoking, PA, obesity, alcohol, salt intake,	N/R	N/R	D	1

N/R: Not reported; N/A: No association; D: Direct association. Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report; (3) Not reported.

Table A1. 17: Characteristics of reviewed studies on no association between composite index and blood pressure

	Author	Year	Country	Type of study	n	Gender	Age	Index	Adjustments	DBP	SBP	HT	Measure
1	Singh BM[267]	1994	India	Cross Sectional	720	Both	15 years		nr	N/R	N/A	N/A	1
2	Piccini R [139]	1994	Brazil	Cross Sectional	1,675	Both	20-69	Index: Occupation, education and income.	Sex, age, skin colour	N/R	N/R	N/A	1
3	Ezeamama A [186]	2006	Samoa	Longitudinal	1289, 963	Both	25 - 58	Index: education and occupation	Sex, location	N/R	N/R	N/A	1
4	Hartmann M [142]	2007	Brazil	Cross Sectional	1,020	Female	20 - 60	Index: material goods, education level of head of household and domestic worker in household.	Age, marital status, race, family history of hypertension	N/R	N/R	N/A	1
5	Da Costa J [163]	2007	Brazil	Cross Sectional	1,968	Both	20-69	Index according to Brazilian Association of Marketing Research	Age, skin colour, gender, family history of hypertension, extra salt intake, diabetes mellitus, smoking, alcohol	N/R	N/R	N/A	1
6	Sodjinou R[256]	2008	Benin	Cross Sectional	200	Both	25-60	Index: education, occupation and household amenities	Age, sex,	N/R	N/R	N/A	1

N/R: Not reported; N/A: No association. Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report and (3) Not reported.

Table A1. 18: Epidemiological studies of the association between area based SEP and blood pressure.

	Author/Year	Country	n	Type of study	Context SEP measure	Area studied	DBP	SBP	HT	Measure
1	Harburg E, 1973 [270].	USA	492	Cross Sectional	Index: - Economic deprivation and crime - Family stability - Area stressor score	382 tracts in Detroit	Inverse in black men and in women	Inverse in black men and in women	N/R	1
2	Smith G, 1998 [238].	Scotland	14,952	Longitudinal	Index: - Male employment - Overcrowding - Car ownership - % social class IV and V	Fourteen postcode sectors in Renfrew/Paisley	N/A	N/R	N/R	1

Table A1. 18 (cont.): Epidemiological studies of the association between area based SEP and blood pressure.

	Author/Year	Country	n	Type of study	Context SEP measure	Area studied	DBP	SBP	HT	Measure
3	Diez Roux A 2002 [120]	USA	8,187	Longitudinal	Index: - Household income - Education (% of adult with high school and complete college education) - Occupation (% of people in different levels of occupation)	Neighbourhood	N/R	N/R	I	1
4	Galobardes B, 2003. [83]	Switzerland	588	Cross Sectional	Index SSH: - Neighbourhood; - Streets and area surrounding the buildings (stores, green areas, traffic, etc); - External and internal aspects of the building (material of construction, degree of dirtiness, etc.)	Neighbourhood	N/R	N/R	Higher risk in middle group	1
5	Cubbin C, 2006 [255]	Sweden	18,081	Cross Sectional	Index: - Building - Elderly alone - Foreign born - Unemployed - Single parents - Moved residence - Education - Children under 5	6,182 Small area Market Statistics	N/R	N/R	N/A	2
6	Merlo J, 2001[125]	Sweden	15,569	Cross Sectional	- Education	17 urban areas in city of Malmo with median number of 2,229 inhabitants	I	N/R	N/R	1
7	Dragano N, 2007 [126].	Germany Czech Republic	11,554	Cross Sectional Multilevel	- Unemployment - Overcrowding	220 Neighbourhood with a median number of 3,517 inhabitants	N/R	N/R	N/A	1

Table A1. 18 (cont.): Epidemiological studies of the association between area based SEP and blood pressure.

	Author/Year	Country	n	Type of study	Context SEP measure	Area studied	DBP	SBP	HT	Measure
8	Morenoff J, 2007 [113].	USA	3,105	Cross Sectional	Index: - Racial ethnic composition - Socioeconomic status - Age composition - Family structure - Owner occupied housing - Residential stability	343 neighbourhood clusters with roughly 8,000 inhabitants	N/R	N/R	I	1
9	Chaix B, 2008 [128]	France	7,850	Cross Sectional	Index: - Education - Population density	1,387 areas with a median number of 1,954 inhabitants	N/R	I	N/R	1
10	Fleischer N, 2008 [144]	Argentina	1,510	Cross Sectional	- Education: percentage of residents per censal fraction with incomplete secondary education	Censal fractions with an average of 3,600 residents	N/R	N/R	N/A	2
11	Chen Z, 2008 [211]	China	26,659	Longitudinal	- Income	Urban neighbourhood. Rural communities with an average population about 3,800	N/R	N/R	D	1
12	Metcalf P, 2008 [176]	New Zealand	4,020	Cross Sectional	Index: - Household income - Unemployment - Assets (phone, car) - Family structure - Education (% of people without any qualifications) - Home ownership - Overcrowding	Small areas with a population of at least 100 people	I	N/A	Higher risk in middle group	1

Table A1. 18 (cont.): Epidemiological studies of the association between area based SEP and blood pressure.

	Author/Year	Country	n	Type of study	- Context SEP measure	Area studied	DBP	SBP	HT	Measure
13	Chaix B, 2010 [116]	France	5,941	Longitudinal Multilevel	- Proportion of people with upper tertiary education - Median income - Mean value of dwelling sold	Neighbourhood with a median of 2,393 residents	N/R	Inverse for dimension related to education	N/R	1
14	Tabassum F, 2010 [271]	England	4,774	Longitudinal NoMLM	Index: PCA - gross average weekly household income, - average household weekly expenditure - Share of UK employment, - Percentage of working age people with higher education, gross value added per head - Average house price	9 regions in England	N/R	Inverse in people aged over 65	N/R	1
15	Hamano S, 2011[272].	Japan	335	Cross Sectional	Index: questionnaire about social capital with three dimensions. - Lack of fairness - Trust - Helpfulness	30 postcode sectors	N/R	Inverse only with lack of fairness	N/R	1
16	Liu L 2013[135]	USA	17,314	Cross Sectional	Access to recreational facilities, accessibility of fruits/vegetables and groceries, neighbours support and trust, and poverty level	47 neighbourhoods (postal codes)	N/R	N/R	I	2
17	Abeyta IM 2012 [273]	USA	20,739	Cross Sectional	County median household income	64 counties	N/R	N/R	N/A	2

N/R: Not reported; N/A: No association; I: Inverse association; D: Direct association. Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report and (3) Not reported.

Table A1. 19: Characteristics of reviewed studies on trend of inequalities in blood pressure

	Author	Year	Country	Kind of study	n	Gender	Age	SES measure	Adjustments	Results	Measure
1	Pekkanen J [289]	1995	Finland	Cross Sectional	1972, 1977, 1982, and 1987: 20,096	Both	35-64	Education	Age, year of examination, age.	Trends of SE differences were tested in interaction term between education and year of examination. No significant.	1
2	Bennett S [121]	1995	Australia	Cross Sectional	1980, 1983, and 1989 : 19,315	Both	25-64	Education	Age, survey year, survey centre, birthplace.	BP decreased at each level of educational attainment. Trend of Inequalities was tested by interaction term education*year of survey. Inequalities in hypertension tended to increase in women.	1
3	Peltonen M [291]	1998	Sweden	Cross Sectional	1986: ; 1990: ; 1994:	Both	25-64	Education	Age	No clear association between DBP and education was found.	1
4	Bartley M [497]	2000	UK	Cross Sectional	1984: 2,181; 1993: 4,724	Both	20-64	Occupation	Age	RII for DBP decreased. Change in RII for SBP was not significant.	1
5	Osler M[292]	2000	Denmark	Cross Sectional	3,317 women and 3,378 men.	Both	30, 40, 50 60 years	Education	Age	The interaction term time*education was not significant.	1
6	Wong J [206]	2002	Canada	Cross Sectional	20,095; 17,276	Female	20 and older	Income	BMI, PA, DM, smoking, age,	Prevalence of hypertension increased. BP increased in the second and the third income quintiles, and reduced in the fifth. Other measures of inequalities were not analysed.	3
7	Galobardes B [109]	2003	Switzerla nd	Cross Sectional	4,207 men and 3,987 women	Both	35-74	Occupation	age	Hypertension decreased for high and middle SEP group but not for low SEP group. Test for interaction by SEP was not statistically significant.	1
8	Kanjilal S[204]	2006	USA	Cross Sectional	NHANES I, 10,900; NHANES II, 12,939; NHANES III, 12,870; and NHANES 1999-2002, 6,997	Both	25 – 74	Education	Age, sex, survey, interaction terms survey *PIR quartile or education. Index of inequality was calculated.	The prevalence of high blood pressure declined for all groups. SII decreased between NHANES I and III and increased between NHANES III and IV.	1

Table A1. 19 (cont.): Characteristics of reviewed studies on trend of inequalities in blood pressure

	Author	Year	Country	Kind of study	n	Gender	Age	SES measure	Adjustments	Results	Measure
9	Strand B [97]	2006	Norway	Longitudinal	48,422	Both	35 – 49 at baselin e	Education	Age	Interaction term age*education was added to assess trend of educational inequalities. SBP increased. During period studied inequalities increased in women and were stable in men.	1
10	Lee D [207]	2009	Canada	Cross Sectional	1994: 17, 626; 1996: 73, 402; 2001: 131,535; 2003: 135,573; 2005 :132,947.	Both	12 and older	Income	Age, sex	Self-report of hypertension increased. The gap between highest and lowest income groups widened. There was no interaction between income and time.	2
11	Hotchkiss J [293]	2011	Scotland	Cross Sectional	1995: 6,910; 1998: 6,656; 2003: 5,497; 2008: 4,202.	Both	25 - 64	Occupation and Education	Age	The prevalence of self-report of hypertension increased. SII was assessed. There had been no significant changes of inequalities.	2
12	Redondo A [130]	2011	Spain	Cross Sectional	1995-2005: 9,646	Both	35 – 74	Education and occupation	Age, sex.	The prevalence of hypertension decreased. SII not significant.	1
13	Scholes S [290]	2012	England	Cross Sectional	1994-2008 except 1999 and 2004; 117, 631	Both	15 and older	Neighbourho od	Age,	Inequalities over time were assessed using an interaction term IMD*survey year. (IMD: Index of Multiple Deprivation). Both absolute and relative inequality increased in young women.	1
14	Ernstsen L [294]	2012	Norway	Cross Sectional	1984-86: 19,263; 1995-97: 23,658; 2006-08: 17,973	Both	20 years and older	Education	Age	Prevalence of hypertension declined. SII and RII were assessed. In women and men relative inequalities widened. Absolute inequalities narrowed in women and were stable in men.	1
15	Bleich s [131]	2012	USA and England.	Cross Sectional	N/R	Both	20 and older	Education in USA and occupation in England	Age	In USA inequalities in hypertension increased and in England inequalities decreased. Differences in % points in prevalence were assessed.	1
16	Eggen AE[132]	2014	Norway	Cross Sectional	22108 and 11565	Both	30-74	Education	Age	No changes over time	1

Measure: type of blood pressure measure: (1) health examination in survey; (2) self-report and (3) Not reported.

Appendix 2. Chilean national health survey 2003 and 2010 sampling design

NATIONAL HEALTH SURVEY 2003

In 2000, the Ministry of Health and the National Institute of Statistics carried out the National Survey of Quality of Life and Health (ECV2000) which provided information about life styles of individuals and their families including self-reported health conditions.

The National Health Survey 2003 (NHS2003) used a subsample of participants of ECV2000. Individuals in this subsample were re-visited and were taken measurements (weight, height and blood pressure among others), biological samples (blood and urine) and information on symptoms or signs of diseases.

Sample Description of the Quality Of Life Survey 2000

The study is based on a sample of occupied dwellings, and the design corresponded to a three-stage stratified sampling.

Sampling frame

The selection was made based on the sampling frame defined to the integrated program of Households Surveys (PIDEH) conducted by the National Statistics Institute (INE). This program used the data of the households and population collected in the Census of Population and Housing 1992, including mapping.

Stratification

Strata were defined as follow:

1. Urban Population under 50,000
2. Urban Population over 50,000 and under 100,000
3. Urban Population between 100,000 and under 500,000
4. Population of 500,000 and more
9. Rural

Estimation Levels

Given the characteristics of the design of the sample, the Quality of life Survey results can be processed for the following levels:

a) Total country
b) Regions
c) Total urban country
d) Total rural country

The National Health Survey 2003, in turn, being a subsample of the Quality of Life Survey 2000 and considering the size and design, can be processed for: total country, total urban country and total rural country.

Selection of sampling units

The sample was three-staged. The sampling units were spatial clusters or sections (groups of dwellings), occupied dwellings, and people aged 15 and over within the selected dwellings.

<u>First Stage</u>: The clusters were chosen at random, and with a probability of selection proportional to size. Therefore, the inclusion probability of the i-th unit in the first stage $P_h(i)$ was :

$$p_h(i) = n_h \; * \; \frac{M_{hi}}{M_h}$$

Where h represents the stratum h, n_h is the number of the sections of stratum h, M_{hi} is the total number of dwellings in section i in stratum h, and M_h is the total of dwellings in stratum h.

<u>Second Stage</u>: This was performed once the previous step was done. This consisted in the selection of households in each section with equal probability. The probability was given by $p_h(ij)$,

$$p_h(ij) = \frac{m_{hi}}{M'_{hi}}$$

Where, m_{hi} corresponds to the number of households in the sample in section *i* in stratum *h*; and M'_{hi} to the number of dwellings in section *i* in stratum *h* updated.

Third Stage: this stage was carried out using the method of Kish among people aged 15 years and older (only one person was selected).

Expansion Factors

According to the design, the expansion factor corresponds to that applied to a sample in three stages.

The resulting database was formed by a sample of individuals interviewed and this included an expansion factor corresponding to the inverse of the probability of selection of the individual. Three factors were made as follow:

1. Factor for individuals who responded F1 (socio-demographic questions and health question applied by pollster), regardless of their response in the other instruments.
2. Factor for individuals who responded F1 and F2 (questionnaire applied by pollster and measurements made by nurse), regardless of laboratory test.
3. Factor for individuals who responded F1 and F2 and had tests of laboratory.

NATIONAL HEALTH SURVEY 2010

Sampling frame

The sampling frame corresponded to the Population and Housing Census of 2002. Pregnant women and people who reported violent behaviour were excluded from the random selection within the household.

From this sampling frame districts were selected and then segments. In urban areas, the segments were registered to update the information about households that compose them, and then, houses were selected. Finally, one person was selected within households.

Stratification

The sample for the NHS2010 has national and regional representation. The sample design was a stratified multistage. Stratification was done by crossing two variables: region and urban/ rural area. In this way, 29 strata were generated. In addition, the districts were classified according to their size.

In urban areas, the districts were classified into three strata, depending on the total population of that district (including the rural population) aged 15 or more:

- Strata 1: Between 100, 000 and more people
- Strata 2: Between 30, 000 and 99, 999 people
- Strata 3: Under 29,999 people

The rural districts were not classified by size, as only technical criteria were considered.

Selection of sampling units

First, districts were selected, which were chosen in proportion to their population aged 15 and over. Second, segments were taken within each selected district. The amount was proportional to the number of occupied household at the time of the Census. Third, private household were selected within each selected segment. This selection was made randomly, after updated information through the registration framework in urban areas. Finally, one individual was chosen per selected household. This selection was made at random (Kish table method), giving a double probability of selection to those 65 years or older.

Sample size

The sample for NHS2010 can be defined as probabilistic, geographically stratified, multistage and for cluster, with no proportional distribution of surveys per stratum. This sample consisted of a complex design, similar to that used in the previous survey (ENS 2003) and in most social surveys in general population in Chile

The theoretical sample was designed to allow to estimate with adequate accurately (relative error not exceeding 20%) a wide range of prevalence fluctuating between 5% and 80%, with a confidence level of 95%.

Table A2. 1 shows the distribution of Chilean population in Census 2002. The last two age groups (individuals 65 and older) had a low percentage of the population (11.2%). Considering that it is known that this age group had high prevalence of chronic diseases and risk factors, it was decided the over-representing it in the sampling process, through doubling the probability of selection. Thus, it was expected to obtain statistically significant results and with accuracy for this group similar to those of other age groups.

Table A2. 1: Distribution of the Chilean population aged 15 and older by age and sex

Age group	Man		Woman		TOTAL	
	(n)	(%)	(n)	(%)	(n)	%
15 - 24	1.464.492	11,4	1.420.015	11,0	2.884.507	22,4
25 - 44	2.475.568	19,3	2.464.146	19,2	4.939.714	38,4
45 - 64	1.752.730	13,6	1.834.927	14,3	3.587.657	27,9
65 - 74	393.781	3,1	475.852	3,7	869.633	6,8
75 and over	220.674	1,7	350.842	2,7	571.516	4,4
TOTAL	6.307.245	49,1	6.545.782	50,9	12.853.027	100,0

Source: National Census 2002. Statistics National Institute

Expansion Factors

In order to achieve adequate inference of the results for the Chilean population aged 15 years and older, this sample design required that each valid observation was weighted by: 1) the probability of selection that this had at each stage; 2) no observed response and 3) the respective weights derived from demographic adjustment.

The resulting database was formed by a sample of individuals interviewed, in which the expansion factor corresponded to the inverse of the probability of selection of the individual. However, the database had individuals who did not answer all survey instruments (F1, F2, laboratory tests). For this reason, four factors were constructed as follow:

1. Factor for individuals who responded F1, regardless of their response in the other instruments.

2. Factor for individuals who responded F2, regardless of their response in the other instruments.
3. Factor for individuals who underwent laboratory tests, regardless of their response in the other instruments.
4. Factor for individuals with response in the three instruments.

Appendix 3. Comparative analysis between 2003 and 2010 for SBP and DBP.

For this report and in order to make comparable the measurements in the two surveys, a comparative analysis between 2003 and 2010 for systolic blood pressure and diastolic blood pressure was carried out.

Averages of SBP and DBP in 2003 and 2010 were calculated by age groups. For 2010 two averages were calculated for SBP and DBP. The first one was that resulting from the first and second measures and the second one that from the second and the third measures. The average of SBP of the last two measures was systematically lower than the average of the first two. Therefore, it was considered that the averages of the first and second measures of blood pressure in 2010 were more comparable to those in 2003 (Table A3.1).

Table A3. 1 Comparison between averages of diastolic blood pressure and systolic blood pressure 2003 with averages (first and second measure/second and third measure) in 2010

Group of Age	AvSBP12010	AvSBP22010	AvDBP12010	AvDBP22010	AvSBP2003	AvDBP2003
< 25	114.29	113.02	69.01	68.95	116	72
25 -29	115.83	115.32	73.29	73.05	118	75
30 - 34	117.65	116.40	75.35	75.10	120	78
35 - 39	122.05	120.15	78.53	78.30	124	80
40 - 44	122.16	121.23	76.77	76.82	128	83
45 - 49	128.48	127.09	80.92	81.01	133	85
50 - 54	133.01	131.75	82.02	81.56	137	87
55 - 59	136.78	135.32	81.23	80.77	141	87
60 - 64	140.70	138.27	80.24	79.86	147	87
65 - 69	145.15	143.07	79.95	79.44	146	87
70 - 74	150.08	148.70	77.22	77.22	153	87
75 +	152.34	150.23	75.88	75.86	156	85

Appendix 4. Sensitivity analysis of handling missing data

Table A4. 1 Weighted descriptive statistics for study variables for complete cases and imputed data samples. Surveys 2003 and 2010

	2003				*2010*			
Variables	*Complete cases (3,042)*		*Multiple imputed dataset (10 imputations)*		*Complete cases (4,055)*		*Multiple imputed dataset (10 imputations)*	
	Mean/%	*95%CI*	*Mean/%*	*95%CI*	*Mean/%*	*95%CI*	*Mean/%*	*95%CI*
Age	42.56	(41.72;43.40)	42.94	(42.13;43.75)	43.92	(43.11;44.73)	44.73	(43.94;45.53)
Sex (female)	51.6	(49.09;54.10)	51.27	(48.80;53.74)	53.42	(50.78;56.07)	51.88	(49.35;54.42)
Marital status								
Married/cohabiting	62.05	(59.14;64.96)	61.64	(58.76;64.51)	59.94	(57.15;62.73)	60.13	(57.56;62.71)
Single	28.7	(25.71;31.68)	28.38	(25.51;31.26)	30.4	(27.73;33.06)	29.94	(27.46;32.42)
Divorced/Separated/Widowed	9.25	(7.93;10.56)	9.98	(8.68;11.28)	9.66	(8.17;11.16)	9.93	(8.49;11.37)
Place of residence (urban)	85.73	(84.16;87.30)	86.01	(84.56;87465)	87.48	(86.27;88.69)	86.85	(85.38;88.32)
Education level								
High	18.86	16.30;21.43)	19.93	(17.05;22.81)	27.43	(24.86;30.00)	26.26	(23.87;28.65)
Middle	53.89	(51.08;56.69)	52.79	(50.05;55.53)	54.16	(51.45;56.86)	53.02	(50.50;55.54)
Low	27.25	(24.83;29.67)	27.28	(24.83;29.73)	18.42	(16.51;20.32)	20.72	(18.81;22.62)
Assets-based index								
High	14.56	(11.93;17.19)	14.92	(12.14;17.69)	46.99	(44.30;49.68)	45.71	(43.09;48.32)
Middle	61.09	(58.11;64.08)	61.36	(58.45,64.26)	44.41	(41.72;47.11)	44.61	(42.14;47.08)
Low	24.34	(21.88;26.81)	23.73	(21.34;26.12)	8.60	(7.24;9.97)	9.69	(8.30;11.08)

Table A4. 1 (cont.): Weighted descriptive statistics for study variables for complete cases and imputed data samples. Surveys 2003 and 2010

	2003				*2010*			
Variables	*Complete cases (3,042)*		*Multiple imputed dataset (10 imputations)*		*Complete cases (4,055)*		*Multiple imputed dataset (10 imputations)*	
	Mean/%	*95%CI*	*Mean/%*	*95%CI*	*Mean/%*	*95%CI*	*Mean/%*	*95%CI*
Occupation								
Higher worker	11.05	(8.97;13.13)	11.56	(9.50;13.64)	8.97	(7.23;10.72)	8.62	(7.00;10.26)
Intermediate worker	10.83	(8.82;12.84)	11.33	(9.41;13.25)	21.5	(19.16;23.83)	21.66	(19.27;24.05)
Routine and manual worker	27.51	(24.90;30.11)	26.72	(24.09;29.34)	26.58	(24.22;28.95)	26.68	(24.17;29.18)
Homemaker	26.62	(24.14;29.09)	26.19	(23.80;28.57)	21.35	(19.45;23.26)	20.69	(18.91;22.47)
Inactive	16.65	(14.20;19.11)	16.27	(13.95;18.59)	11.12	(9.25;12.99)	11.54	(9.69;13.39)
Retired	7.34	(6.18;8.51)	7.94	(6.67;9.20)	10.48	(9.15;11.81)	10.81	(9.46;12.15)
Hypertension (%)	35.66	(32.93;38.40)	36.15	(33.55;38.76)	30.25	(27.77;32.72)	31.53	(29.09;33.97)
Systolic blood pressure (mean)	129.1	(127.98;130.22)	128.81	(127.68;129.95)	127.39	(126.34;128.43)	128.03	(127.02;129.04)
Diastolic blood pressure (mean)	80.82	(80.08;81.55)	80.63	(79.92;81.34)	77.2	(76.62;77.78)	77.31	(76.77;77.85)
BMI	27.13	(26.88;27.38)	27.1	(26.85;27.34)	27.76	(27.36;28.16)	27.82	(27.45;28.19)
Diabetes Mellitus	6.51	(5.49;7.54)	7.17	(6.05;8.30)	9.52	(8.04;11.01)	10.93	(9.27;12.58)
Family history of hypertension	42.31	(39.63;44.99)	41.99	(39.49;44.50)	44.68	(41.95;47.41)	73.16	(72.4;73.9)
Physical activity								
Three or more times per week	9.74	(8.03;11.50)	9.82	(8.07;11.58)	8.93	(7.21;10.65)	8.84	(7.23;10.45)
Less than three times per week	17.62	(15.39;19.86)	17.48	(15.19;19.77)	14.21	(12.14;16.28)	13.74	(11.83;15.64)
Do not do PA	72.64	(69.90;75.37)	72.7	(69.91;75.49)	76.87	(74.39;79.35)	77.42	(75.11;79.74)
Smoking								
Never smoker	43.08	(39.21;45.01)	42.35	(39.58;45.12)	43.16	(40.59;45.73)	43.23	(35.69;40.83)
Past smoker	14.82	(13.00;16.63)	15.77	(13.76;17.78)	17.37	(15.37;19.36)	18.51	(16.42;20.60)
Current smoker	42.11	(40.15;46.00)	41.88	(39.58;45.12)	39.47	(36.82;42.12)	38.26	(35.69;40.83)

Table A4. 2: Systolic blood pressure, diastolic blood pressure and hypertension in relation to assets-based index. Comparison of results by using complete cases sample and multiple imputed sample. Chile 2003.

a) Basic model	Complete cases (N=3,042)			Multiple imputed sample (10 imputations)		
	Coef	95% CI	P	Coef	95% CI	P
Systolic blood pressure/assets-based index						
High	Reference			Reference		
Middle	3.52	0.27;6.73	0.03	3.51	0.33;6.69	0.03
Low	5.22	1.73;8.70	<0.01	5.33	1.90;8.76	<0.01
P for Trend			<0.01			<0.01
Diastolic blood pressure / assets-based index						
High	Reference			Reference		
Middle	1.76	-0.11;3.63	0.07	1.77	-0.06;3.61	0.06
Low	1.79	-0.36;3.95	0.10	1.81	-0.30;3.91	0.09
P for Trend			0.16			0.11
Hypertension/ assets-based index	PR			PR		
Low	1.18	0.96;1.46	0.11	1.19	0.96;1.46	0.11
Middle	1.21	0.96;1.53	0.11	1.21	0.96;1.53	0.11
High	Reference			Reference		
P for Trend			0.13			0.14

Table A4. 2 (cont.): Systolic blood pressure, diastolic blood pressure and hypertension in relation to assets-based index. Comparison of results by using complete cases sample and multiple imputed sample. Chile 2003.

b) Fully adjusted Model

	Coef	95% CI	P	Coef	95% CI	P
Systolic blood pressure/ assets-based index						
High	Reference			Reference		
Middle	2.31	-0.67;5.28	0.13	2.16	-0.82;5.14	0.15
Low	3.61	0.27;6.95	0.03	3.37	0.03;6.73	0.05
P for Trend			0.03			0.02
Diastolic blood pressure / assets-based index						
High	Reference			Reference		
Middle	0.91	-0.88;2.70	0.32	1.00	-0.90;2.89	0.30
Low	0.81	-1.30;2.92	0.75	0.82	-1.36;2.99	0.50
P for Trend			0.51			0.41
Hypertension/ assets-based index	PR			PR		
High	Reference			Reference		
Middle	1.11	0.91;1.35	0.29	1.12	0.92;1.36	0.28
Low	1.13	0.91;1.41	0.26	1.14	0.91;1.42	0.26
P for Trend			0.30			0.30

Basic model: adjusted for age and sex. Full adjusted model: adjusted for age, sex, marital status, area, BMI, diabetes mellitus, family history of hypertension, smoking and physical activity.

Table A4. 3: SBP, DBP and hypertension in relation to occupation. Comparison of results by using complete cases sample and multiple imputed sample. Chile 2010.

a) Basic model	Complete cases (N=4,055)			Multiple imputed sample (10 imputations)		
Systolic blood pressure	Coef	95% CI	P	Coef	95% CI	P
Higher worker	Ref			Ref		
Intermediate worker	-0.46	-4.5;3.58	0.82	-0.47	-4.46;3.50	0.81
Routine and manual	2.38	-1.73;6.48	0.26	2.10	-1.92;6.12	0.31
Homemaker	3.32	-1.05;7.70	0.14	3.22	-1.08;7.5	0.14
Inactive	4.83	0.28;9.38	0.04	4.45	0.06;8.84	0.05
Retired	2.99	-2.11;8.09	0.125	3.36	-1.65;8.38	0.19
p value for homogeneity			<0.01			<0.01
Diastolic blood pressure						
Higher worker	Ref			Ref		
Intermediate worker	-1.15	-3.92;1.62	0.42	-1.06	-3.77;1.65	0.44
Routine and manual	-0.97	-3.69;1.76	0.49	-1.05	-3.71;1.61	0.44
Homemaker	-1.25	-4.15;1.65	0.40	-1.17	-3.99;1.65	0.42
Inactive	-1.07	-4.09;1.96	0.49	-0.94	-3.92;-2.04	0.54
Retired	-7.08	-10.15;-4.01	<0.01	-6.76	-9.70;-3.82	<0.01
p value for homogeneity			<0.01			<0.01
Hypertension	PR			PR		
Higher worker	Ref			Ref		
Intermediate worker	1.05	0.69;1.60	0.81	1.05	0.69;1.60	0.81
Routine and manual	1.06	0.72;1.56	0.76	1.06	0.72;1.56	0.76
Homemaker	1.11	0.75;1.66	0.60	1.11	0.75;1.66	0.60
Inactive	0.84	0.51;1.38	0.48	0.84	0.51;1.38	0.48
Retired	0.85	0.59;1.22	0.39	0.85	0.59;1.23	0.39
p value for homogeneity			0.05			0.05
b) Fully adjusted model						
Systolic blood pressure						
Higher worker	Ref			Ref		
Intermediate worker	0.25	-2.50;2.99	0.66	0.07	-2.7;2.86	0.97
Routine and manual	3.14	0.16;6.13	0.03	2.84	-0.14;5.81	0.06
Homemaker	3.86	0.71;7.00	<0.01	3.74	0.58;6.90	0.02
Inactive	4.87	1.41;8.33	<0.01	4.74	1.36;8.09	<0.01
Retired	3.45	-0.94;7.85	0.09	3.44	-1.04;7.93	0.13
p value for homogeneity			<0.01			<0.01
Diastolic blood pressure						
Higher worker	Ref			Ref		
Intermediate worker	-0.50	-2.42;1.42	0.61	-0.51	-2.40;1.38	0.59
Routine and manual	-0.36	-2.33;1.60	0.72	-0.43	-2.34;1.49	0.66
Homemaker	-1.25	-3.23;0.74	0.22	-1.22	-3.18;0.74	0.22
Inactive	0.27	-2.02;2.55	0.82	0.56	-1.74;2.87	0.63
Retired	-5.98	-8.38;-3.57	<0.01	-5.99	-8.29;-3.70	<0.01
p value for homogeneity			<0.01			<0.01
Hypertension	PR			PR		
Higher worker	Ref			Ref		
Intermediate worker	1.13	0.82;1.55	0.47	1.13	0.82;1.56	0.46
Routine and manual	1.13	0.84;1.51	0.43	1.13	0.84;1.52	0.41
Homemaker	1.14	0.85;1.52	0.39	1.14	0.85;1.53	0.37
Inactive	0.92	0.61;1.39	0.68	0.92	0.61;1.40	0.70
Retired	0.88	0.66;1.18	0.40	0.89	0.66;1.19	0.42
p value for homogeneity			0.06			0.06

Basic model: adjusted for age and sex. Full adjusted model: adjusted for age, sex, marital status, area, BMI, diabetes mellitus, family history of hypertension, smoking and physical activity.

