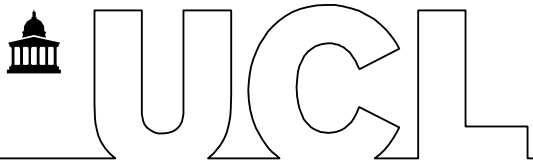

Marriage and physical capability at mid to later life

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Declaration

I, Natasha Wood 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

Research has shown that married men and women have better physical and psychological health and greater longevity than their unmarried counterparts. However, the past 50 years have witnessed changes in the marriage and divorce rates, resulting in more people at older ages who are unmarried or with varied relationship histories. Given the strong association between marriage and health there could potentially be more people at older ages in poorer health, which may be particularly detrimental given the ageing population. Whilst there is much research looking at marriage and physical and psychological health there is little on marriage and physical capability. Physical capability is the capacity to perform the physical tasks of daily living and is predictive of mortality and future social care use.

This PhD investigates the relationship between marriage and physical capability at mid to later life using two measures – grip strength and walking speed – from two nationally representative datasets of people aged 50 years and over in England and the USA. Cross-sectional associations between marriage and physical capability are investigated in a comparative analysis between England and the USA, and longitudinal associations through examining changes in walking speed over a ten year period in England. A descriptive analysis of early life circumstances and its association with entry into and exit out of marriage in England and the USA is also carried out.

Findings show that married people had both higher levels of current physical capability and a slower decline in physical capability over time than their unmarried counterparts. Much of the "marriage advantage" is explained by their greater wealth, but there were some unexplained associations, particularly among widowed men. There were few gender and country differences in the association.

The results of this thesis suggest that marriage is important for maintaining physical capability for people at mid to later life in England and the USA.

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Finally, an extra special thanks to my husband, Marc, for riding the highs and lows of my PhD with me and providing much needed social support, both instrumental and emotional, during the more challenging times. We got married during this PhD and Marc feared he was a participant in an extreme ethnography, whilst I would like to add that he wasn't, he is right about one thing; we really are better together.

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List of abbreviations

ADLs	Activities of daily living
AHEAD	Asset and Health Dynamics among the Oldest Old
BHPS	British Household Panel Study
BMI	Body mass index
CAPI	Computer Assisted Personal Interviewing
CATI	Computer Assisted Telephone Interviewing
CES-D	Centre for Epidemiological Studies Depression score
CVD	Cardio-vascular disease
ELSA	English Longitudinal Study of Ageing
FIML	Full information maximum likelihood
HPA	Hypothalamic-pituitary-adrenal axis
HRS	Health and Retirement Study
HSE	Health Survey for England
kg/m	Grip strength - kilograms divided by height in metres
m/s	Walking speed - metres per second
NCDS	National Child Development Study
NHIS	National Health Interview Survey
NIA	US National Institute of Aging
NSHD	National Survey of Health and Development
ONS	UK Office for National Statistics
SE	Standard error
SEP	Socio-economic position
SHARE	Survey of Health, Ageing and Retirement in Europe
SOC	Standard occupational classification
WHO	World Health Organisation

Chapter 1: Introduction

Since the 19th century research has consistently shown that those who are married live longer and report better physical and psychological health than their unmarried counterparts (Waite and Gallagher, 2000). This has been termed the "marriage advantage" (Farr, 1858). However, whilst there is a wealth of evidence showing a consistent association between marriage and physical and psychological health, there is much less evidence investigating the effects of marriage on indicators of healthy ageing, including physical capability.

The aim of this thesis is to investigate whether marriage is beneficial to physical capability at mid to later life, as it has shown to be for health, and whether the association is modified by gender and by national context through cross national comparative analysis of England and the USA.

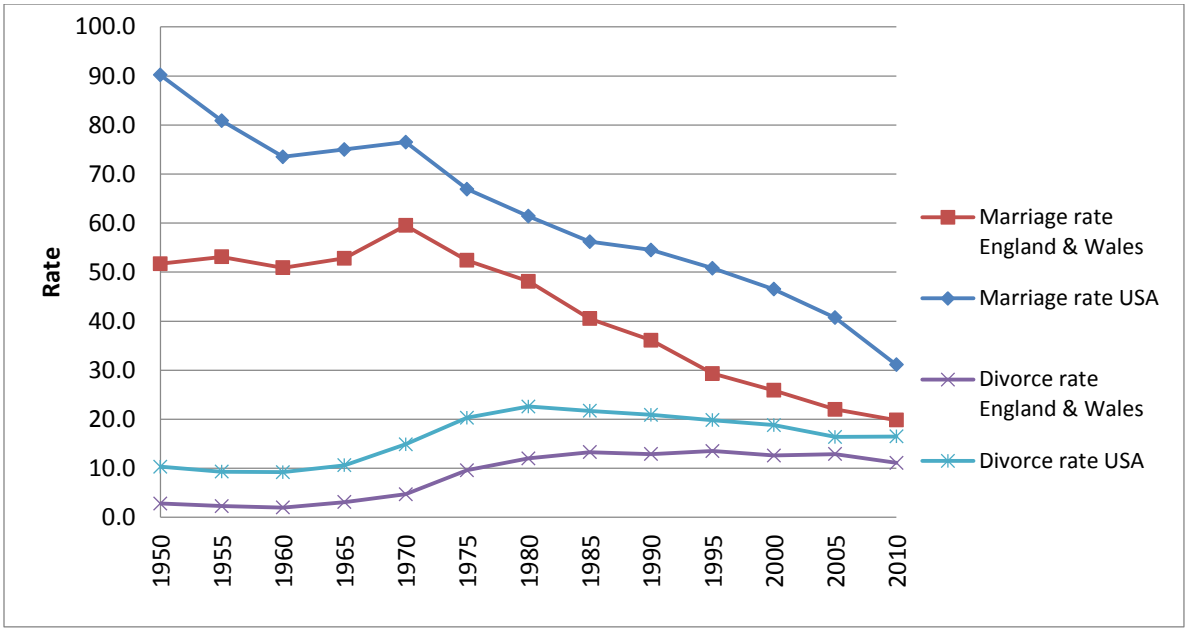
1.1 Marriage

Marriage can be considered to be one of the most important close personal relationships. In most societies it is a legally binding relationship, which confers many legal benefits as well as responsibilities. Marriage has existed for many centuries (Coontz, 2006), however, over the course of the latter half of the 20th century it has experienced a transformation in many developed countries.

1.1.1 The historical context

Over the last 40 to 50 years marriage patterns have changed considerably. From the 1970s onwards there was a decline in the marriage rate in both England and the USA, but particularly in the USA. In 1950, 51.7 women per 1,000 of the unmarried population got married in England and Wales and 90.2 women per 1,000 in the USA[1]. Thirty years later this has fallen to 48 women per 1,000 of the unmarried population in England and Wales and 61.4 women in the USA (Office for National Statistics; US Centers for Disease Control and Prevention) (as shown in Figure 1.1). The decline in the marriage rate was accompanied by an increase in the prevalence of divorce. In 1950 only 2.8 women per 1,000 of the female married population in England and Wales got divorced and in the USA the corresponding figure was 10.3 women per 1,000 of the female married population, but by 1980 this had quadrupled to 12 women per 1,000 of the female married population in England and Wales and more than doubled to 22.6 among women in the USA (Office for National Statistics; US Centers for Disease Control and Prevention).

[1] Figures for women only are presented here as comparable figures for men in the USA were not available.



Marriage rate per 1,000 unmarried population aged 16+ (England & Wales) 15+ (USA). Divorce rate per 1,000 married population
Source: Office for National Statistics (Eng & Wales); Centers for Disease Control & Prevention (USA)

Figure 1.1: Marriage and divorce rates among women in England & Wales and the USA, 1950 to 2010

The decline in the proportions marrying was also accompanied by a delay in entry into marriage. In 1970 the median age of first marriage was 23.2 years for men and 21.3 years for women in England and Wales and 22.5 years for men and 20.6 years for women in the USA, by 1990 this had risen to 26.1 years for men and 24.3 years for women in England and Wales and 26.1 years for men and 23.9 years for women in the USA. In 2009 the rise continued to 30.8 years for men and 28.9 years for women in England and Wales and 28.1 years for men and 25.9 years for women in the USA (Office for National Statistics; US Centers for Disease Control and Prevention).

Cohabitation

Whilst there was a decline and a delay in entry into marriage there was also a rise in the numbers cohabiting. In the 1950s and 1960s cohabitation was still a relatively rare phenomenon and it was either reserved for the poorest members of society who didn't have sufficient economic resources to sustain a marriage, or for those who had previously married but couldn't afford to divorce their estranged spouse, or for those more nonconformist members of society (Bumpass et al., 1991b). Estimates from the British National Survey of Health and Development (NSHD) showed that in the 1960s only 5% had cohabited, but from the 1970s onwards the numbers cohabiting grew and data from the 1958 National Child Development Study (NCDS) showed that by 1981, 19% of women and 14% of men had cohabited (Kiernan, 1988a). By the 1990s cohabitation was ubiquitous in Britain with 70% of never married women reported to have cohabited (Lewis, 2001). Cohabitation was no longer confined to the most disadvantaged members of society, but instead was embraced by all

sections of society. Cohabitation during this period was particularly prevalent among the younger age groups, as it was seen as a precursor to marriage or a "trial marriage", a period where couples tested whether they were compatible prior to turning their relationship into legally binding matrimony. Consequently, cohabitation was generally short lived, on average lasting two years (Cherlin, 2009), either ending in relationship break down or in marriage. Since the late 20th century though attitudes towards cohabitation have changed further and it has started to be viewed as an alternative to marriage (Kiernan, 2001) (Cherlin, 2004). In some European countries, notably Sweden and Denmark, cohabitation has now become effectively indistinct from marriage with children being raised either within marriage or a cohabiting relationship. Kiernan proposed that there were three stages in a society's acceptance of cohabitation. In stage one cohabitation is on the fringes of society for those who were too poor to marry, or those who were ideologically opposed to marriage (this would have been Britain and the USA in the 1950s and the first half of the 1960s). Stage two is when cohabitation is accepted as a testing ground for marriage (Britain and the USA in the 1970s and 1980s). In stage 3 it becomes an alternative to marriage, (where Britain and the USA are at the moment), and at stage four it is indistinguishable from marriage (Kiernan, 2002).

Explanations for the change in the rates of marriage and divorce

Why was there such a substantial change in the marriage and cohabitation patterns and an increase in divorce during the latter half of the 20th century? A number of simultaneous interlinked events which took place in the late 1960s and 70s have been cited as causes for the demographic shifts.

The 1970s witnessed a period of economic stagnation and a decline in the manufacturing industry in both England and the USA (Lee and Payne, 2010), which traditionally provided jobs for men, leading to higher levels of male unemployment. Male employment, during this period, was normally a prerequisite for entry into marriage, as it was traditionally the male role to provide the economic resources for the family (Cherlin, 2009). Lower rates of male employment therefore resulted in either a postponement of entry into marriage, or an abstinence of marriage altogether.

Whilst there were fewer jobs in traditional "male" industries there was an increase in employment opportunities in the service sector, which women began to take up, particularly married women with children who found the part time hours suitable (Campbell and Wright, 2010). The 1970s also saw an expansion of full-time education in England and Wales and the school leaving age rose from 15 to 16 years in 1972. Completing full time education was also a prerequisite for entry into marriage therefore the extension of compulsory education would have led to a rise in the age of first marriage, or for women in particular, coupled with the expanding employment

opportunities, to have the option of delaying marriage to pursue their education and career aspirations.

The expansion of educational and employment opportunities for women not only affected the numbers entering marriage but it also changed the institution of marriage. In the immediate post-war period the "breadwinner family" was the norm with its prescribed gender roles; husbands provided the economic resources and wives the housework, emotional support and care. During the 1970s, with the increase in female education and employment, the traditional "breadwinner family" started to erode and began to be replaced with the "dual earner family" (Coontz, 2006). Marriage therefore became less of an economic necessity, for women, and instead more of a source of personal fulfilment and happiness (Coontz, 2006). There were other changes underway during this time which also altered the shape of marriage. There was a growth in the ideas of individualism and people were encouraged to retain their own identity within their marriage (Cherlin, 2004) (Giddens, 1993) (Beck and Beck-Gernsheim, 2009). Similarly, the rise of feminism at this time questioned the norms surrounding the roles of women in society and particularly within the home. The contraceptive pill was made available in 1969 in Britain and in 1972 in the USA, whilst abortions were legalised in Britain in 1967 and in the USA in the early 1970s, both of these changes freed women from the constraints of constant childbearing so that they were able to pursue other interests away from the home, such as a career. The pill also separated sex from marriage and has been viewed as a cause of the increase in unmarried cohabitation at this time (Kiernan, 1988a) (Christensen, 2012).

In his theory of the *gains to marriage* Gary Becker cited the expansion of female education and employment and the subsequent move away from the "breadwinner family" as the reason for the decline in marriage and the increase in divorce during the 1970s onwards (Becker, 1981). Becker adapted trade theory to marriage and suggested that prior to the 1970s single men and women had different specialisations which they traded; men traded in economic security and women in domesticity. In the "breadwinner family" both had something to gain from marriage; men gained domestic and childrearing provision and women gained economic security. However, with the rise in female employment and the move from the "breadwinner family" to the "dual earner family", along with technological improvements in domestic chores, there were fewer gains to marriage for both men and women. Women were now able to provide economically for themselves whilst men were able to perform domestic chores with some ease. Therefore, people were more able to forego marriage and more likely to divorce if their marriage was not providing the personal happiness and fulfilment that was now expected. Becker's theory has been criticised, largely because there is little empirical evidence showing that women's increase in educational attainment and in employment

led to a decline in marriage formation, although it did have an effect on delaying entry into marriage (Oppenheimer, 1997).

Given the context of the 1960s and 1970s it's easy to understand why there were such great shifts in the attitudes and behaviours towards marriage, divorce and cohabitation, which began in the 1970s and gathered pace in the remainder of the 20th century.

1.1.2 Legislative changes

Along with changing divorce rates and attitudes towards marriage and cohabitation there were also changes in legislation surrounding marriage and divorce. Table 1.1 details the key legislative changes on marriage and divorce in England and the USA. In the USA divorce is legislated at the state level (and to summarise legislation at a state level would go beyond the scope of this thesis), which is why there appear to be fewer legislative changes in the USA. The greatest change to the marriage and divorce laws occurred with the introduction of the "no fault" divorce, introduced in 1969 in Britain (in the Divorce Reform Act) and in 1970 in the USA (first adopted by the state of California in 1970). The divorce reform legislation made divorces much easier to obtain, removing the need for either party to evidence blame. Some have cited the legislative changes as a cause of the increase in divorce in the 1970s, as the divorce rate did rise dramatically after these acts were passed, but others have seen them as a consequence of an already increasing divorce rate (Coontz, 2006).

Table 1.1: Marriage and divorce legislation in England and the USA in the 20th and 21st centuries

Period	England and Wales	USA
1920s	Matrimonial Causes Act 1923: enabled either spouse to petition the court for divorce on the grounds of adultery. Prior to the 1923 act only men could petition the court due to a wife's adultery which had been decreed in the Matrimonial Causes Act of 1857.	
1930s	Matrimonial Causes Act 1937: extended the grounds for divorce from just adultery to also include cruelty, desertion and incurable insanity. A petition for divorce could not be sought in the first three years of marriage.	
1950s	Royal Commission on Marriage and Divorce, 1951 – 1955: was set up in response to calls to reform the divorce laws, however, the Royal Commission recommended no changes to the legislation.	.
1960s	Divorce Reform Act 1969: removed fault of either party from the legislation and allowed a divorce to be granted on the grounds of "irretrievable breakdown" as well as adultery, unreasonable behaviour and desertion. Divorce could be granted by mutual consent if the couple had been separated for 2 or more years or unilaterally if separated for 5 or more years.	Interracial marriages: In 1967 the Supreme Court declared that the ban on interracial marriage was unconstitutional after the case of *Loving v Virginia***.**
1970s	The Divorce Reform Act of 1969 was consolidated into the Matrimonial Causes Act, 1973.	Uniform Marriage and Divorce Act 1970: was adopted firstly in California. By 1983 every state bar South Dakota and New York had adopted no fault divorce. South Dakota adopted no fault divorce in 1985 and New York state in 2010. The divorce law lifted the requirement that one spouse had to be at fault and instead granted divorce on the grounds of "irreconcilable differences". Divorce could be granted within a year of marriage.
1980s	In 1984 the bar on divorcing before three years of marriage was lifted to one year.	
1990s	Family Law Act 1996: Anyone petitioning for a divorce would have to attend an informal meeting to discuss mediation and whether reconciliation could be reached.	Covenant Marriage 1997: In 1997 Louisiana passed legislation on Covenant Marriage whereby couples obtain pre-marital counselling and more restricted access to divorce than a traditional marriage. The covenant marriage was created in response to the concerns about the increasing divorce rates. The legislation was later adopted in Arizona and Arkansas
2000s	Civil Partnership Act, 2004: Allowed same-sex couples to enter into a civil partnership. Marriage Act, 2013 legalised same sex marriage in England and Wales	Civil unions between same sex couples legalised in the state of Vermont in 2000. The Supreme Court ruled that same sex marriages be legalised across all states after *Obergefell v Hodges*, 2015

1.1.3 A life course approach to marriage: marital history

A consequence of the changes in marriage, divorce and cohabitation over the last 50 years means more people are now entering older ages unmarried or having experienced varied relationship histories. Marital status captured at mid to later life does not always reflect previous relationships and experiences throughout the life course, instead marital history in combination with current marital status is a more accurate reflection of the overall experience of marriage up to mid and later life. Marital history takes a life course approach to marriage. The life course approach was developed to explain how certain circumstances, or risks, experienced earlier in the life course can affect physical health later on in the life course. The life course model proposed that the timing of particular events known as 'critical periods', and the sequence of and the accumulation of events experienced across the life course were key in explaining health variations at older ages (Ben-Shlomo and Kuh, 2002). A life course approach to marriage places emphasis on the timing of marital events within the life course, such as the age of entry into marriage and the age of transitions out of marriage, it also emphasises the sequence of marital transitions experienced as well as the number of marriages, and the accumulation of time spent in each marital status. In this thesis elements of marital history as well as current marital status will be considered.

1.2 Healthy ageing and physical capability

With an ageing population, promoting healthy ageing has become a focus of many governments in the developed world in order to try to minimise the burden of an increasing elderly population (Kuh, 2007). Healthy ageing, also known as successful ageing, has been defined as a low probability of disease and disability, high cognitive and physical functioning and active engagement with life at older ages (Kuh, 2014). A key aspect of healthy ageing is maintaining physical capability. Physical capability (which is often referred to as physical functioning) is the capacity to undertake the physical tasks of daily living necessary to maintain independence for the maximum period of time (Cooper, 2013). Loss of physical capability is not specific to a particular disease or condition (Kuh, 2007) (Guralnik and Ferrucci, 2003), but it does have prognostic value and it has shown to be predictive of subsequent disability (den Ouden et al., 2011), social care use, including entry into nursing home (Guralnik et al., 1994) and admission to hospital (Cawthon et al., 2009), and mortality (Cooper et al., 2010). Additionally, a person's quality of life at older ages can also be judged by their ability to maintain physical capability and independence (Guralnik et al., 1989).

Physical capability is conceptually different to disability. The World Health Organisation (WHO) in their *International Classifications of Functioning, Disability and Health* (ICF) defined functioning as referring to "all body functions, activities and participation", whilst disability was defined as

"impairments, activity limitations and restrictions on participation". Disability is the interaction between a person's ability and the features of society in which they live, whilst physical capability emphasises what someone is able to do (WHO, 2002).

1.2.1 Measures of physical capability

There are two main ways that physical capability is measured: through physical performance measures, or through self-reported measures. Physical performance measures are specific tasks which are carried out according to a standardised protocol. Tasks have been developed to measure strength, balance, coordination, flexibility and include how quickly someone is able to rise from a chair, their upper body strength, how long they can balance on one leg for and how fast they can walk a set distance. Two commonly used physical performance measures are grip strength and walking speed. Grip strength measures upper body strength, whilst walking speed measures balance, strength, speed and coordination. Both grip strength and walking speed have shown to be predictive of future disability and mortality (Rantanen et al., 1999) (Artaud et al., 2015) (Guralnik et al., 2000) and have also shown to have a high level of reproducibility, thus allowing physical capability to be measured accurately across time and across different study populations (Guralnik et al., 1989).

The more popular measures of physical capability which have been adopted, largely because they are cheap and easy to administer, are the self-reported measures. Self-reported measures include questions on activities of daily living (ADLs), which ask whether someone experiences any difficulties with a number of tasks necessary for daily living such as dressing oneself, walking across a room, bathing, or getting in and out of bed. There are also questions which measure mobility limitations including whether someone has difficulty with a number of mobility activities such as walking 100 yards, getting up from a chair or climbing several flights of stairs without resting. Self-reported measures assess a person's perception of what they are able to do within a home environment and any reported problems could be defined as a disability.

There is evidence to suggest that the physical performance measures of physical capability can yield a more objective reflection of physical capability than the self-reported measures and are more sensitive to changes in physical capability over time. This is because the measures are not based upon a person's own perception of their ability, which may be discordant with their actual ability (Guralnik et al., 1989), the measures are also not affected by the home environment, which may have been adapted to suit particular physical requirements, and because the tests tend to be measured on a continuous scale, rather than categorised into presence or absence of a particular physical difficulty.

While both the physical performance measures and the self-reported ADLs measure physical capability, it is recognised that they also measure distinct concepts (Reuben et al., 2004). ADLs measure disability, what someone is unable to do in their own environment, whilst the physical performance measures focus on what someone is able to do in a neutral setting, and do not specifically measure disability, but instead their capability.

1.3 Cross-national comparisons between England and the USA:

A large element of the research contained within this thesis comprises comparative analysis between England and the USA. Although there are many similarities between England and the USA with both sharing a similar culture, values and political and economic systems, there are also some notable differences which make cross-national comparisons useful between these two countries on this particular topic. Firstly, the USA has higher marriage and divorce rates than in England (as shown in Figure 1.1). Individuals in the USA are more likely to marry, marry at younger ages, and subsequently divorce than their counterparts in England. The number of entries into and exits out of marriage at a population level has been termed "marriage metabolism" (Schoen and Weinick, 1993) and the USA has the highest "marriage metabolism" out of all other Western nations (Cherlin, 2005). Another difference is in welfare regime. Although in Esping-Andersen's classification system both countries are classified as "liberal", where benefit provision is regressive and limited (Esping-Andersen, 1990), welfare in England is more universally available than in the USA. England provides mostly free at the point of use health care, longer entitlement to unemployment benefit, paid maternity and paternity leave and until 2013 universal child benefit. There are also differences in physical health between the two countries and research suggests that the US population has poorer physical health at older ages than England, irrespective of socio-economic position (SEP) (Banks et al., 2006). Further research has shown that the health disparity between the two countries may stretch across the life course as it was also observed at younger ages (Martinson et al., 2011). There is also emerging evidence showing that the US older population has higher rates of disability than in England (Wahrendorf et al., 2013) (Clarke and Smith, 2011).

These notable differences between England and the USA could mean altered associations between marriage and physical capability. For example, divorce is more prevalent and possibly more normative in the USA which could result in divorced people in the USA having relatively better physical capability than their counterparts in England. Alternatively, since welfare benefit to single parents is more generous in England than in the USA, divorced people in England may have relatively better physical capability than their counterparts in the USA. Comparative research between England and the USA could therefore further our understanding of the association between marriage and physical capability and whether it's modified by national context.

1.4 Structure of the thesis

This thesis is structured in the following format. In Chapter 2 the relevant literature will be reviewed, including the possible pathways linking marriage to physical capability. Also any gaps in the current evidence will be identified. Following on from the literature review, Chapter 3 details the conceptual model and the aims and objectives of this research. The methods used in this thesis are presented in Chapter 4. In Chapters 5, 6 and 7 the results of the analyses are presented. Chapter 5 covers the characteristics of the different marital statuses in England and the USA; Chapter 6 comprises the cross-sectional analysis of marital status and physical capability in England and the USA, whilst Chapter 7 looks at baseline marital status and subsequent changes in physical capability in England only. Chapter 8 presents a detailed discussion of the findings in light of the current evidence and methodological issues, policy implications and conclusions are also discussed.

Chapter 2: Literature Review

The aim of the literature review is to give context to the thesis, to critically assess the current knowledge on marriage and physical capability, and to identify the gaps in the literature and how this thesis aims to bridge some of these gaps. The first sections outline the literature which has investigated the direct link between marriage and physical capability and the subsequent sections review the evidence on the pathways which explain how marriage may be associated with physical capability.

2.1 Marriage and physical capability

Few studies have explored specifically the association between marriage and physical capability and the majority of those that have, have used the self-reported measures of physical limitations (measured through the ADLs) or disability as their outcome, with only a minority which have used the physical performance measures to assess physical capability.

2.1.1 Marital status and self-reported physical capability – cross-sectional evidence

There are a number of studies which have investigated the cross-sectional associations between marriage and self-reported physical capability at mid to later life. All have shown disparities in physical capability between those who were married and those who were unmarried with those who were married showing the best physical capability. Some studies also found variations in the association by gender, but only among those who were unmarried.

Two studies were identified which used marital status as the exposure and both studies used data from the USA. The first study used data from the first wave of the US Health and Retirement Study (HRS) (Pienta et al., 2000), outcomes were both self-reported measures of mobility and ADLs. The study found that among men and women aged 51 years and older those who were married reported the lowest number of physical limitations. Among those who were unmarried there was some variation in the association by gender and amongst men never married men reported the most limitations, whilst amongst women it was those who were divorced. These estimates were unadjusted and the analysis didn't explicitly differentiate between those who were in a first marriage and those in a subsequent marriage, although they did indirectly investigate this through looking at marital duration and physical capability. The study identified that those who had been in their current marriage for a longer period of time (20 or more years) were more likely to be in their first marriage whilst those who had been married for a shorter period of time were more likely to be in a subsequent marriage. The study also found that those who had been in marriages for 20 or more years had better self-reported mobility than those who had been in their current marriage for

a shorter period of time. This suggests that those who had remained in their first marriage reported better mobility than those in a subsequent marriage.

A later study which benefitted from a large sample size (*n*=819,640) through using 5% samples from the US Census (1980, 1990 and 2000) and the American Community Survey 2009 looked at disability by marital status among adults aged 45 to 63 years (Lin and Brown, 2012). Once adjusted for age, the prevalence of disability among the unmarried population was almost double what it was amongst those who were married (21.7% unmarried people reported a disability compared to 11.1% of those who were married). There was variation in the association by gender amongst those who were unmarried; among women widows were more likely to report having a disability whilst among men they too found that those who never married were more likely to report having a disability. Whilst the study used a very large representative sample the measure of disability used included self-reported cognitive as well as physical limitations.

These two studies which have looked at cross-sectional associations between marital status and physical capability have found that men and women who were married reported better physical capability than their unmarried counterparts, with some evidence that those who had remained in one marriage reported the best physical capability. Among those who were unmarried there was some gender variation and both studies found that never married men reported the poorest physical capability, but this was not apparent for never married women. Among women transitions out of marriage were associated with poorer physical capability.

Other studies have looked at both married and unmarried cohabitation combined, rather than marital status specifically, although among older ages the majority of those cohabiting were married. A study which used Australian cross-sectional data from two longitudinal studies, the Australian Longitudinal Study on Women's Health and the Health in Men Study, (Pachana et al., 2011) looked at cohabiting relationships amongst the oldest old (aged 82-87 years). They investigated the association between partnership and reporting limitations with ADLs. The study found that, after adjusting for chronic health conditions, unpartnered men were the most likely to report ADL limitations compared to partnered men and both partnered and unpartnered women, despite women reporting a higher number of chronic health conditions. However, as the main focus of the paper was cohabitation, rather than marital status, the findings didn't differentiate between the different marital statuses of those unpartnered men so couldn't determine whether unpartnered men who had previously been married had different levels of physical capability to those unpartnered men who had never been married. The study also used data which was collected via a postal questionnaire which may not be as accurate as data collected by a trained interviewer and also could be more prone to non-response and the potential bias this can introduce.

Two similar studies have investigated different living arrangements, which included marriage, and physical capability, both using data from the HRS. The first study used data from the first wave of the HRS to investigate whether current living arrangements at mid to later life were associated with current physical capability (Waite and Hughes, 1999) and the second study used waves 1 and 2 of the HRS and measured the same living arrangements at an earlier time point in 1992 (wave 1) and self-reported mobility limitations at a later time point, two years later in 1994 (wave 2) (Hughes and Waite, 2002). Six living arrangements were classified into, married living with spouse only, married living with spouse and children, married living with spouse and others, unmarried living with children, unmarried and living alone and unmarried living with others. The outcome was self-reported mobility. Both studies found that those who were married and either living with just their spouse or with their children as well reported the highest levels of physical capability, after adjusting for age, health conditions and long-term disability, household income and education. Unmarried people who were living with others reported the lowest levels of physical capability. There were no statistically significant gender differences in the association, although in the second study it was also found that unmarried women living alone had equally good physical capability as married women, which was not apparent for unmarried men. This could be due to too few numbers of men in some of the unmarried categories, as there was no significant gender interaction. Whilst these studies used nationally representative data from the HRS, the main drawback for the purpose of understanding marriage differences in physical capability, is that the focus was on living arrangements, rather than specifically marriage. The study treated those who were married and those who were unmarried as two homogenous groups not differentiating between the different marital statuses among those who were unmarried.

To summarise, cross-sectional studies which have looked at the relationship between cohabiting status or living arrangements and self-reported physical capability have found that those who were cohabiting had better physical capability than those who were unpartnered. There was some evidence of gender variations among those who were cohabiting with men who were unpartnered having poorer physical capability relative to unpartnered women (Pachana et al., 2011). When looking at living arrangements those who were married and either living on their own or with their children reported the best physical capability (Hughes and Waite, 2002).