Appendix 5. The role of age and sex on socio-economic inequalities in blood pressure

Table A5. 1: Association between SBP, DBP and hypertension and education, crude and adjusted regressions coefficients, PR and 95% CI. NHS 2003

		No adjusted			Adjusted for age			Adjusted for sex			Adjusted for age and sex		
SBP	n	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value
High	570	Ref	-	-	Ref	-	-	Ref	-	-	Ref	-	-
Middle	1636	5.88	[3.20,8.57]	<0.01	2.58	[-0.18,5.33]	0.07	6.20	[3.67,8.72]	<0.01	2.89	[0.28,5.50]	0.03
Low	836	19.4	[16.13,22.64]	<0.01	3.82	[0.49,7.16]	0.02	20.3	[17.25,23.35]	<0.01	4.71	[1.51,7.92]	<0.01
p for trend				<0.01			0.03			<0.01			<0.01
Age		-	-	-	0.78	[0.71,0.85]	<0.01	-	-	-	0.78	[0.72,0.85]	<0.01
Sex (ref:men)		-	-	-	-	-	-	-6.40	[-8.56,-4.24]	<0.01	-6.7	[-8.45,-4.96]	<0.01
DBP	n	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value
High	570	Ref	-	-	Ref	-	-				Ref	-	-
Middle	1636	2.28	[0.35,4.21]	0.02	0.95	[-0.97,2.88]	0.33	2.56	[0.70,4.42]	0.01	1.23	[-0.63,3.08]	0.19
Low	836	6.69	[4.58,8.80]	<0.01	0.45	[-1.86,2.76]	0.70	7.50	[5.52,9.48]	<0.01	1.22	[-0.96,3.40]	0.27
p for trend				<0.01			0.73			<0.01			0.29
Age		-	-	-	0.31	[0.27,0.35]	<0.01	-	-	-	0.32	[0.28,0.35]	<0.01
Sex (ref:men)		-	-	-	-	-	-	-5.70	[-7.06,-4.34]	<0.01	-5.82	[-7.05,-4.60]	<0.01
Hypertension	n	PR	95% CI	p-value	PR	95% CI	P	PR	95% CI	p-value	PR	95% CI	p-value
High	570	Ref	-	-	Ref	-	-				Ref	-	-
Middle	1636	1.45	[1.06,1.97]	0.02	1.19	[0.90,1.58]	p-value	1.46	[1.08,1.98]	0.01	1.21	[0.92,1.60]	0.17
Low	836	2.59	[1.90,3.52]	<0.01	1.19	[0.88,1.60]	0.25	2.67	[1.98,3.60]	<0.01	1.23	[0.93,1.64]	0.15
p for trend				<0.01			0.30			<0.01			0.15
Age		-	-	-	1.04	[1.03,1.04]	<0.01	-	-	-	1.04	[1.03,1.04]	<0.01
Sex (ref:men)		-	-	-	-	-	-	0.80	[0.70,0.90]	<0.01	0.77	[0.68,0.86]	<0.01

Table A5. 2: Association between SBP, DBP and hypertension and assets-based index, crude and adjusted regressions coefficients, PR and 95% CI. NHS 2003

		No adjusted			Adjusted by age			Adjusted for sex			Adjusted for age and sex		
SBP	Weighted N	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value
High	442	Ref	-	-	Ref	-	-				Ref	-	-
Middle	1859	4.76	[0.79,8.72]	0.02	3.36	[-0.06,6.78]	0.05	4.88	[0.98,8.78]	0.01	3.50	[0.27,6.73]	0.03
Low	741	5.77	[1.54,10.00]	0.01	5.08	[1.43,8.74]	0.01	5.88	[1.70,10.06]	0.01	5.22	[1.73,8.70]	<0.01
p for trend				*0.01*			*<0.01*			*<0.01*			*<0.01*
Age					0.81	[0.75,0.87]	<0.01				0.82	[0.77,0.88]	<0.01
Sex (ref:men)								-4.96	[-7.15,-2.78]	<0.01	-6.52	[-8.25,-4.80]	<0.01
DBP	Weighted N	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value
High	442	Ref	-	-	Ref	-	-				Ref	-	-
Middle	1859	2.17	[0.11,4.23]	0.04	1.63	[-0.32,3.59]	0.10	2.30	[0.28,4.32]	0.03	1.76	[-0.11,3.63]	0.06
Low	741	1.94	[-0.43,4.31]	0.11	1.67	[-0.59,3.94]	0.15	2.05	[-0.26,4.37]	0.08	1.79	[-0.36,3.95]	0.10
p for trend				*0.19*			*0.21*			*0.16*			*0.16*
Age					0.31	[0.28,0.34]	<0.01				0.32	[0.29,0.35]	<0.01
Sex (ref:men)								-5.19	[-6.55,-3.82]	<0.01	-5.80	[-7.01,-4.58]	<0.01
Hypertension	Weighted N	PR	95% CI	p-value	PR	95% CI	p-value	PR	95% CI	p-value	PR	95% CI	p-value
High	442	Ref	-	-	Ref	-	-				Ref	-	-
Middle	1859	1.27	[0.98,1.64]	0.07	1.18	[0.95,1.47]	0.13	1.28	[0.99,1.64]	0.06	1.18	[0.96,1.46]	0.11
Low	741	1.26	[0.96,1.67]	0.10	1.22	[0.96,1.55]	0.10	1.27	[0.96,1.67]	0.09	1.21	[0.96,1.53]	0.11
p for trend				*0.13*			*0.12*			*0.13*			*0.13*
Age					1.04	[1.03,1.04]	<0.01				1.04	[1.03,1.04]	<0.01
Sex (ref:men)								0.85	[0.75,0.97]	0.02	0.77	[0.69,0.87]	<0.01
age*assets		1.02	[1.01,1.02]	<0.01				1.02	[1.01,1.02]	<0.01			
sex*assets		0.93	[0.88,0.99]	<0.01	0.90	[0.86,0.95]	<0.01						

Table A5. 3 Crude regression estimates of the association between occupation and three measures of blood pressure. NHS 2003.

	Men				Women			
SBP	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
Higher worker	236	Ref	-	-	100	Ref	-	-
Intermediate	135	-4.50	[-10.03,1.04]	0.11	193	-11.58	[-19.73,-3.43]	0.01
Manual worker	642	0.11	[-3.57,3.79]	0.95	195	-3.26	[-10.52,4.00]	0.38
Homemaker	0	NA			810	4.21	[-17.38,-2.87]	0.01
Inactive	306	-1.93	[-6.34,2.48]	0.39	201	-10.10	[18.06,38.78]	<0.01
Retired	153	18.70	[13.88,23.56]	<0.01	71	28.40	[-2.50,10.92]	0.22
Wald test for homogeneity				<0.01				<0.01
DBP		Coef	95% CI	p value		Coef	95% CI	p value
Higher worker	236	Ref	-	-	100	Ref	-	-
Intermediate	135	-3.95	[-8.77,0.87]	0.11	193	-7.96	[-13.18,-2.75]	<0.01
Manual worker	642	-1.84	[-4.43,0.75]	0.16	195	-1.85	[-6.38,2.68]	0.42
Homemaker	0	NA			810	0.24	[-11.43,-2.13]	<0.01
Inactive	306	-3.56	[-6.85,-0.28]	0.03	201	-6.78	[2.45,12.61]	<0.01
Retired	153	2.86	[-0.32,6.04]	0.08	71	7.53	[-3.93,4.42]	0.91
Wald test for homogeneity				<0.01				<0.01
Hypertension		PR	95% CI	p value		PR	95% CI	p value
Higher worker	236	Ref	-	-	100	Ref	-	-
Intermediate	135	0.63	[0.37,1.09]	0.10	193	0.55	[0.25,1.20]	0.13
Manual worker	642	0.88	[0.65,1.20]	0.42	195	0.94	[0.48,1.82]	0.85
Homemaker	0	NA			810	1.42	[0.30,1.14]	0.12
Inactive	306	0.82	[0.56,1.21]	0.31	201	0.58	[1.67,5.04]	<0.01
Retired	153	1.65	[1.22,2.23]	<0.01	71	2.90	[0.82,2.46]	0.21
Wald test for homogeneity				<0.01				<0.01

Table A5. 4 : Association between blood pressure and occupation. Age adjusted estimates stratified by sex. NHS 2003.

	Men				Women			
SBP	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
Higher worker	236	Ref	-	-	100	Ref	-	-
Intermediate	135	-2.78	[-8.56,3.00]	0.35	193	-2.63	[-11.07,5.80]	0.54
Manual worker	642	-0.85	[-4.03,2.33]	0.60	195	0.58	[-7.26,8.43]	0.88
Homemaker	0				810	2.79	[-4.36,9.95]	0.44
Inactive	306	-0.69	[-4.78,3.40]	0.74	201	-0.42	[-8.00,7.15]	0.91
Retired	153	0.37	[-4.69,5.43]	0.89	71	4.15	[-5.64,13.95]	0.41
Test for homogeneity				*0.90*				*0.15*
Age		0.65	[0.55,0.75]	<0.01		0.91	[0.83,0.98]	<0.01
DBP	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
Higher worker	236	Ref	-	-	100	Ref	-	-
Intermediate	135	-3.10	[-7.87,1.67]	0.20	193	-4.67	[-10.15,0.80]	0.09
Manual worker	642	-2.31	[-4.63,-0.00]	0.05	195	-0.44	[-5.40,4.53]	0.86
Homemaker	0	NA			810	-0.28	[-4.77,4.22]	0.90
Inactive	306	-2.95	[-6.04,0.14]	0.06	201	-3.21	[-8.15,1.72]	0.20
Retired	153	-6.21	[-9.73,-2.70]	<0.01	71	-1.38	[-6.70,3.93]	0.61
Test for homogeneity				*<0.01*				*0.06*
Age		0.32	[0.26,0.39]	<0.01		0.33	[0.29,0.38]	<0.01
Hypertension	Weighted N	PR	95% CI	p value	Weighted N	PR	95% CI	p value
Higher worker	236	Ref	-	-	100	Ref	-	-
Intermediate	135	0.72	[0.43,1.20]	0.20	193	0.87	[0.39,1.93]	0.72
Manual worker	642	0.82	[0.63,1.07]	0.15	195	1.18	[0.61,2.29]	0.63
Homemaker	0	NA			810	1.22	[0.70,2.11]	0.49
Inactive	306	0.81	[0.57,1.14]	0.23	201	0.78	[0.41,1.47]	0.44
Retired	153	0.56	[0.41,0.76]	<0.01	71	0.99	[0.58,1.71]	0.99
Test for homogeneity				*<0.01*				*0.06*
Age		1.04	[1.03,1.05]	<0.01		1.04	[1.04,1.05]	<0.01

Table A5. 5: Association between blood pressure and occupation (three categories). Crude and age and sex adjusted estimates. NHS2003.

		No adjusted			Age adjusted			Sex adjusted			Adjusted for age and sex		
SBP	Weighted N	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Higher worker	336	Ref	-	-	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	328	-9.82	[-14.72,-4.93]	<0.01	-6.33	[-10.92,-1.74]	0.01	-7.63	[-12.11,-3.14]	<0.01	-3.82	[-8.13,0.49]	0.08
Routine and manual	837	-0.42	[-4.03,3.19]	0.82	-0.25	[-3.77,3.27]	0.89	-0.91	[-4.42,2.60]	0.61	-0.79	[-4.07,2.49]	0.63
P-value for trend				*0.35*			*0.55*			*0.81*			0.92
Age					0.68	[0.56,0.80]	<0.01				0.69	[0.58,0.81]	*<0.01*
Sex (ref:men)								-7.6	[-10.47,-4.72]	<0.01	-8.43	[-11.27,-5.58]	<0.01
DBP	Weighted N	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Higher worker	336	Ref	-	-	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate	328	-7.79	[-10.91,-4.68]	<0.01	-6.13	[-9.09,-3.17]	<0.01	-6.00	[-9.00,-3.00]	<0.01	-4.15	[-7.09,-1.22]	0.01
Routine worker	837	-1.51	[-3.85,0.83]	0.21	-1.43	[-3.75,0.89]	0.23	-1.91	[-4.23,0.41]	0.11	-1.85	[-4.09,0.38]	0.10
P-value for trend				*0.98*			*0.82*			*0.41*			*0.27*
Age					0.32	[0.25,0.40]	<0.01				0.34	[0.26,0.41]	<0.01
Sex (ref:men)								-6.22	[-8.17,-4.27]	<0.01	-6.62	[-8.58,-4.66]	<0.01
Hypertension	Weighted N	PR	95% CI	p value	PR	95% CI	p value	PR	95% CI	p value	PR	95% CI	p value
Higher worker	336	Ref	-	-	Ref	-	-	Ref	-	-	Ref	-	-
Intermediate worker	328	0.53	[0.35,0.79]	<0.01	0.69	[0.47,1.01]	0.05	0.59	[0.40,0.87]	0.01	0.75	[0.52,1.09]	0.14
Routine and manual	837	0.91	[0.68,1.23]	0.54	0.93	[0.70,1.23]	0.61	0.89	[0.66,1.20]	0.45	0.88	[0.67,1.17]	0.38
P-value for trend				*0.97*			*0.88*			*0.75*			*0.50*
Age					1.04	[1.03,1.05]	<0.01				1.04	[1.04,1.05]	<0.01
Sex (ref:men)								0.68	[0.53,0.89]	<0.01	0.65	[0.50,0.84]	<0.01

Table A5. 6: Association between SBP, DBP and hypertension and education, crude and adjusted regressions coefficients, prevalence ratios and 95% CI. NHS 2010

		No adjusted			Adjusted for age			Adjusted for sex			Adjusted for age and sex		
SBP	Weighted N	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value
High	1108	Ref	-	-	Ref	-	-	Ref	-	-	Ref	-	-
Middle	2183	4.55	[1.92,7.17]	<0.01	0.70	[-1.55,2.96]	0.54	4.46	[1.88,7.04]	<0.01	0.56	[-1.65,2.76]	0.62
Low	764	18.1	[14.42,21.76]	<0.01	3.14	[-0.46,6.74]	0.09	18.7	[15.00,22.42]	<0.01	3.61	[0.04,7.17]	0.05
p for trend				<0.01			0.10			<0.01			0.07
Age					0.73	[0.67,0.80]	<0.01				0.74	[0.68,0.81]	<0.01
Sex (ref:men)								-7.86	[-10.09,-5.63]	<0.01	-8.58	[-10.44,-6.72]	<0.01
DBP	Weighted N	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value
High	1108	Ref	-	-	Ref	-	-				Ref	-	-
Middle	2183	0.71	[-0.85,2.27]	0.37	-0.37	[-1.86,1.13]	0.63	0.66	[-0.89,2.21]	0.40	-0.45	[-1.92,1.03]	0.55
Low	764	2.74	[0.89,4.58]	<0.01	-1.46	[-3.49,0.58]	0.16	3.09	[1.24,4.94]	<0.01	-1.20	[-3.18,0.78]	0.23
p for trend				<0.01			0.20			<0.01			0.26
Age					0.21	[0.17,0.24]	<0.01				0.21	[0.17,0.25]	<0.01
Sex (ref:men)								-4.47	[-5.68,-3.27]	<0.01	-4.68	[-5.81,-3.55]	<0.01
Hypertension	Weighted N	PR	95% CI	p-value	PR	95% CI	p-value	PR	95% CI	p-value	PR	95% CI	p-value
High	1108	Ref	-	-	Ref	-	-				Ref	-	-
Middle	2183	1.54	[1.16,2.04]	<0.01	1.24	[0.96,1.59]	0.10	1.53	[1.16,2.03]	<0.01	1.24	[0.96,1.59]	0.10
Low	764	2.61	[1.98,3.45]	<0.01	1.08	[0.84,1.40]	0.55	2.64	[1.99,3.50]	<0.01	1.09	[0.84,1.41]	0.50
p for trend				<0.01			0.67			<0.01			0.61
Age					1.04	[1.04,1.05]	<0.01				1.05	[1.04,1.05]	<0.01
Sex (ref:men)								0.86	[0.73,1.02]	-0.08	0.82	[0.71,0.94]	<0.01

Table A5. 7: Association between SBP, DBP and hypertension and assets-based index, crude and adjusted regressions coefficients, prevalence ratios and 95% CI. NHS 2010

		No adjusted			Adjusted by age			Adjusted for sex			Adjusted for age and sex		
SBP	Weighted N	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value
High	1888	Ref	-	-	Ref	-	-				Ref	-	-
Middle	1819	4.50	[2.21,6.79]	<0.01	2.25	[0.34,4.17]	0.02	4.93	[2.64,7.23]	<0.01	2.72	[0.83,4.61]	<0.01
Low	348	5.83	[2.10,9.55]	<0.01	2.07	[-0.93,5.08]	0.18	6.10	[2.50,9.70]	<0.01	2.33	[-0.46,5.12]	0.10
p for trend				<0.01			0.03			<0.01			<0.01
Age					0.76	[0.70,0.81]	<0.01				0.77	[0.72,0.82]	<0.01
Sex (ref:men)								-7.36	[-9.58,-5.13]	<0.01	-8.62	[-10.48,-6.76]	<0.01
DBP	Weighted N	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value	Coef	95% CI	p-value
High	1888	Ref	-	-	Ref	-	-				Ref	-	-
Middle	1819	0.59	[-0.64,1.82]	0.35	0.01	[-1.18,1.20]	0.98	0.85	[-0.37,2.07]	0.17	0.27	[-0.90,1.44]	0.65
Low	348	0.25	[-1.61,2.11]	0.79	-0.71	[-2.43,1.01]	0.42	0.42	[-1.42,2.26]	0.66	-0.57	[-2.25,1.11]	0.51
p for trend				0.47			0.63			0.27			0.89
Age					0.19	[0.16,0.22]	<0.01				0.2	[0.17,0.23]	<0.01
Sex (ref:men)								-4.39	[-5.58,-3.19]	<0.01	-4.71	[-5.85,-3.58]	<0.01
Hypertension	Weighted N	PR	95% CI	p-value	PR	95% CI	p-value	PR	95% CI	p-value	PR	95% CI	p-value
High	1888	Ref	-	-	Ref	-	-				Ref	-	-
Middle	1819	1.20	[1.01,1.44]	0.04	1.03	[0.88,1.21]	0.68	1.21	[1.01,1.45]	0.03	1.05	[0.89,1.23]	0.57
Low	348	1.22	[0.93,1.59]	0.15	0.95	[0.75,1.21]	0.69	1.22	[0.94,1.59]	0.13	0.95	[0.75,1.21]	0.68
p for trend				0.04			0.96			0.03			0.98
Age					1.04	[1.04,1.05]	<0.01				1.04	[1.04,1.05]	<0.01
Sex (ref:men)								0.89	[0.76,1.04]	-0.15	0.81	[0.70,0.93]	<0.01

Table A5. 8: Association between blood pressure and occupation. Crude estimates stratified by sex. NHS 2010.

	Men				Women			
SBP	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
Higher worker	160	Ref	-	-	203	Ref	-	-
Intermediate	467	-1.26	[-6.52,4.00]	0.64	405	-2.44	[-9.26,4.38]	0.48
Manual worker	795	3.09	[-2.09,8.27]	0.24	284	2.49	[-4.82,9.81]	0.50
Homemaker	34	3.18	[-7.07,13.42]	0.54	832	7.81	[1.02,14.60]	0.02
Inactive	246	-1.85	[-8.05,4.34]	0.56	204	-3.79	[-10.91,3.33]	0.30
Retired	187	21.40	[14.96,27.93]	<0.01	238	27.60	[20.10,35.20]	<0.01
Test for homogeneity				*<0.01*				*<0.01*
DBP	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
Higher worker	160	Ref	-	-	203	Ref	-	-
Intermediate	467	-0.79	[-3.83,2.24]	0.61	405	-2.62	[-7.15,1.91]	0.26
Manual worker	795	-1.19	[-4.03,1.64]	0.41	284	0.10	[-4.62,4.83]	0.97
Homemaker	34	-1.17	[-6.87,4.53]	0.69	832	0.39	[-3.95,4.73]	0.86
Inactive	246	-4.44	[-7.77,-1.11]	0.01	204	-2.79	[-7.58,1.99]	0.25
Retired	187	-0.37	[-3.64,2.90]	0.82	238	1.12	[-3.44,5.68]	0.63
Test for homogeneity				*0.11*				*<0.01*
Hypertension	Weighted N	PR	95% CI	p value	Weighted N	PR	95% CI	p value
Higher worker	160	Ref	-	-	203	Ref	-	-
Intermediate	467	0.96	[0.57,1.63]	0.89	405	0.91	[0.42,1.97]	0.80
Manual worker	795	1.06	[0.65,1.71]	0.82	284	0.99	[0.47,2.07]	0.98
Homemaker	34	1.71	[0.82,3.59]	0.15	832	1.50	[0.76,2.97]	0.24
Inactive	246	0.62	[0.31,1.24]	0.18	204	0.44	[0.18,1.05]	0.07
Retired	187	2.39	[1.50,3.81]	<0.01	238	3.46	[1.76,6.79]	<0.01
Test for homogeneity				*<0.01*				*<0.01*

Table A5. 9: Association between blood pressure and occupation. Age-adjusted estimates. NHS 2010.

	Men				Women			
SBP	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
Higher worker	160	Ref	-	-	203	Ref	-	-
Intermediate	467	0.77	[-4.08,5.62]	0.76	405	-1.73	[-7.83,4.37]	0.58
Manual worker	795	3.85	[-0.94,8.64]	0.12	284	-0.36	[-6.89,6.17]	0.91
Homemaker	34	4.15	[-3.10,11.40]	0.26	832	2.14	[-3.91,8.18]	0.49
Inactive	246	4.67	[-1.17,10.51]	0.12	204	5.28	[-1.21,11.78]	0.11
Retired	187	3.18	[-3.75,10.12]	0.37	238	2.35	[-4.91,9.61]	0.53
Age		0.69	[0.59,0.80]	<0.01		0.84	[0.76,0.92]	<0.01
Test for homogeneity				*0.22*				*<0.01*
DBP	Weighted N	Coef	95% CI	p value	Weighted N	Coef	95% CI	p value
Higher worker	160	Ref	-	-	203	Ref	-	-
Intermediate	467	0.13	[-2.70,2.96]	0.93	405	-2.43	[-6.89,2.03]	0.29
Manual worker	795	-0.85	[-3.55,1.85]	0.54	284	-0.66	[-5.28,3.96]	0.78
Homemaker	34	-0.73	[-8.30,6.85]	0.85	832	-1.12	[-5.37,3.13]	0.61
Inactive	246	-1.48	[-4.77,1.81]	0.38	204	-0.38	[-5.11,4.36]	0.88
Retired	187	-8.67	[-12.36,-4.98]	<0.01	238	-5.62	[-10.26,-0.97]	0.02
Age		0.32	[0.25,0.38]	<0.01		0.22	[0.18,0.27]	<0.01
Test for homogeneity				*<0.01*				*<0.01*
Hypertension	Weighted N	PR	95% CI	p value	Weighted N	PR	95% CI	p value
Higher worker	160	Ref	-	-	203	Ref	-	-
Intermediate	467	1.07	[0.66,1.74]	0.78	405	1.01	[0.49,2.10]	0.98
Manual worker	795	1.09	[0.70,1.68]	0.71	284	0.94	[0.47,1.85]	0.85
Homemaker	34	1.38	[0.57,3.36]	0.48	832	1.12	[0.60,2.08]	0.72
Inactive	246	0.89	[0.50,1.59]	0.69	204	0.72	[0.31,1.66]	0.44
Retired	187	0.71	[0.45,1.14]	0.16	238	1.01	[0.56,1.80]	0.98
Age		1.05	[1.04,1.06]	<0.01		1.05	[1.04,1.05]	<0.01
Test for homogeneity				*0.03*				*0.56*

Table A5. 10: Association between blood pressure and occupation, including only workers, crude and adjusted estimations. NHS 2010.

		Crude			Age adjusted			Sex adjusted			Age and sex adjusted		
SBP	Weighted n	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Higher worker	363	Ref	-	-	Ref	-	-						
Intermediate	872	-0.87	[-5.35,3.60]	0.70	0.35	[-3.69,4.39]	0.87	-1.88	[-6.30,2.54]	0.40	-0.63	[-4.69,3.42]	0.76
Manual worker	1079	5.82	[1.22,10.42]	0.01	5.05	[0.94,9.16]	0.02	2.71	[-1.78,7.21]	0.24	2.06	[-2.01,6.13]	0.32
p-value for trend				*<0.01*			*<0.01*			*0.05*			*0.14*
								-10.50	[-13.08,-7.82]	<0.01	-10.10	[-12.40,-7.74]	<0.01
Age					0.74	[0.65,0.83]	<0.01				0.73	[0.64,0.82]	<0.01
DBP	Weighted n	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Higher worker	363	Ref	-	-	Ref	-	-						
Intermediate	872	-1.14	[-4.03,1.76]	0.44	-0.60	[-3.42,2.22]	0.68	-1.66	[-4.49,1.17]	0.25	-1.12	[-3.90,1.66]	0.43
Manual worker	1079	0.70	[-2.19,3.59]	0.64	0.36	[-2.44,3.16]	0.80	-0.92	[-3.70,1.85]	0.51	-1.21	[-3.91,1.49]	0.38
p-value for trend				*0.31*			*0.58*			*0.75*			*0.42*
Sex								-5.45	[-7.13,-3.77]	<.001	-5.29	[-6.88,-3.69]	<0.01
Age					0.32	[0.26,0.39]	<0.01				0.32	[0.26,0.38]	<0.01
Hypertension	Weighted n	PR	95% CI	p value	PR	95% CI	p value	PR	95% CI	p value	PR	95% CI	p value
Higher worker	363	Ref	-	-	Ref	-	-						
Intermediate	872	0.97	[0.62,1.52]	0.90	1.09	[0.71,1.68]	0.69	0.94	[0.60,1.47]	0.78	1.05	[0.69,1.62]	0.81
Manual worker	1079	1.15	[0.75,1.75]	0.53	1.14	[0.76,1.70]	0.52	1.03	[0.68,1.56]	0.89	1.04	[0.71,1.53]	0.84
p-value for trend				*0.36*			*0.50*			*0.74*			*0.89*
Sex								0.68	[0.51,0.91]	0.01	0.71	[0.54,0.93]	0.01
Age					1.05	[1.04,1.06]	<0.01				1.05	[1.04,1.06]	<0.01

Appendix 6. Multivariable analysis of the association between socioeconomic position and blood pressure

Table A6. 1: Multivariable analysis of the association between SBP and education at different levels of adjustment by sex. 2003 and 2010

2003			**Men**				**Women**	
Education	High	Middle	Low	*P-value for trend*	High	Middle	Low	*P-value for trend*
Age,	Ref	-0.22	-0.49	0.85	Ref	6.67***	9.95***	p<0.01
Age, Place of residence	Ref	-0.56	-1.22	0.60	Ref	6.47***	9.44***	p<0.01
Age, Marital status	Ref	-0.13	-0.35	0.90	Ref	6.86***	9.93***	p<0.01
Age, Body mass index,	Ref	0.31	0.00	0.97	Ref	5.32**	8.15***	p<0.01
Age, Diabetes mellitus,	Ref	-0.29	-0.70	0.78	Ref	6.59***	9.62***	p<0.01
Age, Family history of hypertension,	Ref	0.15	0.01	0.95	Ref	6.73***	10.3***	p<0.01
Age, Smoking,	Ref	0.16	-0.35	0.91	Ref	6.60***	9.37***	p<0.01
Age, Physical activity	Ref	-0.26	-0.65	0.79	Ref	6.50***	9.67***	p<0.01
Fully adjusted	Ref	0.82	0.10	0.91	Ref	5.31**	6.90***	p<0.01
2010			**Men**				**Women**	
Education	High	Middle	Low	*P-value for trend*	High	Middle	Low	*P-value for trend*
Age,	Ref	0.69	1.89	0.44	Ref	0.42	4.78*	0.06
Age, Place of residence	Ref	0.68	1.84	0.47	Ref	0.41	4.74	0.06
Age, Marital status	Ref	1.13	2.18	0.34	Ref	0.76	4.95*	0.04
Age, Body mass index,	Ref	0.94	2.27	0.32	Ref	-0.20	3.40	0.15
Age, Diabetes mellitus,	Ref	0.72	1.69	0.48	Ref	0.44	4.62	0.07
Age, Family history of hypertension,	Ref	0.64	1.98	0.44	Ref	0.30	4.95*	0.05
Age, Smoking,	Ref	0.70	1.80	0.47	Ref	0.23	4.36	0.09
Age, Physical activity	Ref	0.83	1.96	0.42	Ref	0.44	4.79*	0.06
Fully adjusted	Ref	1.76	2.59	0.22	Ref	-0.05	3.15	0.20

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 2: Multivariable analysis of the association between SBP and education at different levels of adjustment in women. Intermediate level of education as reference. Chile 2010

	Coef		
Education	High	Midddle	Low
Age,	-0.42	Ref	4.35*
Age, Place of residence	-0.41	Ref	4.34*
Age, Marital status	-0.76	Ref	4.19*
Age, Body mass index,	0.20	Ref	3.60
Age, Diabetes mellitus,	-0.44	Ref	4.19*
Age, Family history of hypertension,	-0.30	Ref	4.65*
Age, Smoking,	-0.23	Ref	4.14*
Age, Physical activity	-0.44	Ref	4.35*
Fully adjusted	0.05	Ref	3.20

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 3: Multivariable analysis of the association between SBP and education at different levels of adjustment in women. Educational level with two categories. Chile 2010

	Coef	
Education	High/Middle	Low
Age,	Ref	4.46*
Age, Place of residence	Ref	4.42*
Age, Marital status	Ref	4.39*
Age, Body mass index,	Ref	3.52
Age, Diabetes mellitus,	Ref	4.29*
Age, Family history of hypertension,	Ref	4.72*
Age, Smoking,	Ref	4.18*
Age, Physical activity	Ref	4.46*
Fully adjusted	Ref	3.12

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 4: Multivariable analysis of the association between SBP and education at different levels of adjustment by age group. NHS 2003 and 2010

2003	**20-39**				**40-59**				**60 and over**			
Education	High	Middle	Low	*P for trend*	High	Middle	Low	*P for trend*	High	Middle	Low	*P for trend*
Sex,	Ref	2.67	4.25	0.04	Ref	4.50	10.7***	p<0.01	Ref	19.6**	16.8**	0.46
Sex, Place of residence	Ref	2.38	3.59	0.08	Ref	4.30	10.1***	p<0.01	Ref	19.5**	16.5**	0.51
Sex, Marital status	Ref	2.31	3.77	0.07	Ref	4.84	11.1***	p<0.01	Ref	19.4**	16.1**	0.56
Sex, Body mass index,	Ref	2.09	3.62	0.04	Ref	4.30	8.91***	p<0.01	Ref	18.9**	15.9**	0.52
Sex, Diabetes mellitus,	Ref	2.62	4.14	0.05	Ref	4.16	10.0***	p<0.01	Ref	19.6***	16.4**	0.51
Sex, Family history of hypertension,	Ref	2.94*	4.42	0.04	Ref	4.61	11.1***	p<0.01	Ref	20.6**	18.0**	0.42
Sex, Smoking,	Ref	2.85*	3.92	0.05	Ref	4.80	10.1***	p<0.01	Ref	19.5**	16.4**	0.51
Sex, Physical activity	Ref	2.43	3.60	0.08	Ref	4.44	10.5***	p<0.01	Ref	19.7**	16.7**	0.50
Fully adjusted	Ref	2.14	2.57	0.13	Ref	4.48	8.27***	p<0.01	Ref	18.5**	14.4**	0.73
2010	**20-39**				**40-59**				**60 and over**			
Education	High	Middle	Low	*P for trend*	High	Middle	Low	*P for trend*	High	Middle	Low	*P for trend*
Sex,	Ref	0.13	1.89	0.62	Ref	3.90	7.99*	0.02	Ref	2.89	7.11	0.03
Sex, Place of residence	Ref	0.09	1.75	0.67	Ref	3.87	7.91*	0.02	Ref	2.88	7.02	0.03
Sex, Marital status	Ref	-0.08	1.67	0.73	Ref	3.93	8.15*	0.01	Ref	3.23	7.21	0.03
Sex, Body mass index,	Ref	0.32	1.08	0.59	Ref	2.85	6.27	0.05	Ref	2.55	5.73	0.10
Sex, Diabetes mellitus,	Ref	0.10	1.87	0.64	Ref	3.89	7.84*	0.02	Ref	3.17	7.00	0.04
Sex, Family history of hypertension,	Ref	0.10	1.99	0.60	Ref	3.70	7.98*	0.02	Ref	2.97	7.41	0.02
Sex, Smoking,	Ref	0.03	1.65	0.70	Ref	3.79	7.74*	0.02	Ref	2.80	6.83	0.04
Sex, Physical activity	Ref	0.07	1.69	0.69	Ref	3.77	7.76*	0.02	Ref	2.73	6.89	0.03
Fully adjusted	Ref	0.40	1.03	0.58	Ref	2.56	5.97	0.08	Ref	2.72	5.33	0.15

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 5: Multivariable analysis of the association between DBP and education at different levels of adjustment, by sex. 2003 and 2010

2003	**Men**				**Women**			
	Coef			*P-value for trend*	Coef			*P-value for trend*
Education	High	Middle	Low		High	Middle	Low	
Age,	Ref	-1.13	-1.35	0.41	Ref	4.01**	4.05**	0.02
Age, Place of residence	Ref	-1.25	-1.62	0.34	Ref	3.94**	3.87**	0.02
Age, Marital status	Ref	-1.26	-1.54	0.34	Ref	3.75**	4.08**	0.01
Age, Body mass index,	Ref	-0.60	-0.88	0.57	Ref	2.69*	2.30	0.14
Age, Diabetes mellitus,	Ref	-1.14	-1.38	0.41	Ref	4.00**	4.02**	0.02
Age, Family history of hypertension,	Ref	-0.74	-0.83	0.64	Ref	4.07**	4.38**	0.01
Age, Smoking,	Ref	-0.84	-1.34	0.43	Ref	3.98**	3.69*	0.03
Age, Physical activity	Ref	-1.15	-1.51	0.37	Ref	3.90**	3.90**	0.02
Fully adjusted	Ref	-0.18	-0.60	0.73	Ref	2.63*	2.11	0.18
2010	**Men**				**Women**			
	Coef			*P-value for trend*	Coef			*P-value for trend*
Education	High	Middle	Low		High	Middle	Low	
Age,	Ref	0.17	-1.53	0.39	Ref	-1.01	-1.07	0.39
Age, Place of residence	Ref	0.15	-1.62	0.38	Ref	-1.04	-1.13	0.38
Age, Marital status	Ref	-0.20	-1.70	0.29	Ref	-1.32	-1.24	0.30
Age, Body mass index,	Ref	0.36	-1.23	0.51	Ref	-1.50	-2.14*	0.04
Age, Diabetes mellitus,	Ref	0.18	-1.64	0.36	Ref	-1.01	-1.16	0.36
Age, Family history of hypertension,	Ref	0.13	-1.47	0.41	Ref	-1.10	-0.95	0.42
Age, Smoking,	Ref	0.17	-1.56	0.38	Ref	-1.03	-1.09	0.39
Age, Physical activity	Ref	-0.10	-2.03	0.23	Ref	-1.15	-1.24	0.32
Fully adjusted	Ref	0.00	-1.72	0.32	Ref	-1.87*	-2.39*	0.02

*p<0.05, ** p<0.01, *** p<0.001

Table A6. 6: Association between DBP and education at different levels of adjustment by age group. 2003 and 2010.