2.1.2 Marital history and current self-reported physical capability

The studies discussed so far have all focussed on either current marital status, or current partnership status, or living arrangements. Two studies have been identified which have investigated marital history and current physical capability, one using data from the USA and the other using data from Britain. Using data from the first wave (1992) of the HRS, Hughes and Waite

(Hughes and Waite, 2009) looked at prior transitions out of marriage, durations spent married or unmarried and age at entry into first marriage and their association with physical capability, using the self-reported measure of mobility limitations (among other health outcomes). The paper found there to be a strong association between marital history and physical capability after adjusting for age, ethnicity, education and the presence of long-term limiting health conditions. There were few gender differences in the association. In particular, experiencing a prior transition out of marriage was associated with an increased number of mobility limitations, regardless of current marital status, with those who had remarried having poorer mobility than those who were continuously married. Among women those who have spent longer transitioned out of marriage reported more mobility limitations. The second study used pooled data from the first four waves of the British Household Panel Study (BHPS) (Bennett, 2006) to investigate the recency of marital transitions, among those aged 40 years and over, and physical capability using the number of reported ADLs. Those who experienced a divorce or widowhood during the first two years of the four year period were classified as newly divorced or newly widowed and their physical capability was compared to those who retained the same marital status during the period. The study found that those who were newly divorced during the study period were more likely to experience physical limitations compared to those who were continuously married, and those who had been divorced or widowed for longer periods of time, adjusting for age and gender. There were no significant variations by gender. These two papers give a useful insight into how marital history is associated with current levels of physical capability using nationally representative data. They both found that marital history was associated with current levels of physical capability; particularly that transitions out of marriage which occurred earlier in the life course affected current physical capability, although more recent transitions were more detrimental. Hughes and Waite were also able to investigate the physical capability of those who were in a subsequent marriage compared to those who had been continuously married. However, similarly to much of the evidence discussed so far, these studies have relied upon the self-assessed measures of physical capability.

2.1.3 Marital status and the physical performance measures – cross-sectional evidence

Only two studies have been identified which have explored the cross-sectional association between marriage and the physical performance based measures of physical capability. Both studies used nationally representative data from Europe. The first study used cross-sectional data from the British NSHD (Guralnik et al., 2009) to investigate the extent to which both marriage and parenting were associated with physical capability at age 53. Physical capability was measured using tests of grip strength, standing balance and chair rises which were summed to create an overall performance score ranging from 0 to 1. After adjusting for social class, employment status, educational

attainment and BMI, never married men had a lower physical capability score than ever married men with children. There was no such difference among women. Whilst the measure of marital status differentiated between those who were currently married, had previously been married and those who had never been married (as well as parental status), it didn't distinguish between those who were currently divorced and those who were widowed, it also didn't differentiate between those who had remained in one marriage and those who were now in a subsequent marriage. Also, whilst the study conducted cross-sectional analysis it was using data from a birth cohort study which, as with all longitudinal studies, has the potential for bias due to attrition of study members, either through refusal to participate or mortality. It could be that those who dropped out of the study prior to middle age differed in their marital status to those who remained, leading to distorted results.

The second study to use the physical performance measures of physical capability used cross-sectional pan-European data from the Survey of Health Ageing and Retirement in Europe (SHARE) (Clouston et al., 2014). The study measured physical capability using grip strength and lung function and found that those who were never married or were divorced had poorer physical capability than those who were married. The poorer physical capability of those who were divorced or never married remained after adjusting for socio-economic measures, health behaviours and social networks. Similarly to Guralnik *et al* the study found that never married men's physical capability was relatively more disadvantaged than never married women's. Whilst this study went further than Guralnik *et al* in using a more detailed measure of marital status distinguishing between those who were divorced and those who were widowed, it treated those who were currently married as a homogenous group, not differentiating between those who had been continually married throughout their lives and those who had experienced a prior transition out of marriage and were now remarried.

2.1.4 Trends in the association between marital status and physical capability

Whilst there is some evidence that overall rates in disability amongst the older population are declining (Freedman, 2003), there is also evidence that they are not declining at the same rate for people in all marital statuses. Two studies have looked at the association between marital status and rates of disability in the USA (measured through the self-reported ADLs), using cross-sectional time series data from the National Health Interview Survey (NHIS). The first study used annual data from 1992 to 2002 among those aged 70 years and older and found that the disparities in the trends of disability, measured by the self-rated ADLs, between those who were married and those who were unmarried widened during this period, which was due to married people disproportionally experiencing a decrease in their rate of disability (Schoeni et al., 2009). The study benefited from a

large nationally representative sample (the total sample size over the period was 172,227), but the measure of marriage was dichotomised into married or unmarried and did not look into whether all unmarried groups were experiencing a similar rate of disability over the 10 year period. The second study built further upon this research (Liu and Zhang, 2013) by using NHIS data from 1997 to 2010. The study differentiated between the unmarried statuses as well as ethnicity and gender and found that the gap in the rate of disability between those who were married and unmarried was not increasing for all unmarried groups and socio-economic status could not explain these trends. The odds of reporting an ADL limitation decreased during this period for widowed white men and women and divorced white women as it did for those who were married, but it didn't for never married white men and women and divorced men. There were no such differences among black men and women.

2.1.5 Marital status and subsequent changes in physical capability – longitudinal evidence

The cross-sectional evidence presented thus far would suggest that never entering into marriage is detrimental to physical capability, particularly for men. However, cross-sectional evidence only provides evidence at one point in time and these studies cannot determine whether marriage is protective of physical capability in the long-term, or the direction of the association. For this, longitudinal evidence is necessary.

Overall there is less longitudinal evidence on marital status and changes in subsequent physical capability than there is cross-sectional evidence, and again the vast majority of evidence has used the self-reported measures of physical capability, rather than the physical performance measures.

Only two studies were identified which investigated marital status and physical capability longitudinally. The first study by Goldman *et al* (Goldman et al., 1995) looked at physical capability over a six year period among the older US population (aged 70 years and older), who were disability free at baseline. Using two time points from the US Longitudinal Study of Ageing, in 1984 and the follow up in 1990, they measured reports of any physical limitations with ADLs and any work related limitations. After controlling for baseline health the study found marital status differentials in reporting one or more physical limitations 6 years later, particularly for men: widowed men had odds 1.8 times higher than married men of having a physical limitation. Divorced men and never married women had lower probabilities of having developed a physical limitation than married men and women respectively. There are some drawbacks with this study; the physical capability outcome used was binary and all those who reported one ADL or work related disability were deemed to be comparable to those with multiple ADL limitations, which is a crude measure of physical capability. Also similar to many of the studies reported in this review the exposure of

marital status didn't differentiate between those who were in a first marriage and those who were remarried. The study also only used two time points and therefore was unable to investigate progressive changes in physical capability over an extended period of time, only whether someone developed any physical limitations during the six year period.

The second study to use marital status as the exposure looked specifically at widowhood and subsequent physical capability among men over a ten year period, using cohort data from three European countries – Finland, the Netherlands and Italy (van den Brink et al., 2004). The study found that men who were widowed during the period developed more mobility limitations than men who remained married, with those who were more recent widowers being most likely to develop mobility limitations compared to those who had been widowed for longer than five years. The findings from this study are limited by the small sample size, as the sample only comprised a total of 736 men across three countries, additionally the sample was not nationally representative of those countries.

While the studies mentioned above were the only two studies identified which had looked at marital status and longitudinal changes in physical capability, a number of other studies were identified which used a broader exposure of either cohabitation or living arrangements, rather than marital status, at mid to later life and changes in physical capability over time. Data from two non-consecutive waves of the English Longitudinal Study of Ageing (ELSA) (Wave 1 in 2002-2003 and Wave 4 2008-2009) were used to investigate cohabitation and changes in physical capability. Physical capability was measured using both the self-reported ADLs and walking speed. The age adjusted analysis found that men and women who were cohabiting at baseline (most of whom were married) experienced improvements in their physical capability between Wave 1 and Wave 4 with a lower percentage reporting severe physical limitations (31% reported severe physical limitations in Wave 1 compared to 27% in Wave 4). During the same period, men who were not cohabiting reported an increase in physical limitations (in Wave 1, 54% reported no physical limitations but by Wave 4 this had reduced to 47%), but women who were not cohabiting experienced improvements in their physical capability (Zaninotto et al., 2010). Whilst this study only distinguished between those who were cohabiting and not cohabiting, a strength of this study is that the outcome combined both self-reported measures of physical capability and physical performance measures. The findings from this study are similar to those form a Danish study (Nilsson et al., 2008), which found that, after adjusting for baseline age, socio-economic status, mental health and social participation, men (but not women) who were not cohabiting were at higher risk of developing physical limitations during a four year period. However, partnerless men were no more at risk than cohabiting men of experiencing declines in physical capability over the period. Physical limitations

were measured by the Mobility Help scale which measures the number of mobility activities which can be performed without needing help.

Two studies looked at living arrangements and changes in physical capability among women. The first study (Sarwari et al., 1998) investigated living arrangements at baseline (classified as living with a spouse, living with others, living alone) and subsequent declines in physical capability over a 3 year period among 619 white women aged 65 years and older in Baltimore, USA, using ADLs as the measure of physical capability. The study found that women who were living alone and who were not severely impaired at baseline experienced a lower decline in physical capability over the 3 years than women living with a spouse. The study was limited by a small sample size derived from a specific region in the USA. However, a later study carried out similar analysis using data from the Nurses' Health Study, a cohort study of female nurses in the USA, to investigate the association between living arrangements and changes in physical capability over a four year period (Michael et al., 2001). The study used data when the participants were aged 60 to 72 years old and the living arrangement classification was the same as used in Sarwari *et al,* into living alone, living with spouse or living with others at baseline. Functional ability was measured using the Medical Outcomes Study Short-form 36 Health Survey (SF-36). After controlling for baseline age, education, marital status and health behaviours, as well as physical health at follow up, the study found that those women who lived alone had a similar risk of decline in physical capability as those women who lived with a spouse, whilst women who lived with others (who were not their spouse or partner) had the greatest risk of decline in physical capability. The study data were not nationally representative, although the sample size was large at 28,324 women, as it was restricted to women in a specific vocation who may have differing levels of physical capability to the national population.

2.1.6 Summary of literature on marriage and physical capability

To summarise the literature on marriage and physical capability, cross-sectional evidence covered in this review has shown that there are variations in physical capability by marital status. Overall those who were married or cohabiting had better physical capability and lower levels of disability than those who were unmarried or not cohabiting (Pienta et al., 2000) (Pachana et al., 2011). This was apparent among both men and women. However, among those who were unmarried or not cohabiting there were some differences by gender. Studies which looked specifically at marital status differentials in physical capability have shown that never married men had poorer physical capability than married men (Pienta et al., 2000) (Guralnik et al., 2009). Among women there was no such consistent pattern, although a couple of studies found that unmarried women who were not cohabiting experienced either comparable or better physical capability in comparison to married women (Hughes and Waite, 2002). Evidence using marital history found that previous transitions

out of marriage, and in particular more recent transitions, were associated with reduced levels of physical capability (Hughes and Waite, 2009) (Bennett, 2006) (van den Brink et al., 2004).

Cross-sectional trends in physical capability using data from the USA show that despite an overall reduction in the decline in physical capability at older ages over the last 20 years married people have disproportionately experienced the least declines in physical capability compared to those who were unmarried (Schoeni et al., 2009). There were differences in the trends in physical capability among those who were unmarried and never married men and women, and divorced men experienced the greatest decline in physical capability during this period (Liu and Zhang, 2013).

Longitudinal evidence on marriage or cohabiting partnerships and changes in physical capability over time have found that those who were either married or cohabiting also had slower declines in physical capability over time than their unmarried counterparts (Zaninotto et al., 2010). Again there were some gender differences with evidence that unmarried or non-cohabiting men experienced greater declines in physical capability compared to married or cohabiting men, which wasn't apparent among women. On the contrary, some evidence showed that unmarried women who lived alone had comparable declines in physical capability to married women (Michael et al., 2001).

Overall the existing evidence has shown that marriage is associated with both better current and longer term physical capability. There is evidence of some gender differences in the association. Marriage, or partnerships more generally, seem to protect men's physical capability more than women's, as never married or unpartnered men have been shown to have poorer physical capability in a number of studies (Guralnik et al., 2009) (Pienta et al., 2000) (Zaninotto et al., 2010). However there are gaps in the current knowledge on marriage and physical capability which will be addressed at the end of this chapter in Section 2.7. The following section will look at the evidence relating to marriage and health outcomes other than physical capability.

2.2 Marriage and other health outcomes

Although there is little evidence focussing on marriage and physical capability there is much evidence which has explored the association with two other health outcomes: physical health and psychological morbidity; both of which have also been shown to be associated with physical capability.

2.2.1 Marriage and physical health

The association between marriage and physical health has a long history dating back to the 19th century when William Farr observed that married people in France lived longer than their unmarried counterparts (Farr, 1858). Studies which have investigated the association between marriage and

physical health have used a range of different health outcomes including self-rated health, reports of chronic health conditions and mortality. There is far too much evidence to detail in this literature review so the focus in this section will be on providing an overview of the key findings.

Cross-sectional evidence

Cross-sectional evidence, from a number of reviews, show that those who were married had better self-rated health and fewer health conditions than their unmarried counterparts (Ross et al., 1990) (Waite and Gallagher, 2000) (Carr and Springer, 2010) (Robards et al., 2012). As well as better health a systematic review on marriage and mortality at older ages (Manzoli et al., 2007), which pooled data from 53 separate studies conducted in various countries, found that overall married people had a 22% lower relative risk of mortality than their unmarried counterparts.

There was mixed cross-sectional evidence on whether marriage confers equal health benefits for men and women. Some studies find that men's health benefits more from marriage than women's (Gove, 1973) (Rogers, 1995) (Ploubidis et al., 2015), whilst other research shows marriage to be equally beneficial to both men and women (Manzoli et al., 2007) (Hughes and Waite, 2009). There was consistent evidence of gender modification among those who never marry. Never married women in an Australian sample of women aged 70 years and older, reported better health than other women (Cwikel et al., 2006), whilst a study in Scotland showed higher prevalence of cardiovascular disease (CVD) among never married men compared to other men, where this was not apparent among women (Molloy et al., 2009). It is thought that never married women have relatively better health than their male counterparts as they tend to have a higher SEP, whilst conversely, never married men tend to have a lower SEP (Cwikel et al., 2006) (Kiernan, 1988b).

There were also found to be some differences in the association between marriage and health with age, which could be because the importance of personal relationships increases with age (Carstensen et al., 1999). Therefore it would be expected that the marriage advantage in health becomes greater with age. There is both evidence to support and refute this. Williams and Umberson found that the detrimental effects of divorce on self-rated health for men only occurred at older ages and at younger ages those who divorced experienced improvements in health (Williams and Umberson, 2004). Other evidence though has shown that the association between marriage and health diminishes with age (Gove, 1973).

Given the changes in the last 50 years in the proportions marrying as well as the social context and the meaning of marriage (Coontz, 2006), it's possible that the association between marriage and health may have also changed. Two studies investigated whether there were any cohort effects in the association between marriage and health through looking at trends over time in the association

between marital status and self-rated health in the USA. One study (Liu and Umberson, 2008) found that the disparity in health between those who were never married and those who were married was decreasing due to the improvement in the health of those who were never married, but at the same time the gap between those who were previously married and those who were currently married was widening. Similarly, a later study (Liu, 2012) found, contrary to what was expected given the increase in divorce, that divorce seemed to have a greater negative impact on the health of younger cohorts, and widowhood more on older cohorts, although the study relied on small cohort sizes which limited the power of the analysis.

Marital history and physical health

There is a growing body of evidence on the association between marital status across the life course, using marital or partnership histories, and health using various outcomes including self-rated health, mortality, certain health conditions and objective biomarkers. Much of the research has been conducted on the US HRS, but there is also evidence from European samples. Overall, studies using marital histories have found that previous transitions out of marriage through divorce or widowhood were detrimental to health (measured through the number of chronic health conditions and self-rated health) and mortality at older ages, irrespective of current marital status. A longer duration spent married was also associated with better health and lower mortality (Dupre and Meadows, 2007) (Dupre et al., 2009) (Grundy and Tomassini, 2010) (Henretta, 2010) (Brockmann and Klein, 2004). Timing of marriage was important as early entry into marriage was associated with poorer health and higher odds of mortality, largely because those who entered marriage later had a more advantaged SEP (Cherlin, 2005) (Hughes and Waite, 2009). There were some gender differences in the associations as a couple of studies found that entry into widowhood was more detrimental to men's health and mortality whilst divorce was more detrimental to women's (Dupre and Meadows, 2007) (Grundy and Tomassini, 2010).

Although marriage has been shown to be associated with better self-rated health, number of chronic health conditions and mortality, this was not entirely the case with CVD, which was measured through self-reports and biomarkers. Being married and having spent a longer duration married was associated with a higher risk of developing CVD for men, whilst transitions out of marriage didn't adversely affect men's risk of CVD, which was the reverse association to what other studies had found when looking at other physical health outcomes (Ploubidis et al., 2015). Among women the same association was seen as for the other measures of physical health; married women had lower risk of CVD than their unmarried counterparts, while the transitions out of marriage were associated with an increase in their risk of CVD (Zhang, 2006) (McFarland et al., 2013).

2.2.2 Physical health and physical capability

The presence of chronic physical health conditions were associated with reduced physical capability (Guralnik et al., 1993) (Newman et al., 2003) (Stuck et al., 1999). There was a dose-response relationship with a greater number of reported chronic conditions being associated with greater decreases in physical capability (Wolff et al., 2005).

Whilst the literature provides consistent evidence of an association between physical capability and physical health, what is less clear is the direction of causality. A systematic review which included evidence from 24 separate studies explored the association using the measures of physical performance (grip strength, walking speed, chair rises and balance tests) and a range of subsequent physical health outcomes. The review found some evidence that physical capability can predict future fractures, CVD, hospitalisation and institutionalisation, but the evidence was not consistent for other health outcomes (Cooper et al., 2011b). The findings from the review were consistent with more recent research which showed that physical capability measured earlier in the life course can predict the risk of CVD in middle age, among men. Using Swedish conscription data, which contained information on muscle strength measured at 18 years old, it was found that men who had high muscle strength at 18 years of age had a lower risk of CVD in middle age compared to men who had weaker muscle strength (Timpka et al., 2014). Overall, it is likely that the association between physical health and physical capability is bi-directional with poor physical capability being a marker for poorer physical health and vice versa.

2.2.3 Marriage and psychological morbidity

As well as being associated with physical health, marriage has also consistently been shown to be associated with better psychological health. Married men and women exhibited consistently lower levels of psychological morbidity than their unmarried counterparts, and transitions out of marriage in particular were associated with higher levels of psychological morbidity (Ross et al., 1990) (Waite and Gallagher, 2000). Much of the research on marriage and psychological morbidity has used longitudinal data to evaluate whether transitions out of marriage were associated with changes in psychological health.

Cross-sectional and longitudinal evidence

A meta-analysis of 32 cross-sectional and longitudinal studies (Yan et al., 2011) assessed the relationship between marital status and the risk of depression among those aged 55 years and older. After pooling the longitudinal studies the meta-analysis found that married people had a significantly lower risk of depression than those who were unmarried. The meta-analysis compared the risk of depression among the different unmarried statuses and found that those who had previously

transitioned out of marriage through divorce or widowhood reported the highest levels of depression. Interestingly the analysis found that never married and married people had a similar risk of depression, which would suggest that it's the transitions out of marriage which are detrimental to psychological health. A more recent study in Europe using two waves of SHARE showed that recently widowed men and women aged 50 years and older had significantly more depressive symptoms than those who had remained continuously married. There were variations in the strength of the association by country with those who experienced widowhood in Southern European countries more likely to be depressed and those in Scandinavian countries least likely, the author surmised that this could be due to different levels of welfare provision, or because of different cultural gender roles and expectations between the two regions (Schaan, 2013).

Studies which have investigated marriage and the effect of marital transitions across all age groups have also shown that those who transitioned out of marriage, especially those who had transitioned out of marriage more recently, had the highest levels of psychological morbidity (Willitts et al., 2004) (Monden et al., 2015). There is also evidence that there is some modification in the association by type of transition out of marriage. Two notable studies have used longitudinal evidence from the BHPS. The first study used nine waves of the BHPS (Wade and Pevalin, 2004) and compared psychological morbidity before and after a marital transition and whether this varied by the type of transition. All those who transitioned out of marriage reported a higher prevalence of poor psychological well-being after the transition, but for those who were separated or divorced poor psychological morbidity also preceded the transition and endured for longer afterwards, whilst those who became widowed poor psychological morbidity was only observed during the period surrounding the death. This was substantiated by a later study which focussed on partnership splits, including non-marital relationships, (Blekesaune, 2008), which also found that psychological well-being was poorer a few years before and after a divorce or a relationship split.

There is evidence of modification in the association between divorce or partnership breakdown and psychological morbidity by whether children were present in the household and two studies found that the effect of divorce on psychological morbidity was much stronger if there were dependent children present compared to those divorces where there were no dependent children (Williams and Dunne-Bryant, 2006) (Tavares and Aassve, 2013).

Having established the negative effect on psychological health of divorce and widowhood the question remains whether remarriage ameliorates the negative effect of divorce or widowhood on psychological health. There is limited evidence on the psychological health of those who are in a subsequent marriage, but evidence suggests that those who remarry do not experience the same high levels of psychological wellbeing as those who remain in their first marriage (Barrett, 2000), and

they also do not fare any better than those who remain unmarried. One study compared the incidence of depression among remarried men with men who remained divorced, using administrative data on anti-depressant medication usage, and found that remarriage was associated with an increased risk of depression compared to remaining divorced. This was hypothesised to be due to the additional strains in acquiring a step-family, or it could possibly be because remarried men may be more likely to seek medical help for their depression than unmarried men (Hiyoshi et al., 2015).

2.2.4 Psychological morbidity and physical capability

There are consistently observed associations between psychological morbidity and poor physical capability in middle and older ages, which have been demonstrated in two reviews (Schillerstrom et al., 2008) (Lenze et al., 2001). Most of the recent research in this area has used longitudinal analysis, in order to gauge the direction of the relationship using both the physical performance measures and the self-reported measures of physical capability (Cooper et al., 2011a) (Bromberger and di Scalea, 2009). Currently there is some debate about the direction of the relationship with some research suggesting that the relationship is bidirectional with psychological morbidity causing poor physical capability and vice versa (Demakakos et al., 2013) (Bromberger and di Scalea, 2009).

2.3 Explanations for the association between marital status, physical health, psychological morbidity and physical capability

Whilst the evidence presented so far indicates that those who are married have better physical and psychological health and physical capability there is much debate about the possible causes of the association. Three alternative theories have been proposed for the association between marriage and physical health:

Marriage protection or the social causation model: marriage protects health and reduces mortality through increased economic resources, improved health behaviours and social support.

Crisis model: suggests that the differentials in health between those who are married and those who are unmarried exist because of the stress surrounding a transition out of marriage which could lead to poorer health. In this model the health and physical capability of those who have never married and those who are married would be comparable.

Selection effects: those who are the healthiest physically and mentally and have the most economic resources are selected into marriage and remain in one stable marriage.

Evidence exists to support each of these theories: some reviews on marriage and physical health have suggested that marriage is protective of health (Waite and Gallagher, 2000) (Ross et al., 1990), whilst evidence from the USA found that marriage wasn't protective but transitions out of marriage were detrimental to self-rated health, thus providing support for the crisis theory (Williams and Umberson, 2004). Longitudinal evidence from Norway found marriage to retain those with the best mental health (Blekesaune and Barrett, 2005), which shows marriage to be selective. Few studies though have specifically investigated and been able to disentangle whether the "marriage advantage" is a product of selection, protection or the result of a crisis, largely due to the lack of complete life course data. However, in recent years the conclusions are that the health differentials are largely a combination of protection and selection into marriage (Carr and Springer, 2010). There is no evidence which has specifically investigated if any of these theories explain the association between marriage and physical capability, but it's probable, given the close association between health and physical capability, that these theories are also relevant.

In the following sections evidence will be presented, some of which, would suggest that marriage is protective through improving health behaviours, gaining increased economic resources and the provision of social support. This will be followed by evidence which supports the view that marriage is selective by looking at the associations between early life factors and entry into and exit out of marriage.

2.4 Pathways between marital status and physical capability

In this section the evidence will be presented on each of the possible mediating pathways between marital status and physical capability, which comprise health behaviours, material resources and social support. Much of this evidence would suggest that marriage is protective of health.

2.4.1 Health behaviours

The first pathway to be discussed, through which marriage can be associated with physical capability, is through encouraging health promoting behaviours.

The mechanism through which marriage tends to promote healthy behaviours is through social control. Social control regulates health behaviours by encouraging seeking of and adherence to medical advice, as well as providing care when ill (Cohen, 2004). Social control can be direct, whereby a partner openly requests changes in health behaviours, or indirect where a change in health behaviours occurs because of norms within a relationship which are beneficial to health, or because of a sense of responsibility to a partner (Umberson, 1992). There is evidence from the USA which showed that married people experienced higher levels of social control than those who were

unmarried. Married men in particular reported experiencing the most social control, and this was hypothesised to be because women were more likely to monitor their own health behaviour than men are and once married the monitoring is extended to their spouse (Umberson et al., 2010) (Umberson, 1992). A study of people aged 65 years and older in Detroit, USA showed that a transition to widowhood was associated with a significant decline in the frequency of health reminders, which their former spouse had largely provided. Unfortunately the study was unable to look at whether this differed by gender due to the small number of widowed men in the sample (Williams, 2004). Two studies have shown that not all social control is conducive to healthy behaviours: negative social control, in the form of reminding or pressurising, was associated with a tendency to participate in unhealthy behaviours whilst positive social control, such as encouragement, was associated with health enhancing behaviours or adherence to a medical treatment plan (Tucker and Anders, 2001) (Fekete et al., 2006). Both studies though used data from regional samples within the USA which were not generalisable to the national population.

Alcohol consumption

Studies from Australia and the USA have shown that married people have lower alcohol consumption than their unmarried counterparts (Liang and Chikritzhs, 2012) (Umberson, 1987), although there is some contrary evidence from an employment cohort of French women which found that marriage was associated with increased alcohol consumption (Zins et al., 2003), which could be because of country specific norms surrounding gender and alcohol consumption. Longitudinal evidence from the British NCDS has shown that the lower alcohol consumption of those who were married was not due to selection as those who entered into marriage did not consume less alcohol prior to marriage, but instead it seemed to be a protective effect of marriage: after entering into marriage people changed their drinking habits and for women in particular after also becoming a parent (Power et al., 1999).

Evidence from the USA and the Netherlands showed that experiencing a transition out of marriage was associated with increased alcohol consumption, particularly a recent divorce (Karlamangla et al., 2006) (Hajema and Knibbe, 1998). There is evidence that the association is modified by age and one study, using data from the HRS, which explored alcohol consumption and marital transitions among older people found that recent transitions were associated with a reduction in alcohol consumption (Liew, 2012). Men who transitioned to divorce and women who became widowed drank less than those who remained married. Overall the evidence on transitions out of marriage and alcohol consumption suggests that the changes in consumption are a consequence of the transition out of marriage, providing support for the crisis theory. However, other evidence from Russia suggests that heavy alcohol consumption may be a cause of divorce as

those who consumed high levels of alcohol whilst married were at a higher risk of a later divorce, which would suggest selection out of marriage (Keenan et al., 2012).

There is some evidence that alcohol consumption is associated with physical capability among older people, but it is not a strong association. Two systematic reviews (Stuck et al., 1999) (Reid et al., 2002) found that heavy compared to moderate alcohol consumption was associated with an increased risk of a decline in physical capability. Abstinence from alcohol was associated with poorer physical capability, most likely because those who had poorer health and physical capability in the first instance were more likely to abstain from drinking.

Smoking

A number of studies have shown that married people were less likely to smoke than those who were unmarried (Nystedt, 2006) and if they did smoke they were more likely to quit than their unmarried counterparts (Broms et al., 2004). Transitions out of marriage were accompanied with an increase in cigarette consumption through either starting or a relapse in smoking (Umberson, 1992), (Umberson, 1987) (Lee et al., 2005). The transition to divorce in particular was associated with a higher risk of smoking than remaining married, whereas becoming widowed was not so strongly associated with smoking (Nystedt, 2006) (Lindstrom, 2010). Although, one study found that men who remained divorced or widowed had decreased consumption of cigarettes over a four year period compared to continually married men (Eng et al., 2001). This study was based upon a group of male health professionals who may have differential smoking patterns to the wider population, or it could be evidence that smoking increases in the period immediately after a transition out of marriage, but with time smoking patterns return to their pre-transition levels.

There is much evidence showing that smoking and physical capability are associated. Being a current smoker was associated with a higher risk of functional decline (Stuck et al., 1999) and there was a higher prevalence of smoking among those with mobility limitations than those without limitations (Borrelli et al., 2014). Longitudinal evidence from the HRS found that there was a consistent dose-response relationship between the numbers of cigarettes smoked and mobility impairment and that the deleterious effects of smoking on mobility diminished with the length of time since quitting. It also showed that those who didn't smoke were more likely to recover from a mobility impairment than those who did (Ostbye et al., 2002). This is consistent with evidence from the NSHD which found that smoking history, as well as current smoking status, was associated with the physical performance measures of physical capability at mid-life. Those who spent a greater number of years smoking had poorer physical capability at age 53 on the standing balance and chair

rises measures, but not on the measure of grip strength, which didn't seem to be affected by smoking status. Smokers' poorer physical capability was attenuated by SEP (Strand et al., 2011).

Physical activity

The evidence on the association between marriage and physical activity is very much mixed and there seems to be some modification in the association by age. There is evidence that married people aged 65 years and older participated in more physical activity than those who were unmarried (Pettee et al., 2006) (Schone and Weinick, 1998), however, another study also of older people, found evidence to the contrary, that those who were married were less likely to participate in physical activity than those who were unmarried (Kaplan et al., 2001). At younger ages the evidence was more consistent and two systematic reviews have shown that those who were unmarried were more physically active than those who were married (Allender et al., 2008) (Engberg et al., 2012). Some studies included in the systematic reviews found that the transition into marriage was accompanied by a decrease in physical activity, whilst other studies found no such association. Overall though a transition out of marriage through divorce or widowhood, at younger ages, was associated with an increase in physical activity. A longitudinal study using 19 years of data from the German Socio-Economic Panel found that married people's physical activity patterns changed with age. At younger ages those who were married were less physically active than their unmarried counterparts, but at older ages the association was reversed for men and married men were more physically active than their unmarried counterparts (Rapp and Schneider, 2013). It could be that at younger ages those who were married were more likely to have children which could limit the time they have available for physical activity, as evidence shows that having children under the age of 5 years was particularly detrimental to time spent exercising (Nomaguchi and Bianchi, 2004) (Hull et al., 2010). Or it could be that at younger ages those who were unmarried participated in more physical activity to appear attractive in the marriage market, or to provide opportunities to meet potential partners.

Whilst the evidence on marriage and physical activity is mixed, a strong positive association between physical activity and physical capability is demonstrated in two systematic reviews (Stuck et al., 1999) (Paterson and Warburton, 2010). This has been further substantiated by longitudinal evidence from England and the USA, which showed that higher levels of physical activity had a long lasting protective effect which resulted in a lower risk of physical impairment years later among middle aged and older adults (Hillsdon et al., 2005) (Lang et al., 2007). Similarly another study using data from the NSHD found that the benefits of physical activity on physical capability accrued across the life course (Cooper et al., 2011c). There is also evidence from British data which has shown that the type of physical activity was associated with physical capability: two studies found that moderate

to high intensity physical activity was associated with enhanced physical capability. One study found that men who participated in higher intensity physical activity had a stronger grip strength, which was not apparent for women (Bann et al., 2015), whilst the other found that moderate to high intensity physical activity was associated with stronger grip strength, faster chair rise speed, better standing balance and faster get up and go for both men and women (Cooper et al., 2015).

Diet

Evidence suggests that married people have a healthier and a more varied diet than those who are unmarried. A recent review provided evidence that those who were married consumed more fruit and vegetables than those who were unmarried. This was particularly evident among men and the association became stronger with age with single elderly men having the lowest intake of fruit and vegetables (Nicklett and Kadell, 2013) (Conklin et al., 2014). Transitions out of marriage were associated with a reduction in vegetable intake for both men and women (Lee et al., 2005). Widowhood for men was accompanied by an increase in the consumption of fried food (Eng et al., 2001), and a systematic review found that widowhood, for both men and women, was associated with changes in dietary behaviour including skipping meals and eating more ready meals, less home cooked food and fewer fruits and vegetables (Stahl and Schulz, 2014).

Body mass index (BMI)

Linked to diet and physical activity is body mass index (BMI) and here there is evidence that marriage is associated with BMI with modification in the association by gender. Among men, research using US data suggests that those who were married were more likely to have a higher BMI than those who were unmarried, whilst among women the reverse was apparent. In particular never married women were more likely to be obese than their married counterparts (Sobal and Hanson, 2011) (Wilson, 2012) (Hanson et al., 2014). It is possible that this difference in body size among married men and women could be due to gender specific selective factors into marriage regarding body size (Wilson, 2012). Transitions out of marriage were accompanied by similar weight loss for both men and women (Dinour et al., 2012), however, there were differences by the type of the transition out of marriage: divorce was accompanied by temporary weight loss whereas widowhood was associated with sustained weight loss (Umberson et al., 2009).

BMI has been shown to be negatively associated with physical capability (Stuck et al., 1999) (Jenkins, 2004) and having a high BMI was associated with poorer physical capability. Cross-sectional evidence from eight studies of the older population in the UK found that although men with a higher BMI had a stronger grip strength, higher BMI overall was associated with poorer performance on all other physical performance measures for both men and women (Hardy et al.,

2013). Longitudinal evidence from the USA found that weight gain was associated with a higher risk of lower body mobility impairment (Jenkins, 2004).

2.4.2 Material resources

The second pathway from marriage to physical capability to be discussed is the material pathway. Longitudinal studies, largely conducted in the USA, have consistently shown that those who stay in one continuous marriage have accrued the greatest wealth by mid to later life (Zagorsky, 2005) (Wilmoth and Koso, 2002). Married people were more likely to have higher household incomes, which can in part be explained by two people contributing to the household budget, but not having double the consumption of a single person household. However, there is also evidence that married men earn more than their unmarried counterparts (Korenman and Neumark, 1991) (Pollmann-Schult, 2011), what has been termed the "marriage premium", and a number of explanations have been put forward for this. Firstly, the traditional explanation is that married men are able to dedicate more of their time and energy to their careers, whilst their wives carry out the bulk of the domestic chores, as men specialise in breadwinning and women in homemaking, this is known as the "household specialisation" model (Becker, 1981). The second theory surrounds selection into marriage, that men who are more productive or those who have greater earning potential are selected into marriage (Nakosteen and Zimmer, 1997). The third explanation is that employers favour married over unmarried men in promotions and pay rises as they have a family to support, this is known as "the discrimination hypothesis" (Pollmann-Schult, 2011). Evidence exists to support all of these theories. For women there is evidence that marriage lowers female wages between 2% and 4% with motherhood bringing a further reduction (Loughran and Zissimopoulos, 2009), which is partly due to women being more likely to take time out of the labour market to care for children. Despite the fall in wages for married women, on the whole they have historically fared better economically from marriage than men (Hirschl et al., 2003) (Holden and Smock, 1991), because women have tended to earn relatively less than men so marriage provided them with extra economic resources.

Marital disruption is particularly detrimental to wealth (Holden and Kuo, 1996). Studies conducted in various countries (USA, Australia and European countries) have consistently shown that those who have experienced a divorce encounter a substantial reduction in wealth (Zagorsky, 2005) (Hendershott et al., 2009), due to the splitting up of assets. The detrimental effects of divorce on wealth has shown to carry on into older ages (Dewilde et al., 2011) (Holden and Kuo, 1996). Divorce seems to be more detrimental to women's wealth (Ruel and Hauser, 2013) (Dewilde et al., 2011) and income than men's (Jarvis and Jenkins, 1999) (Brewer and Nandi, 2014), which can in part

be explained by women tending to be the main care provider for children and also in part because women on average earn less than men.

Widowhood has also been shown to have a similarly negative effect on income and wealth as divorce (Holden and Kuo, 1996). In many ways this is unexpected as widowhood doesn't result in the splitting up of assets and with life insurance and survivor pensions one would expect that it wouldn't have such a detrimental effect on wealth as divorce. A number of explanations for the association between widowhood and diminished economic resources have been put forward. One explanation suggests that the reduced economic resources in widowhood is a direct consequence of the death of a spouse because of the loss of a spouse's salary, or pension, particularly for women as men have higher average incomes than women (Burkhauser et al., 1991). However, some research suggests that those who became widowed were more economically disadvantaged years prior to widowhood and the reduced wealth seen in widowhood is a continuation of this marital poverty (Sevak et al., 2003) (Hurd and Wise, 1989). Given the strong association between SEP and health and those who have fewer material resources throughout their lives are at risk of experiencing higher mortality. Additionally, those who have fewer material resources are also least able to safeguard economically against the consequential financial losses that widowhood brings (Holden and Kuo, 1996). Thus in this respect the material disadvantage of those who are widowed is in part a result of selection out of marriage (through widowhood) of those who are most economically disadvantaged, but also in part due to the financial loss which widowhood brings (Sevak et al., 2003).

Those who never marry also, similarly to divorced and widowed men and women, tend to have lower levels of wealth than those in their first marriage (Wilmoth and Koso, 2002). Whilst remarriage has been shown to negate some of the negative economic effects of divorce and widowhood, those who remarry are still not as wealthy on average, as those who stay in one continuous marriage (Dewilde et al., 2011) (Wilmoth and Koso, 2002).

Studies have consistently shown that income and wealth are positively associated with maintaining physical capability at older ages (Stuck et al., 1999). Cross-sectional data from ageing studies in Europe, using the self-reported measure of physical capability, show that those with higher wealth and income report fewer physical limitations (Gjonca et al., 2009) (Tabassum et al., 2009). Evidence from the USA shows that a lack of private health insurance, as well as fewer assets and lower income were associated with a higher number of reported problems with the ADLs (Kim and Richardson, 2012).

Studies which have utilised the physical performance measures of physical capability have also found a consistently strong positive association between income, wealth and overall SEP and

physical capability. In the Whitehall II study those from higher employment grades were found to have a faster walking speed (Brunner et al., 2009) and data from the NSHD showed that those from a higher social class had improved balance and faster chair rise times (Kuh et al., 2005). Higher wealth was associated with stronger grip strength, a finding which was consistent across 11 European countries, even after adjusting for physical health (Mohd Hairi et al., 2010). In another study, using data from a regional sample in England, home and car ownership were positively associated with grip strength (Syddall et al., 2009).

Longitudinal evidence suggests that there is a socio-economic gradient in the decline in physical capability over time, with those from more disadvantaged socio-economic groups experiencing greater declines in physical capability over a 9 year period in comparison to those from more advantaged socio-economic groups (Koster et al., 2006). Although longitudinal evidence from three waves of ELSA provides some evidence to the contrary with those who had the highest wealth had a greater decline in walking speed than those with lower wealth, although the discrepancy in walking speed between the richest and the poorest didn't disappear, it just decreased (Zaninotto et al., 2013).

2.4.3 Social support

The third pathway between marriage and physical capability presented is the social support pathway. Another role which marriage, and other close personal relationships, play is in providing social support. Social support, defined as "resources provided by other persons" (Cohen and Wills, 1985), comprises three broad types of support: instrumental, informational and emotional. Instrumental support covers providing help with daily tasks such as with shopping, paying bills; informational support is providing information, advice and guidance; whilst emotional support is providing care, reassurance and trust (Cohen, 2004).

Two causal models have been put forward to explain how social support can affect both physical and mental health: the direct effects model and the stress buffering model. The direct effects model posits that social support directly affects an individual's health through social control (Cohen, 2004), which was described in Section 2.4.1. Additionally, receiving social support in itself can affirm that one is cared for, thus increasing perceptions of self-worth, personal control and give meaning to life, all of which could lead people to improve their own health behaviours and their psychological and physical health (Stansfeld, 2006). Also, being embedded in a social network which provides social support is thought to directly increase positive affect and reduce psychological despair (Kawachi and Berkman, 2001). The second causal model proposed is the "stress buffering" model, where the receipt of social support (or the perception that it is available) indirectly protects health through

"buffering" people from the adverse health effects of stressful life events. Chronic stress has been linked to negative health outcomes both physically and mentally through activating the hypothalamic-pituitary-adrenal (HPA) axis. The HPA has shown to supress immune functioning leading to higher risk of infection and inflammation and poorer psychological and physical health outcomes (Kiecolt-Glaser et al., 2010).

Social support is provided by social networks. Marriage and cohabiting relationships are part of a social network, along with other family members, friends and colleagues. It would be expected that marriage provides its incumbents with a greater source of social support, as marriage tends to be a close intimate bond. It would also be expected that marriage expands one's social network to include a spouse's family and friends, thus providing access to a greater range of sources of social support; however, the evidence here is mixed. Whilst family networks have been shown to increase after marriage, friendship networks have been shown to shrink. This has been termed 'dyadic withdrawal', as couples withdraw from their relationships with other people as they become more involved with each other (Johnson and Leslie, 1982). There is also evidence that men and women tend to receive their social support from different providers: men are more likely to receive the majority of their social support from their spouse, whilst women receive their support from a broader range of sources including other family members and friends (Fuhrer and Stansfeld, 2002) (Cable et al., 2013). This would suggest that a transition out of marriage and the loss of spousal support would be more detrimental to men's social support than women's.

Whilst marriage has been associated with shrinking friendship networks, a transition out of marriage through divorce has been shown to result in a growth in friendship networks and a contraction of family networks (Kalmijn, 2012) (Kalmijn and van Groenou, 2005). Those who became widowed also experienced an increase in contact with friends, but women in particular also reported an increase in support received from family (Kalmijn, 2012). Among those who were never married the association with social support was modified by age. At younger ages those who were never married reported similar or higher levels of perceived social support to those who were married, but at older ages never married people had fewer sources of social support available to them (Barrett, 1999). Linked to this, evidence suggests that social networks shrink over the life course (Wrzus et al., 2013), which could lead to the social support provided by marriage becoming increasingly important with age. Receipt of social support is also likely to depend on the quality of the marital relationship and poor quality relationships are associated with lower levels of social support and higher levels of stress (Kiecolt-Glaser and Newton, 2001) (Robles et al., 2012).

The literature on social support and physical capability is mixed and very little research has directly focussed on social support, but instead indirectly focussed on it by looking at the effects of

social networks which provide social support. Various studies have found that having a large and diverse social network, and therefore potentially more access to social support, was associated with maintaining physical capability and a reduced risk of disability (Avlund et al., 2004) (de Leon et al., 2003, Seeman et al., 1996) (Unger et al., 1997). It's possible that those who have better physical capability were able to participate in more social activities, although longitudinal evidence shows that those who were more socially integrated at baseline were less likely to report physical limitations at a later date than those who were more socially isolated at baseline (de Leon and Rajan, 2014). Whilst social networks were associated with a reduced onset of physical limitations there was no clear evidence that larger social networks reduced the decline in physical capability (de Leon and Rajan, 2014).

Litwin and colleagues found that when looking specifically at family social networks, using data from SHARE, some aspects of the network were negatively associated with improvements in physical capability over a two year period. Those who were childless at older ages reported improvements in mobility over the period, whilst those who lived with their children were least likely to report improvements in physical capability. There was found to be little association between living with a spouse and improvements in physical capability. It could be that those who are childless don't have the social support to rely upon and therefore are forced to maintain independence, equally, those who reside with their children may do so as they have poor physical capability in the first instance (Litwin and Stoeckel, 2013). Similarly, another study found that receipt of social support among the oldest old (aged 80 years and older) was associated with greater risk of decline in physical capability (Avlund et al., 2004).

Overall it is unclear from the evidence how social support is associated with physical capability.

2.5 Early life circumstances and selection into and out of marriage

The previous section, Section 2.4, has focussed on how marriage seems to protect health and physical capability, through improved health behaviours, material resources and social support which in turn are associated with variations in physical capability, and how transitions out of marriage are detrimental to health through the loss of these protective mechanisms. This section though focuses on the third explanation for the association between marriage and physical capability: selection into and out of marriage. The evidence on marriage selection has drawn upon circumstances from earlier in the life course, particularly childhood circumstances and education and how these vary among those who are married and those who are unmarried.

Childhood circumstances

The existing evidence on childhood circumstances and marriage has primarily focussed on childhood SEP and family structure and entry into and exit out of marriage.

The research on childhood SEP and marriage has tended to focus on the age of entry into marriage, showing that those whose families had a less advantaged SEP were more likely to enter into marriage earlier than those who came from a more advantaged SEP (South, 2001) (Kiernan and Eldridge, 1987) (Wiik, 2009). This is thought to be because those who had a higher family SEP were accustomed to living in more comfortable environments and the push factors into leaving home through marriage were not so strong, they may also have chosen to delay entry into marriage until they were able to replicate the standards of living they were accustomed to (Axinn and Thornton, 1992). Parents with high levels of education may also have greater educational aspirations for their children which may lead them to delay entry into marriage in order to complete their education.

There is also evidence that the association between childhood SEP and timing of entry into marriage has changed over time and for younger cohorts the association is not as strong as it was for older cohorts (South, 2001).

Childhood SEP is also indirectly associated with the risk of divorce. Evidence from Britain and the USA found that an early entry into marriage was associated with a higher risk of divorce (Bumpass et al., 1991a) (Kiernan and Mueller, 1998) (Murphy, 1985), which suggest that the effect of family SEP on divorce is partially mediated through age of entry into marriage. However, there is some other evidence, particularly from Europe, which has looked directly at the association between childhood SEP and entry into and exit out of marriage. In contrast to the association between childhood SEP and age of entry into marriage, the evidence shows that those who came from a more advantaged family SEP, measured through parental education and father's occupation, were actually more likely to divorce (de Graaf and Kalmijn, 2006) (Todesco, 2013) (Lyngstad, 2006). The differential findings between these studies and the studies which have looked at age of entry into marriage could be due to evidence coming from various countries which have different divorce rates. It is thought that in periods of time or in countries where divorce is not so prevalent those from a more advantaged SEP have higher rates of divorce as they can not only financially afford to divorce but they also have the cultural resources to deviate from social norms (de Graaf and Kalmijn, 2006). Conversely when divorce is more prevalent and more easily obtainable, both legally and financially, then the association is reversed and those from a less advantaged SEP background are more likely to divorce.

There is much evidence which has focussed on family structure, particularly parental divorce and the effects it has on later adult relationships. Childhood family structure has shown to be an

important factor in marriage and divorce. Evidence confirms that divorce can be transmitted between generations (Amato and Deboer, 2001) with those whose parents were divorced or separated when they were growing up were also more likely to divorce themselves (Glenn and Kramer, 1987) (Lyngstad and Jalovaara, 2010) (Ryan et al., 2009) (Amato, 2010). Further evidence has shown that there was consistency in the association across a number of countries in Europe and the USA (Dronkers and Haerkoenen, 2008), but there was mixed evidence on whether those who have experienced parental divorce or separation were more or less likely to marry or to cohabit (Wolfinger, 2003). Other evidence suggests that living apart from both parents during childhood was associated with increased risk of divorce (Teachman, 2002).

Education, employment and material resources

The second selective factor into marriage is education and employment. There is a strong association between education and marital status with gender and cohort differences in the association. Among men, those with high levels of education were more likely to enter marriage and subsequently less likely to divorce (Martin, 2006) (Shafer and Qian, 2010) (Kiernan and Eldridge, 1987) (Cherlin, 2009) (Glick et al., 2006) (Berrington and Diamond, 2000), whilst, historically, less highly educated women were more likely to marry than those with higher levels of education (Torr, 2011) (Kiernan, 1988b). The gender differences have been attributed to different selective factors into marriage for men and women due to the different gender roles expected within marriage (Cherlin, 2009). Men tended to marry women of a less advantaged SEP to themselves whilst women tended to marry men of a higher SEP (Bernard, 1982). The gender differences between education and entry into marriage resulted in a disparity in the educational attainment of men and women who never married with men in this group having low levels of education, whilst conversely women had high levels of education (Wiik and Dommermuth, 2014) (Kiernan, 1988b) (Shafer and Qian, 2010). In recent years the association between education and marriage has changed, largely due to the expansion of female education and employment and the change from the male breadwinner marriage to the dual earner marriage. Research has found that among more recent cohorts both men and women who were highly educated were more likely to enter into marriage, than those with less education, and also they tended to marry partners with similar levels of education to themselves, a process known as educational homogamy (Shafer and Qian, 2010) (Torr, 2011). Consequently, the association between education and marriage has changed for women, from less educated women being more likely to marry to higher educated women being more likely to do so, which was particularly apparent in gender egalitarian societies or “dual-earner” societies (Blossfeld, 2009).

Similarly to entry into first marriage, there has shown to be an association between education and remarriage for men and women. A study using data from the US 1979 National Longitudinal Study of Youth found that more highly educated men tended to remarry, whilst for women those with higher education were less likely to enter into a subsequent marriage (Shafer and James, 2013).

Linked to education are employment and material resources. Having adequate economic resources and having secured stable employment have shown to be associated with entry into marriage, more so for men than for women (Schneider, 2011) (Xie et al., 2003).

Childhood and early adult physical health and psychological morbidity

Evidence suggests that marriage is selective of those in better physical and psychological health. Longitudinal evidence from the NSHD found that a higher proportion of those who were not married by their mid-thirties were disabled than those who were married (Kiernan, 1988b). This has more recently been corroborated by another study based on 18 waves of the BHPS which found that people with physical disabilities in early life were less likely to marry than their able bodied contemporaries (Clarke and McKay, 2014). There is evidence from Poland based upon analysis of military conscription data that men who never married were assigned lower military categories at aged 18 which suggests that they were in poorer health (Lipowicz, 2014). There is also evidence from various longitudinal studies conducted in Europe showing that divorce is selective of those who were in poorer physical health some years earlier as they were more likely to experience a divorce than those who had better physical health (Joung et al., 1998) (Monden and Uunk, 2013) (Rapp, 2012) (Blekesaune and Barrett, 2005).

Studies on psychological health and marriage have also found evidence of selection effects. One study found that those who exhibited emotional and psychological problems earlier in the life course were less likely to marry and less likely to remain married (Whisman et al., 2007). Similarly a study conducted on the British NCDS found that those who remained single had poorer psychological health at age 23 years than those who subsequently married (Hope et al., 1999). Data, collected over a 17 year period from the German Socio-Economic Panel, showed that those who had higher levels of subjective wellbeing at age 20 were more likely to marry and to marry before the age of 30 years (Stutzer and Frey, 2006).

There is also evidence that marriage is selective of personality and a study which measured personality traits of participants whilst at college found those who had higher scores of pessimism and hostility were more likely to be divorced or to have remained never married 22 years later (Siegler et al., 2013).

Assortative mating

Another factor associated with selection into marriage is assortative mating or homogamy. Assortative mating refers to the tendency for people to choose partners who exhibit similar characteristics, both cultural and genetic, to themselves. There is much research on educational assortative mating (outlined in Section 2.5.1), which shows that in recent decades there has been an increase in the tendency for people with similar levels of education to marry (Blossfeld, 2009). There is also evidence of assortative mating in other factors such as height (Silventoinen et al., 2003), personality traits (Glicksohn and Golan, 2001), affective disorders (Mathews and Reus, 2001) and health behaviours, including smoking (Sutton et al.), alcohol consumption (Agrawal et al., 2006) (Grant et al., 2003) and body size (Fisher et al., 2014) (Di Castelnuovo et al., 2009) (Speakman et al., 2007).

Linked to assortative mating is spousal health concordance, whereby spouses' health behaviours and mental and physical health tend to be in concordance with one another. This has been demonstrated in a systematic review of 103 studies (Meyler et al., 2007). At present it is uncertain whether health concordance is a result of assortative mating or whether it is a result of shared resources and a shared environment across a lifetime within marriage.

2.5.1 Early life circumstances and adult physical capability

There is a growing body of evidence from Britain and the USA showing that childhood and early adult circumstances are associated with physical capability at older ages (Birnie et al., 2011). Life course models explain how early life circumstances can impact on health much later in the life course: the critical period model and the accumulation model. The critical period model suggests that there are critical periods during which exposures can permanently alter later life health outcomes (Ben-Shlomo and Kuh, 2002). One such critical period might be childhood as this is a time of great development, both physically and emotionally and exposures during childhood can have lasting effects both physically and psychologically which can manifest itself later in life in poorer physical capability. The other model is the accumulation model which hypothesises that throughout the life course people experience a number of exposures which can accumulate and are either detrimental to or protective of physical capability. Previous studies have shown that parent's SEP and childhood and early adult health are positively related to physical capability at older ages, even after adjusting for adult circumstances (Birnie et al., 2011). Poor childhood circumstances have also shown to be associated with greater declines in physical capability over a period of time in later life (Haas, 2008). Neither study though explicitly investigated which life course model best explained the association.

This evidence on early life circumstances and physical capability later on in life along with the evidence presented on selection into marriage provides evidence that marriage may be a mediator on the pathway between childhood and early adult circumstances and physical capability. Although, evidence presented earlier in this review showed that marriage provides a number of economic and health benefits, which could account for the variations in physical capability at older ages.

2.6 Children

Marriage and parental status are closely associated, although more recently the association has weakened with growing numbers of children being born outside of marriage in most developed countries (Cherlin, 2005). Parental status has been shown to be associated with physical capability. Childlessness, particularly for men, was associated with poorer physical capability (Guralnik et al., 2009), whilst early child-bearing (Spence, 2008) and short intervals between births (Read et al., 2011) were associated with reporting a greater number of physical limitations for women. One paper (Grundy and Tomassini, 2010) found the association between marital history, ill health and mortality was modified by fertility, and being a parent reduced the odds of long-term illness or mortality among remarried women.

There are a number of pathways through which being a parent has been shown to be associated with physical capability. Being a parent has been shown to improve health behaviours and reduce risk taking behaviours (Power et al., 1999) (Umberson, 1987), although being a parent was also associated with increased BMI (Umberson et al., 2011). Children can provide care and social support at older ages (Grundy and Read, 2012) and being a parent was associated with better health and lower mortality at older ages, although high parity was also associated with higher mortality (Grundy and Tomassini, 2005) (Kravdal et al., 2012) (Read et al., 2011). But there have found to be negative aspects to having children; parenthood can be stressful, particularly at the time of a marital break-up (as described in Section 2.2.3). Children can also place a strain on economic resources directly by being an expense in themselves, or indirectly through preventing participation in the labour market, particularly for women, although there was evidence that parenthood for men improved wages, known as the “fatherhood premium” (Glauber, 2008).

2.7 Summary and identification of gaps in the literature

In summary, evidence shows that marriage is not only associated with better physical capability, but also with better physical and psychological health. Men and women who were married reported the best physical and psychological health and physical capability. There is mixed evidence on whether marriage benefits men’s physical health and capability more than women’s or whether it benefits both men and women equally.

Transitions out of marriage through divorce or widowhood were particularly detrimental to the psychological wellbeing and physical health of both men and women, and experiencing a prior transition out of marriage earlier in the life course was detrimental to health and physical capability at older ages (Hughes and Waite, 2009). Among those who were never married there were some variations in the association by gender: never married men had both poorer physical capability (Guralnik et al., 2009) and also poorer physical health than those who were married (Ploubidis et al., 2015), but this wasn't apparent for never married women.

A number of different pathways explain the association between marriage and physical capability including improved health behaviours, increased material resources and increased provision of social support among married people, which have shown to be associated with better physical capability.

There is though substantial debate about whether marriage is protective of health and physical capability or whether marriage is selective. The evidence presented in this review suggests that marriage is both protective and selective (Carr and Springer, 2010); as when people enter marriage they change their health behaviours, they accrue more wealth through the sharing of resources, and they benefit from a good source of social support. Evidence also shows that men and women who have higher levels of education, particularly men, and consequently the ability to earn a good income, and are both physically and psychologically healthier, are more likely to be selected into marriage and remain married.

A number of gaps have been identified with the current evidence on marriage and physical capability, which this thesis will address.

Very few studies have used marital status as the exposure, with many instead focussing either on cohabitation or living arrangements. Those studies which have used marital status as the exposure have tended to use a less detailed measure of marital status, either just comparing those who were currently married to those who were currently unmarried, or if they have made distinctions between the different unmarried statuses they have still treated those who were married as a homogenous group, not taking into consideration their different relationship histories that they may have at mid to later life. The literature presented in this review shows that there are variations in physical capability between the different unmarried statuses, which merit further investigation. Only one study so far has explicitly compared the physical capability of those who were continuously married to those who were in a subsequent marriage (Hughes and Waite, 2009), the findings of which suggest that remarriage may be associated with poorer physical capability comparative to one continuous marriage. The physical capability of those who are remarried needs to be investigated further.

The second gap in the evidence is with the measure of physical capability. Much of the evidence has used the self-reported measures of mobility limitations or ADLs and only three relevant studies were identified which measured physical capability using the physical performance measures. There is some evidence that the physical performance test may give a more accurate reflection of current levels of physical capability, as they measure capability in a neutral context not modified by home environment or perceptions of ability as the self-reported measures can be (Guralnik et al., 1989). None of the studies which used the physical performance measures of physical capability used a detailed measure of marital status and no studies differentiated between those who were in their first marriage and those in a subsequent marriage (Clouston et al., 2014). One study also did not distinguish between the different unmarried statuses (Zaninotto et al., 2010), and another did not distinguish between those who had previously been married (Guralnik et al., 2009).

The third gap in the evidence is the lack of longitudinal evidence on marital status and subsequent changes in physical capability. Those few studies which have looked at marital status have either only used two time points (Goldman et al., 1995), so changes in physical capability could not be investigated in detail, or focussed on one particular marital status, such as widowhood (van den Brink et al., 2004), or used cohabitation status (Nilsson et al., 2008). No studies were found which have used a detailed measure of marital status and changes in physical capability over three or more time points. It is important to understand whether there is a longer term association between marriage and physical capability, particularly given the growing numbers of people entering older ages unmarried and the potential strain on public resources due to an ageing population.

Finally, there has also been little comparative research on physical capability in England and the USA at older ages (Clarke and Smith, 2011) (Wahrendorf et al., 2013) and no evidence was found which compared the relationship between marriage and physical capability in England and the USA. Given the health disparities, the differential marriage and divorce rates and the different welfare systems between England and the USA there could be differences in the association between marriage and physical capability between the two countries. It is important to carry out research within an international context as it provides a deeper understanding of any association between marriage and physical capability by discovering whether the association is modified by national context and whether there are different or similar explanations for the observed association between countries.

This research aims to bridge these four gaps.

Chapter 3: Conceptual model and research aims

This chapter outlines the conceptual model for this thesis and the research aim, objectives and hypotheses.