2003	20-39				40-59				60 and over			
	Coef			*P-value for trend*	Coef			*P-value for trend*	Coef			*P-value for trend*
Education	High	Middle	Low		High	Middle	Low		High	Middle	Low	
Sex,	Ref	0.86	1.57	0.34	Ref	1.56	4.18**	<0.01	Ref	11.0**	8.24*	0.83
Sex, Place of residence	Ref	0.77	1.36	0.41	Ref	1.50	4.00*	<0.01	Ref	10.9**	8.13*	0.86
Sex, Marital status	Ref	0.40	0.94	0.58	Ref	1.68	4.38**	<0.01	Ref	11.3**	8.33*	0.88
Sex, Body mass index,	Ref	0.38	1.04	0.49	Ref	1.40	2.71	0.06	Ref	10.4**	7.50*	0.94
Sex, Diabetes mellitus,	Ref	0.85	1.55	0.35	Ref	1.50	4.05**	<0.01	Ref	11.0**	8.16*	0.85
Sex, Family history of hypertension,	Ref	1.11	1.73	0.28	Ref	1.67	4.59**	<0.01	Ref	11.9**	9.33*	0.70
Sex, Smoking,	Ref	0.94	1.32	0.39	Ref	1.85	3.81*	0.01	Ref	11.3***	8.27*	0.90
Sex, Physical activity	Ref	0.76	1.23	0.44	Ref	1.51	4.04*	<0.01	Ref	11.0**	8.16*	0.87
Fully adjusted	Ref	0.47	0.57	0.61	Ref	1.72	2.84	0.07	Ref	10.9**	7.76*	0.99
2010	**20-39**				**40-59**				**60 and over**			
	Coef			*P-value for trend*	Coef			*P-value for trend*	Coef			*P-value for trend*
Education	High	Middle	Low		High	Middle	Low		High	Middle	Low	
Sex,	Ref	-0.58	0.88	0.89	Ref	-0.90	-0.75	0.64	Ref	-0.39	0.15	0.80
Sex, Place of residence	Ref	-0.59	0.84	0.87	Ref	-0.90	-0.77	0.62	Ref	-0.39	0.13	0.82
Sex, Marital status	Ref	-1.17	0.19	0.50	Ref	-0.96	-0.80	0.62	Ref	-0.24	0.25	0.77
Sex, Body mass index,	Ref	-0.44	0.32	0.81	Ref	-1.62	-1.94	0.21	Ref	-0.62	-0.80	0.66
Sex, Diabetes mellitus,	Ref	-0.60	0.87	0.87	Ref	-0.90	-0.85	0.59	Ref	-0.21	0.08	0.89
Sex, Family history of hypertension,	Ref	-0.59	0.95	0.89	Ref	-1.03	-0.76	0.64	Ref	-0.34	0.34	0.69
Sex, Smoking,	Ref	-0.61	0.79	0.85	Ref	-0.92	-0.83	0.61	Ref	-0.36	0.14	0.81
Sex, Physical activity	Ref	-0.83	0.34	0.66	Ref	-1.13	-1.14	0.49	Ref	-0.61	-0.21	0.98
Fully adjusted	Ref	-0.93	-0.37	0.41	Ref	-1.92	-2.29	0.15	Ref	-0.64	-1.00	0.56

*p<0.05, ** p<0.01, *** p<0.001

Table A6. 7: Multivariable analysis of the association between hypertension and education at different levels of adjustment, by sex. 2003 and 2010

2003	**Men**				**Women**			
	PR			*P-value for trend*	PR			*P-value for trend*
Education	High	Middle	Low		High	Middle	Low	
Age,	Ref	0.96	0.92	0.60	Ref	2.11*	2.24*	<0.01
Age, Place of residence	Ref	0.95	0.91	0.53	Ref	2.10*	2.22*	<0.01
Age, Marital status	Ref	0.95	0.90	0.47	Ref	2.08*	2.25*	<0.01
Age, Body mass index,	Ref	0.98	0.91	0.48	Ref	1.90*	1.92*	0.03
Age, Diabetes mellitus,	Ref	0.96	0.92	0.57	Ref	2.10*	2.23*	<0.01
Age, Family history of hypertension,	Ref	1.00	0.97	0.86	Ref	2.13*	2.34**	<0.01
Age, Smoking,	Ref	0.98	0.92	0.54	Ref	2.11*	2.19*	0.01
Age, Physical activity	Ref	0.96	0.91	0.49	Ref	2.09*	2.23*	<0.01
Fully adjusted	Ref	1.01	0.92	0.49	Ref	1.91*	1.96*	0.02
2010	**Men**				**Women**			
	PR			*P-value for trend*	PR			*P-value for trend*
Education	High	Middle	Low		High	Middle	Low	
Age,	Ref	1.33	1.03	0.99	Ref	1.14	1.13	0.47
Age, Place of residence	Ref	1.33	1.03	0.91	Ref	1.14	1.13	0.43
Age, Marital status	Ref	1.31	1.02	0.97	Ref	1.13	1.12	0.48
Age, Body mass index,	Ref	1.34	0.96	0.69	Ref	1.17	1.11	0.52
Age, Diabetes mellitus,	Ref	1.35	1.01	0.93	Ref	1.14	1.10	0.57
Age, Family history of hypertension,	Ref	1.34	1.03	0.97	Ref	1.12	1.13	0.45
Age, Smoking,	Ref	1.33	1.03	0.99	Ref	1.15	1.14	0.43
Age, Physical activity	Ref	1.30	0.97	0.72	Ref	1.11	1.10	0.57
Fully adjusted	Ref	1.33	0.93	0.58	Ref	1.13	1.06	0.64

*p<0.05, ** p<0.01, *** p<0.001

Table A6. 8: Association between hypertension and education at different levels of adjustment, by age group. 2003 and 2010

	20-39				**40-59**				**60 and over**			
2003	PR			*P-value for trend*	PR			*P-value for trend*	PR			*P-value for trend*
Education	High	Middle	Low		High	Middle	Low		High	Middle	Low	
Sex,	Ref	1.62	1.86	0.08	Ref	1.13	1.38*	0.01	Ref	0.98	0.95	0.52
Sex, Place of residence	Ref	1.61	1.84	0.09	Ref	1.13	1.37*	0.02	Ref	0.98	0.94	0.48
Sex, Marital status	Ref	1.56	1.76	0.11	Ref	1.15	1.42*	0.01	Ref	0.99	0.94	0.35
Sex, Body mass index,	Ref	1.57	1.81	0.09	Ref	1.13	1.27	0.06	Ref	0.95	0.90	0.37
Sex, Diabetes mellitus,	Ref	1.62	1.86	0.08	Ref	1.13	1.37*	0.01	Ref	0.98	0.94	0.46
Sex, Family history of hypertension,	Ref	1.66	1.89	0.08	Ref	1.14	1.43*	<0.01	Ref	1.07	1.04	0.99
Sex, Smoking,	Ref	1.65	1.84	0.09	Ref	1.16	1.34	0.04	Ref	0.99	0.94	0.36
Sex, Physical activity	Ref	1.61	1.82	0.09	Ref	1.13	1.37*	0.02	Ref	0.98	0.94	0.45
Fully adjusted	Ref	1.59	1.72	0.11	Ref	1.17	1.29	0.06	Ref	1.02	0.93	0.34
2010	**20-39**				**40-59**				**60 and over**			
	PR			*P-value for trend*	PR			*P-value for trend*	PR			*P-value for trend*
Education	High	Middle	Low		High	Middle	Low		High	Middle	Low	
Sex,	Ref	1.22	0.62	0.89	Ref	1.37	1.39	0.10	Ref	1.07	1.14	0.28
Sex, Place of residence	Ref	1.22	0.62	0.89	Ref	1.37	1.39	0.09	Ref	1.07	1.14	0.29
Sex, Marital status	Ref	1.19	0.61	0.97	Ref	1.36	1.40	0.09	Ref	1.09	1.15	0.30
Sex, Body mass index,	Ref	1.35	0.66	0.64	Ref	1.29	1.27	0.22	Ref	1.05	1.03	0.90
Sex, Diabetes mellitus,	Ref	1.22	0.62	0.90	Ref	1.37	1.37	0.11	Ref	1.09	1.13	0.38
Sex, Family history of hypertension,	Ref	1.22	0.63	0.89	Ref	1.35	1.39	0.10	Ref	1.08	1.16	0.23
Sex, Smoking,	Ref	1.22	0.62	0.91	Ref	1.36	1.38	0.10	Ref	1.07	1.14	0.29
Sex, Physical activity	Ref	1.18	0.58	0.98	Ref	1.33	1.32	0.17	Ref	1.04	1.08	0.51
Fully adjusted	Ref	1.27	0.61	0.83	Ref	1.25	1.21	0.32	Ref	1.07	1.02	0.96

*p<0.05, ** p<0.01, *** p<0.001

Table A6. 9: Multivariable analysis of the association between SBP and assets-based at different levels of adjustment by sex. 2003 and 2010

	Men				Women			
	Coef			*P-value for trend*	Coef			*P-value for trend*
Assets-based SEP	High	Middle	Low		High	Middle	Low	
Age,	Ref	1.25	3.06	0.15	Ref	5.75*	7.38**	<0.01
Age, Place of residence	Ref	1.08	2.43	0.24	Ref	5.66*	6.82**	0.01
Age, Marital status	Ref	1.33	3.09	0.15	Ref	5.69*	7.36**	<0.01
Age, Body mass index,	Ref	0.69	3.27	0.10	Ref	4.55*	5.26*	0.04
Age, Diabetes mellitus,	Ref	1.27	3.16	0.13	Ref	5.47*	7.00**	0.01
Age, Family history of hypertension,	Ref	1.45	3.22	0.13	Ref	5.66*	7.73**	<0.01
Age, Smoking,	Ref	1.39	3.39	0.10	Ref	5.59*	6.91**	0.01
Age, Physical activity	Ref	1.12	2.88	0.18	Ref	5.56*	7.09**	0.01
Fully adjusted	Ref	0.88	3.19	0.09	Ref	3.70	4.05	0.13

	Men				Women			
	Coef			*P-value for trend*	Coef			*P-value for trend*
Assets-based SEP	High	Middle	Low		High	Middle	Low	
Age,	Ref	1.60	2.50	0.19	Ref	3.68**	2.25	0.01
Age, Place of residence	Ref	1.60	2.49	0.19	Ref	3.68**	2.24	0.01
Age, Marital status	Ref	1.83	2.39	0.17	Ref	3.58**	2.15	0.01
Age, Body mass index,	Ref	1.67	3.57	0.09	Ref	2.48*	1.89	0.04
Age, Diabetes mellitus,	Ref	1.60	2.33	0.21	Ref	3.75**	2.19	0.01
Age, Family history of hypertension,	Ref	1.70	2.58	0.17	Ref	3.86**	2.24	0.01
Age, Smoking,	Ref	1.62	2.43	0.20	Ref	3.60**	2.18	0.01
Age, Physical activity	Ref	1.73	2.51	0.17	Ref	3.71**	2.30	0.01
Fully adjusted	Ref	2.23	3.18	0.07	Ref	2.43*	1.56	0.06

*p<0.05, ** p<0.01, *** p<0.001

Table A6. 10: Association between SBP and assets-based index at different levels of adjustment in women, 2010. Using intermediate level as reference.

	Coef		
Assets-based index	High	Middle	Low
Age,	-3.68**	Ref	-1.43
Age, Place of residence	-3.68**	Ref	-1.44
Age, Marital status	-3.58**	Ref	-1.44
Age, Body mass index,	-2.48*	Ref	-0.59
Age, Diabetes mellitus,	-3.75**	Ref	-1.56
Age, Family history of hypertension,	-3.86**	Ref	-1.62
Age, Smoking,	-3.60**	Ref	-1.42
Age, Physical activity	-3.71**	Ref	-1.41
Fully adjusted	-2.43*	Ref	-0.88

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 11: Multivariable analysis of the association between SBP and assets-based SEP at different levels of adjustment by age group. 2003 and 2010.

2003	**20-39**				**40-59**				**60 and over**			
	Coef			*P-value*	Coef			*P-value*	Coef			*P-value*
Assets-based SEP	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*
Sex,	Ref	1.92	4.45*	0.02	Ref	8.42***	9.02***	<0.01	Ref	-6.28	-0.55	0.70
Sex, Place of residence	Ref	1.78	3.80	0.05	Ref	8.23***	8.24**	0.01	Ref	-6.48	-1.38	0.81
Sex, Marital status	Ref	1.84	4.12*	0.03	Ref	8.64***	9.27***	<0.01	Ref	-6.58	-0.97	0.75
Sex, Body mass index,	Ref	1.12	3.13	0.08	Ref	7.16**	7.84**	<0.01	Ref	-8.01	-1.89	0.80
Sex, Diabetes mellitus,	Ref	1.87	4.38*	0.02	Ref	8.27***	8.65**	<0.01	Ref	-6.78	-0.85	0.71
Sex, Family history of hypertension,	Ref	1.81	4.52*	0.01	Ref	8.52***	9.28***	<0.01	Ref	-5.90	0.07	0.64
Sex, Smoking,	Ref	2.09	4.67*	0.01	Ref	8.25***	8.49**	0.01	Ref	-6.39	-0.88	0.74
Sex, Physical activity	Ref	1.55	3.92	0.03	Ref	8.24***	8.68**	0.01	Ref	-6.30	-0.77	0.73
Fully adjusted	Ref	0.95	2.67	0.14	Ref	6.80**	6.54**	0.03	Ref	-8.71	-3.44	0.99
2010	**20-39**				**40-59**				**60 and over**			
	Coef			*P-value*	Coef			*P-value*	Coef			*P-value*
Assets-based SEP	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*
Sex,	Ref	2.40*	0.32	0.14	Ref	3.38	3.74	0.05	Ref	7.20**	6.34*	0.01
Sex, Place of residence	Ref	2.35	0.21	0.17	Ref	3.34	3.64	0.06	Ref	7.16**	6.17*	0.01
Sex, Marital status	Ref	2.20	0.19	0.21	Ref	3.38	3.65	0.06	Ref	7.38**	6.33*	0.01
Sex, Body mass index,	Ref	1.28	-0.30	0.45	Ref	3.18	4.86	0.02	Ref	5.83*	6.43*	0.02
Sex, Diabetes mellitus,	Ref	2.36*	0.33	0.15	Ref	3.36	3.62	0.06	Ref	7.38**	6.07	0.01
Sex, Family history of hypertension,	Ref	2.58*	0.17	0.12	Ref	3.38	3.73	0.06	Ref	7.62**	6.76*	0.01
Sex, Smoking,	Ref	2.38*	0.37	0.15	Ref	3.39	3.73	0.05	Ref	6.99**	5.95*	0.01
Sex, Physical activity	Ref	2.44*	0.39	0.13	Ref	3.22	3.66	0.06	Ref	7.20**	6.25*	0.01
Fully adjusted	Ref	1.54	-0.21	0.33	Ref	3.05	4.17	0.05	Ref	5.96*	5.76	0.02

*p<0.05, ** p<0.01, *** p<0.001

Table A6. 12: Multivariable analysis of the association between SBP and assets-based SEP recoded into two categories in 60 plus age group. 2010.

	Coef	
Assets SEP	**High**	**Middle/Low**
Age, sex,	Ref	7.04**
Age, sex, Place of residence	Ref	7.00**
Age, sex, Marital status	Ref	7.19**
Age, sex, Body mass index,	Ref	5.94*
Age, sex, Diabetes mellitus,	Ref	7.14**
Age, sex, Family history of hypertension,	Ref	7.46**
Age, sex, Smoking,	Ref	6.80**
Age, sex, Physical activity	Ref	7.03**
Age, sex, Place of residence, Marital status,	Ref	5.93*

* p<0.05, ** p<0.01

Table A6. 13: Multivariable analysis of the association between DBP and assets index at different levels of adjustment by sex. NHS 2003 and 2010.

	Men				Women			
	Coef			*P-value for trend*	Coef			*P-value for trend*
Assets-based SEP	High	Middle	Low		High	Middle	Low	
Age,	Ref	0.77	0.91	0.59	Ref	2.75*	2.68	0.13
Age, Place of residence	Ref	0.70	0.67	0.67	Ref	2.72*	2.47	0.18
Age, Marital status	Ref	0.66	0.87	0.59	Ref	2.84*	2.69	0.14
Age, Body mass index,	Ref	0.22	1.11	0.38	Ref	1.59	0.62	0.89
Age, Diabetes mellitus,	Ref	0.77	0.92	0.58	Ref	2.72*	2.64	0.14
Age, Family history of hypertension,	Ref	0.98	1.08	0.53	Ref	2.66*	3.06*	0.06
Age, Smoking,	Ref	0.86	1.09	0.50	Ref	2.65	2.38	0.21
Age, Physical activity	Ref	0.71	0.77	0.66	Ref	2.63*	2.48	0.18
Fully adjusted	Ref	0.40	1.15	0.36	Ref	1.39	0.49	0.92

	Men				Women			
	Coef			*P-value for trend*	Coef			*P-value for trend*
Assets-based SEP	High	Middle	Low		High	Middle	Low	
Age,	Ref	-0.27	-1.77	0.34	Ref	0.75	0.49	0.36
Age, Place of residence	Ref	-0.27	-1.76	0.35	Ref	0.76	0.50	0.36
Age, Marital status	Ref	-0.47	-1.60	0.31	Ref	0.83	0.46	0.34
Age, Body mass index,	Ref	-0.22	-0.94	0.56	Ref	-0.18	0.21	0.98
Age, Diabetes mellitus,	Ref	-0.27	-1.86	0.32	Ref	0.79	0.46	0.35
Age, Family history of hypertension,	Ref	-0.20	-1.71	0.37	Ref	0.88	0.49	0.31
Age, Smoking,	Ref	-0.28	-1.76	0.34	Ref	0.76	0.49	0.36
Age, Physical activity	Ref	-0.36	-1.77	0.31	Ref	0.68	0.42	0.42
Fully adjusted	Ref	-0.27	-0.85	0.57	Ref	-0.03	0.13	0.96

*p<0.05, ** p<0.01, *** p<0.001

Table A6. 14: Multivariable analysis of the association between DBP and assets-based SEP at different levels of adjustment by age group. NHS 2003 and 2010.

	20-39				40-59				60 and over			
2003	Coef			*P-value for trend*	Coef			*P-value for trend*	Coef			*P-value for trend*
Assets-based SEP	High	Middle	Low		High	Middle	Low		High	Middle	Low	
Sex,	Ref	0.62	1.67	0.22	Ref	4.20**	3.23*	0.11	Ref	-0.07	0.68	0.76
Sex, Place of residence	Ref	0.57	1.42	0.30	Ref	4.13**	2.92	0.15	Ref	-0.15	0.36	0.84
Sex, Marital status	Ref	0.44	1.23	0.37	Ref	4.44**	3.62*	0.06	Ref	-0.21	0.64	0.76
Sex, Body mass index,	Ref	-0.03	0.59	0.59	Ref	3.17*	2.26	0.23	Ref	-1.49	-0.42	0.94
Sex, Diabetes mellitus,	Ref	0.61	1.66	0.22	Ref	4.17**	3.15*	0.12	Ref	-0.18	0.62	0.76
Sex, Family history of hypertension,	Ref	0.52	1.74	0.19	Ref	4.30**	3.49*	0.07	Ref	0.32	1.32	0.62
Sex, Smoking,	Ref	0.70	1.77	0.20	Ref	4.10**	2.83	0.19	Ref	-0.01	0.65	0.77
Sex, Physical activity	Ref	0.48	1.42	0.29	Ref	4.09**	3.01	0.15	Ref	-0.07	0.58	0.79
Fully adjusted	Ref	-0.13	0.43	0.67	Ref	3.18*	2.04	0.32	Ref	-1.36	-0.50	0.98
2010	Coef			*P-value for trend*	Coef			*P-value for trend*	Coef			*P-value for trend*
Assets-based SEP	High	Middle	Low		High	Middle	Low		High	Middle	Low	
Sex,	Ref	1.23	-0.67	0.52	Ref	0.19	-0.80	0.79	Ref	-0.13	0.24	0.96
Sex, Place of residence	Ref	1.23	-0.68	0.53	Ref	0.19	-0.81	0.78	Ref	-0.13	0.22	0.97
Sex, Marital status	Ref	0.86	-0.94	0.79	Ref	0.27	-0.60	0.90	Ref	0.12	0.38	0.82
Sex, Body mass index,	Ref	0.47	-1.09	0.95	Ref	0.06	-0.04	0.99	Ref	-1.06	0.29	0.73
Sex, Diabetes mellitus,	Ref	1.21	-0.66	0.53	Ref	0.18	-0.87	0.76	Ref	-0.03	0.08	0.98
Sex, Family history of hypertension,	Ref	1.35	-0.77	0.48	Ref	0.19	-0.81	0.79	Ref	0.14	0.50	0.78
Sex, Smoking,	Ref	1.23	-0.68	0.52	Ref	0.19	-0.78	0.80	Ref	-0.17	0.15	0.99
Sex, Physical activity	Ref	1.17	-0.72	0.55	Ref	-0.05	-0.83	0.68	Ref	-0.13	0.10	0.99
Fully adjusted	Ref	0.42	-1.21	0.87	Ref	-0.05	-0.12	0.93	Ref	-0.72	0.28	0.85

*p<0.05, ** p<0.01, *** p<0.001

Table A6. 15: Multivariable analysis of the association between DBP and assets-based SEP, recoded into two categories in 40-59 and age group. NHS 2003

	Coef	
Assets SEP	**High**	**Middle/Low**
Sex,	Ref	3.93**
Sex, Place of residence	Ref	3.80**
Sex, Marital status	Ref	4.23**
Sex, Body mass index,	Ref	2.92*
Sex, Diabetes mellitus,	Ref	3.89**
Sex, Family history of hypertension,	Ref	4.08**
Sex, Smoking,	Ref	3.76**
Sex, Physical activity	Ref	3.80**
Fully adjusted	Ref	2.88*

*p<0.05, ** p<0.01

Table A6. 16: Multivariable analysis of the association between hypertension and assets-based SEP at different levels of adjustment by sex. 2003 and 2010.

2003	**Men**				**Women**			
	PR			*P-value for trend*	PR			*P-value for trend*
Assets-based SEP	High	Middle	Low		High	Middle	Low	
Age,	Ref	1.01	1.06	0.69	Ref	1.43*	1.43*	0.06
Age, Place of residence	Ref	1.01	1.04	0.75	Ref	1.42*	1.41*	0.08
Age, Marital status	Ref	1.01	1.07	0.61	Ref	1.43*	1.44*	0.06
Age, Body mass index,	Ref	0.98	1.05	0.70	Ref	1.26	1.21	0.42
Age, Diabetes mellitus,	Ref	1.01	1.06	0.68	Ref	1.42*	1.42*	0.07
Age, Family history of hypertension,	Ref	1.04	1.09	0.56	Ref	1.44*	1.52*	0.02
Age, Smoking,	Ref	1.02	1.06	0.65	Ref	1.41*	1.40	0.09
Age, Physical activity	Ref	1.01	1.05	0.75	Ref	1.42*	1.41*	0.08
Fully adjusted	Ref	1.00	1.07	0.57	Ref	1.27	1.23	0.35

	Men				**Women**			
2010	PR			*P-value for trend*	PR			*P-value for trend*
Assets-based SEP	High	Middle	Low		High	Middle	Low	
Age,	Ref	1.02	1.04	0.81	Ref	1.07	0.85	0.79
Age, Place of residence	Ref	1.03	1.05	0.74	Ref	1.07	0.86	0.86
Age, Marital status	Ref	1.02	1.07	0.75	Ref	1.09	0.85	0.85
Age, Body mass index,	Ref	0.99	1.12	0.72	Ref	0.98	0.84	0.42
Age, Diabetes mellitus,	Ref	1.03	1.01	0.90	Ref	1.07	0.85	0.81
Age, Family history of hypertension,	Ref	1.03	1.06	0.75	Ref	1.09	0.86	0.88
Age, Smoking,	Ref	1.02	1.04	0.81	Ref	1.07	0.86	0.82
Age, Physical activity	Ref	1.01	1.03	0.87	Ref	1.06	0.84	0.68
Fully adjusted	Ref	0.99	1.12	0.70	Ref	1.01	0.84	0.53

*p<0.05, ** p<0.01, *** p<0.001

Table A6. 17: Multivariable analysis of the association between hypertension and assets-based SEP at different levels of adjustment by age group. 2003 and 2010.

2003	**20-39**				**40-59**				**60 and over**			
	PR			*P-value*	PR			*P-value*	PR			*P-value*
Assets-based SEP	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*
Sex,	Ref	1.90	2.02	0.10	Ref	1.35	1.40	0.07	Ref	0.75***	0.82***	0.07
Sex, Place of residence	Ref	1.89	1.98	0.11	Ref	1.35	1.37	0.10	Ref	0.74***	0.80***	0.05
Sex, Marital status	Ref	1.87	1.93	0.14	Ref	1.38	1.45*	0.04	Ref	0.74***	0.81***	0.10
Sex, Body mass index,	Ref	1.81	1.86	0.15	Ref	1.26	1.32	0.11	Ref	0.68***	0.76***	0.05
Sex, Diabetes mellitus,	Ref	1.90	2.01	0.10	Ref	1.35	1.39	0.07	Ref	0.74***	0.82***	0.09
Sex, Family history of hypertension,	Ref	1.89	2.03	0.10	Ref	1.37	1.43*	0.04	Ref	0.77***	0.87*	0.37
Sex, Smoking,	Ref	1.92	2.05	0.09	Ref	1.34	1.35	0.12	Ref	0.75***	0.82***	0.05
Sex, Physical activity	Ref	1.89	1.98	0.12	Ref	1.34	1.37	0.09	Ref	0.75***	0.82***	0.05
Fully adjusted	Ref	1.80	1.81	0.18	Ref	1.28	1.30	0.14	Ref	0.69***	0.75**	0.06
2010	**20-39**				**40-59**				**60 and over**			
	PR			*P-value*	PR			*P-value*	PR			*P-value*
Assets-based SEP	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*
Sex,	Ref	1.26	1.20	0.50	Ref	1.13	0.99	0.62	Ref	1.07	0.99	0.75
Sex, Place of residence	Ref	1.25	1.19	0.50	Ref	1.13	0.98	0.63	Ref	1.07	0.98	0.81
Sex, Marital status	Ref	1.23	1.18	0.55	Ref	1.14	1.00	0.60	Ref	1.09	0.99	0.67
Sex, Body mass index,	Ref	1.11	1.16	0.70	Ref	1.13	1.05	0.49	Ref	0.97	0.99	0.81
Sex, Diabetes mellitus,	Ref	1.25	1.20	0.50	Ref	1.13	0.98	0.65	Ref	1.09	0.96	0.81
Sex, Family history of hypertension,	Ref	1.27	1.18	0.49	Ref	1.13	1.00	0.61	Ref	1.10	1.01	0.54
Sex, Smoking,	Ref	1.26	1.20	0.50	Ref	1.13	0.99	0.62	Ref	1.07	0.97	0.84
Sex, Physical activity	Ref	1.24	1.19	0.52	Ref	1.09	0.99	0.75	Ref	1.07	0.96	0.88
Fully adjusted	Ref	1.10	1.12	0.75	Ref	1.10	1.05	0.55	Ref	1.01	0.97	0.90

*p<0.05, ** p<0.01, *** p<0.001

Table A6. 18: Multivariable analysis of the association between SBP and occupation at different levels of adjustment by sex. 2003.

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
Men							
Age, sex	Ref	-2.38	-1.08	2.96	-0.40	-3.89	*0.57*
Age, Place of residence	Ref	-2.36	-1.67	2.71	-0.60	-4.22	*0.50*
Age, Marital status	Ref	-2.64	-1.11	3.31	-0.79	-4.06	*0.50*
Age, Body mass index	Ref	-1.58	-0.09	2.92	0.62	-2.40	*0.77*
Age, Diabetes mellitus	Ref	-2.32	-0.98	3.01	-0.57	-4.30	*0.47*
Age, Family history of hypertension	Ref	-2.00	-0.46	3.08	-0.10	-3.47	*0.61*
Age, Smoking	Ref	-2.63	-0.94	2.95	-0.59	-3.97	*0.55*
Age, Physical activity	Ref	-2.66	-1.30	2.88	-0.62	-4.05	*0.54*
Fully adjusted	Ref	-2.19	-0.07	3.50	-0.44	-2.88	*0.61*
Women							
Age, sex	Ref	-3.67	0.14	2.96	-1.55	6.96	*0.02*
Age, Place of residence	Ref	-3.66	0.05	2.71	-1.50	6.78	*0.03*
Age, Marital status	Ref	-3.76	0.20	3.31	-1.79	6.18	*0.02*
Age, Body mass index	Ref	-1.89	-0.35	2.92	0.17	9.57*	*0.05*
Age, Diabetes mellitus	Ref	-3.69	0.38	3.01	-1.59	7.32	*0.02*
Age, Family history of hypertension	Ref	-3.76	-0.04	3.08	-1.26	7.07	*0.02*
Age, Smoking	Ref	-3.31	0.47	2.95	-0.78	7.05	*0.06*
Age, Physical activity	Ref	-3.91	0.05	2.88	-1.36	7.06	*0.02*
Fully adjusted	Ref	-2.06	-0.12	3.50	0.76	8.28	*0.06*

*p<0.05, ** p<0.01, *** p<0.001

Table A6. 19: Multivariable analysis of the association between SBP and occupation at different levels of adjustment by sex. 2010.

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
Men							
Age, sex	Ref	0.99	3.93	4.26	5.4	1.14	*0.23*
Age, Place of residence	Ref	1.00	3.91	4.20	5.38	1.12	*0.24*
Age, Marital status	Ref	0.82	3.90	4.30	4.62	0.71	*0.6*
Age, Body mass index	Ref	1.48	4.64*	6.71	6.13*	2.21	*0.07*
Age, Diabetes mellitus	Ref	0.86	3.77	4.21	5.17	0.71	*0.24*
Age, Family history of hypertension	Ref	0.65	3.86	3.84	4.77	1.35	*0.23*
Age, Smoking	Ref	0.95	3.73	4.41	5.16	0.96	*0.26*
Age, Physical activity	Ref	1.04	3.96	4.23	5.16	1.04	*0.25*
Fully adjusted	Ref	0.85	4.19	6.54	3.51	1.18	*0.14*
Women							
Age, sex	Ref	-1.79	-0.13	2.59	4.56	4.37	*<0.01*
Age, Place of residence	Ref	-1.80	-0.15	2.56	4.55	4.36	*<0.01*
Age, Marital status	Ref	-1.76	-0.18	3.04	4.07	3.70	*<0.01*
Age, Body mass index	Ref	-0.22	0.81	3.26	7.49***	5.91*	*<0.01*
Age, Diabetes mellitus	Ref	-1.80	-0.10	2.44	4.28	4.46	*<0.01*
Age, Family history of hypertension	Ref	-1.97	-0.05	2.51	4.67	4.9	*<0.01*
Age, Smoking	Ref	-1.84	-0.24	2.39	4.36	4.08	*<0.01*
Age, Physical activity	Ref	-1.75	-0.14	2.59	4.69	4.41	*<0.01*
Fully adjusted	Ref	-0.30	0.74	3.55	6.65**	5.09	*<0.01*

*p<0.05, ** p<0.01, *** p<0.001

Table A6. 20: Multivariable analysis of the association between SBP and occupation at different levels of adjustment by age group. 2003.

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
20-39							
Sex	Ref	-6.39*	-0.30	-3.54	-5.39*	-7.16	*<0.01*
Sex, Place of residence	Ref	-6.47*	-0.94	-3.99	-5.54*	-8.09	*0.01*
Sex, Marital status	Ref	-5.94*	-0.18	-3.59	-4.86*	-6.22	*0.02*
Sex, Body mass index	Ref	-3.62	0.69	-2.91	-3.16	-3.49	*0.11*
Sex, Diabetes mellitus	Ref	-6.38*	-0.32	-3.67	-5.37*	-7.63	*<0.01*
Sex, Family history of hypertension	Ref	-6.04*	0.16	-3.04	-5.06*	-6.79	*<0.01*
Sex, Smoking	Ref	-6.78**	-0.24	-4.35	-5.01*	-9.23*	*<0.01*
Sex, Physical activity	Ref	-7.04**	-0.83	-4.38	-5.80**	-6.68	*<0.01*
Fully adjusted	Ref	-4.11	0.32	-3.40	-3.03	-6.05	*0.12*
40-59							
Sex	Ref	-2.52	-1.04	7.45*	1.44	8.89	*<0.01*
Age, Place of residence	Ref	-2.59	-1.42	6.95*	1.26	8.80	*<0.01*
Sex, Marital status	Ref	-2.14	-0.79	7.73*	1.65	9.36*	*<0.01*
Sex, Body mass index	Ref	-2.90	-0.65	5.88*	1.09	8.02	*<0.01*
Sex, Diabetes mellitus	Ref	-2.79	-0.82	7.34*	1.32	8.54	*<0.01*
Sex, Family history of hypertension	Ref	-2.67	-0.85	7.52*	1.57	8.88	*<0.01*
Sex, Smoking	Ref	-1.56	-0.43	7.65*	1.47	8.90	*<0.01*
Sex, Physical activity	Ref	-2.86	-1.02	7.49*	1.37	9.14*	*<0.01*
Fully adjusted	Ref	-2.80	-0.03	6.19*	0.97	8.42*	*<0.01*

Table A6. 20 (cont.): Multivariable analysis of the association between SBP and occupation at different levels of adjustment by age group. 2003.

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
60+							
Sex,	Ref	0.48	-8.39	-0.49	-7.04	-2.18	*0.49*
Sex, Place of residence	Ref	0.69	-8.69	-0.70	-6.98	-2.32	*0.47*
Sex, Marital status	Ref	0.84	-8.20	-0.76	-7.40	-2.49	*0.51*
Sex, Body mass index	Ref	0.90	-7.04	1.31	-3.58	0.36	*0.44*
Sex, Diabetes mellitus	Ref	3.01	-6.90	0.52	-7.01	-1.50	*0.49*
Sex, Family history of hypertension	Ref	0.70	-8.52	-0.58	-7.21	-2.36	*0.48*
Sex, Smoking	Ref	1.63	-8.07	-0.94	-7.06	-2.08	*0.52*
Sex, Physical activity	Ref	0.69	-8.40	-0.06	-6.87	-2.06	*0.43*
Fully adjusted	Ref	4.59	-5.88	1.44	-3.97	0.31	*0.49*

* p<0.05, ** p<0.01, *** p<0.001.

Table A6. 21: Multivariable analysis of the association between SBP and occupation at different levels of adjustment, by age group. 2010.

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
20-39							
Sex,	Ref	-4.75	-2.25	-1.91	-3.77	-6.78	*0.19*
Sex, Place of residence	Ref	-4.76	-2.35	-2.09	-3.82	-6.85	*0.24*
Sex, Marital status	Ref	-4.53	-2.14	-1.82	-3.26	-6.68	*0.29*
Sex, Body mass index	Ref	-1.83	0.59	0.34	0.54	-3.71	*0.33*
Sex, Diabetes mellitus	Ref	-4.77	-2.26	-1.97	-3.80	-6.77	*0.19*
Sex, Family history of hypertension	Ref	-4.83	-1.97	-2.00	-3.82	-5.83	*0.12*
Sex, Smoking	Ref	-4.71	-2.30	-1.92	-3.82	-6.44	*0.21*
Sex, Physical activity	Ref	-4.61	-2.10	-2.02	-3.56	-7.18	*0.22*
Fully adjusted	Ref	-1.78	0.80	0.43	0.12	-2.50	*0.32*
40-59							
Sex, sex	Ref	3.55	7.23*	8.29**	8.78	9.25	*0.04*
Sex, Place of residence	Ref	3.53	7.11*	8.18**	8.69	9.21	*0.05*
Sex, Marital status	Ref	3.49	7.15*	8.25**	8.68	8.83	*0.04*
Sex, Body mass index	Ref	3.07	6.52*	6.74*	8.20	8.07	*0.08*
Sex, Diabetes mellitus	Ref	3.67	7.28*	8.17**	8.66	9.23	*0.04*
Sex, Family history of hypertension	Ref	3.09	7.12*	7.81**	8.16	9.23	*0.04*
Sex, Smoking	Ref	3.50	6.98*	8.05**	8.56	9.08	*0.05*
Sex, Physical activity	Ref	3.44	6.96*	8.17**	8.73	9.17	*0.05*
Fully adjusted	Ref	2.56	5.72*	6.01*	6.87	7.17	*0.16*

Table A6. 21 (cont.): Multivariable analysis of the association between SBP and occupation at different levels of adjustment, by age group. 2010.