3.1 Conceptual model

Figure 3.1 shows the conceptual model for this thesis. At the far left hand side of the model are the factors associated with entry into marriage. Entry into first marriage is usually after completion of full time education (Cherlin, 2009) (Kiernan and Eldridge, 1987), with those who finish education at an earlier age being more likely to marry at younger ages and those who remain in education for longer marrying later (Kiernan, 1988b). In this section of the conceptual model it is recognised that education is an important selective factor into marriage, however for the majority of the analysis contained in this thesis education has been conceptualised as a measure of SEP (along with wealth), as the effects of educational attainment continue into adulthood through employment opportunities. Two other predictors of entry into marriage are securing stable employment and, linked to that, having sufficient economic resources. Those who are unable to secure employment or have insufficient material resources are less likely to get married (Cherlin, 2009). This was particularly important for men during the 1950s and 1960s when the male breadwinner marriage was the predominant marriage model (Cherlin, 2009). Those who have had good childhood and early adult physical and mental health are more likely to marry than those in poor health or those who are disabled (Kiernan, 1988b). Childhood circumstances, such as family structure (Amato and Deboer, 2001) and family SEP (South, 2001) have been shown to be associated with entry into marriage.

The next phase of the model concerns marital status and the mediating pathways between marital status and health. Marriage is associated with improved health behaviours, material resources and social support, all of which are associated with better health. However, these pathways are also potentially bi-directional, for example, unemployment could lead to a loss of material resources, the strain of which could then result in a transition out of marriage through divorce. The far right of the model shows psychological morbidity, physical health and physical capability contained in one box to demonstrate that they are closely associated, since the associations between physical health and physical capability (Cooper et al., 2011b) and between psychological morbidity and physical capability are bi-directional (Demakakos et al., 2013). Changes in health can also affect health behaviours, material resources and social support. To reflect this bi-directional association there is an arrow from health back to health behaviours, material resources and social support.

It is recognised that there are potential gender differences in the pathways shown in the conceptual model. For instance education, employment and having sufficient economic resources are more strongly associated with men's entry into marriage than they are for women's (Cherlin, 2009) (Kiernan and Eldridge, 1987). Similarly, there is evidence that the pathways between marriage and health are different for men and women. Men's health behaviours are more affected by marital status than women's, largely due to the receipt of social control, which tends to be provided by women to the male spouse (Umberson et al., 2010). Men also tend to receive their main source of social support from their spouse, whilst women receive support from a range of sources (Fuhrer and Stansfeld, 2002). Women meanwhile have shown to benefit more from the economic resources provided by marriage than men (Hahn, 1993). Additionally, there have been shown to be gender differences by marital status in men and women's physical health (Williams and Umberson, 2004) (Ploubidis et al., 2015), psychological morbidity (Willitts et al., 2004) and physical capability (Guralnik et al., 2009).

Underneath the pathways between marriage and health are the dynamic elements of the conceptual model, including the transitions into and out of marriage. Part of this thesis will test the association between the transitions out of marriage, through divorce and widowhood, and back into marriage, through remarriage, and physical capability. Under the transitions is the time period during which those who are at mid to later life in the mid 2000s have lived through, from the 1940s to present day. During this time many would have entered into marriage and possibly transitioned out of and back into marriage. The social context highlights the changes which occurred during this period, including changes surrounding attitudes, behaviour and the legislation towards marriage and divorce, as well as the increase in the numbers cohabiting and the changes within the institution of marriage with the move away from the breadwinner family to the dual-earner family.

The analysis contained in this thesis will empirically test whether factors in early life, such as education and childhood circumstances, are associated with entry into first marriage. The analysis will also investigate the association between marital status and physical capability and to what extent that association is explained by health behaviours, material resources as well as psychological morbidity and physical health. The research aim, objectives and hypotheses are outlined in the following sections.

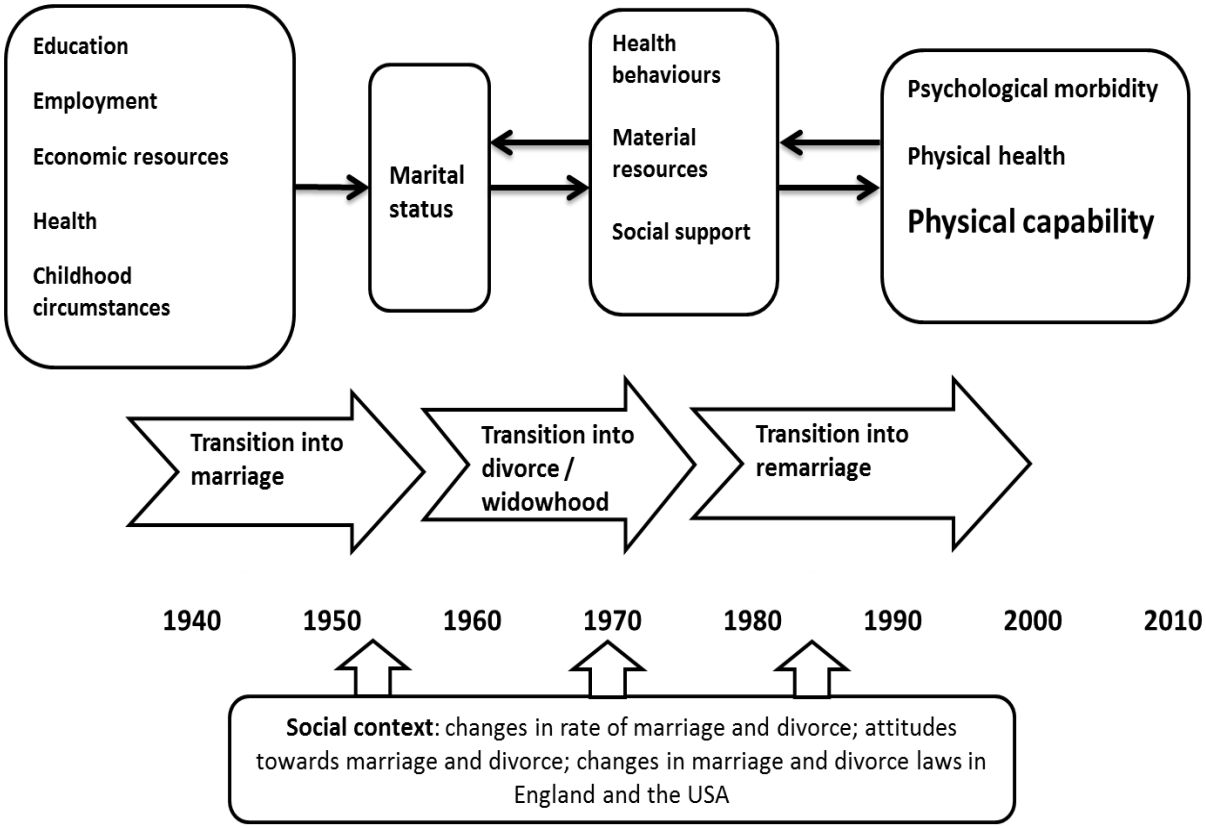


Figure 3.1: Conceptual model of marriage and physical capability

3.2 Research aim

To explore the association between marriage (including elements of marital history) and physical capability among men and women aged 50 years and older in England and in the USA.

3.3 Objectives

To meet the research aim the following objectives will be undertaken.

3.3.1 Demography of marriage and selection into and out of marriage

1. Explore the associations between childhood circumstances, demographic, socio-economic, health behaviour and health characteristics and marital status at aged 50 years and older in England and the USA, separately for men and women.
2. Investigate whether childhood circumstances and education select people into and out of marriage in England and the USA, separately for men and women.

3.3.2 Current marital status and physical capability

1. Investigate the association between current marital status and physical capability at aged 50 years and older in England and the USA and whether the association is explained by material resources, health behaviours, psychological morbidity and physical health, separately for men and women.

2. Investigate whether childhood circumstances explain any of the differences in physical capability by marital status at aged 50 years and older in England and the USA, separately for men and women.

3.3.3 Marital status and longitudinal changes in physical capability

1. Investigate the association between baseline marital status and subsequent changes in walking speed among those aged 60 years and older in England and whether the association is explained by material resources, health behaviours, psychological morbidity and physical health, separately for men and women.

3.4 Hypotheses

In light of the current evidence on marriage and physical capability, the following hypotheses have been developed.

3.4.1 Demography of marriage and selection into and out of marriage

1. Entry into and exit out of marriage is selective, as those who have remained in their first marriage will have the most socio-economically advantageous childhood circumstances and the highest levels of education compared to those who are unmarried.
2. Never married men will have relatively poorer childhood circumstances and lower levels of education relative to never married women.

3.4.2 Current marital status and physical capability

1. Men and women who have remained in their first marriage will show higher levels of physical capability than those men and women who are unmarried or who have remarried.
2. There will be gender differences in the association amongst those who are never married and never married men will have poorer physical capability compared to men in their first marriage, whilst never married women will have comparable physical capability to women in their first marriage.

3.4.3 Marital status and longitudinal changes in physical capability

1. Men and women who are in their first marriage will experience the least rapid decline in physical capability.
2. Never married men will have the greatest declines in physical capability, whilst among women those who are divorced will have the greatest declines in physical capability.

Chapter 4: Methods

This chapter outlines the datasets used for the analyses carried out in this thesis along with the variables which were chosen to measure marital status, physical capability and the covariates.

4.1 Datasets

Two longitudinal studies of ageing have been used which are directly comparable: the English Longitudinal Study of Ageing (ELSA) and the Health and Retirement Study (HRS). Both surveys are part of a wider group of international harmonised longitudinal studies on ageing, funded by the US National Institute of Aging (NIA), which make international comparative research possible.

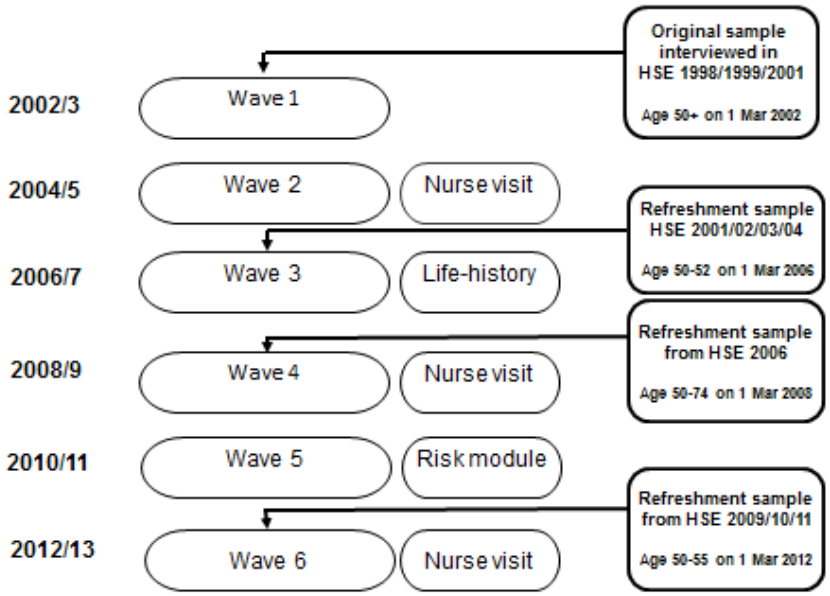
4.1.1 The English Longitudinal Study of Ageing (ELSA)

ELSA is a longitudinal face to face study of approximately 10,000 people aged 50 years and older and their partners in England. The aim of the study is to explore the health, lifestyles and financial situation of people as they grow older. ELSA began in 2002 and is carried out biennially (as shown in Figure 4.1). ELSA receives its funding not only from the NIA, but also from a consortium of UK government departments (Banks et al., 2010).

The ELSA sample was originally selected from participants aged 50 years and older from various years of the Health Survey for England (HSE). The HSE is an annual cross-sectional study which collects detailed information on the health of adults and children. The HSE comprises a random multi-stage stratified sample design. Stage one consisted of selecting postcode sectors from the Post Office Address File (PAF), which were stratified by both health authority and the proportion of households in a non-manual occupation. Post code sectors were selected with probability proportional to their size (PPS). In the second stage a fixed number of addresses from each chosen postcode sector were selected. The third stage comprised a random selection of up to three households from each address and all individuals within that household. The HSE was chosen as a sampling frame for ELSA as it was a cost effective way of identifying people aged 50 years and over.

The original ELSA cohort, (known as Cohort 1) from Wave 1, were selected from the 1998, 1999 and 2001 HSE. Cohort 1 comprised those individuals who were in a household which responded to the HSE and were born on or before 29th February 1952. At Wave 3 Cohort 3[2] was added, which consisted of people born between 1st March 1952 and 28th February 1956 who were in a responding household in the HSE in 2001 to 2004. At Wave 4 a further refreshment sample was added, Cohort 4, who were born between 1 March 1933 and 29 February 1958 and were in a household which responded to the HSE in 2006 (Figure 4.1).

[2] There is not a Cohort 2 in ELSA as a refreshment sample was not included at Wave 2.



Adapted from *(Steptoe et al., 2013)*

Figure 4.1: Composition of the ELSA sample and interview

ELSA is administered via a computer assisted personal interview (CAPI) where detailed information on health, employment, pensions and wealth, and one physical performance test - walking speed - is collected. At alternate waves a nurse visit is carried out by a registered nurse, who collects many other physical performance measures including grip strength (Banks et al., 2010).

ELSA also contains detailed information on partnership history and childhood circumstances, which were collected during a separate life history interview, conducted in 2007 (shown in Figure 4.1). The life history interview collected information on a number of domains across the life course such as parenthood, relationships, housing, employment and health from childhood through to the present day. The interview used an innovative calendar recall method, the life grid, which has been shown to improve recall of life events which may have occurred a number of decades earlier[3]. Data from the life history interview on all marriages and some of the measures of childhood circumstances were used for the analyses in this thesis.

4.1.2 The Health and Retirement Study (HRS)

The HRS is a biennial longitudinal study of 20,000 participants aged 51 years and older and their partners in the USA. The study began in 1992 to investigate how people made the transition from

[3] More detailed information on how the life grid was created can be found in the ELSA life history user guide Ward, K., Medina, J., Mo, M. & Cox, K. 2009. ELSA Wave Three: Life History Interview, a User Guide to the Data.

work to retirement and how such transitions interact with health. In 1998 the study was merged with the Asset and Health Dynamics among the Oldest Old (AHEAD) study. The HRS collects detailed information on demographics, health, housing, family structure, employment, disability and income and wealth. The HRS's funding comes from the NIA and the Social Security Administration in the USA (Sonnega et al., 2014).

The original HRS cohort was born between 1931 and 1941, and the AHEAD cohort was born in 1923 or earlier. In 1998 two new cohorts were added to the sample: the War Babies Cohort and the Children of the Depression Cohort. The War Babies Cohort was born between 1942 and 1947 and the Children of the Depression Cohort was born between 1924 and 1930. In 2004 the Early Baby Boomer Cohort was added to the sample which included persons born between 1948 and 1953. The majority of the HRS sample was selected using a multi-stage cluster sample design comprising four stages of sample selection. The first stage involved the selection of US Metropolitan Statistical Areas (MSAs) and non-MSA counties with probability proportionate to size (PPS). The second stage comprised the selection of area segments. The third stage was a systematic selection of housing units from a list of all the addresses in the selected area segments and the fourth stage was the selection of any age eligible persons and their partners (if they themselves were not age eligible) within the selected housing unit.

A different sample frame, the Health Care Financing Administration (HCFA) enrolment database, was used to select the oldest members of the AHEAD cohort and all the members of the Children of the Depression cohort (Sonnega et al., 2014).

The HRS questionnaire is a multi-mode survey and the questionnaire is administered via both CAPI and computer assisted telephone interviewing (CATI). At each wave half the sample are interviewed by CAPI and the other half by CATI with the mode of interview alternating at each wave between the two halves of the sample. The HRS collects detailed information on health including the physical performance tests of grip strength, walking speed, standing balance and lung function, which were piloted in 2004 and introduced to the main survey in 2006. The physical performance tests are collected by interviewers as part of the main CAPI interview, therefore at each wave only half of the sample are administered the physical performance measures and two waves of data need to be pooled to obtain a complete sample. As well as collecting information on current marital status the HRS also collects detailed information on marital history of up to four marriages, prior to entering the HRS, with dates of entry into marriage, dates of exit out of marriage and reasons for any exits. The HRS does not collect data on cohabitation history.

Figure 4.2 shows the birth years of the different cohorts which comprise ELSA and the HRS that were used for the analyses in this thesis.

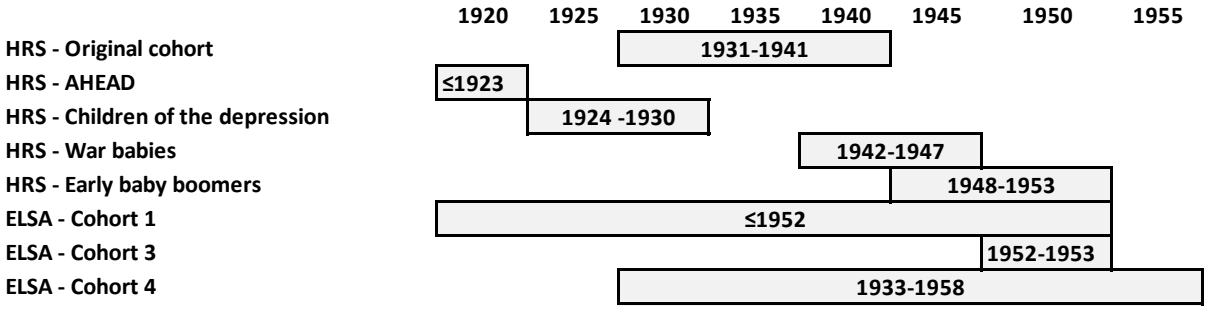


Figure 4.2: Birth years of the different cohorts comprising the HRS and ELSA samples

4.2 Variables

This section details the variables which have been chosen for the analysis.

4.2.1 Marital status including marital history

Current marital status is collected at each wave of ELSA and the HRS and the measure of marital status used for this thesis is categorised as:

- First marriage
- Remarried
- Divorced / separated
- Widowed
- Never married

The measure of current marital status is categorised differently in ELSA and the HRS. In ELSA the measure of marital status which is collected by the interviewers differentiates between a first marriage and remarriage whilst the measure in the HRS does not. In order to make the measures comparable the RAND harmonised[4] HRS marital history derived variables were used to construct a remarried category amongst those who were currently married. The RAND harmonised HRS marital history measures include variables on the number of times participants have been married at each survey wave and from these it could be identified who was in a subsequent marriage and who was in their first marriage. Same sex couples who were in a civil partnership (ELSA only, n = 17) were classified either as married or remarried (depending on their previous marital status). The marital

[4] The RAND organisation have harmonised the measures on a number of the global ageing studies funded by the NIA, including the HRS, in their global aging repository: https://g2aging.org/. Detail on how the variables were derived in the HRS are available here: http://www.rand.org/content/dam/rand/www/external/labor/aging/dataprod/randhrsL.pdf

status measure differentiated between those in a first marriage and those in a subsequent marriage in order to fully capture any association between previous marital transitions and physical capability.

Additionally, a data cleaning exercise was carried out in ELSA between the marital status measure collected in the main interview at each wave and the marital history data collected in the life history interview to ensure that marital status was accurate. More detail on how the measure was cleaned is provided in the appendices (Appendix A).

Cohabitation

With the increase in the prevalence of cohabitation in recent decades, and because it is now viewed as an alternative to marriage in England and the USA (Cherlin, 2005) (Kiernan, 2002), it was considered whether the marital status measure should also distinguish between those who were unmarried and cohabiting and those who were unmarried and not cohabiting. However, there were insufficient numbers of unmarried cohabiters in either survey, (392 in ELSA and 422 in the HRS), for them to be categorised separately, as there simply wouldn't be sufficient sample power to detect differences in physical capability. A decision was taken as to whether unmarried cohabiters should be placed in the married categories or the unmarried categories.

Although, those who cohabit reap many of the benefits associated with marriage: a close intimate relationship, social support and in some respects shared resources, there are many important differences between those who cohabit and those who marry or remarry. Evidence has shown that those who cohabit at older ages were more socio-economically disadvantaged than those who were married and had lower levels of education, lower income and were less likely to own their own home than their married counterparts (Moustgaard and Martikainen, 2009) (Brown et al., 2006) (Chevan, 1996). Cohabiting relationships were also more likely to break up than marriages even at older ages (Moustgaard and Martikainen, 2009). However, cohabiters were also socio-economically different to those who were unmarried and not cohabiting and evidence suggests that they had more favourable SEPs to those who were partnerless, through higher income and higher levels of employment (Brown et al., 2006). Overall, the evidence suggests that those who cohabit, but are not married, are different to both those who are married and those who are partnerless.

In order to fully assess whether those who were cohabiting should be included with the married categories or should remain in their legal marital status a descriptive analysis and detailed sensitivity analysis was carried out. The descriptive analysis compared the demographic and socio-economic characteristics, health behaviour and physical health and psychological morbidity profiles of those who were cohabiting both with those who were married and with those who were unmarried and

not cohabiting (presented in Appendix B). The analysis showed that, consistent with the previous literature, those who cohabited and were unmarried were different to those who were married, but they were also different to those who were partnerless. Overall those who cohabited had a lower SEP than those who were married, they also had slightly poorer health behaviours and, among women only, poorer psychological health to those who were married. A sensitivity analysis was also carried out to compare whether including those who were cohabiting in with the marriage categories changed the cross-sectional association between marital status and physical capability. The results of the sensitivity analysis are also presented in Appendix B and showed that the inclusion of the cohabiters in with the legal marriage categories (first marriage and remarried) did not change the association between marital status and physical capability. Given that those who cohabited and were not married had different characteristics to those who were married, and given the importance of marriage for this cohort of people, it was decided that the exposure used in this thesis would be legal marital status and the cohabiters would be retained in their unmarried statuses.

4.2.2 Physical capability

Two measures of physical capability have been used in this thesis: grip strength and walking speed. These two measures were used as they provide an overall picture of physical capability which includes upper body muscle strength, balance and speed. Grip strength and walking speed were also selected as they were comparable on both surveys, and the only other comparable physical performance measure collected on both surveys was standing balance. Walking speed was chosen over the standing balance test as there was evidence that walking speed on its own was as accurate at predicting future disability as a summary measure derived from a combination of standing balance, chair rises and walking speed physical performance tests (Guralnik et al., 2000). The self-reported measures of ADLs were not used. This was partly because there was more existing research on marriage and physical capability which had used the ADLs as the outcome and far less research which had used the physical performance measures, but also the self-reported measures could be culturally sensitive and therefore possibly not as easy to interpret for international comparative research (Guralnik et al., 1989). Evidence suggests that Americans have better psychological wellbeing (through a higher sense of mastery) than their counterparts in England (Clarke and Smith, 2011), which has shown to be associated with answering the ADLs more positively (Kempen et al., 2006). Therefore using the ADLs, in this research, could lead to biased results. Additionally, the ADLs measures are usually used to measure disability and the outcome of interest for this thesis was physical capability.

Grip Strength

Grip strength measures upper body muscle strength and has shown to be predictive of future disability and mortality (Rantanen et al., 1999), not just at older ages but also across the life course (Sayer and Kirkwood, 2015). Grip strength was measured using a Smedley Dynamometer on both the HRS and ELSA, which participants were asked to squeeze as hard as they could for a couple of seconds on each hand. The protocol on each survey, whilst not identical, was very similar. In ELSA the test was performed three times on each hand, whilst in the HRS it was measured twice on each hand, and in ELSA the test was administered by a trained nurse whilst in the HRS it was administered by a trained interviewer. For this thesis the highest grip strength measurement out of the first two tests on each hand were used on both ELSA and the HRS. The measure has been adjusted for height in metres to take into account body size. This adjustment has been used in previous studies of grip strength (Guralnik et al., 2006) (Guralnik et al., 2009).

Walking speed

Walking speed is a measure of overall physical capability including balance, strength, speed and coordination and, similar to grip strength, has shown to be predictive of disability (Artaud et al., 2015) (Guralnik et al., 2000) and mortality (Studenski et al., 2011). Participants were asked to walk (with a walking aid if necessary) a set distance at their usual walking speed whilst being timed and the test was performed twice. There was some variation in the protocol between ELSA and the HRS; in ELSA the distance walked was 8 feet (2.44 metres) whilst in the HRS it was 8.2 feet (2.50 metres). The age of eligibility also varied between the two surveys; in ELSA all those aged 60 years and older were eligible, whilst in the HRS it was all those aged 65 years and older. To ensure comparability only walking speed measures from those participants aged 65 years and older in ELSA were used in the cross-national analysis in Chapter 6. On both surveys all those who were able to walk (even if it was with a walking aid) were eligible for the test. For the analysis the mean walking speed, measured in metres per second, out of the two walks was used and the derivation took into account the differing distances walked between the two surveys by dividing the time in seconds taken to do the walk by the distance walked.

Unable to do the physical capability tests due to health reasons

A total of 86 participants in ELSA and 349 in the HRS were unable to do the grip strength test due to health reasons and 1,166 participants were unable to do the walking speed test between Waves 1 to 6 of ELSA and 538 participants were unable to do the walking speed test at Waves 8 or 9 in the HRS. Omitting these participants would have led to distorted estimates, as it would be expected that they would have low levels of physical capability. Therefore, rather than omitting them from the analysis they were included. These participants were given a value of the gender and age

specific mean of the bottom grip strength or walking speed quintile. A similar method has been used on previous studies using the physical performance measures of physical capability (Hurst et al., 2013) (Strand et al., 2011). Table 4.1 shows the age specific grip strength value given to men and women unable to do the test, and the numbers of participants assigned that value in ELSA Wave 4 and the HRS Waves 8 and 9. These values were used in the cross-sectional analysis detailed in Chapter 6. A sensitivity analysis which compared the estimates when those who were unable to do the tests due to health reasons were excluded from the analysis and when they were included is detailed in the appendices in Appendix E.

Table 4.1: Calculated grip strength values (kg/m) given to those who were unable to do the grip strength test due to health reasons at Wave 4 of ELSA and Waves 8 and 9 of the HRS

	ELSA				HRS			
	Men		Women		Men		Women	
Age	Value (kg/m)	N	Value (kg/m)	N	Value (kg/m)	N	Value (kg/m)	N
50-59	18.17	6	11.26	11	19.86	13	12.61	49
60-69	16.86	6	10.67	18	17.37	23	11.37	88
70-79	14.59	15	8.59	14	15.42	18	9.77	84
80+	11.50	5	6.60	11	12.15	13	7.72	61
Total (N)	***32***		***54***		***67***		***282***	

Table 4.2 shows the age specific mean walking speed values for men and women given to the participants who were unable to do the walking speed tests due to health reasons for Waves 1 to 6 of ELSA and Waves 8 and 9 of the HRS. These values were used in the cross-sectional analysis detailed in Chapter 6 and the ELSA longitudinal analysis detailed in Chapter 7.

Table 4.2: Calculated walking speed values given to those who were unable to do the walking speed test due to health reasons at Waves 1 to 6 in ELSA and Wave 8 and 9 of the HRS

ELSA				
	Men		Women	
Age group	Mean walking speed (m/s) of bottom 5th	N	Mean walking speed (m/s) of bottom 5th	N
		Wave 1		
60-69	0.561	42	0.527	47
70-79	0.476	37	0.405	64
80+	0.341	17	0.274	68
		Wave 2		
60-69	0.594	48	0.552	43
70-79	0.522	50	0.420	68
80+	0.331	39	0.273	84
		Wave 3		
60-69	0.584	34	0.543	43
70-79	0.489	32	0.400	52
80+	0.351	35	0.257	78
		Wave 4		
60-69	0.610	53	0.554	73
70-79	0.490	50	0.427	90
80+	0.350	34	0.294	97
		Wave 5		
60-69	0.645	47	0.595	71
70-79	0.533	61	0.445	89
80+	0.349	35	0.277	126
		Wave 6		
60-69	0.633	37	0.589	48
70-79	0.539	60	0.479	85
80+	0.387	34	0.324	76
Total (N)	*745*		*1,302*	

HRS				
	Men		Women	
Age group	Mean walking speed (m/s) of bottom 5th	N	Mean walking speed (m/s) of bottom 5th	N
		Waves 8 and 9		
60-69	0.518	39	0.465	66
70-79	0.468	74	0.389	132
80+	0.368	80	0.283	147
Total (N)	*193*		*345*	

Table 4.3 to Table 4.6 show a comparison of the age adjusted percentages of men and women who were able and unable to perform the physical performance tests due to health reasons in each marital status category, and who were included in the cross-sectional analysis in Chapter 6. In ELSA there was no association between marital status and being unable to complete the grip strength measurement for health reasons, whilst in the HRS there was an association; divorced men and women and widowed women were more likely to be unable to do the grip strength test due to health reasons than those in their first marriage. For the measure of walking speed there were some differences between those who were unable to do the test by marital status in ELSA. A higher

percentage of never married men and divorced women in ELSA were unable to do the walking speed test due to health reasons than those in their first marriage. In the HRS a higher percentage of remarried, divorced and widowed men were unable to do the walking speed test due to health reasons, whilst among women all those who were unmarried were more likely to be unable to do the test due to health reasons compared to women in their first marriage.

Removing individuals from the analysis who were unable to participate in the physical capability measures for health reasons would result in an underestimation of the variation in physical capability by marital status, particularly for those who are unmarried and particularly for the measure of walking speed in both ELSA and the HRS.

Table 4.3: Comparison of those who were able and unable to do the grip strength test due to health reasons at Wave 4 of ELSA

	Men					Women				
	First marriage	Remarried	Divorced / separated	Widowed	Never married	First marriage	Remarried	Divorced / separated	Widowed	Never married
	%	%	%	%	%	%	%	%	%	%
Able to do the test	99.3	98.6	99.7	98.6	99.0	99.0	98.9	98.8	98.0	98.6
Unable to do the test due to health reasons	0.7	1.4	0.3	1.4	1.0	1.0	1.1	1.2	2.0	1.4
Total (N)	*2,058*	*490*	*343*	*270*	*221*	*1,953*	*490*	*589*	*853*	*211*

Adjusted for age

** p<0.05 **p<0.001 first marriage v other marital status*

Table 4.4: Comparison of those who were able and unable to do the grip strength test due to health reasons at Wave 8 and 9 of the HRS

	Men					Women				
	First marriage	Remarried	Divorced / separated	Widowed	Never married	First marriage	Remarried	Divorced / separated	Widowed	Never married
	%	%	%	%	%	%	%	%	%	%
Able to do the test	99.0	99.1	96.6**	99.1	98.7	97.0	96.5	95.6*	95.2*	96.8
Unable to do the test due to health reasons	1.0	0.9	3.4	0.9	1.3	3.0	3.5	4.4	4.8	3.2
Total (N)	*2,808*	*1,360*	*599*	*473*	*166*	*2,733*	*1,170*	*1,066*	*2,154*	*222*

Adjusted for age

** p<0.05 **p<0.001 first marriage v other marital status*

Table 4.5: Comparison of those who were able to do the walking speed test and those who unable due to health reasons at Wave 4 of ELSA

	Men					Women				
	First marriage	Remarried	Divorced / separated	Widowed	Never married	First marriage	Remarried	Divorced / separated	Widowed	Never married
	%	%	%	%	%	%	%	%	%	%
Able to do the test	96.9	95.0	96.1	96.5	93.2*	95.8	94.6	92.1*	94.5	93.3
Unable to do the test due to health reasons	3.1	5.0	3.9	3.5	6.8	4.2	5.4	7.9	5.5	6.7
Total (N)	*1,449*	*339*	*197*	*251*	*123*	*1,881*	*845*	*307*	*433*	*75*

Adjusted for age

** p<0.05 **p<0.001 first marriage v other marital status*

Table 4.6: Comparison of those who were able to do the walking speed test and those who unable due to health reasons at Wave 8 and 9 of the HRS

	Men					Women				
	First marriage	Remarried	Divorced / separated	Widowed	Never married	First marriage	Remarried	Divorced / separated	Widowed	Never married
	%	%	%	%	%	%	%	%	%	%
Able to do the test	96.4%	94.8%*	90.9%**	92.6%**	97.3%	95.5%	95.5%	89.6%**	91.9%**	90.9%*
Unable to do the test due to health reasons	3.6%	5.2%	9.1%	7.4%	2.7%	4.5%	4.5%	10.4%	8.1%	9.1%
Total (N)	*1,881*	*845*	*307*	*433*	*75*	*1,664*	*572*	*529*	*1,919*	*112*

Adjusted for age

** p<0.05 **p<0.001 first marriage v other marital status*

4.2.3 Covariates

A number of covariates were adjusted for in the analyses in this thesis. Some of the covariates were included to account for any confounding, whilst others were included as they were thought to be on the mediating pathway between marriage and physical capability, outlined in the conceptual model in Chapter 3.

Childhood circumstances

Measures of childhood were used to investigate whether marital status varied by childhood circumstances. As both ELSA and the HRS are prospective studies, from the age of 50 onwards, details on childhood circumstances were collected retrospectively. In ELSA the data were collected during the one off Life History Interview conducted in 2007, in between Waves 3 and 4, which was detailed in Section 4.1.1. The HRS did not conduct a life history interview, but in 1998 (Wave 4) a number of measures about childhood were introduced into the demographics module in the core interview.

Overall there were few childhood measures which were directly comparable in ELSA and the HRS. This was largely because the HRS only contained a small number of questions about childhood circumstances and many of those questions measured different concepts to those on the ELSA life history. The measures which were considered to be comparable were on childhood self-rated health, parental education, parental unemployment and father's occupation. More detail on each measure is provided and how some of the variables were harmonised to ensure comparability between ELSA and the HRS.

Childhood self-rated health

Both ELSA and the HRS asked participants to retrospectively rate their general health during childhood. In ELSA, participants rated their health up to the age of 15 whilst in the HRS participants rated their health up to the age of 16. As this was only a slight difference in the timeframe the two measures were considered to be comparable. The other minor difference between the two measures was that in ELSA the question included a response category "varied health" which contained very few people (13 men and 9 women) and subsequently it was decided that this should be recoded into the fair / poor category.

ELSA: *Would you say that your health during your childhood was excellent, very good, good, fair, or poor?*[5]

HRS: *Consider your health while you were growing up, from birth to age 16. Would you say that your health during that time was excellent, very good, good, fair, or poor?*

Parents' education

ELSA and the HRS collected data on the level of both mothers' and fathers' education. In ELSA participants were asked the age of their parents when they finished full time continuous education. In the HRS participants were asked what their parents' highest completed grade of school was, which has since been translated into the number of years of education in the RAND harmonised variable (from 0 to 17 years). The RAND harmonised variable was used as it measured the number of years of education, similar to the ELSA parental education variables. The parents' education variables were categorised differently in ELSA and the HRS based upon the education system in the respective countries in the first half of the 20th century, which is when the majority of the ELSA and HRS participants' parents would have been of school age.

In ELSA the parents' education variables were dichotomised into 9 years or fewer education and 10+ years of education. The Education Act of 1918 made education compulsory between the ages of 5 and 14, which was equivalent to 9 or fewer year's education. In the USA the norm was to receive 11 years of schooling from the late 19th century onwards so the corresponding variable in the HRS was dichotomised into 0 to 11 years (less than high school) and 12+ years (high school and above). This was a similar derivation used by Haas using the HRS (Haas, 2008).

ELSA: *At what age did your natural mother / father finish continuous full-time education at school or college?*
Never went to school / 14 or under / At 15 / At 16 / At 17 / At 18 / 19 or over
HRS: *What is the highest grade of school your mother / father completed?*
No formal education / Grades / High school / Some college / College grad / Post college (17+ years) / Other

Parents' unemployment

Both ELSA and the HRS asked whether the participant had experienced a period of parental unemployment when before they were 16 years old, however the two measures were not identical.

[5] Varied health was included as an answer category, but not included in the question text.

In ELSA, participants were asked whether either of their parents were unemployed for more than 6 months, whilst in the HRS the question was only asked with regard to their father. Given that during the period when participants would have been children (circa the first half of the 20th century to the late 1960s) it was predominantly men who were the breadwinners, it's probable that the majority of ELSA participants would have answered the question with regard to their father; therefore, it was judged that these two measures were comparable. The HRS also included two additional categories which were not present in the ELSA question, one category for "not living with father / father not alive" and another category for "father never worked / always disabled". In order to ensure comparability between the two measures these two additional categories were added to the ELSA measure. The additional category "not living with father / father not alive" was created in ELSA using data from a variable in the ELSA core data which asked who the participant lived with for most of their childhood. If the participant had said that they had not grown up with either parent and the unemployment question in the life history had not been answered they were added to the "didn't live with parent / parents not alive category" (this affected 99 individuals). The second category "father never worked /always disabled" was created using the information from the father's occupation measure (on which more information is provided below) which included a category "sick / disabled". All those who said their father was sick or disabled at this question and had not answered the unemployment question were included in a "sick / disabled" category in the unemployment measure. Subsequently, because of the small numbers in this category (66 in ELSA, 64 on HRS) it was decided to merge the "sick / disabled" category with the category who had experienced a period of unemployment.

ELSA: *When you were aged under 16, were either of your parents unemployed for more than 6 months when they wanted to be working?*
Yes
No

HRS: *Before age 16, was there a time of several months or more when your father had no job?*
Yes
No
Father never worked/always disabled
Never lived with father/father was not alive

Father's occupation

Both ELSA and the HRS contain information on father's occupation when participants were growing up, but there were some minor differences between the two measures. In ELSA participants were asked about their father's, or if they didn't live with their father their main carer's occupation when they were 14 years old. In the HRS participants were asked what their father's

occupation was when they were 16. If the participant did not have a father or didn't live with their father they were not routed to this question. Also in ELSA the question included categories for unemployed, sick and retired and there were no comparable categories in the HRS as those whose father never worked or who were disabled were also not routed to this question. In order to harmonise the measure those ELSA and HRS sample members who didn't have a father, or whose father was sick, unemployed or retired were categorised into a separate category termed "Father unemployed / sick / retired / father died / didn't live with father".

Father's occupation in the HRS and ELSA was harmonised into four internationally comparable categories higher / intermediate / routine or manual / other. The harmonisation was achieved using guidance from the Office for National Statistics (ONS) Standard Occupation Classification and the International Standard Classification of Occupations[6]. More detail on how the categories were harmonised are provided in the appendices (Appendix D).

ELSA: *What was your father's main occupation when you were 14?*

HRS: *What was your father's occupation when you were age 16?*

Demographic and socio-economic measures

A number of demographic and socio-economic measures have been adjusted for in the analyses, these include age, ethnicity, education (age left full time education), wealth, current work status, parental status. Age, ethnicity and parental status have been classified as confounders. Education, wealth and work status have been used as measures of SEP and are conceptualised as mediators on the pathway between marriage and physical capability.

Age

Age was categorised into 10 year age bands: 50-59 years / 60-69 years / 70-79 years / 80+ years. It was decided to categorise age because the association between age and physical capability is not linear, as physical capability declines sharply from the age of 70 years and older (see Figure 6.2 and Figure 6.3 in Chapter 6).

Education

Education was measured as age left full time education. Attempts were made to make the measure of education between ELSA and HRS comparable, given the different education systems.

[6] ONS Standard Occupation Classification: http://www.ons.gov.uk/ons/guide-method/classifications/current-standard-classifications/soc2010/soc2010-volume-1-structure-and-descriptions-of-unit-groups/index.html
International Standard Classification of Occupations:
http://www.ilo.org/public/english/bureau/stat/isco/isco68/major.htm

Education was divided into three categories – low, medium and high (shown in Table 4.7). In ELSA, age left full time continuous education was derived into categories which took into account changes in the compulsory school leaving age[7]. In the HRS, age left full time education was derived into the same categories which were applied in other comparative studies using ELSA and the HRS data (Banks et al., 2006)

Table 4.7: Education derivation in ELSA and the HRS

Education level	England	USA
Low	Compulsory school leaver or less (0-11 years of schooling)	High school or less (0-12 years of schooling)
Medium	Between compulsory school leaver and age 18 (12-13 years of schooling)	More than high school but not a college graduate (13-15 years of schooling)
High	Aged 19+ (13+ years of schooling)	College graduate (16+ years of schooling)

Wealth

Wealth instead of income has been used as a measure of material resources. At older ages many people may be on a relatively low income through pension receipt, whereas wealth reflects lifelong income and has been shown to be a more accurate measure of SEP at older ages (Gjonca et al., 2009). Both the HRS and ELSA contain detailed questions on income, assets and debt which makes it possible to derive accurate measures of wealth. Total wealth has been used, which is the sum of savings, investments, physical wealth and housing wealth after financial and mortgage debt have been subtracted. In ELSA the wealth variable was derived by the Institute for Fiscal Studies and in the HRS comparable wealth variables have been derived by RAND[8]. Wealth was measured at the benefit unit level (for example a married couple would count as one benefit unit) and for the purpose of this analysis wealth is categorised into quintiles from low to high.

Work and parental status

Work status was a dichotomous variable indicating whether the participant was currently carrying out any paid work or not. Parental status was also a dichotomous variable which indicated

[7] See the link below for more information on the education derivation created by the Institute for Fiscal Studies. http://discover.ukdataservice.ac.uk/catalogue/?sn=5050&type=Data%20catalogue#documentation

[8] In ELSA the derived wealth variable is available on the publicly archived dataset, whilst on the HRS RAND harmonised wealth derivations for 2006 and 2008 were used; https://mmicdata.rand.org/megametadata/

whether the participant had, had a least one child or not (which included biological, adopted or step children as well as children which were no longer alive).

Health behaviours

A number of health behaviours and related variables – physical activity, smoking status and body mass index (BMI) – have been used. Health behaviours have been conceptualised as being on the pathway between marriage and physical capability and were treated as mediators.

Physical activity

The measure of physical activity used was self-reported and on both surveys was derived from a series of questions which asked how frequently a participant did vigorous, moderate or mild physical activity. In ELSA the derived measure was on the publicly available dataset and also included any physical activity from paid work. The variable was not derived in the HRS dataset, so in order to ensure comparability the measure was created in the HRS using the same derivation in ELSA, including any physical activity from paid work. The derived variable was categorised into sedentary, low, medium and high physical activity. Table 4.8 gives details on how the physical activity measure was derived[9].

[9] More details on how the physical activity measure was derived is contained in the ELSA derived variable user guide: Cox, K. D., C; Philo, D; Nunn, S; Sanchez, M. ELSA Wave 5 Derived Variables, User Guide. *NatCen Social Research*. Available at: http://www.elsa-project.ac.uk/publications/case/guides

Table 4.8: Physical activity categorisation

Level of physical activity	Definition
Sedentary	Either not working or in a sedentary occupation and engages in mild exercise 1 -3 times a month or less, with no moderate or vigorous activity
Low	One of the following: • A standing occupation, engaged in moderate leisure-time exercise once a week or less and no vigorous leisure-time activity. • Engaged in mild leisure-time activity at least 1–3 times a month and moderate leisure-time activity once a week or less and no vigorous leisure time activity. • A sedentary job or no occupation and engaged in moderate leisure-time activity once a week or 1–3 times a month, with no vigorous leisure-time activity.
Moderate	One of the following: • Employed in a physically active job. • Engaged in moderate leisure-time activity more than once a week. • Engaged in vigorous activity once a week to 1–3 times a month.
High	Either employed in heavy manual work, or engaged in vigorous leisure activity more than once a week

Smoking status

Smoking status comprised current smoking status and smoking history. Smoking status from the current and previous waves of both the HRS and ELSA was used to create this variable. Smoking status was categorised into never smoked / former smoker / current smoker.

Body mass index (BMI)

BMI was calculated using the objective measures of height and weight by dividing weight in kilograms by height in metres squared. The BMI values were categorised according to the WHO guidelines: 0-24.9 kg/m^2 (underweight to normal weight); 25-29.9 kg/m^2 (overweight); 30+ kg/m^2 (obese)[10]. The underweight and normal weight categories were combined as there were too few people in both surveys who were underweight (ELSA underweight n = 68; HRS underweight n = 180). BMI was categorised as the association between physical capability and BMI was not linear.

For the analysis on longitudinal changes in walking speed using ELSA, BMI was estimated at Wave 1, Wave 3 and Wave 5, as BMI was not collected at these waves (as there was no nurse visit). BMI

[10] For more details see: http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi

for Wave 1 was estimated by calculating a mean score of the continuous measure of BMI collected earlier at the Health Survey for England (HSE) and the BMI collected at ELSA Wave 2 and was calculated for Wave 3 similarly by calculating the mean of the BMI at Wave 2 and the BMI at Wave 4 and for Wave 5 by using the BMI at Wave 4 and at Wave 6.

Alcohol consumption

A measure of alcohol consumption was not included in the covariates as the association between alcohol consumption and physical capability was shown to be not very strong (Stuck et al., 1999). Additionally, information on long term patterns of alcohol consumption are not accurately measured in ELSA and the HRS, asking about consumption in the last seven days. There is much evidence showing that people underestimate how much alcohol they have consumed (Stockwell et al., 2004). Also, alcohol consumption is collected in the self-completion questionnaire which is prone to non-response, particularly among those participants who are the only ELSA members in the household as the self-completion is left behind after the interview to complete and return, whereas with couples it tends to be completed whilst the other partner is being interviewed. The inclusion of alcohol consumption would have further reduced the analytic sample.

Physical health and psychological morbidity

Physical health and psychological morbidity were both viewed as mediators on the pathway between marriage and physical capability, although the direction of the association between both physical health and psychological morbidity and physical capability is thought to be bi-directional.

Two measures were used to reflect the different dimensions of physical health: self-rated health and the number of doctor diagnosed health conditions, although its recognised that self-rated health measures not just physical health but also psychological morbidity, positive affect and overall well-being (Schuz et al., 2011). Self-rated health has been shown to predict mortality, physical capability and health care use (Schuz et al., 2011). The measure of self-rated health is exactly the same in ELSA and the HRS and was categorised into three categories: excellent to very good, good, and fair to poor. Reports of doctor diagnosed health conditions were also included as they have been shown to predict physical capability outcomes (Wallace and Herzog, 1995). The doctor diagnosed conditions include: hypertension, diabetes, cancer, chronic lung disease, heart disease, stroke and arthritis. The variable was categorised into no conditions, 1 condition, 2 conditions and 3 or more conditions.

To measure psychological morbidity the Centre for Epidemiologic Studies Depression Scale (CES-D) was used. The CES-D is a validated scale of depressive symptoms (Radloff, 1977) used on both ELSA and the HRS. The scale used in ELSA and the HRS is the shortened 8 item scale which comprised a series of 8 questions about how the participant felt in the last week, from which a

cumulative score out of 8 was calculated, with higher scores indicating more depressive symptoms. The variable was dichotomised into fewer than 3 depressive symptoms and 3 or more depressive symptoms, as 3 or more depressive symptoms has been shown to be indicative of clinical depression in the 8 item scale (Schane et al., 2008).

4.3 Stratification by gender

The analysis presented in each of the chapters was stratified by gender. There were two reasons why this was done. Firstly, given that previous evidence has shown there were some gender differences in the association between marriage and physical capability (previously detailed in Chapter 2); it was of interest to explore the association between marriage and physical capability for men and women separately, as well as testing for any gender differences in England and the USA. The second reason was methodological, because both the HRS and ELSA samples contain many couples and as some measures are calculated at the couple level, such as wealth, this would mean that the assumptions of some of the statistical techniques would be violated as the observations would not be independent of on each other. Stratification by gender resolved this issue.

Chapter 5: The demography of marriage in England and the USA

The aim of this chapter is to describe how those in different marital statuses vary in their childhood circumstances, their demographic and socio-economic characteristics, their health behaviours and physical health and psychological morbidity. The second aim of this chapter is to go some way to discovering whether entry into marriage as well as exit out of marriage is selective.

There is much evidence which has shown childhood circumstances to be associated with entry into and exit out of marriage. Childhood SEP is associated with adult marital status, although it is unclear whether those who had a more advantaged childhood SEP were more likely to remain married (Kiernan and Mueller, 1998) or were more likely to divorce (Todesco, 2013). Childhood family structure also varied by marital status, those who experienced parental divorce were less likely to marry and if they did so more likely to divorce (Amato and Deboer, 2001). Additionally, those who were married have been shown to have higher levels of education than those who never marry. This was particularly evident among men (Shafer and James, 2013), whilst evidence suggests that highly educated women were less likely to marry in the first instance (Kiernan, 1988b) and also less likely to remarry after divorce (Shafer and James, 2013). Evidence has also shown that circumstances experienced at mid to later life, including socio-economic circumstances (Zagorsky, 2005) (Wilmoth and Koso, 2002), health behaviours (Liang and Chikritzhs, 2012) (Power et al., 1999) (Rapp and Schneider, 2013) and physical (Robards et al., 2012) and psychological health (Yan et al., 2011) in mid to later adulthood also vary by marital status. However, what is not known is whether these associations varied between England and the USA. It is possible that any associations between childhood and adult circumstances and marital status could vary between England and the USA due to differences in marriage and divorce patterns between the two countries, which could result in different selective factors into and out of marriage.

This chapter addresses the aims raised above through exploring the association between childhood characteristics, and marital status at age 50 years and over and whether the association varies by gender and between England and the USA.

5.1 Analytic sample and method

This section details the analytic samples and methods used in this chapter.

5.1.1 Analytic sample

The analytic sample in this chapter comprised sample members who participated in Wave 4 of ELSA and Waves 8 or 9 of the HRS. Wave 4 of ELSA and Waves 8 and 9 of the HRS were chosen as the physical performance tests were not fully introduced for half of the HRS sample until Wave 8,

which was in 2006, and to the remaining half of the sample in 2008, therefore to ensure that the measures on ELSA were collected within a comparable time frame Wave 4 (2008) of ELSA was selected. Only those who had data on marital status, all the covariates – the demographic and socio-economic, health behaviours and physical health and psychological morbidity measures (detailed earlier in section 4.2.3) and either a valid grip strength or walking speed measure were included in the analysis. This was so that the same analytic sample could be retained for the cross-sectional analysis on marital status and physical capability (detailed in Chapter 6). Unfortunately not all sample members had complete data on all the childhood measures, particularly the ELSA sample as some of the measures were taken from the separate Life History Interview which some sample members did not have the opportunity to participate in. Therefore there were different analytic samples, five for the analysis of marital status and childhood circumstances and one for the analysis of marital status and demographic and socio-economic characteristics, health behaviours and physical health and psychological morbidity.

Figure 5.1 shows how the analytic samples in ELSA were selected. A total of 8,218 sample members participated in the Wave 4 main interview and nurse visit of which 60 cases were missing data on both grip strength and walking speed and none were missing data on marital status. There were 638 cases missing data on one or more of the covariates in the demographic and socio-economic, health behaviours and physical health and psychological morbidity measures. This gave a sample of 7,520 individuals for the analysis on marital status and demographic and socio-economic characteristics, health behaviours and physical health and psychological morbidity. There was additional missing data for the measures of childhood circumstances. Two of the childhood circumstances measures (childhood health and parental unemployment) were collected during the Life History Interview. As a result there is a considerable amount of missing data on these two measures. Out of those 7,520 individuals 5,093 participated in the life history interview. A total of 2,431 cases were missing data on childhood health, 1,881 were missing data on father's education, 1,757 were missing data on mother's education, 28 were missing data on father's occupation and 3,015 cases were missing data on whether father was out of work for 6 months or more. The final analytic sample for the analysis on each measure of childhood circumstances is given at the bottom of Figure 5.1.

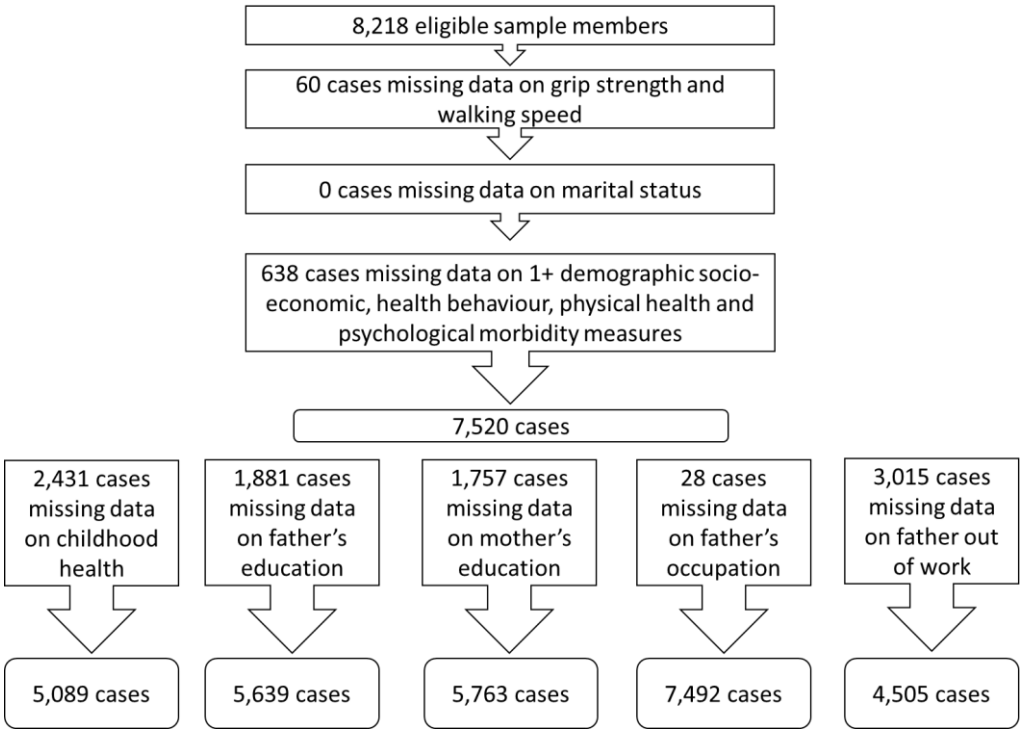


Figure 5.1: Analytic sample for childhood measures, ELSA

Figure 5.2 shows the analytic samples for the HRS. A total of 13,806 sample members participated in a Wave 8 or 9 face to face interview, of which 412 were missing data on both of the physical capability measures and none were missing data on marital status. A total of 291 individuals were missing data on one or more of the demographic and socio-economic, health behaviour and physical health and psychological morbidity measures, which gave an analytic sample of 13,103 cases for majority of the demography of marriage analysis. Similar to ELSA there was additional missing data on the measures of childhood circumstances, although overall there was less missing data than on ELSA as the childhood measures on the HRS were collected during the core interview. Of those 13,103 cases, 5 were missing data on childhood health, 1,852 were missing data on father's education, 1,198 were missing data on mother's education, 2,308 cases were missing data on father's occupation and 137 were missing data on whether father was out of work for 6 or more months. The final analytic samples for each measure of childhood circumstances is given at the bottom of Figure 5.2.

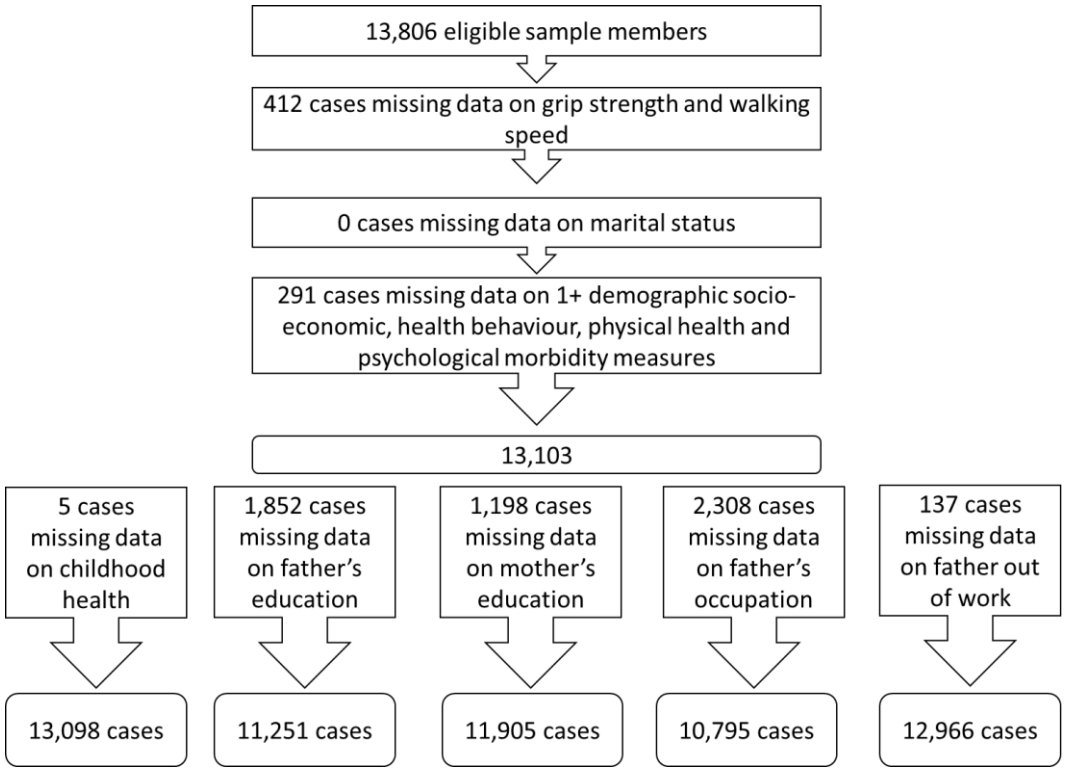


Figure 5.2: Analytic sample for childhood measures, HRS

Table 5.1 and Table 5.2 show marital status comparisons of the complete sample (including those cases with missing data) at Wave 4 of ELSA and Waves 8 and 9 of the HRS respectively, and the analytic sample for the demographic and socio-economic characteristics, health behaviours and physical health and psychological morbidity and the analytic sample for the childhood characteristics. As there were five different analytic samples for the childhood characteristics analysis presented in this chapter, for ease of comparison, the childhood measures analytic sample just for the comparisons of the complete sample with the analytic sample shown in Table 5.1 and Table 5.2 comprise only those individuals who had valid data on all five childhood measures.

On both ELSA and the HRS there were some differences in the marital status composition of the analytic samples compared to the complete sample. Men in ELSA who were in their first marriage were more likely to be included in the two analytic samples than all other men, particularly widowed men. Among women in ELSA there were fewer differences by marital status between the complete sample and the analytic samples than were seen among men. Only widowed women were less likely to be included in both analytic samples than women in their first marriage and never married women were less likely than women in a first marriage to be included in the analysis on childhood circumstances only (Table 5.1).

Table 5.1: Comparison of complete sample and the analytic sample for demography of marriage chapter, ELSA

	Men			Women		
	Complete sample	Analytic sample – adult demographic, socio-ec, and health	Analytic sample - childhood circumstances	Complete sample	Analytic sample – adult demographic, socio-ec, and health	Analytic sample - childhood circumstances
	%	%	%	%	%	%
First marriage	59.8	61.0	67.3	46.9	47.8	50.9
Remarried	14.8	14.5*	13.7*	11.8	11.9	11.2
Divorced / separated	10.4	10.1*	7.3**	14.5	14.3	13.1
Widowed	8.4	8.0**	7.0**	21.6	20.9**	20.5*
Never married	6.7	6.5*	4.7**	5.2	5.1	4.3*
Total (N)	*3,694*	*3,391*	*1,440*	*4,524*	*4,129*	*1,800*

** p<0.05 ** p<0.001 first marriage v other marital statuses*
Adjusted for age
Tests of significance were carried out by running logistic regression comparing the likelihood of being in the analytic sample to not being in the analytic sample by marital status.