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
60 and over							
Sex,	Ref	0.27	2.21	7.93	10.4	7.33	*0.15*
Sex, Place of residence	Ref	0.28	2.11	7.79	10.3	7.24	*0.17*
Sex, Marital status	Ref	0.32	2.51	8.07	10.3	7.11	*0.17*
Sex, Body mass index	Ref	-1.16	1.52	6.44	8.91	5.74	*0.22*
Sex, Diabetes mellitus	Ref	-0.46	1.7	7.16	8.59	6.68	*0.19*
Sex, Family history of hypertension	Ref	-0.02	1.7	7.73	9.89	7.44	*0.13*
Sex, Smoking	Ref	0.24	2.24	7.75	9.8	7.11	*0.18*
Sex, Physical activity	Ref	-0.19	1.67	7.59	9.81	6.87	*0.16*
Fully adjusted	Ref	-1.87	0.94	5.64	6.70	4.64	*0.31*

activity*p<0.05, ** p<0.01, *** p<0.001

Table A6. 22: Multivariable analysis of the association between DBP and occupation at different levels of adjustment by sex. 2003.

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
Men							
Age, sex	Ref	-3.08	-2.32*	-0.27	-2.94	-6.40***	*<0.01*
Age, Place of residence	Ref	-3.08	-2.50*	-0.35	-3.00	-6.50***	*<0.01*
Age, Marital status	Ref	-2.92	-2.33*	-0.56	-2.65	-6.35***	*<0.01*
Age, Body mass index	Ref	-2.34	-1.40	-0.30	-1.98	-5.01**	*0.04*
Age, Diabetes mellitus	Ref	-3.07	-2.31	-0.26	-2.96	-6.47***	*<0.01*
Age, Family history of hypertension	Ref	-2.68	-1.66	-0.14	-2.61	-5.95***	*<0.01*
Age, Smoking	Ref	-3.10	-2.21	-0.31	-2.99	-6.54***	*<0.01*
Age, Physical activity	Ref	-3.24	-2.44*	-0.32	-3.12*	-6.52***	*<0.01*
Fully adjusted	Ref	-2.22	-0.99	-0.25	-1.96	-4.80**	*0.03*
Women							
Age, sex	Ref	-4.72	-0.46	-0.27	-3.26	-1.26	*0.05*
Age, Place of residence	Ref	-4.72	-0.48	-0.35	-3.25	-1.31	*0.06*
Age, Marital status	Ref	-4.65	-0.49	-0.56	-3.04	-0.52	*0.14*
Age, Body mass index	Ref	-3.06	-0.91	-0.30	-1.66	1.17	*0.43*
Age, Diabetes mellitus	Ref	-4.72	-0.42	-0.26	-3.27	-1.20	*0.05*
Age, Family history of hypertension	Ref	-4.82	-0.65	-0.14	-2.95	-1.14	*0.04*
Age, Smoking	Ref	-4.49	-0.24	-0.31	-2.82	-1.11	*0.10*
Age, Physical activity	Ref	-4.87	-0.56	-0.32	-3.21	-1.13	*0.05*
Fully adjusted	Ref	-3.10	-0.98	-0.25	-1.03	1.21	*0.45*

p<0.05, ** p<0.01, *** p<0.001

Table A6. 23: Multivariable analysis of the association between DBP and occupation at different levels of adjustment, by sex. 2010.

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
Men							
Age, sex	Ref	-0.02	-0.90	-0.80	-1.94	-7.37***	*<0.01*
Age, Place of residence	Ref	-0.02	-0.90	-0.79	-1.94	-7.37***	*<0.01*
Age, Marital status	Ref	0.22	-0.78	-0.67	-1.17	-7.03***	*<0.01*
Age, Body mass index	Ref	0.34	-0.38	1.01	-1.40	-6.58***	*<0.01*
Age, Diabetes mellitus	Ref	-0.09	-0.99	-0.82	-2.07	-7.61***	*<0.01*
Age, Family history of hypertension	Ref	-0.24	-0.95	-1.08	-2.37	-7.23***	*<0.01*
Age, Smoking	Ref	-0.03	-0.94	-0.76	-1.98	-7.40***	*<0.01*
Age, Physical activity	Ref	0.09	-0.98	-1.17	-1.76	-7.49***	*<0.01*
Fully adjusted	Ref	0.35	-0.46	0.68	-1.47	-6.57***	*<0.01*
Women							
Age, sex	Ref	-2.39	-0.80	-1.41	0.09	-6.90**	*<0.01*
Age, Place of residence	Ref	-2.39	-0.80	-1.41	0.09	-6.90**	*<0.01*
Age, Marital status	Ref	-2.40	-0.79	-1.74	0.47	-6.69**	*<0.01*
Age, Body mass index	Ref	-1.24	-0.10	-0.91	2.24	-5.77***	*<0.01*
Age, Diabetes mellitus	Ref	-2.39	-0.78	-1.49	-0.07	-6.85**	*<0.01*
Age, Family history of hypertension	Ref	-2.51	-0.74	-1.46	0.16	-6.54**	*<0.01*
Age, Smoking	Ref	-2.37	-0.78	-1.41	0.07	-6.91**	*<0.01*
Age, Physical activity	Ref	-2.58	-1.03	-1.56	0.00	-6.91**	*<0.01*
Fully adjusted	Ref	-1.47	-0.23	-1.29	2.33	-5.61***	*<0.01*

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 24: Multivariable analysis of the association between DBP and occupation at different levels of adjustment by age group. 2003

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
20-39							
Sex,	Ref	-5.43**	-1.18	-2.74	-4.85**	-7.45	*<0.01*
Sex, Place of residence	Ref	-5.45**	-1.37	-2.87	-4.89**	-7.71	*<0.01*
Sex, Marital status	Ref	-5.12*	-1.16	-3.32	-4.33*	-6.36	*0.01*
Sex, Body mass index	Ref	-3.15	-0.37	-2.22	-3.01	-4.44	*0.09*
Sex, Diabetes mellitus	Ref	-5.42**	-1.19	-2.77	-4.84**	-7.54	*<0.01*
Sex, Family history of hypertension	Ref	-5.04*	-0.67	-2.19	-4.48*	-7.04	*<0.01*
Sex, Smoking	Ref	-5.67**	-1.14	-3.32	-4.60*	-8.68*	*<0.01*
Sex, Physical activity	Ref	-5.71**	-1.39	-3.16	-5.08**	-6.89	*<0.01*
Fully adjusted	Ref	-3.13	-0.12	-2.37	-2.59	-4.89	*0.09*
40-59							
Sex, sex	Ref	-3.71	-2.49	2.43	1.00	1.84	*<0.01*
Sex, Place of residence	Ref	-3.73	-2.60	2.28	0.95	1.81	*<0.01*
Sex, Marital status	Ref	-3.43	-2.33	2.37	1.20	2.05	*<0.01*
Sex, Body mass index	Ref	-4.02	-2.18	1.14	0.71	1.12	*0.07*
Sex, Diabetes mellitus	Ref	-3.76	-2.45	2.40	0.97	1.77	*<0.01*
Sex, Family history of hypertension	Ref	-3.88	-2.29	2.50	1.14	1.83	*<0.01*
Sex, Smoking	Ref	-2.98	-2.08	2.59	1.06	1.82	*0.01*
Sex, Physical activity	Ref	-3.87	-2.51	2.45	0.95	1.94	*<0.01*
Fully adjusted	Ref	-3.73	-1.73	1.38	0.85	1.39	*0.10*

Table A6. 24 (cont.): Multivariable analysis of the association between DBP and occupation at different levels of adjustment by age group. 2003

60 and over							
Sex	Ref	6.78	-5.97	-2.95	-5.93	-3.84	*0.09*
Sex, Place of residence	Ref	6.84	-6.05	-3.01	-5.92	-3.88	*0.08*
Sex, Marital status	Ref	6.57	-5.97	-3.15	-6.14	-3.94	*0.10*
Sex, Body mass index	Ref	7.12	-4.86	-1.47	-3.10	-1.76	*0.04*
Sex, Diabetes mellitus	Ref	7.30	-5.66	-2.74	-5.93	-3.70	*0.08*
Sex, Family history of hypertension	Ref	7.02	-6.11	-3.05	-6.13	-4.04	*0.08*
Sex, Smoking	Ref	7.67	-5.73	-3.17	-5.95	-3.79	*0.04*
Sex, Physical activity	Ref	6.83	-6.04	-2.71	-5.92	-3.81	*0.07*
Fully adjusted	Ref	8.00	-4.91	-1.85	-3.47	-2.09	*0.01*

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 25: Multivariable analysis of the association between DBP and occupation at different levels of adjustment by age group. 2010

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
20-39							
Sex,	Ref	-3.16	-3.23	-1.72	-4.47	-1.29	0.15
Sex, Place of residence	Ref	-3.16	-3.24	-1.73	-4.47	-1.30	0.15
Sex, Marital status	Ref	-2.90	-3.15	-2.06	-3.46	-1.49	0.70
Sex, Body mass index	Ref	-1.19	-1.31	-0.20	-1.55	0.78	0.72
Sex, Diabetes mellitus	Ref	-3.17	-3.24	-1.75	-4.49	-1.29	0.15
Sex, Family history of hypertension	Ref	-3.21	-3.05	-1.77	-4.50	-0.69	0.11
Sex, Smoking	Ref	-3.13	-3.23	-1.72	-4.46	-1.16	0.16
Sex, Physical activity	Ref	-3.02	-3.11	-1.90	-4.14	-1.86	0.31
Fully adjusted	Ref	-1.01	-1.09	-0.52	-0.98	0.89	0.90
40-59							
Sex,	Ref	-0.49	-0.40	-0.53	0.24	-4.07	0.46
Sex, Place of residence	Ref	-0.49	-0.41	-0.54	0.23	-4.07	0.46
Sex, Marital status	Ref	-0.44	-0.33	-0.80	0.49	-4.12	0.37
Sex, Body mass index	Ref	-0.82	-0.89	-1.59	-0.16	-4.86*	0.29
Sex, Diabetes mellitus	Ref	-0.42	-0.37	-0.61	0.16	-4.08	0.46
Sex, Family history of hypertension	Ref	-0.78	-0.48	-0.84	-0.15	-4.08	0.44
Sex, Smoking	Ref	-0.50	-0.46	-0.59	0.18	-4.14	0.45
Sex, Physical activity	Ref	-0.68	-0.80	-0.69	0.17	-4.12	0.51
Fully adjusted	Ref	-1.12	-1.28	-2.14	-0.55	-5.15*	0.21

Table A6. 25 (cont.): Multivariable analysis of the association between DBP and occupation at different levels of adjustment by age group. 2010

60 and over							
Sex	Ref	2.15	2.68	1.26	10.5**	-0.40	0.02
Sex, Place of residence	Ref	2.15	2.67	1.25	10.5**	-0.41	0.02
Sex, Marital status	Ref	2.19	2.72	1.16	10.5**	-0.45	0.02
Sex, Body mass index	Ref	1.19	2.21	0.25	9.55*	-1.48	0.02
Sex, Diabetes mellitus	Ref	1.70	2.36	0.78	9.43*	-0.81	0.05
Sex, Family history of hypertension	Ref	1.97	2.36	1.13	10.2**	-0.33	0.03
Sex, Smoking	Ref	2.21	2.74	1.28	10.4**	-0.42	0.02
Sex, Physical activity	Ref	1.57	2.02	0.89	9.88**	-0.96	0.02
Fully adjusted	Ref	0.58	1.54	-0.32	8.31*	-2.11	0.02

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 26: Multivariable analysis of the association between hypertension and occupation at different levels of adjustment by sex. 2003.

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
Men							
Age, sex	Ref	0.72	0.82	1.22	0.81	0.54***	*<0.01*
Age, Place of residence	Ref	0.72	0.81	1.22	0.80	0.54***	*<0.01*
Age, Marital status	Ref	0.73	0.82	1.2	0.82	0.54***	*<0.01*
Age, Body mass index	Ref	0.74	0.86	1.24	0.85	0.55***	*<0.01*
Age, Diabetes mellitus	Ref	0.72	0.82	1.23	0.80	0.54***	*<0.01*
Age, Family history of hypertension	Ref	0.74	0.86	1.22	0.82	0.56***	*<0.01*
Age, Smoking	Ref	0.72	0.82	1.23	0.79	0.54***	*<0.01*
Age, Physical activity	Ref	0.71	0.81	1.23	0.79	0.53***	*<0.01*
Fully adjusted	Ref	0.76	0.89	1.23	0.84	0.56***	*<0.01*
Women							
Age, sex	Ref	0.86	1.17	1.22	0.78	1.02	*0.07*
Age, Place of residence	Ref	0.86	1.17	1.22	0.78	1.02	*0.08*
Age, Marital status	Ref	0.87	1.18	1.20	0.81	1.11	*0.35*
Age, Body mass index	Ref	0.96	1.13	1.24	0.90	1.20	*0.46*
Age, Diabetes mellitus	Ref	0.86	1.18	1.23	0.78	1.04	*0.08*
Age, Family history of hypertension	Ref	0.83	1.14	1.22	0.80	1.00	*0.06*
Age, Smoking	Ref	0.88	1.20	1.23	0.81	1.05	*0.13*
Age, Physical activity	Ref	0.85	1.16	1.23	0.78	1.04	*0.08*
Fully adjusted	Ref	0.96	1.12	1.23	0.95	1.24	*0.55*

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 27: Multivariable analysis of the association between hypertension and occupation at different levels of adjustment by sex. 2010.

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
Men							
Age, sex	Ref	1.07	1.09	1.4	0.88	0.74	*0.04*
Age, Place of residence	Ref	1.07	1.09	1.41	0.89	0.74	*0.04*
Age, Marital status	Ref	1.07	1.09	1.41	0.91	0.75	*0.04*
Age, Body mass index	Ref	1.08	1.11	1.57	0.9	0.70	*<0.01*
Age, Diabetes mellitus	Ref	1.04	1.06	1.38	0.85	0.72	*0.03*
Age, Family history of hypertension	Ref	1.05	1.09	1.34	0.85	0.74	*0.05*
Age, Smoking	Ref	1.06	1.08	1.39	0.88	0.74	*0.04*
Age, Physical activity	Ref	1.07	1.05	1.40	0.89	0.72	*0.03*
Fully adjusted	Ref	1.05	1.07	1.52	0.86	0.68	*<0.01*
Women							
Age, sex	Ref	1.02	0.94	1.11	0.74	0.97	*0.55*
Age, Place of residence	Ref	1.02	0.94	1.12	0.74	0.98	*0.55*
Age, Marital status	Ref	1.02	0.94	1.09	0.75	0.98	*0.71*
Age, Body mass index	Ref	1.31	1.15	1.33	1.02	1.17	*0.52*
Age, Diabetes mellitus	Ref	1.01	0.93	1.08	0.71	0.97	*0.62*
Age, Family history of hypertension	Ref	0.97	0.90	1.07	0.71	0.97	*0.65*
Age, Smoking	Ref	1.03	0.95	1.12	0.74	0.98	*0.55*
Age, Physical activity	Ref	0.98	0.89	1.08	0.72	0.96	*0.57*
Fully adjusted	Ref	1.21	1.06	1.24	0.94	1.16	*0.74*

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 28: Multivariable analysis of the association between hypertension and occupation at different levels of adjustment by age group. 2003.

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
20-44							
Sex,	Ref	0.58	0.82	0.67	0.52*	0.70	*0.28*
Sex, Place of residence	Ref	0.58	0.8	0.66	0.51*	0.67	*0.29*
Sex, Marital status	Ref	0.61	0.82	0.63	0.57	0.87	*0.40*
Sex, Body mass index	Ref	0.65	0.87	0.69	0.58	0.89	*0.41*
Sex, Diabetes mellitus	Ref	0.57	0.82	0.67	0.52*	0.70	*0.27*
Sex, Family history of hypertension	Ref	0.60	0.86	0.71	0.54*	0.71	*0.30*
Sex, Smoking	Ref	0.57	0.83	0.65	0.53*	0.63	*0.28*
Sex, Physical activity	Ref	0.56	0.81	0.65	0.50*	0.75	*0.22*
Fully adjusted	Ref	0.68	0.90	0.66	0.63	0.95	*0.44*
45 and over							
Sex,	Ref	0.89	0.99	1.46*	1.22	1.37*	*<0.01*
Sex, Place of residence	Ref	0.89	0.98	1.44*	1.22	1.36*	*<0.01*
Sex, Marital status	Ref	0.90	1.03	1.46*	1.23	1.36*	*<0.01*
Sex, Body mass index	Ref	0.87	1.00	1.36*	1.23	1.36*	*<0.01*
Sex, Diabetes mellitus	Ref	0.90	1.00	1.46*	1.20	1.35*	*<0.01*
Sex, Family history of hypertension	Ref	0.86	0.99	1.46**	1.22	1.38*	*<0.01*
Sex, Smoking	Ref	0.96	1.02	1.44*	1.19	1.32	*<0.01*
Sex, Physical activity	Ref	0.86	0.98	1.45*	1.19	1.32	*<0.01*
Fully adjusted	Ref	0.88	1.03	1.34*	1.18	1.28	*0.01*

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 29: Multivariable analysis of the association between hypertension and occupation at different levels of adjustment by age group. 2010.

Occupation	Higher worker	Intermediate worker	Routine and manual	Home-maker	Inactive	Retired	*Wald test of homogeneity*
20-44							
Sex, sex	Ref	0.84	0.85	0.81	0.21**	2.08	*<0.01*
Sex, Place of residence	Ref	0.84	0.85	0.8	0.21**	2.07	*<0.01*
Sex, Marital status	Ref	0.86	0.86	0.82	0.22**	1.99	*<0.01*
Sex, Body mass index	Ref	1.11	1.09	1.04	0.29**	2.42	*<0.01*
Sex, Diabetes mellitus	Ref	0.84	0.85	0.8	0.21**	2.09	*<0.01*
Sex, Family history of hypertension	Ref	0.83	0.85	0.8	0.21**	2.09	*<0.01*
Sex, Smoking	Ref	0.85	0.85	0.81	0.21**	2.09	*<0.01*
Sex, Physical activity	Ref	0.85	0.85	0.77	0.22**	1.92	*<0.01*
Fully adjusted	Ref	1.09	1.04	0.97	0.29**	2.08	*0.01*
45 and over							
Sex, sex	Ref	1.03	1.06	1.27	1.25	1.63*	*<0.01*
Sex, Place of residence	Ref	1.03	1.05	1.27	1.25	1.63*	*<0.01*
Sex, Marital status	Ref	1.03	1.05	1.28	1.26	1.56*	*<0.01*
Sex, Body mass index	Ref	1.00	1.04	1.2	1.22	1.53*	*<0.01*
Sex, Diabetes mellitus	Ref	1.02	1.05	1.23	1.24	1.56*	*<0.01*
Sex, Family history of hypertension	Ref	1.01	1.05	1.25	1.2	1.66*	*<0.01*
Sex, Smoking	Ref	1.03	1.04	1.25	1.23	1.58*	*<0.01*
Sex, Physical activity	Ref	1.00	1.00	1.24	1.22	1.54*	*<0.01*
Fully adjusted	Ref	0.95	0.98	1.14	1.11	1.35	*<0.01*

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 30: Multivariable analysis of the association between SBP and occupation (workers) at different levels of adjustment by sex. 2003 and 2010.

	Men				**Women**			
	Coef			*P-value for trend*	Coef			*P-value for trend*
Occupation (workers)	High	Middle	Low		High	Middle	Low	
Age,	Ref	-2.68	-0.91	0.71	Ref	-4.77	-0.33	0.78
Age, Place of residence	Ref	-2.65	-1.40	0.48	Ref	-4.74	-0.39	0.80
Age, Marital status	Ref	-3.00	-1.07	0.66	Ref	-4.78	-0.17	0.74
Age, Body mass index,	Ref	-1.85	0.25	0.73	Ref	-3.06	-1.01	0.92
Age, Diabetes mellitus,	Ref	-2.58	-0.79	0.76	Ref	-4.75	0.00	0.69
Age, Family history of hypertension,	Ref	-2.39	-0.44	0.92	Ref	-4.85	-0.47	0.81
Age, Smoking,	Ref	-3.19	-0.95	0.72	Ref	-4.57	-0.21	0.76
Age, Physical activity	Ref	-2.81	-1.01	0.68	Ref	-4.90	-0.39	0.79
Fully adjusted	Ref	-2.60	0.08	0.78	Ref	-2.96	-0.65	0.99

	Men				**Women**			
	Coef			*P-value for trend*	Coef			*P-value for trend*
Occupation (workers)	High	Middle	Low		High	Middle	Low	
Age,	Ref	0.89	3.89	0.04	Ref	-1.82	-0.01	0.94
Age, Place of residence	Ref	0.88	3.98	0.05	Ref	-1.79	0.05	0.93
Age, Marital status	Ref	0.85	3.98	0.03	Ref	-1.78	-0.11	0.97
Age, Body mass index,	Ref	1.45	4.71*	0.01	Ref	0.00	1.11	0.57
Age, Diabetes mellitus,	Ref	0.69	3.64	0.05	Ref	-1.83	0.03	0.93
Age, Family history of hypertension,	Ref	0.45	3.80	0.03	Ref	-2.05	0.11	0.90
Age, Smoking,	Ref	0.85	3.55	0.06	Ref	-1.96	-0.29	0.99
Age, Physical activity	Ref	0.97	3.84	0.05	Ref	-1.95	-0.17	0.98
Fully adjusted	Ref	0.89	4.27*	0.01	Ref	-0.21	0.88	0.65

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 31: Multivariable analysis of the association between SBP and occupation (workers) at different levels of adjustment by age group. 2003 and 2010

2003	**20-39**				**40-59**				**60 and over**			
	Coef			*P-value for trend*	Coef			*P-value for trend*	Coef			*P-value for trend*
Occupation (workers)	High	Middle	Low		High	Middle	Low		High	Middle	Low	
Sex,	Ref	-5.97*	-0.29	0.60	Ref	-2.30	-1.16	0.68	Ref	0.47	-8.82	0.09
Sex, Place of residence	Ref	-6.03*	-0.70	0.80	Ref	-2.35	-1.40	0.60	Ref	0.60	-9.01	0.09
Sex, Marital status	Ref	-5.84*	-0.30	0.62	Ref	-2.18	-1.10	0.71	Ref	0.25	-8.86	0.09
Sex, Body mass index,	Ref	-2.65	0.84	0.42	Ref	-2.63	-0.78	0.84	Ref	0.93	-7.50	0.15
Sex, Diabetes mellitus,	Ref	-5.92*	-0.31	0.61	Ref	-2.62	-0.89	0.77	Ref	3.63	-7.00	0.15
Sex, Family history of hypertension,	Ref	-5.61*	0.14	0.47	Ref	-2.42	-1.00	0.74	Ref	0.67	-8.99	0.09
Sex, Smoking,	Ref	-6.12*	-0.26	0.58	Ref	-2.27	-0.99	0.73	Ref	0.37	-8.85	0.09
Sex, Physical activity	Ref	-6.26*	-0.53	0.64	Ref	-2.47	-1.19	0.67	Ref	0.52	-8.95	0.09
Fully adjusted	Ref	-2.82	0.63	0.49	Ref	-3.37	-0.58	0.93	Ref	3.56	-6.52	0.18
2010	**20-39**				**40-59**				**60 and over**			
	Coef			*P-value for trend*	Coef			*P-value for trend*	Coef			*P-value for trend*
Occupation (workers)	High	Middle	Low		High	Middle	Low		High	Middle	Low	
Sex,	Ref	-4.87	-2.62	0.63	Ref	3.48	6.99*	0.02	Ref	0.21	1.95	0.73
Sex, Place of residence	Ref	-4.87	-2.63	0.62	Ref	3.47	6.98*	0.02	Ref	0.21	1.94	0.73
Sex, Marital status	Ref	-4.50	-2.38	0.67	Ref	3.38	6.86*	0.02	Ref	0.31	2.53	0.64
Sex, Body mass index,	Ref	-1.50	0.63	0.45	Ref	2.91	6.12*	0.02	Ref	-1.47	1.11	0.78
Sex, Diabetes mellitus,	Ref	-4.92	-2.66	0.62	Ref	3.69	7.07*	0.01	Ref	-1.15	0.99	0.81
Sex, Family history of hypertension,	Ref	-5.00	-2.32	0.72	Ref	2.88	6.80*	0.01	Ref	-0.16	1.27	0.81
Sex, Smoking,	Ref	-4.88	-2.73	0.60	Ref	3.39	6.52*	0.02	Ref	-0.08	1.81	0.74
Sex, Physical activity	Ref	-4.68	-2.46	0.66	Ref	3.21	6.43*	0.03	Ref	-0.61	1.01	0.83
Fully adjusted	Ref	-1.36	0.89	0.38	Ref	2.29	5.04	0.05	Ref	-2.91	0.25	0.84

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 32: Multivariable analysis of the association between DBP and occupation (workers) at different levels of adjustment by sex. 2003 and 2010

	Men				Women			
	Coef			*P-value for trend*	Coef			*P-value for trend*
Occupation (workers)	High	Middle	Low		High	Middle	Low	
Age,	Ref	-3.07	-2.33*	0.08	Ref	-4.66	-0.43	0.73
Age, Place of residence	Ref	-3.07	-2.35	0.08	Ref	-4.66	-0.43	0.73
Age, Marital status	Ref	-3.07	-2.38*	0.07	Ref	-4.70	-0.44	0.74
Age, Body mass index,	Ref	-2.35	-1.33	0.32	Ref	-3.18	-1.02	0.89
Age, Diabetes mellitus,	Ref	-3.05	-2.31	0.08	Ref	-4.65	-0.37	0.71
Age, Family history of hypertension,	Ref	-2.78	-1.86	0.16	Ref	-4.74	-0.57	0.77
Age, Smoking,	Ref	-3.22	-2.34*	0.08	Ref	-4.59	-0.39	0.72
Age, Physical activity	Ref	-3.11	-2.35*	0.07	Ref	-4.72	-0.48	0.74
Fully adjusted	Ref	-2.46	-0.98	0.53	Ref	-3.22	-1.04	0.88

	Men				Women			
	Coef			*P-value for trend*	Coef			*P-value for trend*
Occupation (workers)	High	Middle	Low		High	Middle	Low	
Age,	Ref	0.14	-0.84	0.37	Ref	-2.34	-0.98	0.75
Age, Place of residence	Ref	0.13	-0.68	0.48	Ref	-2.29	-0.88	0.79
Age, Marital status	Ref	0.26	-0.74	0.39	Ref	-2.34	-1.00	0.75
Age, Body mass index,	Ref	0.53	-0.27	0.59	Ref	-1.06	-0.20	0.97
Age, Diabetes mellitus,	Ref	0.05	-0.96	0.34	Ref	-2.35	-0.96	0.76
Age, Family history of hypertension,	Ref	-0.14	-0.90	0.41	Ref	-2.49	-0.91	0.78
Age, Smoking,	Ref	0.12	-0.95	0.32	Ref	-2.33	-0.98	0.76
Age, Physical activity	Ref	0.26	-0.99	0.28	Ref	-2.69	-1.33	0.65
Fully adjusted	Ref	0.41	-0.35	0.59	Ref	-1.34	-0.31	0.94

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 33: Multivariable analysis of the association between DBP and occupation (workers) at different levels of adjustment by age group. 2003 and 2010

	20-39				**40-59**				**60 and over**			
	Coef			*P-value for trend*	Coef			*P-value for trend*	Coef			*P-value for trend*
Occupation (workers)	High	Middle	Low		High	Middle	Low		High	Middle	Low	
Sex,	Ref	-5.15*	-1.18	0.96	Ref	-3.56	-2.57	0.12	Ref	6.77	-6.26	0.03
Sex, Place of residence	Ref	-5.15*	-1.15	0.94	Ref	-3.56	-2.56	0.11	Ref	6.76	-6.24	0.03
Sex, Marital status	Ref	-5.01*	-1.21	0.93	Ref	-3.43	-2.51	0.14	Ref	6.37	-6.35	0.03
Sex, Body mass index,	Ref	-2.44	-0.26	0.85	Ref	-3.83	-2.26	0.16	Ref	7.15	-5.18	0.06
Sex, Diabetes mellitus,	Ref	-5.14*	-1.18	0.96	Ref	-3.63	-2.52	0.13	Ref	7.47	-5.85	0.03
Sex, Family history of hypertension,	Ref	-4.79*	-0.74	0.84	Ref	-3.68	-2.41	0.14	Ref	6.97	-6.42	0.02
Sex, Smoking,	Ref	-5.23*	-1.16	0.98	Ref	-3.44	-2.46	0.14	Ref	6.87	-6.24	0.03
Sex, Physical activity	Ref	-5.22*	-1.21	0.98	Ref	-3.63	-2.62	0.11	Ref	6.73	-6.38	0.02
Fully adjusted	Ref	-2.28	0.11	0.66	Ref	-4.04	-2.08	0.21	Ref	7.23	-5.37	0.06
	20-39				**40-59**				**60 and over**			
	Coef			*P-value for trend*	Coef			*P-value for trend*	Coef			*P-value for trend*
Occupation (workers)	High	Middle	Low		High	Middle	Low		High	Middle	Low	
Sex,	Ref	-3.25	-3.49	0.14	Ref	-0.54	-0.58	0.80	Ref	2.11	2.49	0.44
Sex, Place of residence	Ref	-3.23	-3.36	0.16	Ref	-0.52	-0.42	0.88	Ref	2.10	2.63	0.42
Sex, Marital status	Ref	-2.94	-3.33	0.16	Ref	-0.56	-0.58	0.80	Ref	2.18	2.77	0.37
Sex, Body mass index,	Ref	-0.97	-1.30	0.35	Ref	-0.93	-1.16	0.54	Ref	0.98	1.92	0.51
Sex, Diabetes mellitus,	Ref	-3.27	-3.51	0.14	Ref	-0.44	-0.54	0.79	Ref	1.43	2.01	0.52
Sex, Family history of hypertension,	Ref	-3.33	-3.31	0.17	Ref	-0.91	-0.69	0.82	Ref	1.88	2.07	0.53
Sex, Smoking,	Ref	-3.20	-3.49	0.15	Ref	-0.55	-0.65	0.75	Ref	2.20	2.60	0.43
Sex, Physical activity	Ref	-3.07	-3.39	0.14	Ref	-0.89	-1.22	0.53	Ref	1.24	1.52	0.65
Fully adjusted	Ref	-0.75	-0.95	0.49	Ref	-1.38	-1.67	0.38	Ref	0.23	1.46	0.57

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 34: Multivariable analysis of the association between hypertension and occupation (workers) at different levels of adjustment, by sex. 2003 and 2010

	Men				Women			
	PR			*P-value*	PR			*P-value*
Hypertension/Occupation (workers)	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*
Age,	Ref	0.73	0.81	0.18	Ref	0.88	1.19	0.53
Age, Place of residence	Ref	0.73	0.81	0.18	Ref	0.88	1.19	0.53
Age, Marital status	Ref	0.73	0.81	0.17	Ref	0.88	1.19	0.54
Age, Body mass index,	Ref	0.74	0.87	0.36	Ref	0.99	1.10	0.75
Age, Diabetes mellitus,	Ref	0.73	0.82	0.19	Ref	0.89	1.20	0.51
Age, Family history of hypertension,	Ref	0.75	0.85	0.26	Ref	0.86	1.16	0.57
Age, Smoking,	Ref	0.71	0.81	0.17	Ref	0.88	1.19	0.53
Age, Physical activity	Ref	0.73	0.82	0.19	Ref	0.88	1.18	0.54
Fully adjusted	Ref	0.76	0.90	0.48	Ref	0.96	1.07	0.80

	Men				Women			
	PR			*P-value*	PR			*P-value*
Hypertension/Occupation (workers)	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*
Age,	Ref	1.07	1.09	0.74	Ref	1.04	0.95	0.86
Age, Place of residence	Ref	1.07	1.10	0.69	Ref	1.04	0.96	0.87
Age, Marital status	Ref	1.07	1.09	0.73	Ref	1.05	0.96	0.87
Age, Body mass index,	Ref	1.09	1.12	0.63	Ref	1.59	1.36	0.30
Age, Diabetes mellitus,	Ref	1.04	1.06	0.81	Ref	1.02	0.94	0.82
Age, Family history of hypertension,	Ref	1.05	1.10	0.62	Ref	0.95	0.88	0.70
Age, Smoking,	Ref	1.08	1.08	0.80	Ref	1.01	0.91	0.75
Age, Physical activity	Ref	1.07	1.04	0.97	Ref	0.97	0.88	0.69
Fully adjusted	Ref	1.04	1.05	0.82	Ref	1.34	1.14	0.74

* p<0.05, ** p<0.01, *** p<0.001

Table A6. 35: Multivariable analysis of the association between hypertension and occupation (workers) at different levels of adjustment by age group. 2003 and 2010