In the HRS remarried men were less likely to be included in the analytic sample for the demographic, socio-economic, health behaviour and health characteristics than men in their first marriage. For the analytic sample of childhood circumstances divorced and never married men were less likely to be included than men in their first marriage, whilst widowed men were more likely to be included than men in their first marriage. Among women in the HRS there were no differences by marital status between the analytic sample for the demographic, socio-economic, health behaviour and health characteristics and the complete sample. For the analytic sample on childhood measures women in their first marriage were more likely to be included than women who were either remarried, divorced or never married (Table 5.2).

As there was overall greater missing data among those who were unmarried than those who remained in their first marriage it is possible that some of the estimates in the analysis would under report the differences between those who were in their first marriage and those who were unmarried.

Table 5.2: Comparison of cases with missing data and analytic sample for demography of marriage chapter, HRS

	Men			Women		
	Complete sample	Analytic sample – adult demographic, socio-ec, and health	Analytic sample - childhood circumstances	Complete sample	Analytic sample – adult demographic, socio-ec, and health	Analytic sample - childhood circumstances
	%	%	%	%	%	%
First marriage	51.3	51.7	52.4	36.7	37.0	37.7
Remarried	25.3	25.2*	24.6	15.7	15.7	15.0*
Divorced / separated	11.3	11.1	10.0**	14.8	14.5	12.2**
Widowed	8.9	8.9	10.8*	29.8	29.8*	32.6
Never married	3.2	3.1	2.3**	3.2	3.0	2.4**
Total (N)	*5,753*	*5,512*	*3,438*	*8,053*	*7,591*	*5,042*

** p<0.05 ** p<0.001*
Adjusted for age
Tests of significance were carried out by running logistic regression comparing the likelihood of being in the analytic sample to not being in the analytic sample by marital status.

5.1.2 Analytic method

The analysis in this chapter was descriptive using age adjusted percentages. Age adjusted percentages were estimated in order to minimise any confounding by age in the association between marital status, childhood circumstances, demographic and socio-economic circumstances, health behaviours and physical health and psychological morbidity. Tests of significance were carried out using logistic regression in STATA 14, again adjusting for age. The analysis was stratified by gender and weighted using the cross-sectional survey weights, provided on both ELSA and the HRS, to adjust for selection and non-response bias.[11]

5.2 Sample characteristics

This section describes the sample characteristics of the ELSA and HRS samples used for the analysis in this chapter and in Chapter 6.

5.2.1 Marital status

Table 5.3 shows the distribution of marital status in ELSA and the HRS for which there were differences in the percentages in each marital status in each sample. A higher percentage of men and women in ELSA had remained in their first marriage than in the HRS, whilst a higher percentage of men and women in the HRS were in subsequent marriages, and in ELSA higher proportions were

[11] More detail on which measures were used to create the cross-sectional survey weights in ELSA and the HRS is provided in Table 6.6 in Chapter 6.

never married *(p*<0.05*)*. Marital status distributions were compared to official statistics for those aged 50 years and older from both countries. For England the ONS estimates for 2008 were used and for the USA the US 2010 Census was used (the official statistics table is provided in Appendix G). Compared to the ONS figures the ELSA sample was slightly biased towards those who were married or had previously been married. There were lower percentages of those who had never married in the ELSA sample than what was nationally estimated in 2008 (10.3% males and 7.3% females were estimated by the ONS as never married, but the ELSA sample contained 6.5% never married men and 5.1% never married women). The HRS sample similarly over represented those who were married or had previously been married, in the 2010 census 8.0% of men and 6.8% women were never married, which was almost double the proportions in the HRS sample (3.1% and 3.0% for men and women respectively).

Table 5.3: Distribution of marital status for men and women in the ELSA Wave 4 and HRS Waves 8 and 9

	ELSA		HRS	
	Men	**Women**	**Men**	**Women**
	%	**%**	**%**	**%**
First marriage	61.0	47.7	51.7**	37.0**
Remarried	14.4	11.9	25.2**	15.7**
Divorced / separated	10.1	14.4	11.1**	14.5*
Widowed	8.0	20.9	8.9*	29.8**
Never married	6.5	5.1	3.1**	3.0**
Total (N)	*3,391*	*4,129*	*5,512*	*7,591*

* *p*<0.05 ** *p*<0.001 vs HRS with ELSA

5.2.2 Childhood circumstances

Table 5.4 shows the childhood circumstances of men and women in ELSA and the HRS. Higher percentages of men and women in the HRS compared to ELSA reported positive childhood health and more highly educated parents. There were differences in the distribution of father's occupation between ELSA and the HRS. A higher percentage of men and women in ELSA had fathers who were in higher occupations than in the HRS (around a quarter of the ELSA sample had fathers who had been in higher occupations, whilst in the HRS it was 13%) and consequently there was a much higher percentage of the HRS sample who had fathers in routine or manual occupations (*p*<0.001). There were differences in the percentages who had experienced parental unemployment between the two samples. Double the percentage of men and women in the HRS had experienced a period of time when their father out of work, approximately 20% compared to 10% in ELSA.

Table 5.4: Childhood characteristics for men and women in ELSA Wave 4 and the HRS Waves 8 and 9

	ELSA		HRS	
	Men	**Women**	**Men**	**Women**
	%	**%**	**%**	**%**
Childhood health				
Excellent / good	88.8	86.9	94.6**	93.3*
Fair / poor	11.2	13.1	5.4**	6.7*
Missing (N)	*1,101*	*1,330*	*4*	*1*
Father's education				
9 years or less education / 11 years or less	76.6	77.1	60.4**	65.2**
10+ years education / 12+ years	23.4	22.9	39.6**	34.8**
Missing (N)	*860*	*1,021*	*735*	*1,117*
Mother's education				
9 years or less education / 11 years or less	76.7	76.0	53.9**	61.7**
10+ years education / 12+ years	23.3	24.0	46.1**	38.3**
Missing (N)	*837*	*920*	*535*	*663*
Father's occupation				
Higher occupations	24.7	27.0	13.7*	12.5**
Intermediate occupations	40.1	37.0	35.0**	35.9*
Routine manual occupations	9.9	10.0	40.8**	38.8**
Other occupations	22.2	22.3	1.1**	0.9**
Unemployed /sick/retired	3.2	3.8	9.3**	11.9**
Missing (N)	*9*	*19*	*1,086*	*1,222*
Parent not working for 6 + months				
Yes	10.3	9.7	21.4**	20.0**
No	87.3	88.2	71.5**	70.5**
Didn't live with parents / parents not alive	2.4	2.1	7.1**	9.4**
Missing (N)	*1,365*	*1,650*	*58*	*79*
Total (N)	*3,391*	*4,129*	*5,512*	*7,591*

** p<0.05 vs HRS with ELSA ** p<0.001 vs HRS with ELSA*

5.2.3 Demographic and socio-economic characteristics

Moving onto the demographic and socio-economic characteristics in adulthood, which are shown in Table 5.5. The HRS sample was older than ELSA, two thirds of the ELSA sample and just over half of the HRS sample were aged between 50 to 69 years, whilst a quarter of the ELSA sample and almost a third of the HRS were aged 70-79 years. A higher percentage of women than men in both ELSA and the HRS were aged 80 years and older. In ELSA the vast majority of the sample were white, whilst in the HRS just over three-quarters of the sample were white and 8.0% were Hispanic and 13.0% of the sample were black. Just under half of the ELSA sample and over half of the HRS sample had low education and a higher percentage of men and women in the HRS had high levels of education than men and women in ELSA (28.1% of men and 18.1% of women in the HRS compared to 19.5% and 15.3% of men and women in ELSA). In both samples a higher percentage of men than women had high levels of education and this was particularly evident in the HRS. Men, but not women, in both samples were skewed towards those with higher wealth. The majority of people in each sample were not currently working and were parents, although in ELSA a higher percentage were working and also a higher percentage were childless (approximately 15.0% of men and women in ELSA did not have any children compared to 6.0% of men and women in the HRS).

Table 5.5: Demographic and socio-economic characteristics of men and women in ELSA Wave 4 and the HRS Waves 8 ad 9

	ELSA		HRS	
	Men	**Women**	**Men**	**Women**
	%	**%**	**%**	**%**
Age				
50-59	28.7	28.8	20.4**	19.3**
60-69	38.7	37.0	32.9**	33.6*
70-79	24.2	24.5	31.7**	30.5**
80+	8.4	9.7	15.0**	16.6**
Ethnicity				
White	97.1	97.6	78.4**	74.2**
Non-white (ELSA only)	2.9	2.4		
Hispanic (HRS only)	-	-	8.4	8.9
Black (HRS only)	-	-	11.8	15.4
Other (HRS only)	-	-	1.4	1.5
Education				
Low	45.3	45.0	51.7*	59.7**
Medium	35.2	39.7	20.2**	22.1**
High	19.5	15.3	28.1**	18.1**
Wealth				
1st - low wealth	14.4	17.3	15.7*	21.6**
2nd	17.9	19.6	18.2	21.1
3rd	20.1	20.4	21.1	19.7
4th	23.2	20.9	21.7	19.2*
5th high wealth	24.5	21.8	23.2	18.4**
Work status				
Working	40.6	31.5	35.5**	28.2**
Not working	59.4	68.5	64.5**	71.8**
Parental status				
Has children	84.1	85.0	94.0**	94.3**
No children	15.9	15.0	6.0**	5.7**
Total (N)	*3,391*	*4,129*	*5,512*	*7,591*

** p<0.05 **p<0.001 HRS v ELSA*

5.2.4 Health behaviours

When looking at health behaviours the majority of both samples were not currently smokers, although a sizable proportion had smoked previously, more so among men than women (Table 5.6). There were different levels of self-reported physical activity between the two samples with a greater percentage of the HRS sample reporting high levels of physical activity compared to the ELSA sample (p<0.001). The majority of both samples were either overweight or obese; this was more evident among men than women. A higher percentage of men and women in ELSA were overweight than men and women in the HRS (p<0.001), although a higher percentage of men and women on the HRS were obese than their counterparts in ELSA.

Table 5.6: Health behaviours of the ELSA Wave 4 sample and HRS Waves 8 and 9

	ELSA		HRS	
	Men	**Women**	**Men**	**Women**
	%	**%**	**%**	**%**
Smoking status				
Never smoked	32.4	46.2	31.9	52.2**
Former smoker	54.9	40.4	52.4**	33.8**
Current smoker	12.8	13.5	15.8**	14.1*
Physical activity				
Sedentary	4.8	5.3	6.0	5.2*
Low	17.4	27.3	21.1*	31.4*
Moderate	52.9	49.9	40.0**	39.9**
High	24.9	17.6	32.9**	23.4**
Body Mass Index				
Underweight to normal weight (≤24)	21.7	31.1	27.0**	33.5
Overweight BMI (25 -29)	49.2	35.7	41.1**	31.7**
Obese BMI (≥30)	29.0	33.2	31.9**	34.9**
Total (N)	*3,391*	*4,129*	*5,512*	*7,591*

** p<0.05 **p<0.001 HRS v ELSA*

5.2.5 Physical health and psychological morbidity

In both samples men reported similar levels of self-rated health (Table 5.7). However, both men and women in the HRS sample were more likely than those in ELSA to have been diagnosed with at least one chronic health condition. Overall, women were more likely to report 3 or more depressive symptoms than men and this was apparent in both samples.

Table 5.7: Physical health and psychological morbidity of the ELSA Wave 4 and the HRS Waves 8 and 9 samples

	ELSA		HRS	
	Men	**Women**	**Men**	**Women**
	%	**%**	**%**	**%**
Self-rated health				
Excellent / very good	44.2	41.8	41.2	39.7
Good	31.5	32.9	31.2	31.7
Fair / poor	24.3	25.3	27.7*	28.5*
Chronic health conditions				
0 reported conditions	32.8	28.3	14.2**	11.3**
Reported 1 condition	31.3	32.7	24.7**	24.8**
Reported 2 conditions	21.4	22.6	26.5**	29.8**
Reported 3+ conditions	14.5	16.3	34.6**	34.2**
CES-D				
CES-D<3	85.3	75.0	83.6*	76.1
CES-D≥3	14.7	25.0	16.4	23.9
Total (N)	*3,391*	*4,129*	*5,512*	*7,591*

** p<0.05 **p<0.001 HRS v ELSA*

5.3 Current marital status and childhood circumstances

The rest of this chapter contains the analysis on the demography of marriage. Firstly, analysis was carried out looking at whether childhood circumstances - measured through childhood health, parents' education, father's occupation and parental unemployment - varied between the different marital statuses for men and women. Childhood circumstances can provide evidence of whether individuals from more advantaged childhood circumstances are more likely to marry than their less advantaged counterparts.

5.3.1 Men

Those who had a more disadvantaged childhood may have been less likely to enter into marriage (shown in Table 5.8). Whilst never married men had similar childhood health and their parents had similar levels of education to men in their first marriage, their fathers were more likely to have been in a lower occupation or to have experienced a period of unemployment than men in their first marriage (p<0.05). A higher proportion of men who were never married in ELSA had experienced a period when a parent was out of work, almost double the percentage of those in their first marriage.

Widowed men, particularly in the HRS, also had a more disadvantaged upbringing than those in their first marriage. In the HRS widowed men's fathers were less educated than those who were in their first marriage; 62.7% of widowed men had a father with low education compared to 55.3% of men in their first marriage. A higher percentage of widowed men than men in their first marriage had fathers who had been out of work for a period of time (p<0.05). This association was not apparent in ELSA although there was not a statistically significant effect modification by country.

Whilst never married and widowed men had a more disadvantaged childhood than men in their first marriage remarried men in both ELSA and the HRS had a more advantaged childhood than men in their first marriage. A higher percentage of remarried men had fathers with higher levels of education than men in their first marriage; over a quarter (26.4%) of remarried men in ELSA and almost half (49.3%) of remarried men in the HRS had fathers who had high levels of education compared to 21.0% of men in their first marriage in ELSA and 44.7% in the HRS. In other aspects remarried men had comparable childhood circumstances to those in their first marriage.

Table 5.8: Age adjusted childhood circumstances by marital status in ELSA and the HRS, men

	ELSA					HRS				
	First marriage	Remarried	Divorced / separated	Widowed	Never married	First marriage	Remarried	Divorced / separated	Widowed	Never married
	%	%	%	%	%	%	%	%	%	%
Childhood self-rated health										
Excellent / good	89.4	88.1	87.5	89.7	83.7	95.1	94.7	94.9	93.8	97.8
Fair / poor	10.6	11.9	12.5	10.3	16.3	4.9	5.3	5.1	6.2	2.2
Total (N)	*1,415*	*334*	*202*	*206*	*133*	*2,850*	*1,387*	*610*	*492*	*169*
Father's education										
Low	79.0	73.6*	78.3	79.9	75.1	55.3	50.7*	58.3	62.7*	55.6
High	21.0	26.4*	21.7	20.1	24.9	44.7	49.3*	41.7	37.3*	44.4
Total (N)	*1,598*	*358*	*241*	*168*	*166*	*2,524*	*1,199*	*498*	*414*	*142*
Mother's education										
Low	77.3	77.8	78.2	77.1	78.0	47.5	44.8	47.0	51.3	51.9
High	22.7	22.2	21.8	22.9	22.0	52.5	55.2	53.0	48.7	48.1
Total (N)	*1,617*	*363*	*245*	*164*	*165*	*2,606*	*1,247*	*537*	*432*	*155*
Father's occupation										
Higher occupations	24.3	26.1	18.9*	20.1	23.0	16.5	14.5	13.9	12.7	7.6
Intermediate occupations	40.5	37.8	39.8	40.7	39.6	32.6	31.7	29.8	31.0	36.1
Routine / manual occupations	9.4	8.9	13.5*	13.4	14.1*	40.8	43.8	42.1	39.5	32.9
Other occupations	22.8	24.7	23.3	23.8	16.9	1.6	1.3	2.6	4.4*	2.6
Unemployed /sick/retired	3.1	2.6	4.8	1.8	6.2*	8.8	9.1	12.1	14.4*	21.5*
Total (N)	*2,061*	*488*	*342*	*270*	*221*	*2,309*	*1,115*	*436*	*467*	*99*
Parent unemployed for 6+ months										
No	87.9	90.2	82.5	87.0	78.6*	74.1	71.6	75.6	66.7*	71.6
Yes	9.7	6.9	13.9	12.9	17.3*	20.6	22.3	17.0	25.5*	17.7
Didn't live with parent / parent not alive	2.4	2.9	3.7	0.0	4.0	5.3	6.1	7.4	7.6	10.8*
Total (N)	*1,305*	*283*	*164*	*168*	*106*	*2,829*	*1,372*	*601*	*483*	*169*

* *p<0.05 marital status v first marriage* ** *p<0.001 marital status v first marriage*

5.3.2 Women

Among women, there were two notable differences in childhood circumstances between the marital statuses. The first difference surrounded widowed women. Widowed women had a more disadvantaged childhood than other women and this was more apparent in the HRS than in ELSA (Table 5.9). A lower percentage of widowed women's fathers in ELSA and the HRS were highly educated than other women's (p<0.05). In the HRS widowed women were more disadvantaged on a number of other aspects of childhood circumstances; a higher percentage of widowed women also had mothers with low levels of education than women in their first marriage (61.5% compared to 53.2% of those in their first marriage), widowed women were less likely to have had fathers in a higher occupational category (p<0.001), and more likely to have had a father who had been out of work for 6 months or more when they were growing up than women in their first marriage (22.7% of widowed women compared to 19.8% of women in their first marriage). Although these associations were not present in ELSA there was no significant modification in the association between the two countries.

The second significant difference to emerge among women was that a higher percentage of never married women in ELSA compared to other women had mothers with high levels of education (p<0.001) (shown in Figure 5.3). This association was not present in the HRS where never married women's mothers had comparable levels of education to other women. There was also a difference here by gender in ELSA, and a relatively higher percentage of never married women had mothers with higher levels of education than never married men (p<0.05).

There was also an association between marriage and childhood health, but only among women in the HRS where all unmarried women reported poorer childhood health than women in their first marriage (p<0.05).

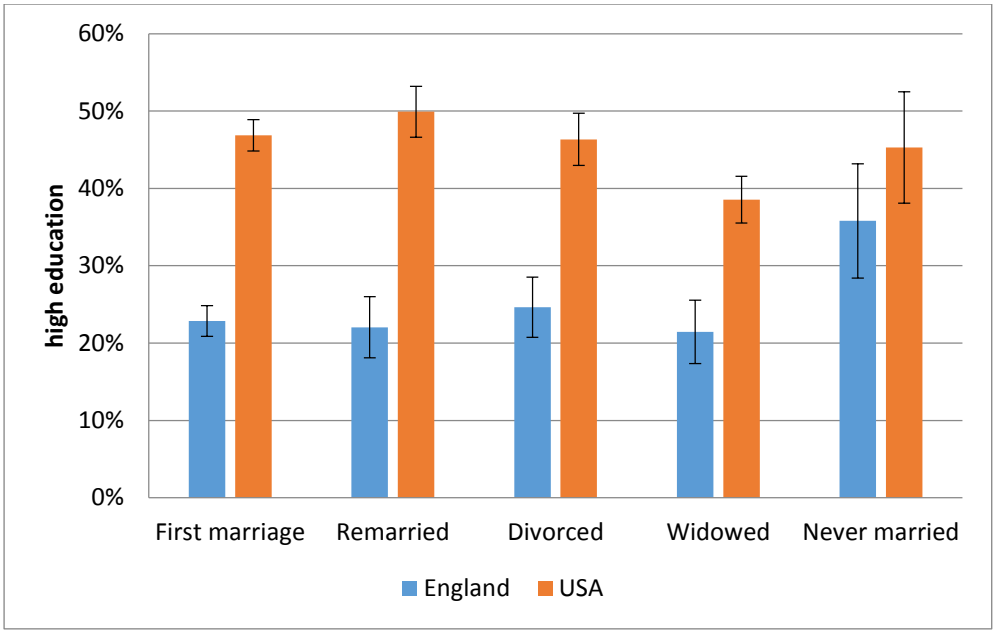


Figure 5.3: Age adjusted proportions of women who had mothers with high education by marital status

5.3.3 Key findings

There were some notable differences in childhood circumstances by marital status. Among men all those who were widowed or never married had a more disadvantaged childhood than those who were married, through their fathers having a lower occupation and lower education than men who were in their first marriage. Remarried men had similar childhood circumstances to men in their first marriage, although they were slightly more advantaged as they were more likely to have had fathers who were more educated.

Among women those who were widowed also had a more disadvantaged childhood than women who were in the first marriage, as they had mothers who were less educated and fathers of a lower social class. Never married women had comparatively better childhood circumstances than women in their first marriage, as they had more highly educated mothers. This association was only evident in ELSA not in the HRS.

Table 5.9: Age adjusted childhood circumstances by marital status in ELSA and the HRS, women

	ELSA					HRS				
	First marriage	Remarried	Divorced / separated	Widowed	Never married	First marriage	Remarried	Divorced / separated	Widowed	Never married
	%	%	%	%	%	%	%	%	%	%
Childhood self-rated health										
Excellent / good	87.8	87.5	86.9	87.0	82.7	95.0	93.6	90.0**	92.9*	91.0*
Fair / poor	12.2	12.5	13.1	13.0	17.3	5.0	6.4	10.0**	7.1*	9.0*
Total (N)	*1,318*	*321*	*386*	*637*	*137*	*2,808*	*1,192*	*1,104*	*2,258*	*228*
Father's education										
Low	76.3	80.6	76.6	81.7*	74.0	57.1	54.9	58.9	66.6**	59.0
High	23.7	19.4	23.4	18.3*	26.0	42.9	45.1	41.1	33.4**	41.0
Total (N)	*1,555*	*365*	*448*	*585*	*155*	*2,500*	*1,033*	*886*	*1,873*	*182*
Mother's education										
Low	77.2	78.0	75.4	78.5	64.2**	53.2	50.1	53.7	61.5**	54.7
High	22.8	22.0	24.6	21.5	35.8**	46.8	49.9	46.3	38.5**	45.3
Total (N)	*1,591*	*381*	*467*	*607*	*163*	*2,628*	*1,099*	*1,002*	*1,991*	*208*
Father's occupation										
Higher occupations	25.8	25.8	26.3	26.2	28.4	15.0	17.0	13.2	10.4**	18.3
Intermediate occupations	37.6	37.5	35.6	35.0	35.8	35.0	30.7*	28.3*	34.3	26.0*
Routine / manual occupations	9.9	9.9	12.0	11.5	8.9	40.9	40.9	37.4	40.1	35.8
Other occupations	23.0	24.0	20.0	23.3	21.8	1.1	1.9	1.0	0.8	1.9
Unemployed /sick/retired	3.7	2.9	6.1*	3.9	5.1	8.1	9.6	20.1**	14.5**	18.4**
Total (N)	*1,960*	*489*	*589*	*862*	*210*	*2,377*	*963*	*807*	*2,063*	*159*
Parent unemployed for 6+ months										
No	87.9	90.6	84.0	87.7	81.5	74.1	75.7	68.9*	68.5**	71.9
Yes	10.3	7.5	11.0	10.1	13.2	19.8	17.8	18.7	22.7*	17.1
Didn't live with parent / parent not alive	1.8	1.9	5.0*	2.1	5.3*	6.1	6.5	12.5**	8.8*	10.9*
Total (N)	*1,201*	*283*	*315*	*559*	*121*	*2,788*	*1,180*	*1,088*	*2,229*	*227*

* *p<0.05 marital status v first marriage* ** *p<0.001 marital status v first marriage*

5.4 Current marital status and demographic and socio-economic characteristics

In this next section demographic and adult socio-economic characteristics and marital status were analysed for men and women.

5.4.1 Men

Among men those who were in their first marriage were more socio-economically advantaged in adulthood than all other men, as shown in Table 5.10. A higher percentage of men in their first marriage had high levels of education, were in the highest wealth quintile and were currently working compared to unmarried men, particularly compared to those who had experienced a previous transition out of marriage through divorce or widowhood. For example, 20.3% of men in their first marriage had high levels of education compared to 10.9% of divorced men in ELSA and in the HRS the comparable percentages were 36.3% of men in their first marriage compared to 24.1% of divorced men and 18.8% of widowed men (Figure 5.4). There was some differences by country and divorced men in ELSA were relatively more likely to have low levels of education than their counterparts in the HRS (p<0.05).

The contrasts between marital status and wealth were even starker between men in their first marriage and divorced and widowed men, over a quarter of men in their first marriage in ELSA (26.0%) were in the highest wealth quintile compared to just 10.6% of divorced men and 19.0% of widowed men and a similar pattern was observed in the HRS (p<0.001) (also shown in Figure 5.5).

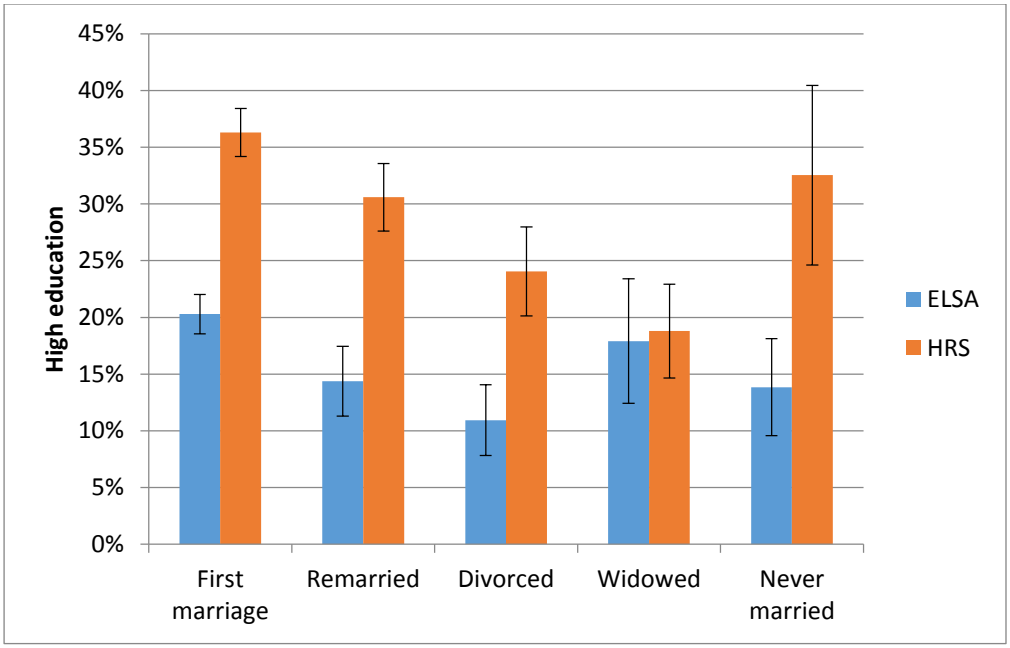


Figure 5.4: Age adjusted percentage of men with high levels of education by marital status

Never married men also had a lower SEP than men in their first marriage. Whilst they had similar levels of education to men in their first marriage, they had lower levels of wealth (31.8% of never married men in ELSA and 28.7% of never married men in the HRS were in the lowest wealth quintile compared to just 9.0% of men in their first marriage in ELSA and the HRS). Never married men were also less likely to be in paid work than men in their first marriage ($p<0.05$).

Remarried men, on both ELSA and the HRS, also had slightly lower SEP than men in their first marriage as they had less wealth and were less educated than men in their first marriage ($p<0.05$).

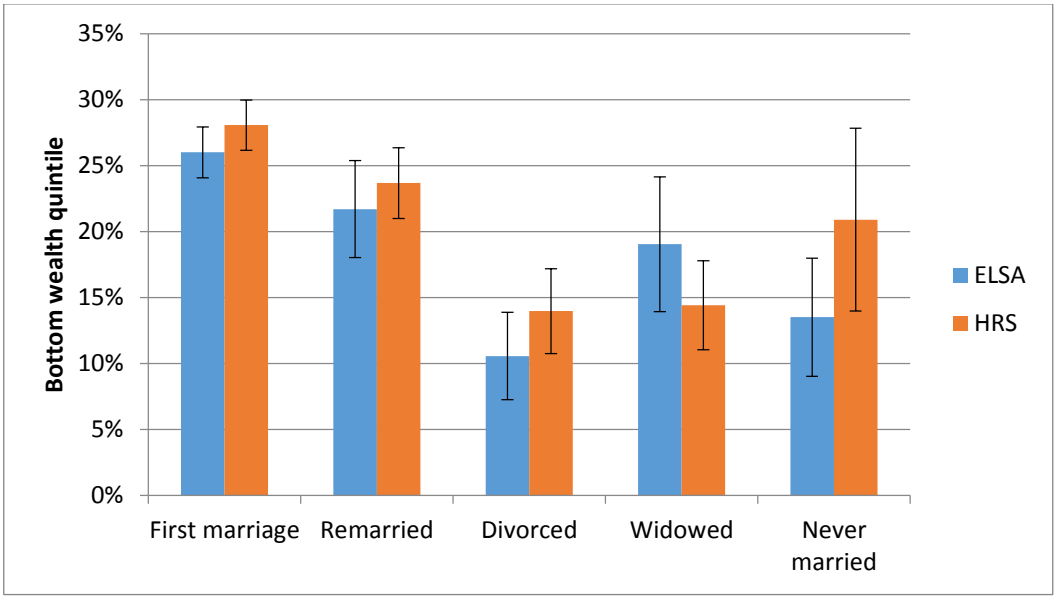


Figure 5.5: Age adjusted percentage of men in the highest wealth quintile by marital status

Table 5.10: Age adjusted demographic and socio-economic characteristics by marital status, men

	ELSA					HRS				
	First marriage	Remarried	Divorced / separated	Widowed	Never married	First marriage	Remarried	Divorced / separated	Widowed	Never married
	%	%	%	%	%	%	%	%	%	%
Education										
Low	45.0	48.0*	62.1**	51.5	48.8	43.6	45.1	49.1*	64.1**	42.0
Medium	34.8	37.9	27.8*	29.7	37.8	20.1	24.3*	26.9*	17.2	25.5
High	20.3	14.4**	10.9**	17.9	13.8	36.3	30.6*	24.1**	18.8**	32.5
Wealth										
1 Low wealth	8.9	17.3**	42.6**	25.3**	31.8**	9.0	12.8*	33.3**	29.0**	28.7**
2	17.6	20.0	21.8	21.4	17.0	17.7	20.1	19.4	23.3*	13.3
3	21.8	21.7	14.4*	17.3	18.6	20.4	22.7	17.7	18.5	25.6
4	25.6	19.4*	11.6**	15.8*	19.8	25.1	20.8*	14.1**	18.4*	10.5**
5 High wealth	26.0	21.7	10.6**	19.0*	13.5**	28.1	23.7*	14.0**	14.4**	20.9
Work status										
Working	45.6	45.3	36.1**	34.7*	31.9**	47.5	46.8	41.7*	39.6*	35.0*
Not working	54.4	54.7	63.9**	65.3*	68.1**	52.5	53.2	58.3*	60.4*	65.0*
Ethnicity										
White	95.6	96.2	96.8	96.8	98.7*	85.4	85.3	74.9**	78.1*	82.7
Non-White (ELSA only)	4.4	3.8	3.2	3.2	1.3*					
Hispanic (HRS only)	-	-	-	-	-	7.4	6.4	8.3	4.8	3.7
Black (HRS only)	-	-	-	-	-	5.3	7.2	15.3**	14.7**	13.7**
Other (HRS only)	-	-	-	-	-	2.0	1.1	1.5	2.2	0.0
Children										
Has children	90.4	90.1	82.8**	87.0	13.2**	96.2	96.7	93.6*	91.9*	22.7**
No children	9.6	9.9	17.2**	13.0	86.8**	3.8	3.3	6.4*	8.1*	77.3**
Total (N)	*2,067*	*490*	*343*	*270*	*221*	*2,851*	*1,388*	*611*	*493*	*169*

** p<0.05 marital status v first marriage ** p<0.001 marital status v first marriage*

5.4.2 Women

There were similar associations between the socio-economic measures and marital status among women in ELSA and the HRS to those observed among men. Women in their first marriage had a higher SEP than women who were widowed or divorced (Table 5.11). A higher percentage of women in their first marriage in ELSA and the HRS had high levels of education compared to divorced and widowed women; 15.0% of women in their first marriage in ELSA were highly educated compared to 11.3% of divorced women and 13.0% of widowed women, the comparable figures in the HRS were 26.0% of women in their first marriage compared to 22.2% of divorced and 11.3% of widowed women (as shown in Figure 5.6). The greatest disparity in SEP between those in their first marriage and women who were divorced and widowed was with wealth (and particularly between women in their first marriage and divorced women). Only 9.6% of women in their first marriage in ELSA and 7.2% in the HRS were in the bottom wealth quintile, which was under half the percentages of divorced and widowed women ($p<0.001$).

There were some gender differences in the association between marital status and wealth. A relatively lower percentage of divorced and widowed women were in the highest wealth quintile than divorced and widowed men ($p<0.05$).

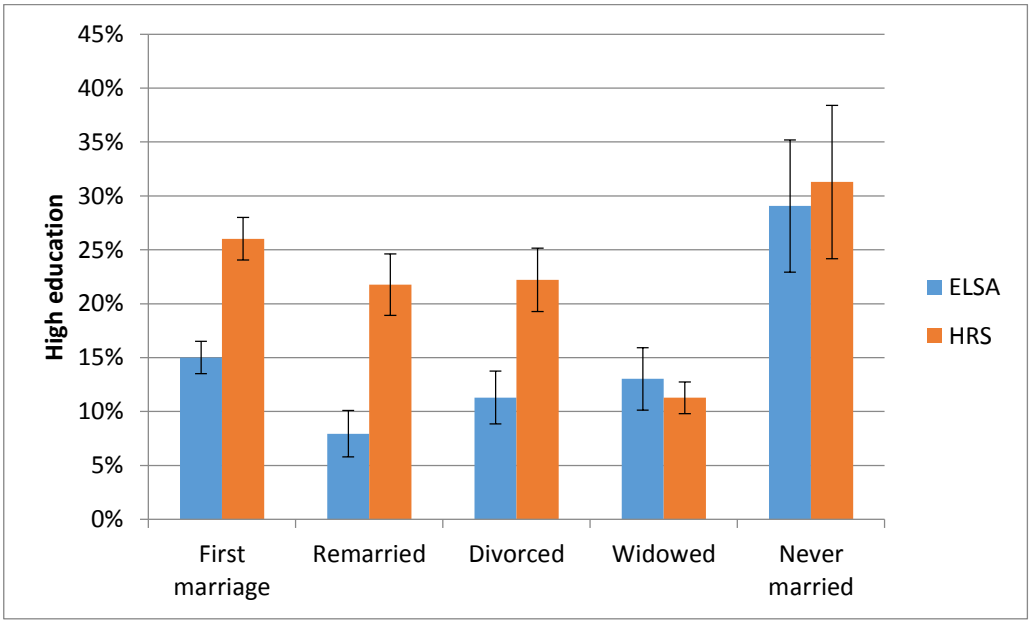


Figure 5.6: Age adjusted percentage of women with high education by marital status

In some aspects never married women were more socio-economically disadvantaged than women in their first marriage, particularly as they had far lower levels of wealth; a quarter of never married women (25.8%) in ELSA compared to 9.6% in their first marriage were in the bottom wealth quintile and in the HRS the disparity was even greater, 44.9% of never married women in the HRS

had low wealth compared to just 7.2% of women in their first marriage. However, in other aspects never married women were similar to women in their first marriage and in ELSA could even be considered to be more advantaged. Never married women were just as likely to be working as women in their first marriage on both ELSA and the HRS, but in ELSA a greater percentage of never married women had high levels of education than women in their first marriage. Almost double the percentage of never married women in ELSA (29.1%) had high levels of education than women in their first marriage (15.0%) as shown in Figure 5.6. This pattern was not present in the HRS where never married women had comparable levels of education to those in their first marriage. Never married women in both countries though had relatively higher levels of education than never married men ($p<0.05$).

Similarly to men, remarried women were more socio-economically disadvantaged than women in their first marriage, they were less educated and less wealthy than their counterparts who had remained in one marriage. It would seem that for both men and women the financial cost of a transition out of marriage is not recovered through a subsequent marriage.

5.4.3 Key findings

There were differences by marital status in the adult demographic and socio-economic characteristics, with some key gender and country differences. Among men those who were in their first marriage had the highest socio-economic positions, through higher levels of education and higher levels of wealth than other men, but particularly compared to divorced and widowed men. Among women, whilst women in their first marriage had the highest level of wealth, women who had never married had higher levels of education than women in their first marriage. Never married women also had higher levels of education than never married men. There were some differences surrounding education between ELSA and the HRS. Divorced men in ELSA had relatively lower levels of education than divorced men in the HRS and never married women in ELSA had relatively higher education than never married women in the HRS.

Table 5.11: Age adjusted demographic and socio-economic characteristics by marital status, women

	ELSA					HRS				
	First marriage	Remarried	Divorced / separated	Widowed	Never married	First marriage	Remarried	Divorced / separated	Widowed	Never married
	%	%	%	%	%	%	%	%	%	%
Education										
Low	44.8	54.7**	48.4	51.2**	29.2**	49.1	51.1	52.5	69.6**	46.6
Medium	40.3	38.2	40.6	34.8*	40.6	24.8	27.2	25.2	19.1**	22.1
High	15.0	7.9**	11.3*	13.0	29.1**	26.0	21.8*	22.2*	11.3**	31.3
Wealth										
1 – Low wealth	9.6	16.6**	42.3**	22.8**	25.8**	7.2	13.1**	39.7**	31.5**	44.9**
2	15.8	23.0**	23.2**	25.3**	25.1*	17.0	17.9	23.9**	26.0**	18.5
3	22.1	20.3	15.3*	20.4	17.4	22.0	22.2	13.7**	17.4*	12.0*
4	25.4	18.5*	12.2**	15.6**	18.6*	24.7	23.0	12.4**	15.5**	13.9*
5 – High wealth	26.9	21.3*	7.8**	14.9**	12.9**	29.5	24.3*	9.6**	11.0**	10.2**
Working status										
Currently working	34.6	36.4	35.5	32.1	34.1	36.3	37.5	38.8	37.0	38.9
Not currently working	65.4	63.6	64.5	67.9	65.9	63.7	62.5	61.2	63.0	61.1
Ethnicity										
White	97.2	99.0*	95.0*	96.3	95.7	86.3	88.4	72.0**	74.2**	61.1**
Non-white (ELSA only)	2.8	1.0*	5.0*	3.7	4.3	-	-	-	-	-
Hispanic (HRS only)	-	-	-	-	-	6.9	4.8*	9.5*	8.6	8.5
Black (HRS only)	-	-	-	-	-	5.1	5.4	16.7**	15.1**	27.3**
Other(HRS only)	-	-	-	-	-	1.8	1.4	1.7	2.2	2.8
Children	-	-	-	-	-					
Has children	90.4	90.0	84.7**	86.7*	23.4**	96.4	96.6	90.5**	95.9	33.3**
No children	9.6	10.0	15.3	13.3	76.6	3.6	3.4	9.5	4.1	66.7
Total (N)	*1,972*	*491*	*592*	*863*	*211*	*2,808*	*1,192*	*1,104*	*2,259*	*228*

** p<0.05 marital status v first marriage ** p<0.001 marital status v first marriage*

5.5 Current marital status and health behaviours

In this next section health behaviours were analysed across the different marital statuses for men and women.

5.5.1 Men

All unmarried, and particularly divorced and widowed, men showed poorer health behaviours than those in their first marriage on both ELSA and the HRS. Men who were in their first marriage were less likely to smoke than all other men; 10.1% of men in their first marriage in ELSA were current smokers less than half the proportion of divorced men (27.5%) and similarly in the HRS 13.6% of men in their first marriage were smokers compared to 30.4% of divorced men. Overall, unmarried men were less physically active than men in their first marriage; 24.0% of divorced and never married men in ELSA reported low levels of physical activity compared to a 16.4% of men in their first marriage and in the HRS 26.4% of widowed men reported low levels of physical activity compared to 18.1% of men in their first marriage. With BMI the association was slightly different to the other health behaviours. A higher percentage of never married men on both ELSA and the HRS had a BMI which was classified as underweight to normal weight than men in their first marriage; 20.5% of men in their first marriage in ELSA were classified as underweight to normal weight, but a third of never married men had a BMI which fell within this classification (33.7%) and in the HRS a quarter (24.0%) of men in their first marriage compared to 37.8% of never married men were classified as underweight to normal weight (Figure 5.7).

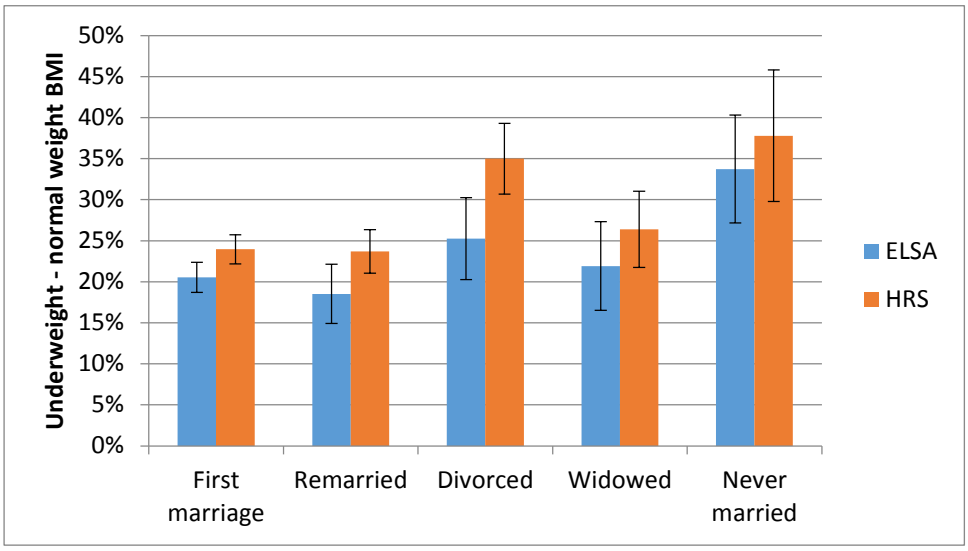


Figure 5.7: Age adjusted percentage of men with underweight to normal weight BMI by marital status

Table 5.12: Age adjusted health behaviours by marital status, men

	ELSA					HRS				
	First marriage	Remarried	Divorced / separated	Widowed	Never married	First marriage	Remarried	Divorced / separated	Widowed	Never married
	%	%	%	%	%	%	%	%	%	%
Smoking status										
Never smoked	34.8	27.8*	22.4*	33.3	31.5	38.9	27.0**	23.7**	30.7*	38.8
Former smoker	55.3	57.6	49.3*	49.3	46.5*	47.7	55.9**	44.6	43.4	44.1
Current smoker	10.1	14.7*	27.5**	18.3*	21.1**	13.6	17.2*	30.4**	28.3**	16.8
Physical activity										
Sedentary	5.0	5.1	7.7	7.4	5.6	5.2	5.9	5.8	6.2	3.2
Low	16.4	18.4	24.1*	17.7	24.3*	18.1	19.8	26.4**	21.2	25.4
Moderate	53.7	51.0	43.8*	53.7	52.9	39.9	40.7	33.0*	41.3	36.8
High	25.0	25.9	25.4	17.4*	18.2*	37.0	33.9	35.2	28.6*	34.1
BMI										
Underweight / normal weight BMI (0- 25)	20.5	18.5	25.3	21.9	33.7*	24.0	23.7	35.0**	26.4	37.8**
Overweight BMI (26 -29)	50.8	47.9	45.6	45.3	41.2*	41.6	41.9	38.1	41.1	40.5
Obese BMI (30+)	28.7	33.5*	29.3	32.9	25.4	34.5	34.4	27.6*	31.9	22.8*
Total (N)	*2,067*	*490*	*343*	*270*	*221*	*2,851*	*1,388*	*611*	*493*	*169*

** p<0.05 first marriage v other marital status ** p<0.001 first marriage v other marital status*

5.5.2 Women

Among women, similarly to men, overall those in their first marriage on both ELSA and the HRS had the best health behaviours, particularly compared to divorced and widowed women (Table 5.13). Lower percentages of women in their first marriage in ELSA and the HRS were current smokers; 10.4% of women in their first marriage in ELSA and 8.8% in the HRS were current smokers, less than half the percentage of divorced women (24.3 % in ELSA and 22.7% in the HRS). Women in their first marriage were also more physically active than those who were widowed on both ELSA and the HRS ($p<0.05$). However, there were also divergences between ELSA and the HRS in the association between marital status and some of the health behaviours. Whilst divorced women in ELSA were, similarly to widowed women, less physically active than women in their first marriage this was not the case in the HRS where divorced women reported doing equivalent high levels of physical activity to those in their first marriage (27.1% of divorced women compared to 28.9% of women in their first marriage). The association between marital status and BMI also differed by country. In the HRS women in their first marriage were more likely to have a BMI which was classified as underweight to normal weight than all unmarried women, over a third (36.5%) of women in their first marriage had a BMI which was classified as underweight to normal weight, but only 31.8% of divorced and 28.1% of never married women had a similar BMI. This was also a different pattern to what was observed among men where men who were divorced or never married were more likely to have a BMI classified as underweight to normal weight than married men, but among women the reverse was apparent ($p<0.001$). This pattern was not evident in ELSA where married and unmarried women had comparable BMIs.

5.5.3 Key findings

Among both men and women those who were in their first marriage had the best health behaviours, particularly with regard to smoking, where a higher percentage of men and women who had never smoked were in their first marriage. There were some gender and country differences with the measure of BMI. Among men those who were never married were more likely to have an underweight to normal weight BMI in both ELSA and the HRS, but among women, in the HRS only, those who were never married were more likely to obese than those in their first marriage.

Table 5.13: Age adjusted health behaviours by marital status, women

	ELSA					HRS				
	First marriage	Remarried	Divorced / separated	Widowed	Never married	First marriage	Remarried	Divorced / separated	Widowed	Never married
	%	%	%	%	%	%	%	%	%	%
Smoking status										
Never smoked	51.6	38.5**	33.6**	44.0*	42.0*	59.6	45.8**	41.6**	50.9**	52.7
Former smoker	38.4	45.3*	41.3	38.2	40.6	32.0	38.9**	35.1	29.2	29.4
Current smoker	10.4	16.1*	24.3**	18.8**	16.9*	8.8	15.4**	22.7**	21.2**	17.6**
Physical activity										
Sedentary	5.0	6.0	8.9*	5.5	6.5	3.6	3.3	6.0*	5.3*	7.4*
Low	25.1	30.0*	28.0	31.3*	30.2	26.9	29.7	28.4	32.3**	28.0
Moderate	52.0	44.7*	50.2	46.1*	46.0	40.7	39.7	38.7	37.5	44.2
High	18.0	19.1	13.4*	16.1	15.9	28.9	26.9	27.1	22.9**	21.1*
BMI										
Underweight / normal weight BMI (0- 25)	30.0	28.1	34.4	31.8	36.2	36.5	34.1	31.8*	30.8**	28.1*
Overweight BMI (26 -29)	37.3	36.0	34.2	31.2*	30.4	30.3	35.5*	28.7	30.6	29.7
Obese BMI (30+)	32.8	35.8	31.4	37.3	33.3	33.4	30.7	39.3*	38.9*	41.9*
Total (N)	*1,972*	*491*	*592*	*863*	*211*	*2,808*	*1,192*	*1,104*	*2,259*	*228*

** p<0.05 first marriage v other marital status ** p<0.001 first marriage v other marital status*

5.6 Current marital status and physical health and psychological morbidity

Finally, descriptive analysis of marital status and physical health and psychological morbidity was carried out for men and women, the results of which are shown in Table 5.14 and Table 5.15.

5.6.1 Men

A lower percentage of divorced men reported excellent or very good health compared to men in their first marriage on both ELSA and the HRS (45.2% of men in their first marriage in ELSA reported excellent or very good health but only 37.0% of divorced men did so, in the HRS 46.6% of men in their first marriage reported excellent or very good health compared to 38.3% of divorced men). In the HRS remarried and widowed men also reported poorer self-rated health to those in their first marriage (p<0.05), however this was not so evident in ELSA. Overall never married men reported comparable health to men in their first marriage.

Whilst there was little difference in physical health between men in the different marital statuses there were differences in their levels of psychological morbidity. Figure 5.8 shows that higher proportions of unmarried men, particularly widowed men, reported higher levels of psychological morbidity than men in their first marriage and this was apparent in both ELSA and the HRS. Over double the percentage of widowed men in ELSA and the HRS reported 3 or more depressive symptoms compared to men in their first marriage (p<0.001). Remarried men had comparable psychological morbidity to men in their first marriage on both ELSA and the HRS. There was no modification in the association by country for any of the health measures.

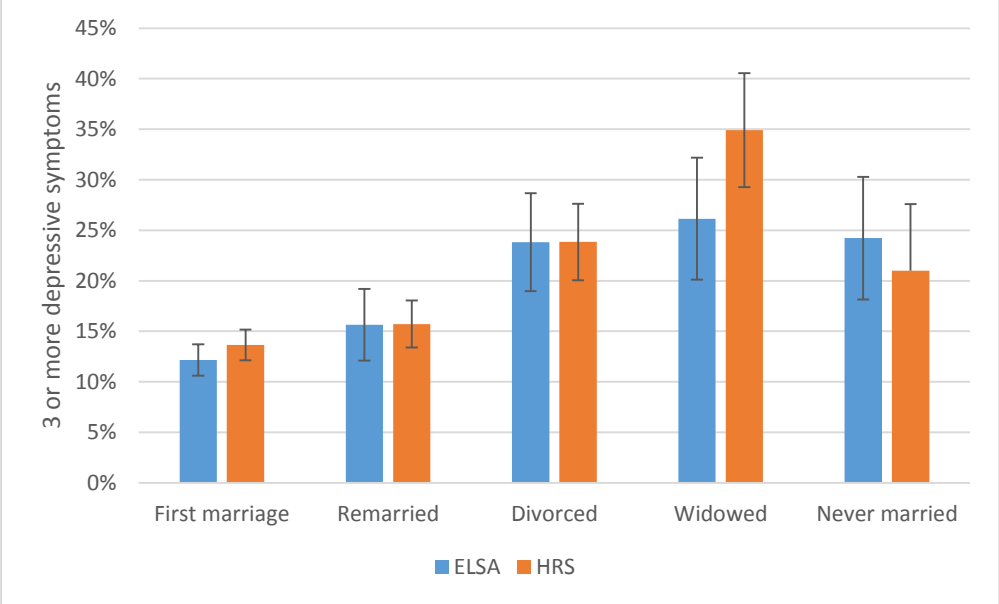


Figure 5.8: Age adjusted percentage of men with high levels of psychological morbidity by marital status

Table 5.14: Physical health and psychological morbidity by marital status, men

	ELSA					HRS				
	First marriage	Remarried	Divorced / separated	Widowed	Never married	First marriage	Remarried	Divorced / separated	Widowed	Never married
	%	%	%	%	%	%	%	%	%	%
Self-rated health										
Excellent / very good	45.2	43.5	37.0*	41.8	40.9	46.6	42.3*	38.3*	36.7*	44.4
Good	31.5	31.7	26.8	31.8	27.7	31.3	31.1	27.5	28.6	26.0
Fair / poor	23.3	24.9	36.9**	25.7	31.7	22.2	26.7*	34.5*	33.6*	29.6*
Health conditions										
No conditions	34.1	33.9	32.9	31.1	31.4	18.3	16.2	16.7	15.8	23.3
Reported 1 condition	32.1	28.0	27.7	26.6	35.0	28.1	26.7	27.8	28.7	22.4
Reported 2 conditions	20.6	21.3	22.1	24.3	18.1	25.0	26.3	23.7	20.6	25.6
Reported 3+ conditions	13.6	17.9*	18.4*	14.1	15.4	29.1	31.5	32.4	32.1	27.1
Psychological morbidity										
CES-D<3	87.8	84.4	76.2**	73.8**	75.8**	86.3	84.3	76.2**	65.1**	79.0*
CES-D3+	12.2	15.6	23.8**	26.2**	24.2**	13.7	15.7	23.8**	34.9**	21.0*
Total (N)	*2,067*	*490*	*343*	*270*	*221*	*2,851*	*1,388*	*611*	*493*	*169*

* $p<0.05$ first marriage v other marital status ** $p<0.001$ first marriage v other marital status

5.6.2 Women

Among women in ELSA and the HRS overall those in their first marriage had better physical health than women who had previously transitioned out of marriage (remarried, divorced and widowed). Higher percentages of women in their first marriage reported excellent or very good self-rated health than remarried, divorced and widowed women ($p<0.05$). Women who were divorced or widowed were also more likely to have a greater number of doctor diagnosed health conditions than women in their first marriage; in ELSA 18.5% of divorced and widowed women reported 3 or more health conditions compared to 13.2% of women in their first marriage and similarly in the HRS 36.6% of divorced and 32.3% of widowed women compared to a quarter of women in their first marriage. Whilst women who had previously transitioned out of marriage reported poorer health, never married women particularly in ELSA, shared equally good health to women in their first marriage and had comparable self-rated health and a similar number of health conditions. There were also some modifications by gender between self-rated health and marital status, but only in the HRS where never married women reported relatively poorer self-rated health than never married men.

As was seen among men, there was a strong association between marital status and psychological morbidity with unmarried women showing higher levels of psychological morbidity (shown in Figure 5.9). In ELSA 34.6% of divorced and 36.6% of widowed women reported 3 or more depressive symptoms compared to just 17.9% of women in their first marriage, whilst in the HRS just under a third of unmarried women reported 3 or more depressive symptoms compared to 17.4% of women in their first marriage.

There was some modification by gender in the measure of psychological morbidity but only in the HRS with a relatively higher percentage of widowed women reporting higher levels of psychological morbidity than widowed men.

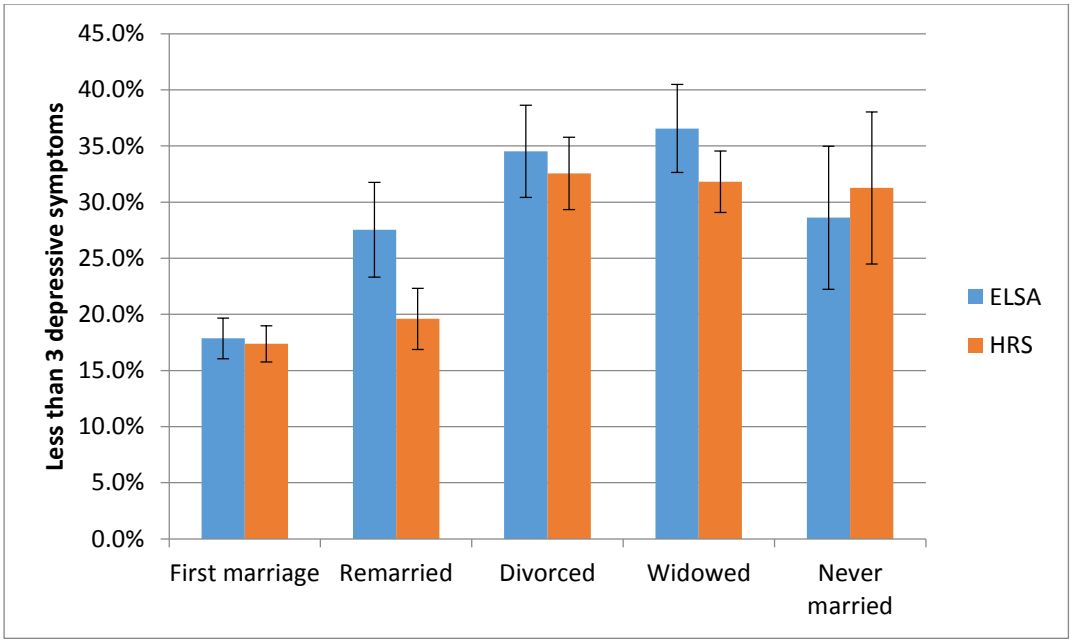


Figure 5.9: Age adjusted percentage of women with high levels of psychological morbidity by marital status

5.6.3 Key findings

Among both men and women there were some differences in physical health by marital status. Divorced and widowed men reported poorer self-rated health than men in their first marriage and divorced and widowed women reported more chronic health conditions than women in their first marriage.

There were clear differences in the psychological morbidity of married and unmarried men and women. All married men and women in their first marriage had lower levels of psychological morbidity than unmarried men and women. Remarried women in ELSA had higher levels of psychological morbidity than women in their first marriage, but this wasn't apparent among remarried women in the HRS.

Table 5.15: Physical health and psychological morbidity by marital status, women

	ELSA					HRS				
	First marriage	Remarried	Divorced / separated	Widowed	Never married	First marriage	Remarried	Divorced / separated	Widowed	Never married
	%	%	%	%	%	%	%	%	%	%
Self-rated health										
Excellent / very good	45.3	38.9*	33.7**	38.8**	41.4	49.6	46.5	36.2**	37.1**	34.7**
Good	33.2	33.2	28.9	33.2	32.0	31.2	28.1	29.8	29.0	33.7
Fair / poor	21.5	28.0*	37.8**	27.5*	26.3	19.1	25.2**	34.2**	33.4**	31.8**
Health conditions										
No conditions	31.4	26.6*	27.9	29.0	32.0	15.9	15.4	14.1	14.6	13.0
Reported 1 condition	34.5	32.7	32.2	29.3*	30.3	28.8	29.8	23.1*	24.8*	24.5
Reported 2 conditions	21.1	25.7*	21.6	21.3	20.2	31.1	25.4*	26.8*	26.6*	31.6
Reported 3+ conditions	13.2	15.4	18.5*	18.0*	15.3	24.5	29.3*	36.6**	32.3**	31.2*
Psychological morbidity										
CES-D<3	82.1	72.6**	65.4**	63.4**	71.5**	82.6	80.4	67.5**	68.2**	68.7**
CES-D3+	17.9	27.4**	34.6**	36.6**	28.5**	17.4	19.6	32.5**	31.8**	31.3**
Total (N)	*1,972*	*491*	*592*	*863*	*211*	*2,808*	*1,192*	*1,104*	*2,259*	*228*

** p<0.05 first marriage v other marital status ** p<0.001 first marriage v other marital status*

5.7 Summary

In summary this chapter has shown that there are differences between the different marital statuses in their childhood circumstances, their adult demographic and socio-economic characteristics, their health behaviours and their physical health and psychological morbidity. Men and women who were married had a higher childhood SEP than those who were unmarried. Married men and women also had a higher adult SEP than unmarried men and women, although remarried men and women had lower levels of wealth than those in their first marriage. Men and women in a first marriage displayed the best health behaviours and overall most advantageous physical and psychological health than their unmarried counterparts. Out of those who were unmarried widowed men and women in particular seemed to have had a more disadvantaged childhood than men in their first marriage. Their father's had lower levels of education and they were more likely to have experienced a period of time when a parent was out of work. Widowed men and women also had a lower adult SEP, poorer health behaviours and physical health and higher levels of psychological morbidity to those who were still in their first marriage.