	20-39				40-59				60 and over			
	PR			*P-value*	PR			*P-value*	PR			*P-value*
Hypertension/Occupation (workers)	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*
Sex,	Ref	0.58	0.87	0.87	Ref	0.75	0.84	0.29	Ref	1.26	0.94	0.49
Sex, Place of residence	Ref	0.58	0.87	0.85	Ref	0.75	0.83	0.28	Ref	1.26	0.93	0.48
Sex, Marital status	Ref	0.61	0.87	0.85	Ref	0.76	0.85	0.34	Ref	1.19	0.92	0.46
Sex, Body mass index,	Ref	0.74	0.93	0.93	Ref	0.72	0.88	0.49	Ref	1.34*	0.95	0.52
Sex, Diabetes mellitus,	Ref	0.58	0.87	0.86	Ref	0.74	0.84	0.31	Ref	1.34	0.97	0.61
Sex, Family history of hypertension,	Ref	0.60	0.91	0.96	Ref	0.74	0.85	0.37	Ref	1.28	0.92	0.42
Sex, Smoking,	Ref	0.58	0.87	0.88	Ref	0.75	0.84	0.30	Ref	1.27	0.93	0.48
Sex, Physical activity	Ref	0.58	0.88	0.90	Ref	0.75	0.83	0.27	Ref	1.24	0.92	0.45
Fully adjusted	Ref	0.78	0.97	0.98	Ref	0.73	0.90	0.58	Ref	1.34	0.93	0.46

	20-39				40-59				60 and over			
	PR			*P-value*	PR			*P-value*	PR			*P-value*
Hypertension/Occupation (workers)	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*	High	Middle	Low	*for trend*
Sex,	Ref	0.67	0.50	0.15	Ref	1.31	1.43	0.19	Ref	1.00	0.85	0.45
Sex, Place of residence	Ref	0.67	0.50	0.15	Ref	1.31	1.43	0.20	Ref	1.00	0.85	0.46
Sex, Marital status	Ref	0.69	0.50	0.15	Ref	1.30	1.42	0.20	Ref	1.00	0.87	0.48
Sex, Body mass index,	Ref	1.35	0.98	0.77	Ref	1.27	1.33	0.29	Ref	0.91	0.83	0.44
Sex, Diabetes mellitus,	Ref	0.67	0.49	0.15	Ref	1.33	1.43	0.19	Ref	0.91	0.79	0.35
Sex, Family history of hypertension,	Ref	0.66	0.51	0.16	Ref	1.23	1.39	0.18	Ref	1.00	0.82	0.39
Sex, Smoking,	Ref	0.67	0.49	0.14	Ref	1.30	1.39	0.25	Ref	1.00	0.85	0.47
Sex, Physical activity	Ref	0.70	0.51	0.15	Ref	1.25	1.31	0.37	Ref	0.87	0.74	0.21
Fully adjusted	Ref	1.24	0.86	0.52	Ref	1.19	1.18	0.60	Ref	0.74	0.71	0.24

* p<0.05, ** p<0.01, *** p<0.001

Appendix 7. Statistical testing of the linearity assumption for RII and SII

Table A7. 1: Statistical testing of the linearity assumption for RII. Quadratic regression coefficients for education, assets-based index and occupation. 2003

	2003								
RII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Education									
Score_education	0.10	[-0.01,0.21]	0.07	0.06	[-0.06,0.18]	0.31	2.25	[0.60,8.41]	0.23
Score_education^2	-0.06	[-0.16,0.04]	0.25	-0.05	[-0.16,0.06]	0.40	0.55	[0.18,1.68]	0.30
Sex (ref:men)	-0.05	[-0.06,-0.03]	<0.01	-0.07	[-0.08,-0.05]	<0.01	0.78	[0.68,0.89]	<0.01
Age (continuous)	0.01	[0.01,0.01]	<0.01	0.00	[0.00,0.00]	<0.01	1.04	[1.03,1.04]	<0.01
Marital Status									
Married/cohabiting	0.02	[-0.00,0.03]	0.06	0.01	[-0.01,0.03]	0.43	1.05	[0.90,1.22]	0.56
Single	0.01	[-0.01,0.03]	0.37	-0.03	[-0.05,-0.01]	0.01	0.76	[0.60,0.95]	0.02
Divorced/Separated/Widowed	0.01	[-0.01,0.03]	0.48	-0.01	[-0.03,0.01]	0.38	0.93	[0.81,1.07]	0.30
Assets-based index									
Score_assets	0.10	[-0.02,0.21]	0.11	0.10	[-0.02,0.21]	0.09	2.00	[0.72,5.59]	0.19
Score_assets^2	-0.06	[-0.16,0.05]	0.28	-0.08	[-0.18,0.03]	0.15	0.62	[0.25,1.51]	0.29
Sex (ref:men)	-0.05	[-0.06,-0.03]	<0.01	-0.07	[-0.08,-0.05]	<0.01	0.79	[0.69,0.90]	<0.01
Age (continuous)	0.01	[0.01,0.01]	<0.01	0.00	[0.00,0.00]	<0.01	1.04	[1.03,1.04]	<0.01
Marital Status									
Married/cohabiting	0.01	[-0.00,0.03]	0.09	0.01	[-0.01,0.03]	0.45	1.04	[0.89,1.21]	0.61
Single	0.01	[-0.01,0.03]	0.43	-0.03	[-0.05,-0.01]	0.01	0.75	[0.60,0.94]	0.01
Divorced/Separated/Widowed	0.01	[-0.02,0.03]	0.59	-0.01	[-0.03,0.01]	0.34	0.92	[0.80,1.06]	0.23

Table A7. 1 (cont.): Statistical testing of the linearity assumption for RII. Quadratic regression coefficients for education, assets-based index and occupation. 2003

	2003								
RII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Occupation									
Score_occupation	-0.39	[-0.82,0.03]	0.07	-0.58	[-1.09,-0.08]	0.02	0.04	[0.00,8.31]	0.24
$Score\_occupation^2$	0.55	[-0.06,1.16]	0.08	**0.79**	**[0.06,1.51]**	**0.03**	68.50	[0.03,134368.15]	0.27
Sex (ref:men)	-0.06	[-0.09,-0.04]	<0.01	-0.08	[-0.11,-0.05]	<0.01	0.67	[0.49,0.92]	0.01
Age (continuous)	0.01	[0.00,0.01]	<0.01	0.00	[0.00,0.00]	<0.01	1.04	[1.03,1.05]	<0.01
Marital Status									
Married/cohabiting	0.01	[-0.01,0.04]	0.21	0.00	[-0.03,0.02]	0.91	1.00	[0.78,1.29]	0.98
Single	0.01	[-0.01,0.03]	0.24	-0.01	[-0.04,0.02]	0.49	0.81	[0.58,1.12]	0.21
Divorced/Separated/Widowed	0.00	[-0.04,0.04]	0.85	-0.01	[-0.05,0.03]	0.50	0.87	[0.61,1.24]	0.45

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 2: Statistical testing of the linearity assumption for RII. Quadratic regression coefficients for education, assets-based index and occupation. 2010

	2010								
RII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Education									
Score_education	0.00	[-0.11,0.10]	0.95	-0.02	[-0.13,0.08]	0.66	3.37	[0.93,12.25]	0.06
Score_education^2	0.04	[-0.07,0.14]	0.47	0.00	[-0.10,0.10]	0.99	0.35	[0.12,1.02]	0.05
Sex (ref:men)	-0.07	[-0.08,-0.05]	<0.01	-0.06	[-0.07,-0.04]	<0.01	0.82	[0.71,0.96]	0.01
Age (continuous)	0.01	[0.01,0.01]	<0.01	0.00	[0.00,0.00]	<0.01	1.04	[1.04,1.05]	<0.01
Marital Status									
Married/cohabiting	0.00	[-0.02,0.02]	0.85	0.00	[-0.02,0.02]	0.99	0.97	[0.80,1.18]	0.77
Single	0.01	[-0.00,0.03]	0.14	-0.03	[-0.05,-0.01]	<0.01	0.88	[0.71,1.08]	0.22
Divorced/Separated/Widowed	0.01	[-0.01,0.04]	0.25	-0.01	[-0.03,0.01]	0.42	0.98	[0.81,1.20]	0.87
Assets-based index									
Score_assets	0.13	[-0.02,0.28]	0.09	0.06	[-0.10,0.21]	0.47	1.98	[0.44,8.92]	0.37
Score_assets^2	-0.09	[-0.22,0.05]	0.20	-0.05	[-0.19,0.09]	0.45	0.55	[0.13,2.22]	0.40
Sex (ref:men)	-0.07	[-0.08,-0.05]	<0.01	-0.06	[-0.07,-0.05]	<0.01	0.82	[0.70,0.95]	0.01
Age (continuous)	0.01	[0.01,0.01]	<0.01	0.00	[0.00,0.00]	<0.01	1.04	[1.04,1.05]	<0.01
Marital Status									
Married/cohabiting	0.00	[-0.02,0.02]	0.81	0.00	[-0.02,0.02]	0.75	0.97	[0.79,1.18]	0.73
Single	0.01	[-0.00,0.03]	0.14	-0.03	[-0.04,-0.01]	<0.01	0.86	[0.70,1.06]	0.16
Divorced/Separated/Widowed	0.01	[-0.01,0.04]	0.30	-0.01	[-0.03,0.02]	0.48	0.97	[0.79,1.18]	0.75

Table A7. 2 (cont.): Statistical testing of the linearity assumption for RII. Quadratic regression coefficients for education, assets-based index and occupation. 2010

	2010								
RII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Occupation									
Score_occupation	-0.06	[-0.26,0.14]	0.56	-0.07	[-0.30,0.15]	0.53	1.42	[0.08,23.89]	0.81
$Score\_occupation^2$	0.10	[-0.10,0.31]	0.32	0.07	[-0.16,0.30]	0.56	0.72	[0.04,13.12]	0.82
Sex (ref:men)	-0.08	[-0.10,-0.06]	<0.01	-0.07	[-0.09,-0.05]	<0.01	0.70	[0.52,0.95]	0.02
Age (continuous)	0.01	[0.00,0.01]	<0.01	0.00	[0.00,0.00]	<0.01	1.05	[1.04,1.06]	<0.01
Marital Status									
Married/cohabiting	-0.01	[-0.03,0.02]	0.63	-0.02	[-0.05,0.01]	0.31	0.95	[0.69,1.32]	-0.77
Single	0.01	[-0.01,0.03]	0.34	-0.01	[-0.03,0.02]	0.58	1.01	[0.72,1.42]	-0.95
Divorced/Separated/Widowed	0.03	[-0.01,0.07]	0.10	0.02	[-0.02,0.05]	0.33	1.09	[0.68,1.74]	-0.71

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 3: Statistical testing of the linearity assumption for SII. Quadratic regression coefficients for education, assets-based index and occupation. 2003

	2003								
SII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Education									
Score_education	10.80	[-2.63,24.14]	0.12	4.48	[-4.89,13.85]	0.35	1.14	[0.82,1.57]	0.44
Score_education^2	-5.51	[-18.39,7.38]	0.40	-3.34	[-12.08,5.40]	0.45	0.94	[0.69,1.28]	0.69
Sex (ref:men)	-6.65	[-8.48,-4.81]	<0.01	-5.81	[-7.06,-4.56]	<0.01	0.92	[0.88,0.96]	<0.01
Age (continuous)	0.80	[0.72,0.88]	<0.01	0.30	[0.25,0.34]	<0.01	1.01	[1.01,1.02]	<0.01
Marital Status	1.94	[-0.11,3.98]	0.06	0.63	[-0.91,2.17]	0.42	1.01	[0.96,1.07]	0.70
Married/cohabiting									
Single	1.48	[-0.82,3.78]	0.21	-2.03	[-3.57,-0.49]	0.01	0.98	[0.93,1.04]	0.57
Divorced/Separated/Widowed	1.35	[-1.89,4.58]	0.41	-0.93	[-2.88,1.02]	0.35	1.00	[0.93,1.07]	0.98
Assets-based index									
Score_assets	12.80	[-1.93,27.56]	0.09	7.66	[-1.32,16.63]	0.09	1.25	[0.91,1.72]	0.17
Score_assets^2	-7.43	[-20.29,5.43]	0.26	-6.00	[-14.25,2.24]	0.15	0.86	[0.64,1.15]	0.30
Sex (ref:men)	-6.48	[-8.29,-4.67]	<0.01	-5.79	[-7.02,-4.55]	<0.01	0.92	[0.88,0.96]	<0.01
Age (continuous)	0.83	[0.76,0.90]	<0.01	0.30	[0.26,0.34]	<0.01	1.02	[1.01,1.02]	<0.01
Marital Status	1.78	[-0.29,3.86]	0.09	0.62	[-0.97,2.20]	0.44	1.01	[0.95,1.07]	0.72
Married/cohabiting									
Single	1.41	[-0.88,3.70]	0.23	-2.08	[-3.62,-0.55]	0.01	0.98	[0.93,1.04]	-0.54
Divorced/Separated/Widowed	1.11	[-2.13,4.35]	0.50	-1.00	[-2.90,0.91]	0.31	1.00	[0.93,1.07]	-0.96

Table A7. 3 (cont.): Statistical testing of the linearity assumption for SII. Quadratic regression coefficients for education, assets-based index and occupation. 2003

	2003								
SII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Occupation									
Score_occupation	-48.50	[-101.44,4.40]	0.07	-47.10	[-86.86,-7.36]	0.02	0.52	[0.14,1.99]	0.34
Score_occupation^2	67.90	[-7.45,143.22]	0.08	**63.60**	**[6.90,120.24]**	**0.03**	2.31	[0.36,14.99]	0.38
Sex (ref:men)	-8.34	[-11.53,-5.14]	<0.01	-6.49	[-8.75,-4.23]	<0.01	0.89	[0.82,0.96]	<0.01
Age (continuous)	0.73	[0.62,0.84]	<0.01	0.33	[0.25,0.41]	<0.01	1.01	[1.01,1.02]	<0.01
Marital Status	1.72	[-1.04,4.48]	0.22	-0.17	[-2.28,1.94]	0.87	1.00	[0.92,1.09]	0.92
Married/cohabiting									
Single	1.87	[-0.91,4.65]	0.19	-0.66	[-2.82,1.50]	0.55	0.98	[0.91,1.06]	0.66
Divorced/Separated/Widowed	-0.68	[-5.83,4.46]	0.80	-1.28	[-4.48,1.93]	0.43	0.94	[0.83,1.07]	0.37

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 4: Statistical testing of the linearity assumption for SII. Quadratic regression coefficients for education, assets-based index and occupation. 2010

	2010								
SII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Education									
Score_education	-2.71	[-15.86,10.45]	0.69	-2.16	[-10.29,5.98]	0.60	1.19	[0.88,1.61]	0.27
Score_education^2	7.31	[-6.19,20.81]	0.29	0.33	[-7.34,8.00]	0.93	0.87	[0.65,1.16]	0.34
Sex (ref:men)	-8.74	[-10.57,-6.92]	<0.01	-4.61	[-5.73,-3.49]	<0.01	0.94	[0.90,0.98]	0.01
Age (continuous)	0.75	[0.68,0.82]	<0.01	0.19	[0.15,0.24]	<0.01	1.01	[1.01,1.02]	<0.01
Marital Status	0.13	[-2.12,2.38]	0.91	0.10	[-1.36,1.57]	0.89	1.00	[0.94,1.06]	0.99
Married/cohabiting									
Single	1.99	[-0.02,4.00]	0.05	-2.06	[-3.39,-0.74]	0.41	1.03	[0.98,1.08]	0.26
Divorced/Separated/Widowed	2.41	[-0.85,5.68]	0.15	-0.81	[-2.73,1.10]	0.35	1.05	[0.96,1.14]	0.27
Assets-based index									
Score_assets	16.60	[-2.57,35.79]	0.09	4.62	[-7.31,16.54]	0.45	1.25	[0.79,1.99]	0.35
Score_assets^2	-11.40	[-28.86,6.05]	0.20	-4.41	[-15.31,6.49]	0.43	0.82	[0.53,1.26]	0.36
Sex (ref:men)	-8.78	[-10.61,-6.95]	<0.01	-4.65	[-5.77,-3.53]	<0.01	0.94	[0.90,0.98]	0.01
Age (continuous)	0.78	[0.72,0.84]	<0.01	0.18	[0.15,0.22]	<0.01	1.01	[1.01,1.02]	<0.01
Marital Status	0.13	[-2.09,2.34]	0.91	-0.15	[-1.63,1.33]	0.84	1.00	[0.94,1.07]	0.92
Married/cohabiting									
Single	2.00	[0.04,3.97]	0.05	-1.96	[-3.31,-0.60]	<0.01	1.02	[0.98,1.07]	0.33
Divorced/Separated/Widowed	2.29	[-1.03,5.61]	0.18	-0.71	[-2.63,1.22]	0.47	1.05	[0.96,1.14]	0.30

Table A7. 4 (cont.): Statistical testing of the linearity assumption for SII. Quadratic regression coefficients for education, assets-based index and occupation. 2010

	2010								
SII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Occupation									
Score_occupation	-7.94	[-33.48,17.61]	0.54	-6.39	[-24.51,11.74]	0.49	1.07	[0.55,2.08]	0.85
$Score\_occupation^2$	13.10	[-12.58,38.69]	0.32	5.81	[-12.37,23.99]	0.53	0.92	[0.46,1.83]	0.81
Sex (ref:men)	-10.50	[-12.74,-8.22]	<0.01	-5.33	[-6.88,-3.77]	<0.01	0.91	[0.86,0.97]	0.01
Age (continuous)	0.74	[0.64,0.83]	<0.01	0.31	[0.25,0.37]	<0.01	1.01	[1.01,1.02]	<0.01
Marital Status	-0.41	[-3.60,2.79]	0.80	-1.08	[-3.41,1.25]	0.36	0.99	[0.91,1.08]	0.81
Married/cohabiting									
Single	1.59	[-1.05,4.22]	0.24	-0.39	[-2.32,1.54]	0.69	1.03	[0.96,1.10]	0.42
Divorced/Separated/Widowed	4.03	[-0.58,8.64]	0.09	1.32	[-1.51,4.15]	0.36	1.06	[0.91,1.23]	0.48

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 5: Statistical testing of the linearity assumption for RII. Quadratic regression coefficients for education by gender, 2003

	2003								
RII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Men									
Score_education	-0.01	[-0.15,0.12]	0.85	-0.07	[-0.22,0.08]	0.36	0.80	[0.19,3.38]	0.76
Score_education^2	0.03	[-0.10,0.16]	0.68	0.06	[-0.08,0.20]	0.41	1.22	[0.33,4.48]	0.77
Age (continuous)	0.00	[0.00,0.01]	<0,01	0.00	[0.00,0.00]	<0,01	1.03	[1.02,1.04]	<0,01
Marital Status									
Married/cohabiting	0.01	[-0.01,0.03]	0.31	0.00	[-0.02,0.03]	0.80	1.07	[0.85,1.34]	0.57
Single	0.00	[-0.02,0.02]	0.98	-0.03	[-0.06,-0.00]	0.03	0.66	[0.47,0.92]	0.02
Divorced/Separated/Widowed	-0.02	[-0.05,0.01]	0.30	-0.02	[-0.06,0.01]	0.21	0.88	[0.68,1.14]	0.32
Women									
Score_education	0.25	[0.09,0.42]	<0,01	0.24	[0.06,0.43]	0.01	26.40	[1.22,571.63]	0.04
Score_education^2	**-0.18**	**[-0.33,-0.03]**	**0.02**	**-0.20**	**[-0.36,-0.03]**	**0.02**	0.08	[0.01,0.97]	0.05
Age (continuous)	0.01	[0.01,0.01]	<0,01	0.00	[0.00,0.00]	<0,01	1.04	[1.03,1.05]	<0,01
Marital Status									
Married/cohabiting	0.02	[0.00,0.04]	0.05	0.01	[-0.01,0.04]	0.24	1.06	[0.88,1.28]	0.56
Single	0.01	[-0.02,0.03]	0.72	-0.03	[-0.06,-0.00]	0.03	0.80	[0.59,1.09]	0.16
Divorced/Separated/Widowed	0.00	[-0.03,0.03]	0.82	-0.02	[-0.05,0.01]	0.17	0.85	[0.71,1.03]	0.09

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 6: Statistical testing of the linearity assumption for RII. Quadratic regression coefficients for education by gender, 2010

	2010								
RII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Men									
Score_education	0.02	[-0.13,0.17]	0.81	0.04	[-0.11,0.20]	0.58	6.73	[1.14,39.81]	0.04
Score_education^2	0.02	[-0.14,0.17]	0.84	-0.08	[-0.23,0.08]	0.33	**0.17**	**[0.04,0.74]**	**0.02**
Age (continuous)	0.01	[0.00,0.01]	<0,01	0.00	[0.00,0.00]	<0,01	1.04	[1.04,1.05]	<0,01
Marital Status									
Married/cohabiting	0.00	[-0.03,0.02]	0.76	0.00	[-0.03,0.03]	0.88	1.08	[0.82,1.41]	0.59
Single	0.01	[-0.01,0.03]	0.40	-0.03	[-0.06,-0.01]	0.01	0.90	[0.65,1.25]	0.54
Divorced/Separated/Widowed	0.02	[-0.03,0.06]	0.42	0.02	[-0.02,0.06]	0.34	1.08	[0.72,1.60]	0.72
Women									
Score_education	-0.03	[-0.17,0.11]	0.69	-0.08	[-0.22,0.06]	0.28	1.79	[0.27,11.68]	0.55
Score_education^2	0.06	[-0.08,0.20]	0.40	0.07	[-0.06,0.20]	0.31	0.66	[0.14,3.11]	0.60
Age (continuous)	0.01	[0.01,0.01]	<0,01	0.00	[0.00,0.00]	<0,01	1.05	[1.04,1.05]	<0,01
Marital Status									
Married/cohabiting	0.00	[-0.02,0.03]	0.72	0.00	[-0.02,0.03]	0.68	0.88	[0.67,1.17]	0.38
Single	0.01	[-0.01,0.03]	0.43	-0.02	[-0.05,0.00]	0.08	0.83	[0.62,1.12]	0.22
Divorced/Separated/Widowed	0.00	[-0.02,0.03]	0.79	-0.02	[-0.05,0.01]	0.11	0.90	[0.73,1.11]	0.34

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 7: Statistical testing of the linearity assumption for SII. Quadratic regression coefficients for education by gender, 2003

	2003								
SII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Men									
Score_education	-2.84	[-19.87,14.19]	0.74	-6.23	[-18.52,6.06]	0.32	0.88	[0.55,1.40]	0.58
Score_education^2	5.02	[-11.87,21.91]	0.56	5.43	[-6.46,17.32]	0.37	1.14	[0.71,1.80]	0.59
Age (continuous)	0.66	[0.56,0.76]	<0.01	0.25	[0.17,0.32]	<0.01	1.01	[1.01,1.02]	<0.01
Marital Status									
Married/cohabiting	1.47	[-1.38,4.32]	0.31	0.33	[-2.04,2.70]	0.78	1.02	[0.94,1.11]	0.64
Single	0.34	[-2.41,3.08]	0.81	-2.29	[-4.52,-0.06]	0.04	0.94	[0.86,1.02]	0.16
Divorced/Separated/Widowed	-2.48	[-6.95,1.99]	0.28	-1.96	[-4.90,0.97]	0.19	0.96	[0.83,1.10]	0.55
Women									
Score_education	26.90	[7.02,46.86]	0.01	17.00	[2.95,31.11]	0.02	1.57	[1.02,2.42]	0.04
Score_education^2	-18.60	[-37.31,0.20]	0.05	**-13.70**	**[-26.51,-0.90]**	**0.04**	0.73	[0.49,1.09]	0.13
Age (continuous)	0.91	[0.80,1.02]	<0.01	0.34	[0.28,0.40]	<0.01	1.02	[1.01,1.02]	<0.01
Marital Status									
Married/cohabiting	2.68	[-0.23,5.59]	0.07	1.13	[-0.81,3.08]	0.25	1.01	[0.95,1.09]	0.69
Single	1.39	[-1.98,4.75]	0.42	-2.11	[-4.23,0.02]	0.05	1.02	[0.96,1.10]	0.49
Divorced/Separated/Widowed	0.38	[-3.78,4.54]	0.86	-1.48	[-3.94,0.97]	0.24	1.01	[0.92,1.10]	0.88

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 8: Statistical testing of the linearity assumption for SII. Quadratic regression coefficients for education by gender, 2010

	2010								
SII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
Men									
Score_education	1.25	[-18.41,20.91]	0.90	3.41	[-8.97,15.79]	0.59	1.55	[0.98,2.47]	0.06
Score_education^2	3.39	[-16.46,23.24]	0.74	-6.08	[-18.64,6.48]	0.34	0.66	[0.42,1.03]	0.07
Age (continuous)	0.67	[0.57,0.78]	<0.01	0.21	[0.14,0.28]	<0.01	1.02	[1.01,1.02]	<0.01
Marital Status									
Married/cohabiting	-0.43	[-3.93,3.08]	0.81	-0.09	[-2.71,2.54]	0.95	1.02	[0.93,1.13]	0.63
Single	1.68	[-1.26,4.63]	0.26	-2.45	[-4.41,-0.49]	0.01	1.04	[0.96,1.12]	0.34
Divorced/Separated/Widowed	3.43	[-2.94,9.79]	0.29	1.84	[-1.68,5.37]	0.31	1.09	[0.89,1.33]	0.43
Women									
Score_education	-6.72	[-24.14,10.69]	0.45	-6.34	[-17.20,4.53]	0.25	0.96	[0.65,1.44]	0.86
Score_education^2	10.70	[-7.31,28.75]	0.24	5.16	[-4.57,14.88]	0.30	1.07	[0.73,1.56]	0.72
Age (continuous)	0.82	[0.72,0.91]	<0.01	0.18	[0.13,0.23]	<0.01	1.01	[1.01,1.02]	<0.01
Marital Status									
Married/cohabiting	1.02	[-1.85,3.88]	0.49	0.39	[-1.17,1.95]	0.62	0.98	[0.91,1.06]	0.60
Single	1.87	[-0.89,4.63]	0.18	-1.55	[-3.37,0.26]	0.09	1.03	[0.96,1.09]	0.44
Divorced/Separated/Widowed	1.22	[-2.56,5.00]	0.53	-1.71	[-3.86,0.43]	0.12	1.04	[0.95,1.13]	0.39

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 9: Statistical testing of the linearity assumption for RII. Quadratic regression coefficients for education by age group, 2003

	2003								
RII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
20-39									
Score_education	0.05	[-0.08,0.18]	0.42	0.00	[-0.16,0.16]	0.99	5.83	[0.25,138.17]	0.27
Score_education^2	-0.02	[-0.16,0.12]	0.77	0.01	[-0.16,0.18]	0.90	0.33	[0.02,6.38]	0.46
Sex (ref:men)	-0.09	[-0.11,-0.07]	<0,01	-0.09	[-0.12,-0.07]	<0,01	0.48	[0.30,0.79]	<0,01
Marital Status									
Married/cohabiting	0.02	[-0.00,0.05]	0.06	0.02	[-0.02,0.05]	0.35	1.12	[0.71,1.76]	0.64
Single	-0.03	[-0.05,-0.01]	0.01	-0.04	[-0.07,-0.02]	<0,01	0.62	[0.39,1.00]	0.05
Divorced/Separated/Widowed	0.02	[-0.05,0.08]	0.59	0.01	[-0.07,0.10]	0.77	1.23	[0.36,4.21]	0.74
40-59									
Score_education	0.08	[-0.13,0.28]	0.46	0.02	[-0.18,0.22]	0.84	1.19	[0.22,6.27]	0.84
Score_education^2	0.03	[-0.16,0.22]	0.76	0.05	[-0.13,0.23]	0.60	1.31	[0.31,5.56]	0.71
Sex (ref:men)	-0.04	[-0.06,-0.01]	<0,01	-0.07	[-0.09,-0.04]	<0,01	0.78	[0.65,0.94]	0.01
Marital Status									
Married/cohabiting	-0.01	[-0.04,0.01]	0.33	-0.02	[-0.05,0.01]	0.18	0.97	[0.79,1.20]	0.80
Single	-0.03	[-0.06,0.00]	0.08	-0.03	[-0.07,0.01]	0.10	0.75	[0.56,1.01]	0.06
Divorced/Separated/Widowed	-0.02	[-0.06,0.03]	0.42	-0.02	[-0.06,0.02]	0.32	0.80	[0.57,1.13]	0.21
60 and over									
Score_education	0.52	[0.15,0.90]	0.01	0.58	[0.20,0.95]	<0,01	0.52	[0.16,1.77]	0.30
Score_education^2	**-0.44**	**[-0.77,-0.12]**	**0.01**	**-0.50**	**[-0.82,-0.19]**	**<0,01**	1.46	[0.49,4.33]	0.50
Sex (ref:men)	0.00	[-0.03,0.03]	0.79	-0.03	[-0.05,-0.00]	0.04	0.99	[0.86,1.14]	0.88
Marital Status									
Married/cohabiting	0.04	[0.01,0.07]	0.02	0.03	[-0.00,0.07]	0.08	1.04	[0.92,1.19]	0.51
Single	0.05	[-0.03,0.13]	0.20	0.01	[-0.04,0.06]	0.73	1.12	[0.93,1.35]	0.24
Divorced/Separated/Widowed	0.05	[0.02,0.07]	<0,01	0.02	[-0.01,0.04]	0.23	1.23	[1.08,1.40]	<0,01

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 10: Statistical testing of the linearity assumption for RII. Quadratic regression coefficients for education by age group, 2010

	2010								
RII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
20-39									
Score_education	-0.02	[-0.15,0.10]	0.71	-0.10	[-0.28,0.09]	0.31	12.30	[0.18,854.52]	0.25
$Score\_education^2$	0.03	[-0.10,0.16]	0.61	0.10	[-0.12,0.31]	0.39	0.04	[0.00,2.87]	0.14
Sex (ref:men)	-0.08	[-0.10,-0.06]	<0,01	-0.05	[-0.07,-0.02]	<0,01	0.97	[0.53,1.77]	0.92
Marital Status									
Married/cohabiting	0.02	[-0.00,0.04]	0.06	0.02	[-0.02,0.05]	0.34	1.72	[0.89,3.31]	0.11
Single	0.00	[-0.02,0.02]	0.87	-0.02	[-0.04,0.01]	0.17	0.86	[0.46,1.63]	0.65
Divorced/Separated/Widowed	0.04	[-0.04,0.12]	0.35	0.04	[-0.04,0.12]	0.31	2.12	[0.48,9.42]	0.32
40-59									
Score_education	0.05	[-0.15,0.25]	0.61	-0.07	[-0.25,0.10]	0.42	3.42	[0.53,21.96]	0.20
$Score\_education^2$	0.03	[-0.17,0.22]	0.79	0.06	[-0.10,0.22]	0.45	0.48	[0.09,2.41]	0.37
Sex (ref:men)	-0.08	[-0.11,-0.05]	<0,01	-0.09	[-0.11,-0.06]	<0,01	0.61	[0.49,0.77]	<0,01
Marital Status									
Married/cohabiting	0.01	[-0.03,0.04]	0.76	0.00	[-0.03,0.03]	0.88	1.05	[0.78,1.42]	0.73
Single	-0.04	[-0.08,-0.01]	0.01	-0.06	[-0.09,-0.02]	<0,01	0.78	[0.55,1.09]	0.14
Divorced/Separated/Widowed	0.01	[-0.02,0.05]	0.49	0.01	[-0.03,0.05]	0.62	1.29	[0.89,1.87]	0.18
60 and over									
Score_education	0.02	[-0.29,0.34]	0.90	-0.06	[-0.31,0.20]	0.66	1.07	[0.22,5.19]	0.94
$Score\_education^2$	0.04	[-0.22,0.31]	0.75	0.06	[-0.16,0.29]	0.57	1.14	[0.32,4.05]	0.84
Sex (ref:men)	-0.03	[-0.06,0.01]	0.12	-0.05	[-0.08,-0.02]	<0,01	0.98	[0.84,1.14]	0.77
Marital Status									
Married/cohabiting	-0.02	[-0.06,0.01]	0.17	-0.03	[-0.06,0.00]	0.05	0.81	[0.68,0.96]	0.01
Single	0.04	[-0.00,0.08]	0.06	-0.01	[-0.04,0.02]	0.54	1.09	[0.91,1.31]	0.36
Divorced/Separated/Widowed	0.02	[-0.01,0.06]	0.20	-0.01	[-0.04,0.03]	0.69	1.05	[0.89,1.24]	0.54

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 11: Statistical testing of the linearity assumption for SII. Quadratic regression coefficients for education by age group, 2003

	2003								
SII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
20-39									
Score_education	6.60	[-8.93,22.14]	0.40	0.12	[-12.19,12.44]	0.98	1.21	[0.82,1.80]	0.34
Score_education^2	-2.65	[-19.25,13.94]	0.75	0.67	[-12.56,13.89]	0.92	0.90	[0.59,1.36]	0.62
Sex (ref:men)	-10.60	[-12.97,-8.32]	<0,01	-7.11	[-8.93,-5.28]	<0,01	0.91	[0.85,0.96]	<0,01
Marital Status									
Married/cohabiting	2.83	[-0.08,5.74]	0.06	1.22	[-1.24,3.67]	0.33	1.02	[0.94,1.10]	0.68
Single	-3.34	[-5.76,-0.92]	0.01	-3.28	[-5.12,-1.44]	<0,01	0.94	[0.88,1.00]	0.05
Divorced/Separated/Widowed	2.53	[-5.47,10.54]	0.53	1.28	[-5.35,7.91]	0.70	1.04	[0.82,1.33]	0.73
40-59									
Score_education	10.30	[-16.81,37.33]	0.46	2.58	[-14.41,19.57]	0.77	1.06	[0.53,2.10]	0.88
Score_education^2	4.24	[-20.25,28.74]	0.73	3.61	[-11.74,18.96]	0.64	1.17	[0.63,2.17]	0.62
Sex (ref:men)	-5.13	[-8.50,-1.75]	<0,01	-5.92	[-8.02,-3.82]	<0,01	0.89	[0.82,0.97]	0.01
Marital Status									
Married/cohabiting	-1.77	[-5.42,1.88]	0.34	-1.61	[-3.99,0.77]	0.18	0.99	[0.89,1.10]	0.80
Single	-3.59	[-7.67,0.49]	0.08	-2.62	[-5.59,0.35]	0.08	0.88	[0.79,0.99]	0.03
Divorced/Separated/Widowed	-2.40	[-8.20,3.39]	0.42	-1.77	[-5.19,1.66]	0.31	0.91	[0.80,1.04]	0.17
60 and over									
Score_education	77.20	[22.97,131.50]	0.01	49.60	[18.54,80.67]	<0,01	0.60	[0.22,1.62]	0.31
Score_education^2	**-65.70**	**[-113.16,-18.17]**	**0.01**	**-43.70**	**[-69.70,-17.63]**	**<0,01**	1.36	[0.56,3.29]	0.50
Sex (ref:men)	-0.65	[-5.11,3.82]	0.78	-2.43	[-4.72,-0.14]	0.04	0.99	[0.89,1.10]	0.88
Marital Status									
Married/cohabiting	6.08	[1.01,11.15]	0.02	2.97	[-0.37,6.32]	0.08	1.03	[0.94,1.14]	0.51
Single	7.84	[-4.45,20.13]	0.21	0.69	[-3.79,5.17]	0.76	1.09	[0.94,1.25]	0.25
Divorced/Separated/Widowed	7.09	[2.70,11.49]	<0,01	1.39	[-0.87,3.65]	0.23	1.17	[1.07,1.29]	<0,01

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 12: Statistical testing of the linearity assumption for SII. Quadratic regression coefficients for education by age group, 2010

	2003								
SII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
20-39									
Score_education	-3.03	[-18.14,12.09]	0.69	-7.22	[-21.14,6.70]	0.31	1.24	[0.85,1.81]	0.26
Score_education^2	4.18	[-11.10,19.46]	0.59	7.11	[-9.14,23.36]	0.39	0.76	[0.53,1.08]	0.12
Sex (ref:men)	-9.90	[-12.18,-7.62]	<0,01	-3.38	[-5.16,-1.59]	<0,01	1.00	[0.94,1.06]	0.93
Marital Status									
Married/cohabiting	2.47	[-0.11,5.06]	0.06	1.32	[-1.41,4.06]	0.34	1.07	[0.97,1.17]	0.17
Single	0.16	[-2.04,2.35]	0.89	-1.25	[-3.02,0.51]	0.16	0.99	[0.93,1.05]	0.64
Divorced/Separated/Widowed	4.39	[-5.91,14.69]	0.40	3.05	[-3.34,9.43]	0.35	1.12	[0.82,1.53]	0.47
40-59									
Score_education	6.51	[-19.05,32.07]	0.62	-5.98	[-20.22,8.26]	0.41	1.46	[0.83,2.56]	0.18
Score_education^2	3.62	[-21.42,28.67]	0.78	4.97	[-7.53,17.46]	0.44	0.80	[0.47,1.34]	0.39
Sex (ref:men)	-10.50	[-13.85,-7.08]	<0,01	-6.86	[-8.65,-5.08]	<0,01	0.84	[0.78,0.91]	<0,01
Marital Status									
Married/cohabiting	0.82	[-3.67,5.30]	0.72	-0.04	[-2.23,2.15]	0.97	1.02	[0.91,1.14]	0.74
Single	-5.45	[-9.59,-1.31]	0.01	-4.31	[-6.75,-1.87]	<0,01	0.93	[0.84,1.02]	0.11
Divorced/Separated/Widowed	1.73	[-3.17,6.63]	0.49	0.69	[-2.25,3.63]	0.64	1.09	[0.94,1.27]	0.23
60 and over									
Score_education	2.07	[-44.39,48.52]	0.93	-4.29	[-24.53,15.94]	0.68	1.03	[0.36,2.96]	0.95
Score_education^2	7.20	[-32.31,46.71]	0.72	4.92	[-12.88,22.72]	0.59	1.11	[0.47,2.60]	0.81
Sex (ref:men)	-4.15	[-9.42,1.12]	0.12	-4.04	[-6.40,-1.67]	<0,01	0.98	[0.88,1.10]	0.77
Marital Status									
Married/cohabiting	-3.60	[-8.70,1.50]	0.17	-2.37	[-4.77,0.02]	0.05	0.87	[0.78,0.96]	0.01
Single	5.95	[-0.40,12.29]	0.07	-0.82	[-3.24,1.61]	0.51	1.06	[0.93,1.21]	0.38
Divorced/Separated/Widowed	3.39	[-1.92,8.70]	0.21	-0.54	[-3.11,2.02]	0.68	1.04	[0.92,1.16]	0.55

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 13: Statistical testing of the linearity assumption for RII. Quadratic regression coefficients for assets-based index by age group, 2003

	2003								
RII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
20-39									
Score_assets	0.05	[-0.10,0.19]	0.54	0.02	[-0.15,0.18]	0.86	15.60	[0.41,596.80]	0.14
Score_assets^2	-0.01	[-0.14,0.12]	0.88	0.00	[-0.15,0.15]	0.99	0.13	[0.01,2.89]	0.19
Sex (ref:men)	-0.09	[-0.11,-0.07]	0.00	-0.09	[-0.12,-0.07]	<0,01	0.49	[0.30,0.78]	<0,01
Marital Status									
Married/cohabiting	0.02	[-0.00,0.05]	0.07	0.01	[-0.02,0.05]	0.41	1.18	[0.74,1.88]	0.49
Single	-0.03	[-0.05,-0.01]	<0,01	-0.04	[-0.07,-0.02]	<0,01	0.61	[0.38,0.99]	0.05
Divorced/Separated/Widowed	0.02	[-0.04,0.08]	0.48	0.01	[-0.07,0.10]	0.74	1.44	[0.49,4.25]	0.50
40-59									
Score_assets	0.28	[0.09,0.47]	<0,01	0.24	[0.06,0.41]	0.01	3.82	[0.74,19.71]	0.11
Score_assets^2	**-0.19**	**[-0.36,-0.02]**	**0.03**	**-0.19**	**[-0.35,-0.03]**	**0.02**	0.41	[0.10,1.62]	0.20
Sex (ref:men)	-0.03	[-0.05,-0.01]	0.02	-0.06	[-0.09,-0.04]	<0,01	0.81	[0.67,0.97]	0.02
Marital Status									
Married/cohabiting	-0.01	[-0.04,0.02]	0.63	-0.01	[-0.04,0.02]	0.47	0.99	[0.80,1.22]	0.92
Single	-0.03	[-0.06,-0.00]	0.03	-0.03	[-0.07,0.00]	0.06	0.73	[0.55,0.97]	0.03
Divorced/Separated/Widowed	-0.03	[-0.07,0.02]	0.24	-0.02	[-0.06,0.02]	0.23	0.77	[0.55,1.08]	0.14
60 and over									
Score_assets	-0.25	[-0.61,0.10]	0.16	-0.03	[-0.31,0.25]	0.83	0.22	[0.12,0.37]	<0,01
Score_assets^2	0.23	[-0.05,0.51]	0.10	0.03	[-0.20,0.25]	0.83	**3.67**	**[2.09,6.46]**	**<0,01**
Sex (ref:men)	0.00	[-0.03,0.03]	0.81	-0.02	[-0.05,0.00]	0.10	0.99	[0.86,1.13]	0.88
Marital Status									
Married/cohabiting	0.03	[-0.00,0.07]	0.06	0.03	[-0.01,0.06]	0.10	1.03	[0.92,1.17]	0.58
Single	0.05	[-0.02,0.13]	0.15	0.02	[-0.04,0.07]	0.52	1.09	[0.92,1.29]	0.30
Divorced/Separated/Widowed	0.05	[0.02,0.07]	<0,01	0.02	[-0.01,0.04]	0.23	1.22	[1.08,1.38]	<0,01

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 14: Statistical testing of the linearity assumption for RII. Quadratic regression coefficients for assets-based index by age group, 2010

	2010								
RII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
20-39									
Score_assets	0.18	[-0.06,0.42]	0.13	0.19	[-0.11,0.48]	0.21	3.20	[0.00,3864.84]	0.75
$Score\_assets^2$	-0.16	[-0.38,0.07]	0.17	-0.18	[-0.45,0.10]	0.21	0.38	[0.00,298.52]	0.78
Sex (ref:men)	-0.08	[-0.10,-0.06]	<0,01	-0.05	[-0.07,-0.02]	<0,01	0.98	[0.53,1.80]	0.94
Marital Status									
Married/cohabiting	0.02	[-0.01,0.04]	0.14	0.02	[-0.02,0.05]	0.39	1.56	[0.77,3.17]	0.22
Single	0.00	[-0.02,0.02]	0.68	-0.01	[-0.04,0.01]	0.35	0.86	[0.44,1.72]	0.68
Divorced/Separated/Widowed	0.04	[-0.05,0.13]	0.37	0.05	[-0.04,0.13]	0.30	2.15	[0.48,9.61]	0.31
40-59									
Score_assets	0.11	[-0.19,0.41]	0.46	0.07	[-0.16,0.30]	0.55	3.71	[0.29,47.17]	0.31
$Score\_assets^2$	-0.06	[-0.33,0.22]	0.68	-0.06	[-0.27,0.15]	0.55	0.33	[0.03,3.79]	0.38
Sex (ref:men)	-0.08	[-0.11,-0.05]	<0,01	-0.09	[-0.11,-0.06]	<0,01	0.61	[0.49,0.77]	<0,01
Marital Status									
Married/cohabiting	0.01	[-0.03,0.04]	0.67	0.00	[-0.03,0.02]	0.81	1.09	[0.80,1.48]	0.58
Single	-0.05	[-0.08,-0.01]	<0,01	-0.06	[-0.09,-0.02]	<0,01	0.77	[0.55,1.07]	0.12
Divorced/Separated/Widowed	0.01	[-0.03,0.05]	0.80	0.01	[-0.03,0.05]	0.60	1.27	[0.86,1.85]	0.23
60 and over									
Score_assets	0.18	[-0.11,0.47]	0.23	-0.07	[-0.36,0.22]	0.64	1.27	[0.33,4.87]	0.72
$Score\_assets^2$	-0.09	[-0.34,0.16]	0.48	0.08	[-0.18,0.34]	0.56	0.88	[0.25,3.05]	0.84
Sex (ref:men)	-0.03	[-0.06,0.01]	0.10	-0.05	[-0.08,-0.02]	<0,01	0.98	[0.83,1.15]	0.80
Marital Status									
Married/cohabiting	-0.03	[-0.06,0.01]	0.16	-0.03	[-0.06,0.00]	0.08	0.83	[0.68,1.01]	0.06
Single	0.03	[-0.01,0.07]	0.17	-0.01	[-0.04,0.02]	0.52	1.08	[0.90,1.29]	0.42
Divorced/Separated/Widowed	0.02	[-0.01,0.06]	0.23	-0.01	[-0.04,0.03]	0.71	1.05	[0.89,1.25]	0.55

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 15: Statistical testing of the linearity assumption for SII. Quadratic regression coefficients for assets-based index by age group, 2003

	2003								
SII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
20-39									
Score_assets	5.33	[-11.51,22.16]	0.54	1.10	[-11.43,13.64]	0.86	1.36	[0.95,1.95]	0.09
Score_assets^2	-1.07	[-16.51,14.36]	0.89	0.05	[-11.71,11.81]	0.99	0.79	[0.55,1.13]	0.20
Sex (ref:men)	-10.60	[-12.91,-8.34]	<0,01	-7.11	[-8.92,-5.31]	<0,01	0.91	[0.85,0.96]	<0,01
Marital Status									
Married/cohabiting	2.63	[-0.29,5.56]	0.08	1.08	[-1.43,3.60]	0.40	1.02	[0.94,1.11]	0.56
Single	-3.42	[-5.79,-1.04]	<0,01	-3.27	[-5.13,-1.41]	<0,01	0.93	[0.88,1.00]	0.04
Divorced/Separated/Widowed	2.76	[-4.50,10.03]	0.46	1.35	[-5.11,7.81]	0.68	1.06	[0.84,1.33]	0.64
40-59									
Score_assets	37.30	[13.07,61.52]	<0,01	20.50	[6.12,34.97]	0.01	1.75	[0.94,3.26]	0.08
Score_assets^2	**-25.80**	**[-48.07,-3.59]**	**0.02**	**-16.30**	**[-29.79,-2.78]**	**0.02**	0.69	[0.40,1.22]	0.20
Sex (ref:men)	-4.10	[-7.46,-0.75]	0.02	-5.46	[-7.52,-3.40]	<0,01	0.90	[0.83,0.98]	0.02
Marital Status									
Married/cohabiting	-0.90	[-4.77,2.98]	0.65	-0.90	[-3.41,1.61]	0.48	0.99	[0.89,1.10]	0.90
Single	-4.47	[-8.51,-0.44]	0.03	-2.97	[-5.92,-0.01]	0.05	0.87	[0.78,0.97]	0.02
Divorced/Separated/Widowed	-3.52	[-9.29,2.25]	0.23	-2.15	[-5.49,1.20]	0.21	0.90	[0.79,1.02]	0.10
60 and over									
Score_assets	-38.20	[-93.82,17.48]	0.18	-2.79	[-27.29,21.71]	0.82	0.28	[0.19,0.42]	<0,01
Score_assets^2	35.50	[-8.30,79.34]	0.11	2.22	[-17.71,22.16]	0.83	**2.92**	**[1.92,4.44]**	**<0,01**
Sex (ref:men)	0.48	[-4.21,5.16]	0.84	-2.02	[-4.47,0.43]	0.11	0.99	[0.90,1.10]	0.88
Marital Status									
Married/cohabiting	5.00	[-0.26,10.26]	0.06	2.57	[-0.57,5.71]	0.11	1.03	[0.93,1.13]	0.60
Single	8.22	[-3.32,19.76]	0.16	1.55	[-3.28,6.38]	0.53	1.07	[0.94,1.21]	0.32
Divorced/Separated/Widowed	7.05	[2.68,11.43]	<0,01	1.39	[-0.91,3.69]	0.24	1.17	[1.06,1.28]	<0,01

SII: Slope index of inequality. RII: Relative index of inequality.

Table A7. 16: Statistical testing of the linearity assumption for SII. Quadratic regression coefficients for assets-based index by age group, 2010

	2003								
SII	SBP			DBP			Hypertension		
	Coef	95% CI	p value	Coef	95% CI	p value	Coef	95% CI	p value
20-39									
Score_assets	22.60	[-5.67,50.81]	0.12	14.30	[-7.37,35.89]	0.20	1.12	[0.54,2.32]	0.75
$Score\_assets^2$	-19.20	[-45.46,7.16]	0.15	-13.40	[-33.48,6.75]	0.19	0.91	[0.46,1.80]	0.78
Sex (ref:men)	-9.94	[-12.19,-7.69]	<0,01	-3.36	[-5.16,-1.56]	<0,01	1.00	[0.94,1.06]	0.94
Marital Status									
Married/cohabiting	2.13	[-0.66,4.92]	0.13	1.19	[-1.59,3.98]	0.40	1.05	[0.96,1.16]	0.26
Single	0.47	[-1.95,2.89]	0.70	-0.92	[-2.84,1.00]	0.35	0.99	[0.93,1.05]	0.68
Divorced/Separated/Widowed	4.45	[-6.20,15.10]	0.41	3.29	[-3.40,9.98]	0.34	1.12	[0.82,1.53]	0.47
40-59									
Score_assets	15.30	[-23.56,54.07]	0.44	5.92	[-12.47,24.32]	0.53	1.61	[0.68,3.80]	0.27
$Score\_assets^2$	-8.02	[-43.82,27.78]	0.66	-5.27	[-21.90,11.36]	0.53	0.67	[0.30,1.50]	0.32
Sex (ref:men)	-10.20	[-13.74,-6.76]	<0,01	-6.86	[-8.66,-5.06]	<0,01	0.85	[0.78,0.91]	<0,01
Marital Status									
Married/cohabiting	1.08	[-3.39,5.54]	0.64	-0.13	[-2.21,1.96]	0.90	1.03	[0.92,1.16]	0.57
Single	-6.03	[-10.01,-2.05]	<0,01	-4.28	[-6.76,-1.80]	<0,01	0.92	[0.84,1.01]	0.09
Divorced/Separated/Widowed	0.71	[-4.53,5.95]	0.79	0.73	[-2.23,3.68]	0.63	1.09	[0.93,1.26]	0.28
60 and over									
Score_assets	26.80	[-17.14,70.64]	0.23	-5.51	[-28.43,17.42]	0.64	1.19	[0.47,3.02]	0.71
$Score\_assets^2$	-13.30	[-51.03,24.38]	0.49	6.33	[-14.32,26.98]	0.55	0.91	[0.39,2.14]	0.83
Sex (ref:men)	-4.32	[-9.54,0.90]	0.10	-3.96	[-6.34,-1.57]	<0,01	0.99	[0.88,1.10]	0.81
Marital Status									
Married/cohabiting	-4.04	[-9.61,1.54]	0.16	-2.43	[-5.12,0.25]	0.08	0.88	[0.78,1.00]	0.05
Single	4.50	[-2.01,11.02]	0.18	-0.89	[-3.47,1.69]	0.50	1.05	[0.92,1.20]	0.44
Divorced/Separated/Widowed	3.34	[-2.07,8.75]	0.23	-0.52	[-3.09,2.05]	0.69	1.04	[0.92,1.17]	0.55

SII: Slope index of inequality. RII: Relative index of inequality.

Appendix 8. The role of the district-level SEP in inequalities in blood pressure

Table A8. 1: MLM for SBP in 2003 including one SEP index one at a time

	Model 1 Including only Education	Model 2 Including only Assets-based index	Model 3 Including only occupation
		Coef (95% CI)	
Sex			
Male		Ref	Ref
Female	-8.64***[-9.94,-7.34]	-8.56***[-9.86,-7.25]	-9.15***[-10.78,-7.52]
Age (centred on 50)	0.74***[0.67,0.81]	0.75***[0.69,0.81]	0.75***[0.68,0.81]
Marital status			
Married/cohabiting			
Single	4.13***[2.41,5.85]	3.97***[2.28,5.67]	4.13***[2.42,5.85]
Divorced/separated/widowed	2.62[-0.04,5.27]	2.29[-0.36,4.95]	2.62[-0.07,5.30]
Place of residence			
Urban			
Rural	2.23[-0.42,4.88]	1.79[-0.79,4.37]	2.42[-0.14,4.99]
Education			
Higher			
Intermediate	1.87*[0.04,3.69]		
Low	1.68[-0.88,4.24]		
Assets-based SEP			
High			
Middle		2.68**[0.86,4.51]	
Low		3.93**[1.52,6.33]	
Occupational social class			
Higher worker			
Intermediate			-1.81[-5.00,1.38]
Routine and manual			-0.62[-3.25,2.02]
Homemaker			0.86[-2.08,3.80]
Inactive			0.69[-1.91,3.30]
Retired			-0.17[-3.83,3.50]
Body mass index (centred on 27.8)	0.87***[0.72,1.03]	0.87***[0.72,1.03]	0.87***[0.72,1.03]
Diabetes Mellitus	5.13**[1.61,8.65]	5.16**[1.65,8.67]	5.07**[1.57,8.57]

Table A8. 1 (cont.): MLM for SBP in 2003 including one SEP index one at a time

	Model 1 Including only Education	Model 2 Including only Assets-based index	Model 3 Including only occupation
		Coef (95% CI)	
Family history of hypertension	1.80*[0.37,3.24]	1.88*[0.44,3.31]	1.81*[0.38,3.24]
Smoking			
Never			
Past	-3.36**[-5.64,-1.08]	-3.32**[-5.61,-1.04]	-3.28**[-5.58,-0.99]
Current	-3.96***[-5.44,-2.48]	-3.92***[-5.39,-2.45]	-3.85***[-5.33,-2.36]
Physical Activity			
3 or more times			
Less than 3 times	0.52[-1.99,3.04]	0.38[-2.18,2.95]	0.74[-1.88,3.35]
None	1.55[-0.54,3.63]	1.34[-0.83,3.52]	1.79[-0.39,3.97]
District-level variance (SE)	16.92 (7.78)	16.75 (7.91)	17.45 (7.86)

Table A8. 2: MLM for SBP in 2010 including one SEP index one at a time

	Model including only Education	Model including only Assets-based index	Model including only Occupation
	Coef (95% CI)		
Individual-level variables			
Sex			
Male	Ref	Ref	Ref
Female	-9.83***[-11.27,-8.39]	-9.86***[-11.29,-8.43]	-9.75***[-11.36,-8.14]
Age (centred on 50)	0.70***[0.64,0.75]	0.71***[0.66,0.76]	0.71***[0.65,0.76]
Marital status			
Married/cohabiting	Ref	Ref	Ref
Single	3.48***[2.04,4.92]	3.33***[1.88,4.78]	3.28***[1.76,4.80]
Divorced/separated/widowed	3.70**[1.48,5.92]	3.54**[1.31,5.78]	3.60**[1.27,5.92]
Place of residence			
Urban	Ref	Ref	Ref
Rural	0.011[-2.22,2.24]	-0.091[-2.44,2.26]	-0.087[-2.32,2.15]
Education			
Higher	Ref		
Intermediate	0.73[-0.56,2.03]		
Low	2.02[-0.68,4.71]		
Assets-based SEP			
High		Ref	
Middle		1.46*[0.12,2.80]	
Low		1.34[-0.98,3.67]	
Occupational social class			
Higher worker			Ref
Intermediate			-0.018[-2.18,2.15]
Routine and manual			2.46*[0.27,4.65]
Homemaker			2.09*[0.13,4.04]
Inactive			2.71*[0.26,5.15]
Retired			2.16[-1.28,5.60]

Table A8. 2 (cont.): MLM for SBP in 2010 including one SEP index one at a time

	Model including only Education	Model including only Assets-based index	Model including only Occupation
		Coef (95% CI)	
Body mass index (centred on 27.8)	0.78***[0.68,0.89]	0.78***[0.67,0.88]	0.80***[0.69,0.90]
Diabetes Mellitus	3.69**[0.99,6.40]	3.77**[1.03,6.52]	3.63**[0.94,6.32]
Family history of hypertension	3.40***[2.07,4.73]	3.39***[2.04,4.74]	3.34***[1.98,4.70]
Smoking			
Never	Ref	Ref	Ref
Past	-3.14***[-4.72,-1.57]	-3.21***[-4.78,-1.64]	-3.12***[-4.69,-1.55]
Current	-2.50***[-3.85,-1.16]	-2.61***[-3.93,-1.28]	-2.50***[-3.83,-1.17]
Physical Activity			
3 or more times	Ref	Ref	Ref
Less than 3 times	-0.51[-3.34,2.32]	-0.59[-3.45,2.26]	-0.43[-3.24,2.39]
None	-0.63[-3.11,1.84]	-0.67[-3.14,1.79]	-0.48[-2.95,1.99]
District-level variance (SE)	8.88 (3.13)	8.96 (3.19)	8.84 (3.09)

Sensitivity analysis for hypertension models: scale-effective method and unweighted data.

Table A8. 3:Two-level random intercept model for hypertension with predictor variables 2003 (scale-method effective)

	Model 1	Model 2	Model 3
	Coef (95% CI)		
Individual-level variables			
Sex			
Male		Ref	Ref
Female		0.49*** [0.36,0.67]	0.37*** [0.27,0.51]
Age (centred on 50)		1.09*** [1.08,1.10]	1.09*** [1.08,1.10]
Marital status			
Married/cohabiting			
Single		1.07 [0.78,1.46]	1.36 [0.98,1.90]
Divorced/separated/widowed		1.13 [0.79,1.61]	1.35 [0.94,1.94]
Place of residence			
Urban			
Rural		1.16 [0.85,1.58]	1.21 [0.87,1.68]
Education			
Higher			
Intermediate		1.11 [0.75,1.63]	1.12 [0.75,1.68]
Low		1.01 [0.65,1.58]	0.90 [0.56,1.44]
Assets-based SEP			
High			
Middle		1.30 [0.98,1.71]	1.26 [0.95,1.66]
Low		1.47 [0.99,2.18]	1.46 [0.98,2.20]
Occupational social class			
Higher worker			
Intermediate		0.60 [0.35,1.03]	0.66 [0.37,1.18]
Routine and manual		0.56** [0.37,0.86]	0.64 [0.41,1.00]
Homemaker		0.78 [0.51,1.20]	0.79 [0.51,1.24]
Inactive		0.59* [0.37,0.94]	0.69 [0.43,1.12]
Retired		0.48** [0.28,0.83]	0.54* [0.31,0.94]
Body mass index (centred on 27.8)			1.13*** [1.10,1.16]
Diabetes Mellitus			1.24 [0.83,1.86]
Family history of hypertension			1.50** [1.17,1.93]

Table A8. 3 (cont.):Two-level random intercept model for hypertension with predictor variables 2003 (scale-method effective)

	Model 1	Model 2	Model 3
		Coef (95% CI)	
Smoking			
Never			
Past			0.71* [0.54,0.94]
Current			0.62*** [0.47,0.80]
Physical Activity			
3 or more times			
Less than 3 times			0.84 [0.52,1.37]
None			1.00 [0.65,1.56]
District-level variance (SE)	0.17 (0.06)	0.30 (0.12)	0.31 (0.12)
% of total variance (partition)			
Individual level (%)	95.09	91.64	91.39
District level (%)	4.91	8.36	8.61
% change in district-level var	-	76.47	3.33
Wald test p-value	-	< 0.01	< 0.01

* p<0.05, ** p<0.01, *** p<0.001.

Table A8. 4: Two-level random intercept model for hypertension with predictor variables 2010 (scale-method effective)

	Model 1	Model 2	Model 3
	Coef (95% CI)		
Individual-level variables			
Sex			
Male		Ref	Ref
Female		0.62** [0.47,0.83]	0.47*** [0.35,0.63]
Age (centred on 48)			
Marital status			
Married/cohabiting		1.09*** [1.08,1.10]	1.09*** [1.08,1.10]
Single		1.14 [0.87,1.50]	1.29 [1.00,1.67]
Divorced/separated/widowed			
Place of residence			
Urban			
Rural		0.85 [0.59,1.23]	0.87 [0.62,1.23]
Education			
Higher			
Intermediate		1.11 [0.81,1.52]	1.05 [0.77,1.45]
Low		0.84 [0.55,1.29]	0.75 [0.49,1.17]
Assets-based SEP			
High			
Middle		1.13 [0.84,1.52]	1.06 [0.82,1.36]
Low		0.98 [0.67,1.44]	0.98 [0.68,1.42]
Occupational social class			
Higher worker			
Intermediate		0.66 [0.36,1.19]	0.82 [0.52,1.30]
Routine and manual		0.82 [0.43,1.55]	1.06 [0.66,1.70]
Homemaker		0.89 [0.47,1.68]	1.1 [0.68,1.77]
Inactive		0.55 [0.27,1.12]	0.7 [0.39,1.27]
Retired		0.66 [0.35,1.23]	0.88 [0.55,1.44]
Body mass index (centred on 28.2)			1.11*** [1.08,1.13]
Diabetes Mellitus			1.70** [1.22,2.35]
Family history of hypertension			1.82*** [1.48,2.22]

Table A8. 4 (cont.): Two-level random intercept model for hypertension with predictor variables 2010 (scale-method effective)

	Model 1	Model 2	Model 3
	Coef (95% CI)		
Smoking			
Never			
Past			0.73* [0.55,0.97]
Current			0.74** [0.59,0.93]
Physical Activity			
3 or more times			
Less than 3 times			0.91 [0.52,1.59]
None			1.15 [0.76,1.73]
District-level variance (SE)	0.12 (0.04)	1.18 (0.82)	0.11 (0.05)
% of total variance (partition)			
Individual level (%)	96.48	98.98	96.76
District level (%)	3.52	1.02	3.24
% change in district-level var	-	-21.60	-2.50
Wald test p-value	-	< 0.01	< 0.01

* p<0.05, ** p<0.01, *** p<0.001

Table A8. 5: Two-level random intercept model for hypertension with predictor variables 2003 (unweighted models)

	Empty Model	
	2003	2010
District-level variance (SE)	0.04 (0.03)	0.06 (0.03)
% of total variance (partition)		
Individual level (%)	98.80	98.21
District level (%)	1.20	1.79
% change in district-level var	-	-
LR test	< 0.01	< 0.01
AIC	4211.03	5166.31
BIC	4223.07	5178.93

* p<0.05, ** p<0.01, *** p<0.001

Sensitivity analysis for SBP and DBP models: Unweighted Models

Table A8. 6: Two-level random intercept model for SBP with predictor variables 2003. Models 1 to 4a (unweighted model).

	Model 1	Model 2	Model 3	Model 4a
	Coef (95% CI)			
Individual-level variables				
Sex				
Male		Ref	Ref	Ref
Female		-6.54*** [-8.38,-4.71]	-7.75*** [-9.57,-5.93]	-7.75*** [-9.57,-5.93]
Age (centred on 50)		0.84*** [0.78,0.89]	0.77*** [0.72,0.83]	0.77*** [0.72,0.83]
Marital status				
Married/cohabiting		Ref	Ref	Ref
Single		1.70 [-0.16,3.55]	3.45*** [1.62,5.27]	3.45*** [1.62,5.27]
Divorced/separated/widowed		0.86 [-1.19,2.92]	2.20* [0.19,4.20]	2.20* [0.19,4.20]
Place of residence				
Urban		Ref	Ref	Ref
Rural		2.98** [0.97,4.99]	3.03** [1.08,4.98]	3.04** [1.08,5.01]
Education				
Higher		Ref	Ref	Ref
Intermediate		2.38 [-0.03,4.78]	1.97 [-0.36,4.30]	1.97 [-0.36,4.31]
Low		3.00* [0.18,5.81]	1.50 [-1.24,4.24]	1.51 [-1.24,4.26]
Assets-based SEP				
High		Ref	Ref	Ref
Middle		1.66 [-0.81,4.13]	1.12 [-1.28,3.52]	1.13 [-1.28,3.54]
Low		3.44* [0.59,6.30]	3.08* [0.31,5.86]	3.10* [0.31,5.88]

Table A8. 6 (cont.): Two-level random intercept model for SBP with predictor variables 2003. Models 1 to 4a (unweighted model).

	Model 1	Model 2 Coef (95% CI)	Model 3 Coef (95% CI)	Model 4a Coef (95% CI)
Occupational social class				
Higher worker		Ref	Ref	Ref
Intermediate		-2.85 [-6.35,0.64]	-1.77 [-5.16,1.61]	-1.77 [-5.16,1.62]
Routine and manual		-3.75* [-6.68,-0.83]	-2.40 [-5.25,0.44]	-2.40 [-5.25,0.44]
Homemaker		-1.36 [-4.43,1.70]	-0.74 [-3.72,2.24]	-0.74 [-3.71,2.24]
Inactive		-1.77 [-4.81,1.26]	-0.21 [-3.17,2.75]	-0.21 [-3.16,2.75]
Retired		-4.15* [-7.44,-0.86]	-2.60 [-5.81,0.60]	-2.60 [-5.81,0.60]
Body mass index (centred on 27.8)			0.78*** [0.64,0.92]	0.78*** [0.64,0.92]
Diabetes Mellitus			5.71*** [3.53,7.89]	5.71*** [3.53,7.89]
Family history of hypertension			1.74* [0.34,3.14]	1.74* [0.34,3.14]
Smoking				
Never			Ref	Ref
Past			-1.96* [-3.78,-0.14]	-1.96* [-3.78,-0.14]
Current			-3.90*** [-5.50,-2.29]	-3.90*** [-5.50,-2.29]
Physical Activity				
3 or more times			Ref	Ref
Less than 3 times			0.43 [-2.52,3.37]	0.42 [-2.52,3.37]
None			0.99 [-1.49,3.48]	0.99 [-1.50,3.48]
District Level variables				
Overcrowding index[1]				-0.51 [-10.82,9.80]
District-level variance (SE)	15.81 (6.27)	11.20 (4.39)	9.86 (3.95)	9.86 (3.95)
% of total variance (partition)				
Individual level (%)	97.34	96.93	97.11	97.11
District level (%)	2.66	3.07	2.89	2.89
% change in district-level var	-	-29.16	-11.96	0.00
LR test	< 0.01	< 0.01	< 0.01	0.92
AIC	28049.41	26585.26	26400.52	26402.51
BIC	28067.47	26687.61	26545.00	26553.01

* p<0.05, ** p<0.01, *** p<0.001. (1) Overcrowding: as a continuous a variable.

Table A8. 7: Two-level random intercept model for SBP with predictor variables 2003.Models 4b to 4e (unweighted model)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Individual-level variables				
Sex				
Male	Ref	Ref	Ref	Ref
Female	-7.76*** [-9.59,-5.94]	-7.72*** [-9.55,-5.90]	-7.73*** [-9.55,-5.90]	-7.71*** [-9.54,-5.89]
Age (centred on 50)	0.77*** [0.72,0.83]	0.77*** [0.72,0.83]	0.77*** [0.72,0.83]	0.77*** [0.72,0.83]
Marital status				
Married/cohabiting	Ref	Ref	Ref	Ref
Single	3.44*** [1.62,5.27]	3.45*** [1.63,5.28]	3.46*** [1.63,5.28]	3.44*** [1.62,5.27]
Divorced/separated/widowed	2.20* [0.20,4.21]	2.21* [0.20,4.21]	2.20* [0.20,4.21]	2.20* [0.20,4.21]
Place of residence				
Urban	Ref	Ref	Ref	Ref
Rural	3.21** [1.08,5.33]	3.10** [1.14,5.05]	2.93** [0.96,4.90]	2.95** [0.95,4.96]
Education				
Higher	Ref	Ref	Ref	Ref
Intermediate	2.00 [-0.34,4.33]	1.96 [-0.37,4.30]	1.94 [-0.40,4.27]	1.97 [-0.36,4.31]
Low	1.55 [-1.20,4.31]	1.51 [-1.24,4.25]	1.45 [-1.29,4.20]	1.52 [-1.23,4.27]
Assets-based SEP				
High	Ref	Ref	Ref	Ref
Middle	1.16 [-1.25,3.57]	1.09 [-1.31,3.49]	1.04 [-1.37,3.46]	1.10 [-1.30,3.51]
Low	3.16* [0.36,5.96]	3.03* [0.26,5.81]	2.98* [0.19,5.77]	3.00* [0.21,5.79]
Occupational social class				
Higher worker	Ref	Ref	Ref	Ref
Intermediate	-1.77 [-5.15,1.62]	-1.77 [-5.15,1.62]	-1.79 [-5.17,1.60]	-1.77 [-5.15,1.62]
Routine and manual	-2.40 [-5.24,0.45]	-2.39 [-5.24,0.45]	-2.42 [-5.27,0.42]	-2.41 [-5.25,0.44]
Homemaker	-0.73 [-3.71,2.25]	-0.77 [-3.75,2.21]	-0.76 [-3.74,2.22]	-0.76 [-3.74,2.21]
Inactive	-0.20 [-3.15,2.76]	-0.25 [-3.20,2.71]	-0.24 [-3.20,2.72]	-0.21 [-3.16,2.75]
Retired	-2.60 [-5.80,0.60]	-2.64 [-5.84,0.56]	-2.65 [-5.85,0.56]	-2.56 [-5.76,0.64]
Body mass index (centred on 27.8)	0.78*** [0.64,0.92]	0.78*** [0.64,0.92]	0.78*** [0.64,0.92]	0.78*** [0.64,0.92]
Diabetes Mellitus	5.71*** [3.54,7.89]	5.74*** [3.57,7.92]	5.70*** [3.52,7.88]	5.72*** [3.54,7.89]

Table A8. 7 (cont.): Two-level random intercept model for SBP with predictor variables 2003.Models 4b to 4e (unweighted model)

	Model 4b	Model 4c	Model 4d	Model 4e
Family history of hypertension	1.73* [0.33,3.13]	1.69* [0.29,3.10]	1.73* [0.33,3.13]	1.75* [0.34,3.15]
Smoking				
Never	Ref	Ref	Ref	Ref
Past	-1.98* [-3.80,-0.16]	-1.97* [-3.79,-0.15]	-1.95* [-3.77,-0.13]	-1.95* [-3.78,-0.13]
Current	-3.91*** [-5.52,-2.31]	-3.91*** [-5.51,-2.30]	-3.90*** [-5.50,-2.29]	-3.88*** [-5.48,-2.28]
Physical Activity				
3 or more times	Ref	Ref	Ref	Ref
Less than 3 times	0.43 [-2.51,3.38]	0.45 [-2.49,3.40]	0.41 [-2.53,3.36]	0.42 [-2.52,3.36]
None	1.01 [-1.48,3.50]	1.00 [-1.48,3.49]	0.98 [-1.51,3.47]	0.97 [-1.52,3.46]
District Level variables				
Schooling (in years)	0.12 [-0.49,0.74]			
Unemployment		0.12 [-0.14,0.38]		
Income (mean)			-0.09 [-0.36,0.19]	
Deprivation index				
Least deprived				Ref
2 quintile				0.85 [-2.17,3.87]
3 quintile				-1.00 [-4.08,2.07]
4 quintile				0.45 [-2.57,3.47]
Most deprived				0.53 [-2.45,3.52]
p for trend deprivation index				*0.83*
District-level variance (SE)	10.02 (4.00)	10.12 (3.97)	9.66 (3.92)	9.30 (3.89)
% of total variance (partition)				
Individual level (%)	97.06	97.07	97.17	97.56
District level (%)	2.94	2.93	2.83	2.44
% change in district-level var	1.62	2.63	-2.03	-5.68
LR test	0.70	0.37	0.54	0.72
AIC	26402.37	26401.70	26402.14	26406.44
BIC	26552.88	26552.21	26552.65	26575.01

* p<0.05, ** p<0.01, *** p<0.001. (1) Schooling: in years as an ordinal variable; (2) Unemployment: rate as a continuous variable; (3) Income: mean as a continuous variable.

Table A8. 8: Two-level random intercept model for SBP with predictor variables 2010. Models 1 to 4a (unweighted models).

	Model 1	Model 2	Model 3	Model 4a
	Coef (95% CI)			
Individual-level variables				
Sex				
Male		Ref	Ref	Ref
Female		-9.39*** [-10.82,-7.96]	-10.4*** [-11.86,-9.00]	-10.4*** [-11.87,-9.01]
Age (centred on 48)		0.80*** [0.75,0.85]	0.75*** [0.70,0.80]	0.75*** [0.70,0.80]
Marital status				
Married/cohabiting		Ref	Ref	Ref
Single		1.50 [-0.01,3.00]	2.39** [0.92,3.85]	2.37** [0.90,3.83]
Divorced/separated/widowed		3.29*** [1.34,5.24]	3.88*** [1.97,5.78]	3.87*** [1.97,5.78]
Place of residence				
Urban		Ref	Ref	Ref
Rural		0.82 [-1.15,2.78]	0.63 [-1.29,2.54]	0.59 [-1.32,2.50]
Education				
Higher		Ref	Ref	Ref
Intermediate		0.84 [-1.03,2.71]	-0.02 [-1.84,1.80]	0.04 [-1.79,1.86]
Low		1.92 [-0.46,4.30]	0.62 [-1.71,2.94]	0.67 [-1.65,3.00]
Assets-based SEP				
High		Ref	Ref	Ref
Middle		1.03 [-0.36,2.41]	1.12 [-0.23,2.47]	1.14 [-0.21,2.49]
Low		1.54 [-0.69,3.77]	2.04 [-0.13,4.21]	2.07 [-0.10,4.24]
Occupational social class				
Higher worker		Ref	Ref	Ref
Intermediate		-0.22 [-3.07,2.64]	0.08 [-2.70,2.85]	0.11 [-2.66,2.89]
Routine and manual		1.49 [-1.47,4.45]	1.93 [-0.95,4.81]	1.98 [-0.91,4.86]
Homemaker		2.43 [-0.56,5.41]	2.22 [-0.68,5.13]	2.28 [-0.62,5.19]
Inactive		2.86 [-0.40,6.12]	3.24* [0.07,6.41]	3.28* [0.10,6.45]
Retired		-0.47 [-3.74,2.80]	0.11 [-3.07,3.29]	0.15 [-3.03,3.33]
Body mass index (centred on 28.2)			0.67*** [0.56,0.79]	0.67*** [0.56,0.79]
Diabetes Mellitus			4.92*** [2.99,6.86]	4.93*** [2.99,6.86]
Family history of hypertension			3.54*** [2.34,4.74]	3.55*** [2.35,4.75]

Table A8. 8 (cont.): Two-level random intercept model for SBP with predictor variables 2010. Models 1 to 4a (unweighted models).

	Model 1	Model 2	Model 3	Model 4a
	Coef (95% CI)			
Smoking				
Never			Ref	Ref
Past			-3.47*** [-5.09,-1.85]	-3.48*** [-5.11,-1.86]
Current			-2.89*** [-4.23,-1.54]	-2.90*** [-4.25,-1.56]
Physical Activity				
3 or more times			Ref	Ref
Less than 3 times			-0.19 [-2.93,2.54]	-0.17 [-2.90,2.57]
None			0.30 [-2.01,2.62]	0.33 [-1.98,2.64]
District Level variables				
Overcrowding inde[1]				-3.30 [-12.27,5.68]
District-level variance (SE)	15.93 (4.95)	6.16 (2.35)	5.72 (2.16)	5.42 (2.15)
% of total variance (partition)				
Individual level (%)	97.28	98.34	98.36	98.36
District level (%)	2.72	1.66	1.64	1.55
% change in district-level var	-	-61.33	-7.14	-5.25
LR test	< 0.01	< 0.01	< 0.01	0.48
AIC	37317.65	35509.75	35283.94	35285.44
BIC	37336.57	35616.99	35435.33	35443.14

* p<0.05, ** p<0.01, *** p<0.001. (1) Overcrowding: as a continuous a variable.

Table A8. 9: Two-level random intercept model for SBP with predictor variables 2010. Models 4b to 4e (Unweighted models)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Individual-level variables				
Sex				
Male	Ref	Ref	Ref	Ref
Female	-10.30*** [-11.77,-8.91]	-10.40*** [-11.83,-8.97]	-10.40*** [-11.79,-8.93]	-10.40*** [-11.81,-8.95]
Age (centred on 48)	0.76*** [0.71,0.81]	0.75*** [0.70,0.80]	0.76*** [0.70,0.81]	0.76*** [0.71,0.81]
Marital status				
Married/cohabiting	Ref	Ref	Ref	Ref
Single	2.47*** [1.00,3.93]	2.41** [0.94,3.87]	2.42** [0.95,3.88]	2.45** [0.99,3.92]
Divorced/separated/widowed	3.92*** [2.02,5.82]	3.85*** [1.94,5.75]	3.89*** [1.99,5.80]	3.86*** [1.96,5.76]
Place of residence				
Urban	Ref	Ref	Ref	Ref
Rural	-0.40 [-2.37,1.57]	0.69 [-1.22,2.60]	0.36 [-1.56,2.29]	0.28 [-1.66,2.22]
Education				
Higher	Ref	Ref	Ref	Ref
Intermediate	-0.36 [-2.18,1.47]	-0.05 [-1.87,1.77]	-0.19 [-2.02,1.64]	-0.22 [-2.05,1.61]
Low	0.03 [-2.32,2.37]	0.62 [-1.71,2.94]	0.37 [-1.97,2.71]	0.36 [-1.97,2.69]
Assets-based SEP				
High	Ref	Ref	Ref	Ref
Middle	0.98 [-0.36,2.33]	1.10 [-0.25,2.45]	1.05 [-0.30,2.40]	1.05 [-0.30,2.39]
Low	1.79 [-0.38,3.95]	2.00 [-0.17,4.17]	1.97 [-0.20,4.14]	1.80 [-0.38,3.98]
Occupational social class				
Higher worker	Ref	Ref	Ref	Ref
Intermediate	-0.05 [-2.81,2.72]	0.04 [-2.73,2.81]	-0.10 [-2.87,2.68]	0.04 [-2.73,2.80]
Routine and manual	1.65 [-1.23,4.53]	1.91 [-0.97,4.79]	1.73 [-1.16,4.62]	1.82 [-1.06,4.71]
Homemaker	1.97 [-0.93,4.87]	2.20 [-0.70,5.10]	2.00 [-0.91,4.91]	2.09 [-0.81,4.99]
Inactive	3.06 [-0.11,6.24]	3.19* [0.02,6.36]	3.08 [-0.10,6.25]	3.10 [-0.08,6.27]
Retired	-0.12 [-3.29,3.06]	0.08 [-3.10,3.26]	-0.08 [-3.26,3.10]	-0.05 [-3.23,3.14]
Body mass index (centred on 28.2)	0.67*** [0.55,0.78]	0.67*** [0.56,0.79]	0.67*** [0.56,0.78]	0.67*** [0.56,0.79]
Diabetes Mellitus	4.95*** [3.01,6.88]	4.92*** [2.98,6.85]	4.92*** [2.98,6.86]	4.92*** [2.98,6.85]
Family history of hypertension	3.50*** [2.31,4.70]	3.49*** [2.29,4.69]	3.52*** [2.32,4.72]	3.46*** [2.26,4.66]

Table A8. 9 (cont.): Two-level random intercept model for SBP with predictor variables 2010. Models 4b to 4e (Unweighted models)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Smoking				
Never	Ref	Ref	Ref	Ref
Past	-3.40*** [-5.02,-1.78]	-3.48*** [-5.10,-1.86]	-3.44*** [-5.06,-1.82]	-3.46*** [-5.08,-1.84]
Current	-2.75*** [-4.10,-1.41]	-2.89*** [-4.24,-1.55]	-2.83*** [-4.18,-1.49]	-2.82*** [-4.16,-1.48]
Physical Activity				
3 or more times	Ref	Ref	Ref	Ref
Less than 3 times	-0.42 [-3.15,2.32]	-0.15 [-2.88,2.59]	-0.29 [-3.03,2.44]	-0.22 [-2.95,2.51]
None	0.15 [-2.16,2.46]	0.34 [-1.98,2.65]	0.21 [-2.11,2.52]	0.29 [-2.02,2.60]
District Level variables				
Schooling (in years)[1]	-0.93*** [-1.41,-0.44]			
Unemployment [2]		0.15 [-0.06,0.37]		
Income (mean)[3]			-0.18* [-0.35,-0.00]	
Deprivation index				
Least deprived				Ref
2 quintile				0.94 [-1.57,3.45]
3 quintile				1.31 [-1.07,3.69]
4 quintile				2.2 [-0.14,4.54]
Most deprived				3.23** [0.90,5.57]
p for trend deprivation index				*<0.01*
District-level variance (SE)	4.08 (1.84)	5.44 (2.10)	5.45 (2.08)	5.09 (2.02)
% of total variance (partition)				
Individual level (%)	98.12	98.44	98.44	98.54
District level (%)	1.88	1.56	1.56	1.46
% change in district-level var	-28.67	-4.89	-4.72	-11.01
LR test	<0.01	0.17	0.05	0.08
AIC	35272.95	35284.01	35281.98	35283.58
BIC	35430.64	35441.70	35439.67	35460.19

* p<0.05, ** p<0.01, *** p<0.001. . (1) Schooling: in years as an ordinal variable; (2) Unemployment: rate as a continuous variable; (3) Income: mean as a continuous variable.

Table A8. 10: Two-level random intercept model for DBP with predictor variables 2003. Models 1 to 4a (unweighted models)

	Model 1	Model 2	Model 3	Model 4a
	Coef (95% CI)			
Individual-level variables				
Sex				
Male		Ref	Ref	Ref
Female		-5.57*** [-6.73,-4.42]	-6.63*** [-7.75,-5.50]	-6.64*** [-7.76,-5.51]
Age (centred on 50)		0.27*** [0.24,0.31]	0.24*** [0.21,0.28]	0.24*** [0.21,0.28]
Marital status				
Married/cohabiting		Ref	Ref	Ref
Single		-1.32* [-2.49,-0.16]	0.30 [-0.82,1.43]	0.29 [-0.83,1.42]
Divorced/separated/widowed		-0.51 [-1.80,0.79]	0.60 [-0.64,1.84]	0.60 [-0.64,1.83]
Place of residence				
Urban		Ref	Ref	Ref
Rural		1.42* [0.18,2.67]	1.66** [0.47,2.85]	1.71** [0.52,2.91]
Education				
Higher		Ref	Ref	Ref
Intermediate		1.87* [0.35,3.38]	1.59* [0.15,3.02]	1.61* [0.17,3.05]
Low		2.02* [0.25,3.79]	1.03 [-0.66,2.72]	1.07 [-0.62,2.76]
Assets-based SEP				
High		Ref	Ref	Ref
Middle		0.23 [-1.32,1.79]	-0.16 [-1.64,1.32]	-0.11 [-1.59,1.37]
Low		0.70 [-1.09,2.49]	0.37 [-1.34,2.08]	0.44 [-1.28,2.15]
Occupational social class				
Higher worker		Ref	Ref	Ref
Intermediate		-2.76* [-4.96,-0.56]	-1.95 [-4.04,0.14]	-1.94 [-4.03,0.15]
Routine and manual		-3.19*** [-5.03,-1.34]	-2.26* [-4.02,-0.51]	-2.26* [-4.01,-0.50]
Homemaker		-2.77** [-4.70,-0.84]	-2.18* [-4.02,-0.34]	-2.17* [-4.00,-0.33]
Inactive		-3.66*** [-5.57,-1.75]	-2.18* [-4.00,-0.36]	-2.16* [-3.99,-0.34]
Retired		-5.12*** [-7.19,-3.04]	-3.71*** [-5.69,-1.74]	-3.71*** [-5.69,-1.74]
Body mass index (centred on 27.8)			0.71*** [0.63,0.80]	0.72*** [0.63,0.80]
Diabetes Mellitus			0.64 [-0.70,1.98]	0.64 [-0.70,1.98]
Family history of hypertension			2.03*** [1.17,2.90]	2.03*** [1.16,2.89]

Table A8. 10 (cont.): Two-level random intercept model for DBP with predictor variables 2003. Models 1 to 4a (unweighted models)

	Model 1	Model 2	Model 3	Model 4a
			Coef (95% CI)	
Smoking				
Never			Ref	Ref
Past			-0.40 [-1.52,0.73]	-0.40 [-1.52,0.72]
Current			-2.09*** [-3.08,-1.10]	-2.08*** [-3.07,-1.10]
Physical Activity				
3 or more times			Ref	Ref
Less than 3 times			-0.83 [-2.64,0.99]	-0.85 [-2.66,0.97]
None			0.11 [-1.43,1.64]	0.10 [-1.44,1.63]
District Level variables				
Overcrowding index[1]				-2.41 [-8.54,3.73]
District-level variance (SE)	3.13 (1.59)	2.83 (1.44)	3.00 (1.40)	2.94 (1.39)
% of total variance (partition)				
Individual level (%)	98.2	98.03	97.68	97.73
District level (%)	1.80	1.97	2.32	2.27
% change in district-level var	-	-9.58	6.01	-2.04
LR test	< 0.01	< 0.01	< 0.01	0.44
AIC	24321.00	23762.73	23456.00	23457.41
BIC	24339.07	23865.07	23600.48	23607.92

* p<0.05, ** p<0.01, *** p<0.001. (1) Overcrowding: as a continuous variable.

Table A8. 11: Two-level random intercept model for DBP with predictor variables 2003. Models 4b to 4e (Unweighted models)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Individual-level variables				
Sex				
Male	Ref	Ref	Ref	Ref
Female	-6.69*** [-7.81,-5.56]	-6.61*** [-7.74,-5.49]	-6.64*** [-7.76,-5.51]	-6.64*** [-7.77,-5.52]
Age (centred on 50)	0.24*** [0.21,0.28]	0.24*** [0.21,0.28]	0.24*** [0.21,0.28]	0.24*** [0.21,0.28]
Marital status				
Married/cohabiting	Ref	Ref	Ref	Ref
Single	0.27 [-0.85,1.40]	0.30 [-0.82,1.43]	0.30 [-0.83,1.42]	0.26 [-0.86,1.39]
Divorced/separated/widowed	0.63 [-0.61,1.86]	0.61 [-0.63,1.84]	0.60 [-0.64,1.84]	0.60 [-0.64,1.84]
Place of residence				
Urban	Ref	Ref	Ref	Ref
Rural	2.27*** [0.97,3.56]	1.70** [0.50,2.89]	1.71** [0.50,2.91]	1.82** [0.60,3.03]
Education				
Higher	Ref	Ref	Ref	Ref
Intermediate	1.69* [0.25,3.14]	1.58* [0.15,3.02]	1.60* [0.16,3.04]	1.61* [0.17,3.05]
Low	1.24 [-0.46,2.94]	1.04 [-0.65,2.73]	1.05 [-0.64,2.74]	1.11 [-0.59,2.80]
Assets-based SEP				
High	Ref	Ref	Ref	Ref
Middle	-0.01 [-1.49,1.48]	-0.18 [-1.66,1.30]	-0.12 [-1.61,1.36]	-0.13 [-1.62,1.35]
Low	0.67 [-1.06,2.39]	0.35 [-1.36,2.05]	0.42 [-1.30,2.14]	0.42 [-1.30,2.14]
Occupational social class				
Higher worker	Ref	Ref	Ref	Ref
Intermediate	-1.94 [-4.02,0.15]	-1.94 [-4.03,0.14]	-1.94 [-4.03,0.15]	-1.97 [-4.06,0.12]
Routine and manual	-2.24* [-4.00,-0.49]	-2.26* [-4.01,-0.50]	-2.25* [-4.01,-0.50]	-2.28* [-4.04,-0.53]
Homemaker	-2.16* [-4.00,-0.32]	-2.20* [-4.03,-0.36]	-2.17* [-4.01,-0.33]	-2.16* [-4.00,-0.33]
Inactive	-2.15* [-3.97,-0.33]	-2.20* [-4.02,-0.38]	-2.17* [-3.99,-0.34]	-2.15* [-3.98,-0.33]
Retired	-3.72*** [-5.69,-1.74]	-3.73*** [-5.71,-1.76]	-3.70*** [-5.67,-1.72]	-3.73*** [-5.71,-1.76]
Body mass index (centred on 27.8)	0.72*** [0.63,0.80]	0.71*** [0.63,0.80]	0.72*** [0.63,0.80]	0.72*** [0.63,0.80]
Diabetes Mellitus	0.65 [-0.69,1.99]	0.66 [-0.69,2.00]	0.64 [-0.70,1.98]	0.63 [-0.71,1.97]
Family history of hypertension	2.02*** [1.15,2.88]	2.01*** [1.14,2.87]	2.04*** [1.17,2.90]	2.06*** [1.19,2.92]

Table A8. 11 (cont.): Two-level random intercept model for DBP with predictor variables 2003. Models 4b to 4e (Unweighted models)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Smoking				
Never	Ref	Ref	Ref	Ref
Past	-0.46 [-1.59,0.66]	-0.40 [-1.52,0.72]	-0.40 [-1.52,0.72]	-0.40 [-1.53,0.72]
Current	-2.14*** [-3.13,-1.16]	-2.09*** [-3.08,-1.10]	-2.09*** [-3.08,-1.10]	-2.09*** [-3.08,-1.11]
Physical Activity				
3 or more times	Ref	Ref	Ref	Ref
Less than 3 times	-0.81 [-2.62,1.01]	-0.81 [-2.63,1.00]	-0.82 [-2.64,1.00]	-0.85 [-2.66,0.97]
None	0.16 [-1.38,1.69]	0.11 [-1.42,1.65]	0.11 [-1.42,1.65]	0.08 [-1.46,1.61]
District Level variables				
Schooling (in years)[1]	0.43* [0.06,0.80]			
Unemployment [2]		0.06 [-0.10,0.21]		
Income (mean)[3]			0.04 [-0.13,0.20]	
Deprivation index				
Least deprived				Ref
2 quintile				0.21 [-1.52,1.94]
3 quintile				-0.53 [-2.31,1.25]
4 quintile				0.37 [-1.37,2.11]
Most deprived				-0.86 [-2.59,0.88]
p for trend deprivation index				
District-level variance (SE)	2.88 (1.37)	3.08 (1.40)	2.99 (1.40)	2.41 (1.36)
% of total variance (partition)				
Individual level (%)	97.77	97.62	97.69	98.14
District level (%)	2.23	2.38	2.31	1.86
% change in district-level var	-4.00	2.67	-0.33	-19.67
LR test	0.02	0.47	0.66	0.36
AIC	23452.70	23457.47	23457.81	23457.16
BIC	23603.21	23607.98	23608.31	23607.66

* p<0.05, ** p<0.01, *** p<0.001. . (1) Schooling: in years as an ordinal variable; (2) Unemployment: rate as a continuous variable; (3) Income: mean as a continuous variable.

Table A8. 12: Two-level random intercept model for DBP with predictor variables 2010. Models 1 to 4a (unweighted models).

	Model 1	Model 2	Model 3	Model 4a
	Coef (95% CI)			
Individual-level variables				
Sex				
Male		Ref	Ref	Ref
Female		-4.81*** [-5.63,-3.99]	-5.56*** [-6.36,-4.76]	-5.57*** [-6.37,-4.76]
Age (centred on 48)		0.23*** [0.20,0.25]	0.20*** [0.17,0.23]	0.20*** [0.17,0.23]
Marital status				
Married/cohabiting		Ref	Ref	Ref
Single		-0.86* [-1.72,-0.01]	-0.17 [-0.99,0.65]	-0.18 [-1.00,0.64]
Divorced/separated/widowed		-0.50 [-1.62,0.62]	-0.06 [-1.13,1.00]	-0.07 [-1.13,1.00]
Place of residence				
Urban		Ref	Ref	Ref
Rural		0.49 [-0.63,1.60]	0.35 [-0.73,1.43]	0.32 [-0.76,1.40]
Education				
Higher		Ref	Ref	Ref
Intermediate		0.36 [-0.70,1.43]	-0.30 [-1.32,0.73]	-0.26 [-1.29,0.76]
Low		-0.45 [-1.81,0.91]	-1.36* [-2.66,-0.05]	-1.32* [-2.63,-0.01]
Assets-based SEP				
High		Ref	Ref	Ref
Middle		-0.14 [-0.93,0.65]	-0.15 [-0.91,0.61]	-0.14 [-0.89,0.62]
Low		-0.58 [-1.86,0.69]	-0.27 [-1.49,0.95]	-0.26 [-1.47,0.96]
Occupational social class				
Higher worker		Ref	Ref	Ref
Intermediate		-0.92 [-2.55,0.70]	-0.76 [-2.31,0.80]	-0.73 [-2.29,0.82]
Routine and manual		-0.15 [-1.84,1.54]	0.11 [-1.51,1.73]	0.14 [-1.48,1.75]
Homemaker		-0.69 [-2.39,1.02]	-0.82 [-2.45,0.81]	-0.79 [-2.42,0.84]
Inactive		-1.16 [-3.02,0.71]	-0.65 [-2.43,1.13]	-0.63 [-2.41,1.15]
Retired		-5.53*** [-7.40,-3.66]	-5.02*** [-6.81,-3.24]	-5.00*** [-6.78,-3.21]
Body mass index (centred on 28.2)			0.56*** [0.50,0.63]	0.56*** [0.50,0.63]
Diabetes Mellitus			1.11* [0.02,2.19]	1.11* [0.02,2.20]
Family history of hypertension			2.53*** [1.85,3.20]	2.53*** [1.86,3.20]

Table A8. 12 (cont.): Two-level random intercept model for DBP with predictor variables 2010. Models 1 to 4a (unweighted models).

	Model 1	Model 2	Model 3	Model 4a
		Coef (95% CI)		
Smoking				
Never			Ref	Ref
Past			-1.37** [-2.28,-0.46]	-1.38** [-2.29,-0.47]
Current			-1.11** [-1.87,-0.36]	-1.12** [-1.88,-0.37]
Physical Activity				
3 or more times			Ref	Ref
Less than 3 times			-0.08 [-1.61,1.46]	-0.06 [-1.59,1.48]
None			0.68 [-0.62,1.97]	0.69 [-0.60,1.99]
District Level variables				
Overcrowding index[1]				-2.15 [-7.27,2.97]
District-level variance (SE)	2.37 (0.84)	1.89 (0.67)	1.97 (0.66)	1.89 (0.66)
% of total variance (partition)				
Individual level (%)	98.26	98.44	98.21	98.28
District level (%)	1.74	1.56	1.79	1.72
% change in district-level var	-	-20.25	4.23	-4.06
LR test	< 0.01	< 0.01	< 0.01	0.42
AIC	31428.68	30965.00	30596.27	30597.61
BIC	31447.6	31073.04	30747.66	30755.31

* p<0.05, ** p<0.01, *** p<0.001. (1) Overcrowding: as a continuous variable.

Table A8. 13: Two-level random intercept model for DBP with predictor variables 2010. Models 1 to 4a (unweighted models)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Individual-level variables				
Sex				
Male	Ref	Ref	Ref	Ref
Female	-5.52*** [-6.33,-4.72]	-5.56*** [-6.36,-4.75]	-5.52*** [-6.33,-4.72]	-5.55*** [-6.35,-4.75]
Age (centred on 48)	0.20*** [0.17,0.23]	0.20*** [0.17,0.23]	0.20*** [0.17,0.23]	0.20*** [0.17,0.23]
Marital status				
Married/cohabiting	Ref	Ref	Ref	Ref
Single	-0.14 [-0.96,0.69]	-0.17 [-0.99,0.66]	-0.15 [-0.97,0.67]	-0.15 [-0.98,0.67]
Divorced/separated/widowed	-0.05 [-1.11,1.02]	-0.07 [-1.14,1.00]	-0.06 [-1.12,1.01]	-0.05 [-1.12,1.02]
Place of residence				
Urban	Ref	Ref	Ref	Ref
Rural	-0.06 [-1.18,1.06]	0.36 [-0.72,1.44]	0.23 [-0.86,1.31]	0.27 [-0.83,1.37]
Education				
Higher	Ref	Ref	Ref	Ref
Intermediate	-0.42 [-1.45,0.61]	-0.30 [-1.32,0.72]	-0.38 [-1.40,0.65]	-0.35 [-1.37,0.68]
Low	-1.58* [-2.90,-0.26]	-1.36* [-2.66,-0.05]	-1.47* [-2.78,-0.16]	-1.43* [-2.73,-0.12]
Assets-based SEP				
High	Ref	Ref	Ref	Ref
Middle	-0.20 [-0.96,0.56]	-0.15 [-0.91,0.60]	-0.18 [-0.94,0.57]	-0.15 [-0.91,0.61]
Low	-0.39 [-1.60,0.83]	-0.28 [-1.50,0.94]	-0.31 [-1.53,0.91]	-0.29 [-1.52,0.93]
Occupational social class				
Higher worker	Ref	Ref	Ref	Ref
Intermediate	-0.80 [-2.35,0.75]	-0.76 [-2.31,0.79]	-0.84 [-2.40,0.72]	-0.79 [-2.34,0.77]
Routine and manual	0.01 [-1.61,1.62]	0.11 [-1.51,1.72]	0.01 [-1.61,1.63]	0.05 [-1.57,1.67]
Homemaker	-0.92 [-2.55,0.71]	-0.83 [-2.45,0.80]	-0.93 [-2.56,0.70]	-0.87 [-2.50,0.76]
Inactive	-0.72 [-2.50,1.06]	-0.66 [-2.44,1.12]	-0.73 [-2.51,1.05]	-0.70 [-2.48,1.08]
Retired	-5.11*** [-6.89,-3.33]	-5.03*** [-6.81,-3.24]	-5.11*** [-6.90,-3.33]	-5.09*** [-6.88,-3.30]
Body mass index (centred on 28.2)	0.56*** [0.50,0.62]	0.56*** [0.50,0.63]	0.56*** [0.50,0.63]	0.56*** [0.50,0.63]
Diabetes Mellitus	1.11* [0.03,2.20]	1.11* [0.02,2.19]	1.11* [0.02,2.19]	1.10* [0.01,2.19]
Family history of hypertension	2.51*** [1.83,3.18]	2.52*** [1.85,3.20]	2.52*** [1.84,3.19]	2.51*** [1.84,3.18]

Table A8. 13 (cont.): Two-level random intercept model for DBP with predictor variables 2010. Models 1 to 4a (unweighted models). Coef (95% CI)

	Model 4b	Model 4c	Model 4d	Model 4e
Smoking				
Never	Ref	Ref	Ref	Ref
Past	-1.35** [-2.26,-0.44]	-1.37** [-2.28,-0.46]	-1.36** [-2.27,-0.45]	-1.37** [-2.28,-0.46]
Current	-1.06** [-1.81,-0.30]	-1.11** [-1.87,-0.36]	-1.09** [-1.84,-0.33]	-1.10** [-1.85,-0.34]
Physical Activity				
3 or more times	Ref	Ref	Ref	Ref
Less than 3 times	-0.16 [-1.69,1.37]	-0.07 [-1.60,1.46]	-0.12 [-1.66,1.41]	-0.08 [-1.61,1.46]
None	0.62 [-0.68,1.92]	0.68 [-0.62,1.98]	0.63 [-0.67,1.93]	0.68 [-0.61,1.98]
District Level variables				
Schooling (in years)[1]	-0.36* [-0.64,-0.08]			
Unemployment [2]		0.02 [-0.10,0.14]		
Income (mean)[3]			-0.09 [-0.19,0.01]	
Deprivation index				
Least deprived				Ref
2 quintile				0.61 [-0.84,2.06]
3 quintile				0.19 [-1.19,1.56]
4 quintile				0.97 [-0.38,2.31]
Most deprived				0.72 [-0.62,2.06]
p for trend deprivation index				
District-level variance (SE)	1.67 (0.61)	1.96 (0.66)	1.86 (0.64)	1.85 (0.65)
% of total variance (partition)				
Individual level (%)	98.48	98.22	98.31	98.32
District level (%)	1.52	1.78	1.69	1.68
% change in district-level var	-15.23	-0.51	-5.58	-6.09
LR test	0.01	0.76	0.09	0.24
AIC	30592.20	30598.18	30595.41	30596.89
BIC	30749.90	30755.87	30753.10	30754.58

* p<0.05, ** p<0.01, *** p<0.001. . (1) Schooling: in years as an ordinal variable; (2) Unemployment: rate as a continuous variable; (3) Income: mean as a continuous variable.

Scale-method effective

Table A8. 14: Two-level random intercept model for SBP with predictor variables 2003. Models 1 to 4a (scale-method effective)

	Model 1	Model 2	Model 3	Model 4a
	Coef (95% CI)			
Individual-level variables				
Sex				
Male		Ref	Ref	Ref
Female		-7.99*** [-9.70,-6.27]	-9.28*** [-10.94,-7.62]	-9.28*** [-10.93,-7.63]
Age (centred on 50)		0.85*** [0.78,0.92]	0.77*** [0.70,0.84]	0.77*** [0.70,0.84]
Marital status				
Married/cohabiting		Ref	Ref	Ref
Single		2.28* [0.47,4.08]	4.05*** [2.28,5.82]	4.05*** [2.28,5.82]
Divorced/separated/widowed		1.17 [-1.71,4.05]	2.47 [-0.30,5.25]	2.47 [-0.30,5.25]
Place of residence				
Urban		Ref	Ref	Ref
Rural		1.81 [-0.62,4.23]	1.75 [-0.61,4.12]	1.76 [-0.64,4.15]
Education				
Higher		Ref	Ref	Ref
Intermediate		2.12* [0.12,4.12]	1.86 [-0.10,3.82]	1.86 [-0.08,3.81]
Low		2.21 [-0.69,5.10]	1.01 [-1.86,3.88]	1.02 [-1.83,3.86]
Assets-based SEP				
High		Ref	Ref	Ref
Middle		3.21** [0.99,5.42]	2.72* [0.61,4.83]	2.72* [0.62,4.83]
Low		4.50** [1.62,7.38]	4.06** [1.20,6.92]	4.07** [1.17,6.97]
Occupational social class				
Higher worker		Ref	Ref	Ref
Intermediate		-3.90* [-7.34,-0.46]	-2.78 [-6.06,0.49]	-2.78 [-6.06,0.50]
Routine and manual		-3.85* [-6.86,-0.84]	-2.38 [-5.23,0.47]	-2.38 [-5.24,0.48]
Homemaker		-0.92 [-4.21,2.36]	-0.53 [-3.66,2.60]	-0.53 [-3.66,2.60]
Inactive		-1.85 [-4.82,1.12]	-0.28 [-2.98,2.41]	-0.28 [-2.98,2.42]
Retired		-3.71 [-7.79,0.36]	-1.87 [-5.75,2.00]	-1.87 [-5.75,2.00]
Body mass index (centred on 27.8)			0.88*** [0.73,1.03]	0.88*** [0.73,1.03]
Diabetes Mellitus			4.57* [0.92,8.22]	4.57* [0.92,8.22]

Table A8. 14 (cont.): Two-level random intercept model for SBP with predictor variables 2003. Models 1 to 4a (scale-method effective)

	Model 1	Model 2	Model 3	Model 4a
		Coef (95% CI)		
Family history of hypertension			1.77* [0.38,3.16]	1.77* [0.38,3.16]
Smoking				
Never			Ref	Ref
Past			-3.05* [-5.40,-0.69]	-3.05* [-5.40,-0.69]
Current			-3.66*** [-5.20,-2.12]	-3.66*** [-5.20,-2.12]
Physical Activity				
3 or more times			Ref	Ref
Less than 3 times			0.29 [-2.30,2.89]	0.29 [-2.31,2.89]
None			1.54 [-0.74,3.81]	1.53 [-0.74,3.81]
District Level variables				
Overcrowding index[1]				-0.19 [-9.77,9.39]
District-level variance (SE)	7.01 (5.58)	3.92 (3.22)	2.97 (2.97)	2.96 (2.99)
% of total variance (partition)				
Individual level (%)	98.62	98.74	98.97	98.97
District level (%)	1.38	1.26	1.03	1.03
% change in district-level var	-	8.70	-23.00	-0.34
Wald test p-value	-	< 0.01	< 0.01	0.97

* p<0.05, ** p<0.01, *** p<0.001. (1) Overcrowding: as a continuous variable.

Table A8. 15: Two-level random intercept model for SBP with predictor variables 2003. Models 1 to 4a (scale-method effective)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Individual-level variables				
Sex				
Male	Ref	Ref	Ref	Ref
Female	-9.24*** [-10.89,-7.59]	-9.26*** [-10.91,-7.60]	-9.23*** [-10.88,-7.58]	-9.23*** [-10.87,-7.59]
Age (centred on 50)	0.77*** [0.70,0.84]	0.77*** [0.70,0.84]	0.77*** [0.70,0.84]	0.77*** [0.70,0.84]
Marital status				
Married/cohabiting	Ref	Ref	Ref	Ref
Single	4.08*** [2.31,5.86]	4.05*** [2.28,5.82]	4.08*** [2.31,5.86]	4.06*** [2.28,5.85]
Divorced/separated/widowed	2.46 [-0.33,5.24]	2.47 [-0.31,5.25]	2.48 [-0.30,5.25]	2.48 [-0.31,5.27]
Place of residence				
Urban	Ref	Ref	Ref	Ref
Rural	1.37 [-1.29,4.03]	1.79 [-0.55,4.13]	1.53 [-0.88,3.94]	1.59 [-0.91,4.09]
Education				
Higher	Ref	Ref	Ref	Ref
Intermediate	1.78 [-0.14,3.71]	1.86 [-0.10,3.82]	1.77 [-0.16,3.71]	1.86 [-0.10,3.81]
Low	0.86 [-1.97,3.69]	1.03 [-1.85,3.91]	0.91 [-1.94,3.76]	1.01 [-1.86,3.87]
Assets-based SEP				
High	Ref	Ref	Ref	Ref
Middle	2.59* [0.49,4.68]	2.71* [0.60,4.81]	2.49* [0.40,4.57]	2.67* [0.56,4.78]
Low	3.84** [0.95,6.73]	4.03** [1.14,6.92]	3.74* [0.85,6.63]	3.88** [0.97,6.80]
Occupational social class				
Higher worker	Ref	Ref	Ref	Ref
Intermediate	-2.8 [-6.07,0.46]	-2.79 [-6.06,0.49]	-2.80 [-6.07,0.47]	-2.74 [-6.03,0.55]
Routine and manual	-2.41 [-5.25,0.43]	-2.38 [-5.23,0.47]	-2.41 [-5.25,0.43]	-2.39 [-5.24,0.46]
Homemaker	-0.56 [-3.68,2.57]	-0.56 [-3.68,2.57]	-0.56 [-3.69,2.56]	-0.55 [-3.64,2.55]
Inactive	-0.28 [-2.97,2.40]	-0.31 [-3.00,2.39]	-0.30 [-2.97,2.38]	-0.35 [-3.05,2.34]
Retired	-1.88 [-5.75,2.00]	-1.90 [-5.78,1.97]	-1.95 [-5.83,1.93]	-1.82 [-5.71,2.06]
Body mass index (centred on 27.8)	0.88*** [0.72,1.03]	0.88*** [0.72,1.03]	0.87*** [0.72,1.02]	0.87*** [0.72,1.03]
Diabetes Mellitus	4.56* [0.90,8.21]	4.60* [0.96,8.24]	4.56* [0.91,8.21]	4.56* [0.91,8.22]
Family history of hypertension	1.78* [0.40,3.17]	1.74* [0.32,3.15]	1.74* [0.35,3.14]	1.77* [0.38,3.16]

Table A8. 15 (cont.): Two-level random intercept model for SBP with predictor variables 2003. Models 1 to 4a (scale-method effective)

	Model 4b	Model 4c	Model 4d	Model 4e
		Coef (95% CI)		
Smoking				
Never	Ref	Ref	Ref	Ref
Past	-3.00* [-5.34,-0.65]	-3.03* [-5.38,-0.68]	-3.00* [-5.35,-0.65]	-2.94* [-5.28,-0.60]
Current	-3.62*** [-5.16,-2.08]	-3.66*** [-5.20,-2.13]	-3.66*** [-5.19,-2.13]	-3.65*** [-5.18,-2.13]
Physical Activity				
3 or more times	Ref	Ref	Ref	Ref
Less than 3 times	0.29 [-2.31,2.88]	0.30 [-2.30,2.90]	0.26 [-2.34,2.87]	0.27 [-2.36,2.90]
None	1.51 [-0.77,3.79]	1.54 [-0.74,3.81]	1.52 [-0.76,3.81]	1.51 [-0.82,3.83]
District Level variables				
Schooling (in years)[1]	-0.26 [-0.85,0.34]			
Unemployment [2]		0.06 [-0.20,0.32]		
Income (mean)[3]			-0.21 [-0.43,0.01]	
Deprivation index				
Least deprived				Ref
2 quintile				-0.96 [-3.25,1.33]
3 quintile				-1.45 [-4.17,1.27]
4 quintile				0.36 [-2.59,3.31]
Most deprived				0.29 [-2.46,3.04]
p for trend deprivation index				*0.39*
District-level variance (SE)	2.79 (2.90)	3.22 (3.23)	2.90 (2.95)	2.45 (3.01)
% of total variance (partition)				
Individual level (%)	99.03	98.87	99.00	99.15
District level (%)	0.97	1.13	1.00	0.85
% change in district-level var	-6.06	8.42	-2.36	-17.51
Wald test p-value	0.40	0.65	0.06	0.53

* p<0.05, ** p<0.01, *** p<0.001. . (1) Schooling: in years as an ordinal variable; (2) Unemployment: rate as a continuous variable; (3) Income: mean as a continuous variable.

Table A8. 16: Two-level random intercept model for SBP with predictor variables 2010. Models 1 to 4a (scale-method effective)

	Model 1	Model 2	Model 3	Model 4a
	Coef (95% CI)			
Individual-level variables				
Sex				
Male		Ref	Ref	Ref
Female		-8.89*** [-10.46,-7.33]	-9.90*** [-11.47,-8.33]	-9.90*** [-11.48,-8.33]
Age (centred on 48)		0.76*** [0.69,0.82]	0.70*** [0.64,0.77]	0.70*** [0.64,0.76]
Marital status				
Married/cohabiting		Ref	Ref	Ref
Single		2.25* [0.54,3.97]	3.15*** [1.48,4.82]	3.11*** [1.46,4.77]
Divorced/separated/widowed		3.07* [0.52,5.62]	3.71** [1.29,6.13]	3.71** [1.29,6.12]
Place of residence				
Urban		Ref	Ref	Ref
Rural		-0.22 [-2.77,2.33]	-0.08 [-2.55,2.39]	-0.15 [-2.55,2.26]
Education				
Higher		Ref	Ref	Ref
Intermediate		0.89 [-0.82,2.59]	0.19 [-1.47,1.84]	0.26 [-1.40,1.92]
Low		2.09 [-0.75,4.92]	0.93 [-1.85,3.71]	1.00 [-1.77,3.77]
Assets-based SEP				
High		Ref	Ref	Ref
Middle		1.26 [-0.18,2.70]	1.07 [-0.27,2.42]	1.09 [-0.26,2.43]
Low		0.82 [-1.66,3.30]	1.03 [-1.36,3.41]	1.10 [-1.25,3.46]
Occupational social class				
Higher worker		Ref	Ref	Ref
Intermediate		-0.85 [-3.75,2.04]	-0.19 [-2.77,2.38]	-0.12 [-2.70,2.47]
Routine and manual		1.27 [-2.02,4.56]	2.12 [-0.74,4.98]	2.21 [-0.65,5.07]
Homemaker		1.31 [-1.38,4.00]	1.60 [-0.84,4.04]	1.70 [-0.74,4.15]
Inactive		1.65 [-1.38,4.67]	2.46 [-0.26,5.18]	2.53 [-0.18,5.25]
Retired		0.34 [-3.73,4.40]	1.62 [-2.10,5.34]	1.71 [-2.00,5.42]
Body mass index (centred on 28.2)			0.79*** [0.68,0.91]	0.79*** [0.68,0.91]
Diabetes Mellitus			3.65** [0.99,6.31]	3.66** [1.00,6.32]

Table A8. 16 (cont.) Two-level random intercept model for SBP with predictor variables 2010. Models 1 to 4a (scale-method effective)

	Model 1	Model 2	Model 3	Model 4a
			Coef (95% CI)	
Family history of hypertension			3.34*** [2.05,4.62]	3.35*** [2.07,4.64]
Smoking				
Never			Ref	Ref
Past			-3.46*** [-5.18,-1.75]	-3.48*** [-5.19,-1.76]
Current			-2.81*** [-4.18,-1.44]	-2.82*** [-4.19,-1.45]
Physical Activity				
3 or more times			Ref	Ref
Less than 3 times			-0.60 [-3.39,2.19]	-0.56 [-3.36,2.24]
None			-0.53 [-2.99,1.93]	-0.49 [-2.95,1.97]
District Level variables				
Overcrowding index[1]				-4.67 [-13.24,3.89]
District-level variance (SE)	6.91 (3.15)	4.67 (2.77)	3.94 (2.97)	3.43 (2.33)
% of total variance (partition)				
Individual level (%)	98.63	98.58	98.71	98.71
District level (%)	1.37	1.42	1.29	1.13
% change in district-level var	-	-32.42	-15.63	-12.94
Wald test p-value	-	< 0.01	< 0.01	0.29

* p<0.05, ** p<0.01, *** p<0.001. (1) Overcrowding: as a continuous variable.

Table A8. 17: Two-level random intercept model for SBP with predictor variables 2010. Models 4b to 4e (scale-method effective)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Individual-level variables				
Sex				
Male	Ref	Ref	Ref	Ref
Female	-9.86*** [-11.43,-8.28]	-9.84*** [-11.40,-8.27]	-9.84*** [-11.42,-8.27]	-9.88*** [-11.46,-8.29]
Age (centred on 48)	0.71*** [0.65,0.77]	0.71*** [0.64,0.77]	0.71*** [0.64,0.77]	0.71*** [0.65,0.77]
Marital status				
Married/cohabiting	Ref	Ref	Ref	Ref
Single	3.23*** [1.56,4.91]	3.16*** [1.50,4.83]	3.20*** [1.52,4.87]	3.24*** [1.58,4.90]
Divorced/separated/widowed	3.80** [1.37,6.23]	3.60** [1.17,6.03]	3.74** [1.31,6.17]	3.68** [1.27,6.10]
Place of residence				
Urban	Ref	Ref	Ref	Ref
Rural	-0.84 [-3.20,1.51]	0.04 [-2.38,2.45]	-0.28 [-2.74,2.17]	-0.51 [-2.87,1.85]
Education				
Higher	Ref	Ref	Ref	Ref
Intermediate	-0.07 [-1.75,1.62]	0.15 [-1.49,1.80]	0.06 [-1.61,1.72]	-0.05 [-1.72,1.61]
Low	0.46 [-2.41,3.33]	0.97 [-1.80,3.74]	0.74 [-2.06,3.55]	0.61 [-2.22,3.43]
Assets-based SEP				
High	Ref	Ref	Ref	Ref
Middle	0.97 [-0.37,2.31]	1.02 [-0.32,2.37]	1.01 [-0.33,2.35]	1.00 [-0.35,2.35]
Low	0.83 [-1.59,3.25]	0.91 [-1.48,3.30]	0.94 [-1.46,3.33]	0.73 [-1.68,3.14]
Occupational social class				
Higher worker	Ref	Ref	Ref	Ref
Intermediate	-0.24 [-2.81,2.34]	-0.25 [-2.81,2.31]	-0.37 [-2.98,2.24]	-0.23 [-2.77,2.32]
Routine and manual	1.90 [-0.99,4.79]	2.10 [-0.73,4.93]	1.92 [-0.98,4.82]	1.97 [-0.85,4.79]
Homemaker	1.42 [-1.03,3.86]	1.58 [-0.84,4.00]	1.38 [-1.08,3.84]	1.45 [-0.96,3.85]
Inactive	2.32 [-0.43,5.08]	2.42 [-0.26,5.10]	2.31 [-0.42,5.04]	2.27 [-0.39,4.94]
Retired	1.53 [-2.20,5.27]	1.52 [-2.17,5.22]	1.44 [-2.29,5.17]	1.42 [-2.27,5.12]
Body mass index (centred on 28.2)	0.79*** [0.67,0.90]	0.79*** [0.68,0.90]	0.79*** [0.68,0.90]	0.79*** [0.68,0.91]
Diabetes Mellitus	3.68** [1.01,6.34]	3.65** [0.99,6.30]	3.65** [0.98,6.31]	3.67** [1.00,6.34]

Table A8. 17 (cont.) Two-level random intercept model for SBP with predictor variables 2010. Models 4b to 4e (scale-method effective)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Family history of hypertension	3.32*** [2.03,4.61]	3.23*** [1.92,4.53]	3.33*** [2.04,4.61]	3.25*** [1.97,4.52]
Smoking				
Never	Ref	Ref	Ref	Ref
Past	-3.39*** [-5.10,-1.68]	-3.46*** [-5.18,-1.75]	-3.43*** [-5.14,-1.72]	-3.47*** [-5.18,-1.75]
Current	-2.70*** [-4.06,-1.33]	-2.81*** [-4.19,-1.44]	-2.76*** [-4.13,-1.39]	-2.71*** [-4.08,-1.35]
Physical Activity				
3 or more times	Ref	Ref	Ref	Ref
Less than 3 times	-0.73 [-3.54,2.08]	-0.5 [-3.28,2.27]	-0.67 [-3.48,2.15]	-0.59 [-3.38,2.19]
None	-0.59 [-3.07,1.88]	-0.47 [-2.93,1.98]	-0.59 [-3.08,1.89]	-0.49 [-2.96,1.98]
District Level variables				
Schooling (in years)[1]	-0.68* [-1.25,-0.10]			
Unemployment [2]		0.26* [0.03,0.49]		
Income (mean)[3]			-0.15 [-0.33,0.04]	
Deprivation index				
Least deprived				Ref
2 quintile				1.55 [-1.01,4.10]
3 quintile				0.96 [-1.19,3.12]
4 quintile				2.28* [0.20,4.36]
Most deprived				3.46** [1.24,5.69]
p for trend deprivation index				*<0.01*
District-level variance (SE)	2.89 (2.17)	3.12 (2.29)	3.68 (2.31)	2.70 (2.21)
% of total variance (partition)				
Individual level (%)	99.04	98.97	98.79	99.11
District level (%)	0.96	1.03	1.21	0.89
% change in district-level var	-26.65	-20.81	-6.60	-31.47
Wald test p-value	0.02	0.03	0.13	0.03

* p<0.05, ** p<0.01, *** p<0.001. . (1) Schooling: in years as an ordinal variable; (2) Unemployment: rate as a continuous variable; (3) Income: mean as a continuous variable.

Table A8. 18: Two-level random intercept model for DBP with predictor variables 2003. Models 1 to 4a (scale-method effective)

	Model 1	Model 2	Model 3	Model 4a
	Coef (95% CI)			
Individual-level variables				
Sex				
Male		Ref	Ref	Ref
Female		-6.55*** [-7.69,-5.42]	-7.71*** [-8.73,-6.68]	-7.71*** [-8.73,-6.69]
Age (centred on 50)		0.34*** [0.30,0.38]	0.29*** [0.25,0.33]	0.29*** [0.25,0.33]
Marital status				
Married/cohabiting		Ref	Ref	Ref
Single		-0.78 [-2.07,0.52]	0.91 [-0.27,2.10]	0.91 [-0.28,2.10]
Divorced/separated/widowed		-0.83 [-2.66,1.00]	0.33 [-1.41,2.07]	0.33 [-1.42,2.07]
Place of residence				
Urban		Ref	Ref	Ref
Rural		0.88 [-0.89,2.66]	0.95 [-0.78,2.68]	0.99 [-0.76,2.74]
Education				
Higher		Ref	Ref	Ref
Intermediate		1.00 [-0.56,2.57]	0.86 [-0.58,2.29]	0.88 [-0.56,2.32]
Low		0.58 [-1.38,2.54]	-0.22 [-2.11,1.66]	-0.19 [-2.08,1.69]
Assets-based SEP				
High		Ref	Ref	Ref
Middle		1.49* [0.06,2.93]	1.22 [-0.15,2.58]	1.27 [-0.10,2.64]
Low		2.07* [0.25,3.89]	1.79* [0.02,3.57]	1.87* [0.09,3.65]
Occupational social class				
Higher worker		Ref	Ref	Ref
Intermediate		-3.27** [-5.73,-0.81]	-2.31* [-4.62,-0.00]	-2.30 [-4.61,0.00]
Routine and manual		-3.48*** [-5.52,-1.44]	-2.42* [-4.35,-0.48]	-2.41* [-4.35,-0.47]
Homemaker		-1.99 [-4.08,0.10]	-1.55 [-3.51,0.41]	-1.53 [-3.48,0.42]
Inactive		-3.63** [-5.82,-1.44]	-2.22* [-4.28,-0.15]	-2.21* [-4.27,-0.15]
Retired		-6.01*** [-8.64,-3.39]	-4.34*** [-6.75,-1.93]	-4.35*** [-6.76,-1.94]
Body mass index (centred on 27.8)			0.78*** [0.68,0.88]	0.78*** [0.69,0.88]

Table A8. 18 (cont.) Two-level random intercept model for DBP with predictor variables 2003. Models 1 to 4a (scale-method effective)

	Model 1	Model 2	Model 3	Model 4a
		Coef (95% CI)		
Diabetes Mellitus			0.20 [-1.81,2.21]	0.20 [-1.81,2.21]
Family history of hypertension			1.98*** [0.98,2.97]	1.97*** [0.97,2.97]
Smoking				
Never			Ref	Ref
Past			-1.20 [-2.70,0.30]	-1.20 [-2.70,0.29]
Current			-2.26*** [-3.25,-1.28]	-2.26*** [-3.25,-1.27]
Physical Activity				
3 or more times			Ref	Ref
Less than 3 times			-0.74 [-2.69,1.22]	-0.75 [-2.70,1.21]
None			0.57 [-1.09,2.22]	0.56 [-1.09,2.21]
District Level variables				
Overcrowding index[1]				-2.18 [-9.34,4.99]
District-level variance (SE)	3.96 (2.51)	3.38 (2.05)	3.12 (1.93)	3.03 (1.91)
% of total variance (partition)				
Individual level (%)	97.68	97.47	97.35	97.35
District level (%)	2.32	2.53	2.65	2.58
% change in district-level var	-	-14.65	-7.69	-2.88
Wald test p-value	-	< 0.01	< 0.01	0.55

* p<0.05, ** p<0.01, *** p<0.001. (1) Overcrowding: as a continuous variable.

Table A8. 19: Two-level random intercept model for DBP with predictor variables 2003. Models 4b to 4e (scale-method effective)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Individual-level variables				
Sex				
Male	Ref	Ref	Ref	Ref
Female	-7.74*** [-8.76,-6.71]	-7.70*** [-8.72,-6.68]	-7.70*** [-8.72,-6.68]	-7.73*** [-8.75,-6.71]
Age (centred on 50)	0.29*** [0.25,0.33]	0.29*** [0.25,0.33]	0.29*** [0.25,0.33]	0.29*** [0.25,0.33]
Marital status				
Married/cohabiting	Ref	Ref	Ref	Ref
Single	0.89 [-0.29,2.07]	0.91 [-0.27,2.10]	0.92 [-0.26,2.10]	0.87 [-0.32,2.06]
Divorced/separated/widowed	0.34 [-1.40,2.09]	0.33 [-1.41,2.07]	0.33 [-1.41,2.07]	0.34 [-1.41,2.09]
Place of residence				
Urban				
Rural	1.30 [-0.65,3.25]	0.96 [-0.77,2.69]	0.92 [-0.85,2.68]	1.12 [-0.69,2.92]
Education				
Higher	Ref	Ref	Ref	Ref
Intermediate	0.92 [-0.53,2.37]	0.86 [-0.58,2.29]	0.84 [-0.59,2.28]	0.90 [-0.54,2.34]
Low	-0.10 [-2.02,1.81]	-0.22 [-2.11,1.66]	-0.24 [-2.12,1.64]	-0.13 [-2.02,1.77]
Assets-based SEP				
High	Ref	Ref	Ref	Ref
Middle	1.33 [-0.03,2.68]	1.22 [-0.15,2.58]	1.18 [-0.18,2.53]	1.25 [-0.11,2.61]
Low	1.99* [0.21,3.77]	1.79* [0.01,3.58]	1.74 [-0.04,3.52]	1.85* [0.08,3.62]
Occupational social class				
Higher worker	Ref	Ref	Ref	Ref
Intermediate	-2.3 [-4.60,0.01]	-2.31* [-4.62,-0.00]	-2.31* [-4.62,-0.01]	-2.30 [-4.61,0.02]
Routine and manual	-2.39* [-4.34,-0.45]	-2.42* [-4.35,-0.48]	-2.42* [-4.36,-0.48]	-2.43* [-4.38,-0.49]
Homemaker	-1.53 [-3.49,0.43]	-1.55 [-3.50,0.40]	-1.55 [-3.51,0.40]	-1.52 [-3.46,0.43]
Inactive	-2.22* [-4.29,-0.15]	-2.22* [-4.27,-0.16]	-2.22* [-4.28,-0.16]	-2.25* [-4.32,-0.18]
Retired	-4.34*** [-6.76,-1.93]	-4.34*** [-6.74,-1.93]	-4.35*** [-6.76,-1.94]	-4.34*** [-6.77,-1.91]
Body mass index (centred on 27.8)	0.78*** [0.69,0.88]	0.78*** [0.68,0.88]	0.78*** [0.68,0.88]	0.78*** [0.68,0.88]
Diabetes Mellitus	0.22 [-1.79,2.22]	0.20 [-1.80,2.20]	0.20 [-1.81,2.20]	0.15 [-1.86,2.16]
Family history of hypertension	1.97*** [0.97,2.96]	1.98*** [0.97,2.98]	1.97*** [0.98,2.97]	2.00*** [1.00,2.99]

Table A8. 19 (cont.): Two-level random intercept model for DBP with predictor variables 2003. Models 4b to 4e (scale-method effective)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Smoking				
Never	Ref	Ref	Ref	Ref
Past	-1.24 [-2.72,0.24]	-1.20 [-2.69,0.30]	-1.19 [-2.68,0.30]	-1.18 [-2.65,0.30]
Current	-2.30*** [-3.29,-1.31]	-2.27*** [-3.25,-1.28]	-2.26*** [-3.25,-1.28]	-2.29*** [-3.27,-1.30]
Physical Activity				
3 or more times	Ref	Ref	Ref	Ref
Less than 3 times	-0.73 [-2.69,1.22]	-0.74 [-2.70,1.22]	-0.74 [-2.70,1.22]	-0.76 [-2.73,1.22]
None	0.59 [-1.06,2.25]	0.57 [-1.09,2.22]	0.56 [-1.09,2.22]	0.56 [-1.11,2.23]
District Level variables				
Schooling (in years)[1]	0.24 [-0.21,0.70]			
Unemployment [2]		0.01 [-0.18,0.19]		
Income (mean)[3]			-0.04 [-0.22,0.14]	
Deprivation index				Ref
Least deprived quintile				
2 quintile				-0.86 [-2.59,0.88]
3 quintile				-1.30 [-3.30,0.71]
4 quintile				0.04 [-1.92,1.99]
Most deprived				-1.26 [-3.18,0.67]
p for trend deprivation index				*0.56*
District-level variance (SE)	3.07 (1.95)	3.13 (1.99)	3.16 (1.93)	2.21 (1.91)
% of total variance (partition)				
Individual level (%)	97.39	97.34	97.32	98.13
District level (%)	2.61	2.66	2.68	1.87
% change in district-level var	-1.60	0.32	1.28	-29.17
Wald test p-value	0.29	0.97	0.69	0.44

* p<0.05, ** p<0.01, *** p<0.001. . (1) Schooling: in years as an ordinal variable; (2) Unemployment: rate as a continuous variable; (3) Income: mean as a continuous variable.

Table A8.20: Two-level random intercept model for DBP with predictor variables 2010. Models 1 to 4a (scale-method effective)

	Model 1	Model 2	Model 3	Model 4a
	Coef (95% CI)			
Individual-level variables				
Sex				
Male		Ref	Ref	Ref
Female		-4.58*** [-5.53,-3.63]	-5.38*** [-6.36,-4.41]	-5.39*** [-6.37,-4.41]
Age (centred on 48)		0.25*** [0.21,0.29]	0.21*** [0.18,0.25]	0.21*** [0.18,0.25]
Marital status				
Married/cohabiting		Ref	Ref	Ref
Single		-0.74 [-1.84,0.36]	0.01 [-1.00,1.02]	-0.02 [-1.02,0.98]
Divorced/separated/widowed		-0.3 [-1.62,1.03]	0.24 [-1.05,1.54]	0.24 [-1.05,1.53]
Place of residence				
Urban		Ref	Ref	Ref
Rural		-0.46 [-1.75,0.83]	-0.39 [-1.63,0.85]	-0.45 [-1.68,0.78]
Education				
Higher		Ref	Ref	Ref
Intermediate		0.31 [-0.76,1.37]	-0.20 [-1.28,0.88]	-0.15 [-1.22,0.92]
Low		-0.42 [-1.92,1.08]	-1.17 [-2.66,0.31]	-1.12 [-2.60,0.35]
Assets-based SEP				
High		Ref	Ref	Ref
Middle		0.07 [-0.88,1.01]	-0.16 [-1.05,0.74]	-0.15 [-1.04,0.75]
Low		-0.76 [-2.19,0.66]	-0.71 [-2.12,0.69]	-0.67 [-2.08,0.74]
Occupational social class				
Higher worker		Ref	Ref	Ref
Intermediate		-1.28 [-3.24,0.68]	-0.85 [-2.57,0.87]	-0.80 [-2.52,0.92]
Routine and manual		-0.67 [-2.80,1.47]	-0.10 [-1.94,1.74]	-0.04 [-1.87,1.80]
Homemaker		-1.33 [-3.24,0.58]	-1.06 [-2.79,0.67]	-1.00 [-2.72,0.73]
Inactive		-1.62 [-3.62,0.39]	-0.83 [-2.66,1.00]	-0.78 [-2.60,1.05]
Retired		-6.31*** [-8.83,-3.79]	-5.27*** [-7.56,-2.97]	-5.21*** [-7.49,-2.92]
Body mass index (centred on 28.2)			0.58*** [0.51,0.66]	0.58*** [0.51,0.66]
Diabetes Mellitus			1.05 [-0.37,2.47]	1.05 [-0.36,2.47]

	Model 1	Model 2	Model 3	Model 4a
		Coef (95% CI)		
Family history of hypertension			2.61*** [1.82,3.40]	2.61*** [1.82,3.41]

Table A8. 20 (cont.) Two-level random intercept model for DBP with predictor variables 2010. Models 1 to 4a (scale-method effective)

	Model 1	Model 2	Model 3	Model 4a
		Coef (95% CI)		
Smoking				
Never			Ref	Ref
Past			-0.93 [-1.96,0.09]	-0.94 [-1.97,0.08]
Current			-0.93* [-1.76,-0.09]	-0.93* [-1.76,-0.10]
Physical Activity				
3 or more times			Ref	Ref
Less than 3 times			-0.04 [-1.94,1.86]	-0.01 [-1.91,1.89]
None			0.96 [-0.59,2.50]	0.99 [-0.56,2.53]
District Level variables				
Overcrowding index[1]				-3.36 [-8.84,2.11]
District-level variance (SE)	0.97 (0.71)	1.18 (0.82)	1.21 (0.74)	1.05 (0.69)
% of total variance (partition)				
Individual level (%)	99.99	98.98	98.8	98.99
District level (%)	0.01	1.02	1.20	1.01
% change in district-level var	-	-21.6	-2.50	-13.22
Wald test p-value	-	< 0.01	< 0.01	0.23

* p<0.05, ** p<0.01, *** p<0.001. (1) Overcrowding: as a continuous variable.

Table A8. 21: Two-level random intercept model for DBP with predictor variables 2010. Models 4b to 4e (scale-method effective)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Individual-level variables				
Sex				
Male	Ref	Ref	Ref	Ref
Female	-5.37*** [-6.35,-4.39]	-5.37*** [-6.34,-4.39]	-5.36*** [-6.34,-4.38]	-5.39*** [-6.37,-4.40]
Age (centred on 48)	0.21*** [0.18,0.25]	0.21*** [0.18,0.25]	0.21*** [0.18,0.25]	0.21*** [0.18,0.25]
Marital status				
Married/cohabiting	Ref	Ref	Ref	Ref
Single	0.04 [-0.98,1.05]	0.01 [-1.00,1.02]	0.03 [-0.99,1.04]	0.03 [-0.98,1.04]
Divorced/separated/widowed	0.27 [-1.02,1.57]	0.21 [-1.09,1.51]	0.26 [-1.03,1.55]	0.27 [-1.02,1.56]
Place of residence				
Urban	Ref	Ref	Ref	Ref
Rural	-0.66 [-1.86,0.53]	-0.36 [-1.59,0.88]	-0.48 [-1.71,0.75]	-0.50 [-1.68,0.67]
Education				
Higher	Ref	Ref	Ref	Ref
Intermediate	-0.29 [-1.39,0.80]	-0.21 [-1.28,0.86]	-0.26 [-1.34,0.82]	-0.28 [-1.36,0.81]
Low	-1.34 [-2.87,0.20]	-1.16 [-2.64,0.32]	-1.26 [-2.75,0.24]	-1.27 [-2.78,0.24]
Assets-based SEP				
High	Ref	Ref	Ref	Ref
Middle	-0.19 [-1.10,0.71]	-0.17 [-1.07,0.73]	-0.19 [-1.09,0.72]	-0.15 [-1.06,0.75]
Low	-0.80 [-2.21,0.62]	-0.76 [-2.17,0.65]	-0.76 [-2.18,0.66]	-0.74 [-2.18,0.69]
Occupational social class				
Higher worker	Ref	Ref	Ref	Ref
Intermediate	-0.87 [-2.59,0.86]	-0.87 [-2.58,0.84]	-0.93 [-2.67,0.81]	-0.88 [-2.59,0.83]
Routine and manual	-0.18 [-2.03,1.67]	-0.11 [-1.94,1.73]	-0.19 [-2.05,1.67]	-0.17 [-2.01,1.66]
Homemaker	-1.14 [-2.87,0.59]	-1.07 [-2.80,0.65]	-1.17 [-2.91,0.58]	-1.12 [-2.84,0.60]
Inactive	-0.88 [-2.72,0.96]	-0.85 [-2.67,0.98]	-0.90 [-2.73,0.93]	-0.87 [-2.69,0.95]
Retired	-5.30*** [-7.60,-3.00]	-5.30*** [-7.59,-3.01]	-5.35*** [-7.66,-3.04]	-5.35*** [-7.63,-3.07]
Body mass index (centred on 28.2)	0.58*** [0.50,0.66]	0.58*** [0.50,0.66]	0.58*** [0.50,0.66]	0.58*** [0.50,0.66]
Diabetes Mellitus	1.06 [-0.37,2.48]	1.05 [-0.37,2.47]	1.05 [-0.37,2.47]	1.04 [-0.39,2.46]
Family history of hypertension	2.60*** [1.81,3.39]	2.57*** [1.77,3.37]	2.60*** [1.81,3.39]	2.58*** [1.79,3.38]

Table A8. 21 (cont.) Two-level random intercept model for DBP with predictor variables 2010. Models 4b to 4e (scale-method effective)

	Model 4b	Model 4c	Model 4d	Model 4e
	Coef (95% CI)			
Smoking				
Never	Ref	Ref	Ref	Ref
Past	-0.91 [-1.93,0.12]	-0.93 [-1.96,0.09]	-0.92 [-1.94,0.11]	-0.93 [-1.96,0.10]
Current	-0.88* [-1.72,-0.05]	-0.93* [-1.76,-0.09]	-0.90* [-1.74,-0.07]	-0.90* [-1.73,-0.06]
Physical Activity				
3 or more times	Ref	Ref	Ref	Ref
Less than 3 times	-0.08 [-1.99,1.83]	-0.01 [-1.91,1.89]	-0.07 [-1.99,1.85]	-0.01 [-1.91,1.89]
None	0.93 [-0.61,2.48]	0.98 [-0.57,2.52]	0.93 [-0.63,2.49]	0.99 [-0.54,2.53]
District Level variables				
Schooling (in years)[1]	-0.24 [-0.57,0.09]			
Unemployment [2]		0.08 [-0.04,0.21]		
Income (mean)[3]			-0.07 [-0.19,0.05]	
Deprivation index				
Least deprived quintile				Ref
2 quintile				0.90 [-0.72,2.51]
3 quintile				0.10 [-1.22,1.42]
4 quintile				1.03 [-0.34,2.39]
Most deprived				0.79 [-0.47,2.05]
p for trend deprivation index				*0.26*
District-level variance (SE)	1.02 (0.72)	1.10 (0.72)	1.14 (0.73)	1.00
% of total variance (partition)				
Individual level (%)	99.02	98.94	98.89	99.03
District level (%)	0.98	1.06	1.11	0.97
% change in district-level var	-15.70	-9.09	-5.79	-17.36
Wald test p-value	0.16	0.21	0.28	0.50

* p<0.05, ** p<0.01, *** p<0.001. (1) Schooling: in years as as an ordinal variable; (2) Unemployment: rate as a continuous variable; (3) Income: mean as a continuous variable.