There were some notable gender and country differences. Firstly there were quite stark gender differences in the association between education and marital status. While for men those who were married had a higher childhood SEP and the highest levels of education, this was not the case among women and here there were also differences between England and the USA. Among women never married women in England had higher levels of education and were more likely to have had mothers with high levels of education than women in their first marriage, and also relatively more likely than never married men. This was not apparent among never married women in the USA who had more comparable childhood SEP and education to women in their first marriage, although they were more highly educated than never married men. The second gender and country difference was that divorced men in England were less educated than both divorced men and women in the USA and divorced women in England.

This chapter has set the scene for the subsequent analyses on marriage and physical capability at mid to later life by showing that there are marital status differentials in socio-economic circumstances across the life course and health characteristics. The following chapters will explore whether these differences help explain any marital status variations in physical capability.

5.7.1 Limitations

The limitations to this analysis surround the childhood measures which were used. As both the HRS and ELSA only collected data prospectively from age 50 years and older the childhood measures on both surveys were collected retrospectively. It is unknown how accurate the

childhood measures in ELSA and the HRS are. Previous research has shown that objective data, such as the number of rooms in the accommodation that was lived in as a child, are recalled relatively accurately (Brown, 2014), but childhood health, father's occupation and parental education are recalled less accurately with a tendency to procure more positive responses than data which was collected contemporaneously (Berney and Blane, 1997) (Batty et al., 2005). Father's occupation in ELSA looked as though it may have been recalled inaccurately as many more respondents reported that their father was in a higher occupation category than in the HRS. This could mean that any differences between marital status and father's occupation between the two countries (such as never married men and widowed men in England being more likely to have had a father in a higher occupation than their counterparts in the USA) should be treated with caution.

There were also a couple of harmonisation issues on the childhood measures. Firstly there were few directly comparable measures on both studies. The ELSA life history included a number of detailed questions on early life circumstances, however the HRS did not carry out a life history interview and only included a few questions on early life circumstances in the core interview. Therefore the analysis was limited to only a few comparable measures, which have not captured all elements of childhood circumstances. One such omission from the measures of childhood circumstances was on parental separation, which has shown to be associated with entry into and exit out of marriage (detailed in Section 2.5). The HRS didn't include data on parental separation in childhood, but ELSA did, although in ELSA only 5.8% (134 men and 160 women) had experienced parental divorce so it's possible that this measure wouldn't have had enough statistical power to detect differences if it was included in the analysis. Although, overall the childhood measures which were selected were comparable some needed to be altered to ensure direct comparability, such as parental unemployment, which was asked only about fathers in the HRS but in ELSA about either parent. Also harmonising father's occupation on both surveys was challenging as it was not clear, particularly in ELSA, whether some occupation categories should be treated as intermediate or routine / manual. This could have led to discrepancies in the father's occupational groupings between the two surveys.

The third limitation with the childhood circumstances used in this analysis surrounded the additional missing data. The childhood measures included a greater amount of item non-response than the adult measures which were used. The analysis of the childhood circumstances analytic sample compared to the complete sample showed that the analytic sample was biased towards those who were married, therefore this analysis could be either under reporting or over reporting the differences between those who were in their first marriage and those who were remarried or unmarried, as those unmarried people who had values on all the childhood measures could be

different to those who were missing values. Similarly, it could be overemphasising some of the relative advantage of remarried men to men in their first marriage as those remarried men who were included in the analysis could be more advantaged than those who were not included, which could be why remarried men were shown to have more advantageous childhood circumstances than men in their first marriage. Although, some of the missing data in ELSA was due to Cohort 4 not participating in the life history interview and in this respect the missing data would be missing completely at random so there should be few differences between those who had data on the childhood measures, which were collected during the life history, and those who did not have such data.

Chapter 6: Current marital status and physical capability in England and the USA

This chapter describes the cross-sectional analysis which was carried out to investigate the association between marital status and physical capability in England and the USA and to what extent the association is explained by demographic and socio-economic characteristics, health behaviours and physical health and psychological morbidity. The analysis was then extended to investigate whether childhood circumstances also explained any marital status variations in physical capability.

Existing evidence on cross-sectional associations between marital status and physical capability has found that married people had better physical capability than unmarried people (Clouston et al., 2014) (Lin and Brown, 2012). Among unmarried people there were some gender differences with never married men displaying the lowest levels of physical capability (Guralnik et al., 2009) (Pienta et al., 2000), but this association wasn't apparent among never married women. There has been very little research which has investigated the physical capability of remarried people in comparison to those in their first marriage (Hughes and Waite, 2009) and no research which has investigated the association cross-nationally. This chapter aims to go some way in bridging this knowledge gap.

6.1 Analytic sample and method

This section details the analytic samples and methods used for the analysis in this chapter.

6.1.1 Analytic sample

The final analytic samples comprised only cases with complete data and there were different analytic samples for the analysis of grip strength and walking speed. For the measure of grip strength a total of 8,218 sample members had completed a nurse visit at ELSA Wave 4, during which grip strength was measured, and were therefore eligible for the measure of grip strength. Of those 8,218 individuals (shown in Figure 6.1), 357 were missing data on grip strength and a further 383 individuals were missing data on one or more covariates, giving a final analytic sample of 7,478 individuals. In the HRS a total of 13,806 individuals agreed to the physical measures module and were therefore eligible for the measure of grip strength. Of those 13,806 individuals 774 were missing data on grip strength, 0 individuals were missing data on marital status and 281 were missing data on one or more covariates, giving a final analytic sample of 12,751 individuals for the measure of grip strength. In ELSA 4,134 individuals aged 65 years and older who had a personal interview and a nurse visit and were therefore eligible for the timed walk; 90 were missing data on

walking speed and a further 399 were excluded as they were missing data on one or more of the covariates. The final analytic sample for the timed walk in ELSA comprised 3,645 individuals. In the HRS there were 9,125 individuals who agreed to the physical measures module and were age eligible (aged 65 years and older) for the timed walk measure, of which 602 were missing data on walking speed and a further 186 individuals were missing data on one or more covariates giving a final analytic sample of 8,337 individuals. The two samples included mostly the same participants with the main difference between the two samples being that the younger participants under the age of 65 were not included in the timed walk analysis due to the age restriction for this physical performance measure.

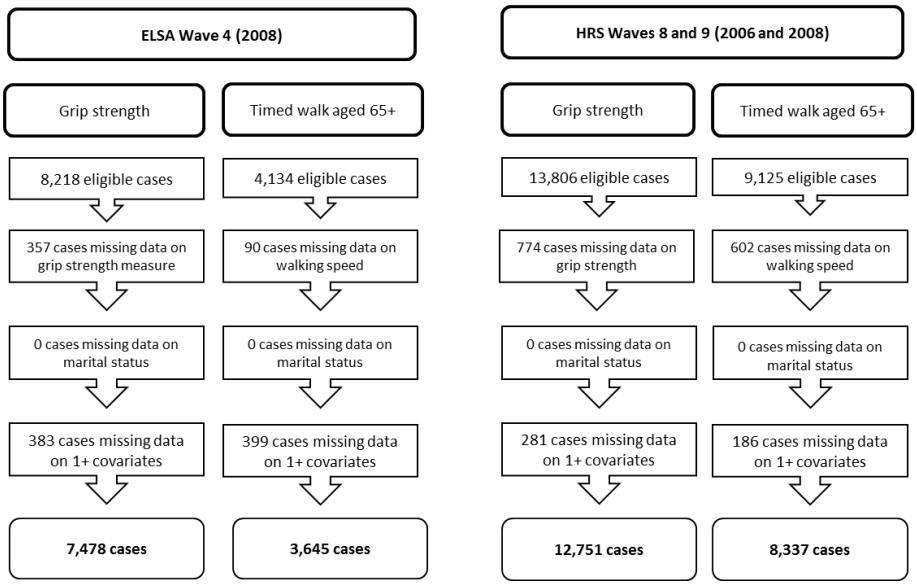


Figure 6.1: Detail of the ELSA and HRS analytic sample for the cross-sectional analysis on marital status and physical capability

Comparison of final analytic sample with the complete sample including cases with missing data

Tests were run to assess whether mean grip strength and walking speed in the final analytic sample was significantly different to the estimates in the complete sample, which included the cases that were dropped as they contained missing data. Table 6.1 and Table 6.2 show the mean grip strength and walking speed for the analytic sample and the sample containing the cases with missing data for ELSA and the HRS.

The final analytic sample and the complete sample had comparable mean grip strength for men and women on both ELSA and the HRS. There were also few significant differences in the age adjusted mean grip strength by marital status between the final analytic sample and the complete sample, although in ELSA widowed women in the final analytic sample had a stronger grip strength

than widowed women in the complete sample. Widowed women in the final analytic sample had a mean grip strength of 14.63 kg/m whilst in the complete sample widowed women had a mean grip strength of 14.57 kg/m. There were no differences by marital status between the analytic sample and the complete sample for the measure of grip strength in the HRS.

For both men and women in ELSA the final analytic sample had an overall faster mean walking speed than the complete sample (p<0.001), but there were no differences in walking speed by marital status between the two samples. Among men in the HRS the two samples had comparable walking speeds, but among women the analytic sample had an overall faster walking speed. There was one difference between the two samples by marital status. In the HRS widowed men in the final analytic sample had a slower walking speed than the sample containing the missing data, 0.717 m/s in the analytic sample compared to 0.723 m/s in the complete sample. The omission of cases with missing data in ELSA could mean that any differences in grip strength between widowed women and women in their first marriage could be underestimated, whilst for the measure of walking speed it could mean that any differences between widowed men and men in their first marriage could be overestimated in the HRS.

Table 6.1: Comparison of grip strength (in kg/m) estimates by marital status between the analytic sample and the complete sample in ELSA and the HRS

	ELSA							
	Men				Women			
	Final analytic sample		Complete sample		Final analytic sample		Complete sample	
	Mean (kg/m)	SE	Mean (kg/m)	SE	Mean (kg/m)	SE	Mean (kg/m)	SE
Overall Mean	22.89	0.07	22.90	0.07	14.83	0.06	14.82	0.06
First marriage	23.07	0.10	23.05	0.51	14.88	0.08	14.89	0.08
Remarried	23.71	0.21	23.71	0.79	15.05	0.16	15.06	0.15
Divorced / separated	22.65	0.26	22.73	1.03	14.49	0.14	14.53	0.14
Widowed	22.44	0.30	22.39	1.37	14.63	0.13	14.57*	0.13
Never married	21.46	0.32	21.38	1.37	14.48	0.24	14.39	0.23
Total (N)	*3,382*		*3,559*		*4,096*		*4,302*	
	HRS							
	Men				Women			
	Final analytic sample		Complete sample		Final analytic sample		Complete sample	
	Mean (kg/m)	SE	Mean (kg/m)	SE	Mean (kg/m)	SE	Mean (kg/m)	SE
Overall Mean	22.83	0.05	22.82	0.05	15.08	0.05	15.07	0.05
First marriage	23.02	0.09	23.01	0.09	15.20	0.07	15.19	0.07
Remarried	23.28	0.12	23.26	0.12	15.15	0.10	15.14	0.10
Divorced / separated	22.23	0.19	22.24	0.19	15.10	0.11	15.06	0.10
Widowed	22.08	0.22	22.07	0.22	14.81	0.08	14.81	0.08
Never married	20.74	0.36	20.68	0.35	15.29	0.23	15.31	0.23
Total (N)	*5,406*		*5,502*		*7,345*		*7,530*	

** p<0.05 final analytic sample v sample with missing data*

***p<0.001 final analytic sample v sample with missing data*

Adjusted for age

Tests of significance were carried out by running a linear regression on grip strength and marital status adjusted for age, with interactions between marital status and variable which flagged whether cases was in the analytic sample or not.

Table 6.2: Comparison of walking speed (in m/s) estimates by marital status between the analytic sample and the complete sample in ELSA and the HRS

	ELSA							
	Men				Women			
	Final analytic sample		Complete sample		Final analytic sample		Complete sample	
	Mean (m/s)	SE	Mean (m/s)	SE	Mean (m/s)	SE	Mean (m/s)	SE
Overall mean	0.857	0.007	0.826**	0.006	0.782	0.006	0.752**	0.005
First marriage	0.883	0.008	0.861	0.008	0.803	0.009	0.770	0.008
Remarried	0.879	0.018	0.847	0.016	0.778	0.021	0.748	0.018
Divorced / separated	0.795	0.025	0.753	0.022	0.753	0.018	0.731	0.016
Widowed	0.817	0.018	0.792	0.016	0.759	0.010	0.727	0.009
Never married	0.776	0.030	0.741	0.025	0.752	0.027	0.719	0.024
Total (N)	*1,630*		*1,808*		*2,015*		*2,236*	
	HRS							
	Men				Women			
	Final analytic sample		Complete sample		Final analytic sample		Complete sample	
	Mean (m/s)	SE	Mean (m/s)	SE	Mean (m/s)	SE	Mean (m/s)	SE
Overall mean	0.780	0.004	0.780	0.004	0.699	0.004	0.697*	0.004
First marriage	0.799	0.006	0.798	0.006	0.731	0.006	0.730	0.006
Remarried	0.800	0.009	0.799	0.009	0.736	0.010	0.736	0.010
Divorced / separated	0.737	0.015	0.737	0.015	0.666	0.011	0.662	0.011
Widowed	0.717	0.013	0.723*	0.013	0.666	0.006	0.664	0.006
Never married	0.718	0.030	0.718	0.029	0.657	0.023	0.657	0.023
Total (N)	*3,541*		*3,608*		*4,796*		*4,915*	

** p<0.05 final analytic sample v sample with missing data*
***p<0.001 final analytic sample v sample with missing data*
Adjusted for age
Tests of significance were carried out by running a linear regression on walking speed and marital status adjusted for age, with interactions between marital status and a variable which flagged whether cases was in the analytic sample or not.

Marital status, childhood circumstances and physical capability analytic sample

The analysis which included measures of childhood circumstances used the same analytic sample described above. The measures of childhood circumstances used were childhood self-rated health, parents' educational attainment and father's occupation. The measure of father's unemployment was not included in the analysis due to multicollinearity between this measure and the measure of father's occupation as the father's occupation measure also included a category for father never worked or permanently sick.

There were a number of cases included in the analysis which contained missing data on the childhood measures, which are detailed in Table 6.3 for the two physical capability outcomes[12]. A total of 3,727 cases in the grip strength analysis were missing data on one or more of the childhood measures in ELSA and 4,032 cases in the HRS. For the measure of walking speed 1,777 cases were

[12] The analysis of missing data for the childhood circumstances measures by marital status is detailed earlier in Table 5.1 and Table 5.2 for ELSA and the HRS, respectively.

missing data on 1 or more of the childhood measures in ELSA and 1,617 in the HRS. The high numbers of missing data in ELSA were partly because one of the childhood measures (childhood health) was collected in the life history interview in which not all Wave 4 ELSA sample members had the opportunity to participate in. For the measure of grip strength of the 3,727 men and women who were missing data on one or more of the childhood measures, over half (2,419) did not participate in the life history interview and for the walking speed measure, of the 1,777 who did not have data on one or more of the childhood measures 944 men and women did not participate in the life history interview.

Table 6.3: Missing data on childhood measures for men and women in ELSA and the HRS

	ELSA			HRS		
	Men	**Women**	**Total**	**Men**	**Women**	**Total**
Grip strength						
Total with complete data	1,675	2,076	3,751	3,628	5,091	8,719
Missing data on 1+ childhood measures	1,707 (50.5%)	2,020 (49.3%)	3,727 (49.8%)	1,778 (32.8%)	2,254 (30.7%)	4,032 (31.6%)
Total (N)	*3,382*	*4,096*	*7,478*	*5,406*	*7,345*	*12,751*
Walking Speed						
Total with complete data	814	1,054	1,868	2,900	3,820	6,720
Missing data on 1+ childhood measures	816 (50.1%)	961 (47.7%)	1,777 (48.8%)	641 (18.1%)	976 (20.4%)	1,617 (19.4%)
Total (N)	*1,630*	*2,015*	*3,645*	*3,541*	*4,796*	*8,337*

Linear regression was carried out to check whether the cases containing missing data on 1 or more of the childhood measures had a different mean grip strength and walking speed to the cases without missing data and whether this also varied by marital status among men and women. The mean grip strength estimates for the sample containing no missing data and the sample containing missing data on the childhood measures are shown in Table 6.4. On both ELSA and the HRS the cases which contained missing data on the childhood measures did not have a significantly different mean grip strength to those which did not have any missing data on the childhood measures.

Table 6.4: Mean grip strength between the sample with complete data on the childhood measures and the complete analytic sample, by marital status for men and women in ELSA and the HRS

ELSA								
	Men				Women			
	Complete data on childhood measures		Complete analytic sample including missing data on 1+ childhood measures		Complete data on childhood measures		Complete analytic sample including missing data on 1+ childhood measures	
	Mean (kg/m)	SE	Mean (kg/m)	SE	Mean (kg/m)	SE	Mean (kg/m)	SE
Overall mean	23.23	0.12	22.72	0.11	14.85	0.08	14.68	0.08
First marriage	23.22	0.14	22.89	0.15	15.04	0.11	14.74	0.11
Remarried	23.88	0.31	23.48	0.30	14.95	0.23	15.17	0.22
Divorced / separated	23.51	0.40	22.28	0.34	14.55	0.20	14.45	0.20
Widowed	22.72	0.44	21.76	0.40	14.67	0.18	14.46	0.18
Never married	22.00	0.49	21.31	0.42	14.53	0.36	14.53	0.32
Total (N)	*1,675*		*3,382*		*2,076*		*4,096*	
HRS								
	Men				Women			
	Complete data on childhood measures		Complete analytic sample including missing data on 1+ childhood measures		Complete data on childhood measures		Complete analytic sample including missing data on 1+ childhood measures	
	Mean (kg/m)	SE	Mean (kg/m)	SE	Mean (kg/m)	SE	Mean (kg/m)	SE
Overall mean	22.94	0.08	22.66	0.13	15.11	0.05	14.95	0.08
First marriage	23.13	0.11	22.79	0.17	15.27	0.08	15.03	0.13
Remarried	23.37	0.15	23.10	0.23	15.24	0.12	14.93	0.18
Divorced / separated	22.34	0.25	22.05	0.30	15.04	0.14	15.17	0.17
Widowed	22.16	0.25	21.96	0.43	14.85	0.09	14.75	0.14
Never married	20.46	0.52	20.92	0.50	15.56	0.31	14.95	0.34
Total (N)	*3,628*		*5,406*		*5,091*		*7,345*	

**p<0.05 **p<0.001 first marriage v other marital status*

Tests of significance were carried out by running a linear regression on grip strength and marital status adjusted for age, with interactions between marital status and a variable which flagged whether cases had data on all the childhood measures or not.

However, the mean estimates of walking speed did differ between the two samples. On both ELSA and the HRS those cases which contained missing data on the childhood measures had an overall slower walking speed than those cases which didn't contain any missing data. There was no difference in the mean walking speed by marital status between the two samples though (as shown in Table 6.5).

Table 6.5: Mean walking speed between the sample with complete data on the childhood measures and the complete analytic sample, by marital status for men and women in ELSA and the HRS

ELSA

	Men				Women			
	Complete data on childhood measures		Complete analytic sample including missing data on 1+ childhood measures		Complete data on childhood measures		Complete analytic sample including missing data on 1+ childhood measures	
	Mean (m/s)	SE	Mean (m/s)	SE	Mean (m/s)	SE	Mean (m/s)	SE
Overall mean	0.891	0.009	0.835*	0.009	0.799	0.008	0.753*	0.009
First marriage	0.909	0.012	0.856	0.012	0.837	0.012	0.775	0.014
Remarried	0.906	0.026	0.857	0.025	0.786	0.032	0.780	0.027
Divorced / separated	0.851	0.037	0.762	0.034	0.773	0.024	0.728	0.027
Widowed	0.835	0.027	0.783	0.024	0.772	0.014	0.731	0.014
Never married	0.841	0.052	0.750	0.037	0.741	0.038	0.749	0.040
Total (N)	*814*		*1,630*		*1,054*		*2,015*	

HRS

	Men				Women			
	Complete data on childhood measures		Complete analytic sample including missing data on 1+ childhood measures		Complete data on childhood measures		Complete analytic sample including missing data on 1+ childhood measures	
	Mean (m/s)	SE	Mean (m/s)	SE	Mean (m/s)	SE	Mean (m/s)	SE
Overall mean	0.790	0.005	0.745**	0.010	0.709	0.004	0.647**	0.008
First marriage	0.809	0.006	0.749	0.015	0.743	0.007	0.674	0.015
Remarried	0.804	0.010	0.786	0.020	0.749	0.011	0.677	0.024
Divorced / separated	0.744	0.016	0.710	0.032	0.673	0.012	0.640	0.023
Widowed	0.728	0.014	0.675	0.027	0.678	0.007	0.624	0.012
Never married	0.715	0.033	0.732	0.066	0.682	0.026	0.541	0.055
Total (N)	*2,900*		*3,541*		*3,820*		*4,796*	

**p<0.05 **p<0.001 first marriage v other marital status*

Tests of significance were carried out by running a linear regression on walking speed and marital status adjusted for age, with interactions between marital status and a variable which flagged whether cases had data on all the childhood measures or not.

6.1.2 Analytic method

The outcomes of grip strength and walking speed were continuous and normally distributed therefore multiple linear regression was carried out using STATA 14. The models were sequentially adjusted for age only (model 1); the demographic and socio-economic measures – ethnicity, education, wealth, work status and parental status (model 2); health behaviours – smoking status, physical activity and BMI (model 3); physical health - self-rated health and number of chronic health conditions - and psychological morbidity - CES-D (model 4); and then childhood

circumstances – childhood self-rated health, parental education and father's occupation (model 5). Additionally, the data for ELSA and the HRS were combined in order to test for marital status by gender interactions and for marital status by country interactions.

Full Information Maximum Likelihood (FIML)

As the additional missing data on the childhood circumstances (described previously in Section 6.1.1) would have resulted in reduced sample sizes, a consequent increase in standard errors and loss of sample power, estimates were generated using Full Information Maximum Likelihood (FIML) in STATA. FIML is a technique for dealing with missing data which estimates parameters using all the information available within the dataset. FIML assumes that the data is either missing completely at random (MCAR) or missing at random (MAR) and has shown to give more accurate estimates than complete case analysis (or listwise deletion) (Enders and Bandalos, 2001). FIML was deemed appropriate for this analysis in order to retain the same sample numbers throughout the analysis in this chapter. Also there didn't seem to be any differences in the marital status estimates for grip strength and walking speed between the complete sample containing the missing data on the childhood measures and the cases with complete data on the childhood measures, which suggests that the missing data was not related to the exposure or the outcome and could be classified as missing at random (MAR). Therefore, in these circumstances FIML was the best solution for including those cases with missing data on childhood circumstances in the analysis.

Weights

The data were not weighted in this analysis. The reason for this was largely because the timed walk analysis was carried out on a subsample of the ELSA and HRS samples (aged 65 years and older) and in this instance the survey weights would not have been appropriate, as they are designed to be used when analysis is carried out on the whole sample (Levy and Lemeshow, 2008). Also, the analysis already adjusted for the majority of the factors associated with selection and non-response which were used to create the cross-sectional weights (which are shown in Table 6.6). As the weights were not used on the timed walk analysis it seemed appropriate not to use the weights on the grip strength analysis. A sensitivity analysis was carried out to compare the unweighted analysis with the weighted analysis (included in Appendix F), the results of which showed few differences between the weighted and the unweighted estimates.

Table 6.6: Demographic and socio-economic measures used to create the cross-sectional weights in ELSA and the HRS

ELSA	HRS
Age by sex	Geographic area
Highest educational qualifications	Marital status
Household type (1 adult / 2 adults, family / large adult household)	Age
National Statistics Socio-Economic Classification (NS-SEC)	Sex
Whether had a long-term limiting illness	Ethnicity
Marital status	
Housing tenure	
White/non-white ethnicity	

6.2 Sample characteristics

The remainder of this chapter details the results of the cross-sectional analysis.

Table 6.7 shows the physical capability measures for the ELSA Wave 4 and the HRS Waves 8 and 9 samples. Men in ELSA and the HRS had a similar grip strength, whilst women in the HRS had a stronger grip strength than women in ELSA. Individuals in ELSA had a faster walking speed than those in the HRS. Men in both countries had a stronger grip strength and faster walking speed than women (p<0.05).

Table 6.7: Age adjusted physical capability of the ELSA Wave 4 sample and HRS Waves 8 and 9 samples

	ELSA				HRS			
	Men		Women		Men		Women	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Highest grip strength (kgs/m)	22.92	0.07	14.81	0.06	22.83	0.05	15.08**	0.05
Total (N)	*3,382*		*4,096*		*5,406*		*7,345*	
Walking speed (m/s)	0.857	0.007	0.782	0.006	0.779**	0.004	0.699**	0.004
Total (N)	*1,630*		*2,015*		*3,541*		*4,796*	

Adjusted for age
** p<0.05 **p<0.001 HRS v ELSA*

Based upon cross sectional analysis physical capability declined with age and those in the older age categories had substantially weaker grip strength and slower walking speed than those in the younger age categories (p<0.001), as shown in Figure 6.2 and Figure 6.3. There were also some gender differences, whilst men had a stronger grip strength than women their grip strength

declined more rapidly with age on both ELSA and the HRS (p<0.001) and on the HRS women's walking speed declined faster with age than it did for men on the HRS (p<0.05).

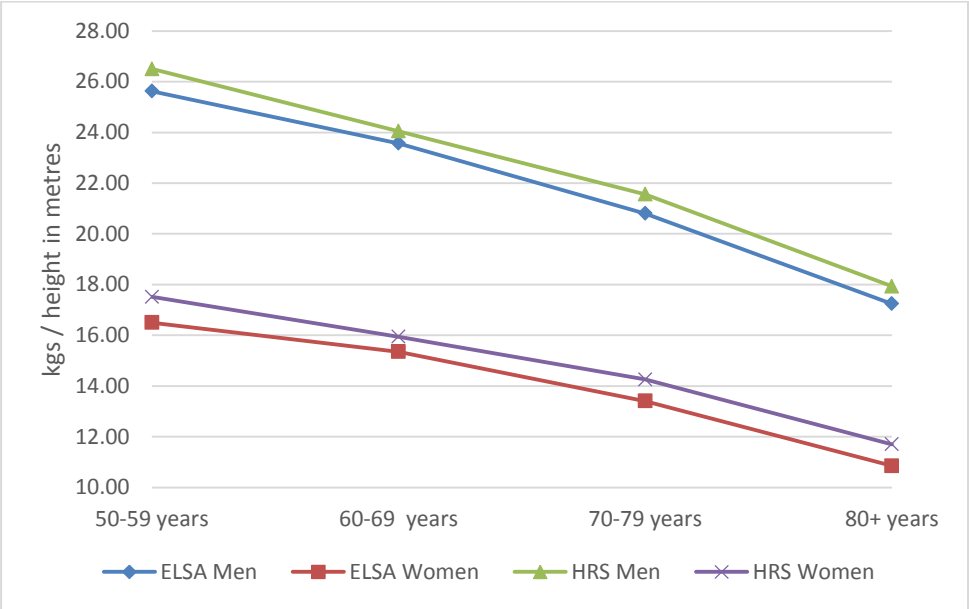


Figure 6.2: Cross-sectional association between grip strength and age for men and women in ELSA and the HRS

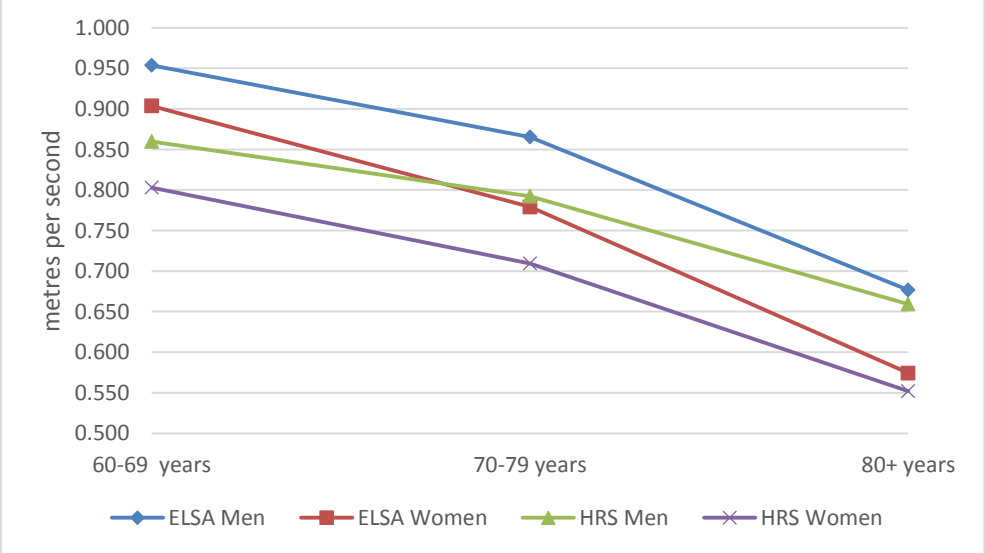


Figure 6.3: Cross-sectional association between walking speed and age for men and women in ELSA and the HRS

6.3 Grip strength

Linear regression analysis was then run for the two outcomes grip strength and walking speed, for men and women separately.

Firstly, age adjusted models were estimated for grip strength separately for men and women in ELSA and the HRS. The mean estimated grip strength for each marital status is shown in Figure 6.4 for men and Figure 6.5 for women. In both ELSA and the HRS there was variation in grip strength among the different marital statuses. Among men in ELSA (Figure 6.4), those who were widowed and never married had significantly weaker grip strength than men in their first marriage (22.17 kgs and 21.60 kgs respectively, compared to 23.06 kgs for men in their first marriage), whilst men who had remarried had a stronger grip strength than men in their first marriage (23.68 kgs compared to 23.06 kgs). A similar pattern was apparent in the HRS where all unmarried men displayed a weaker grip strength compared to those in their first marriage.

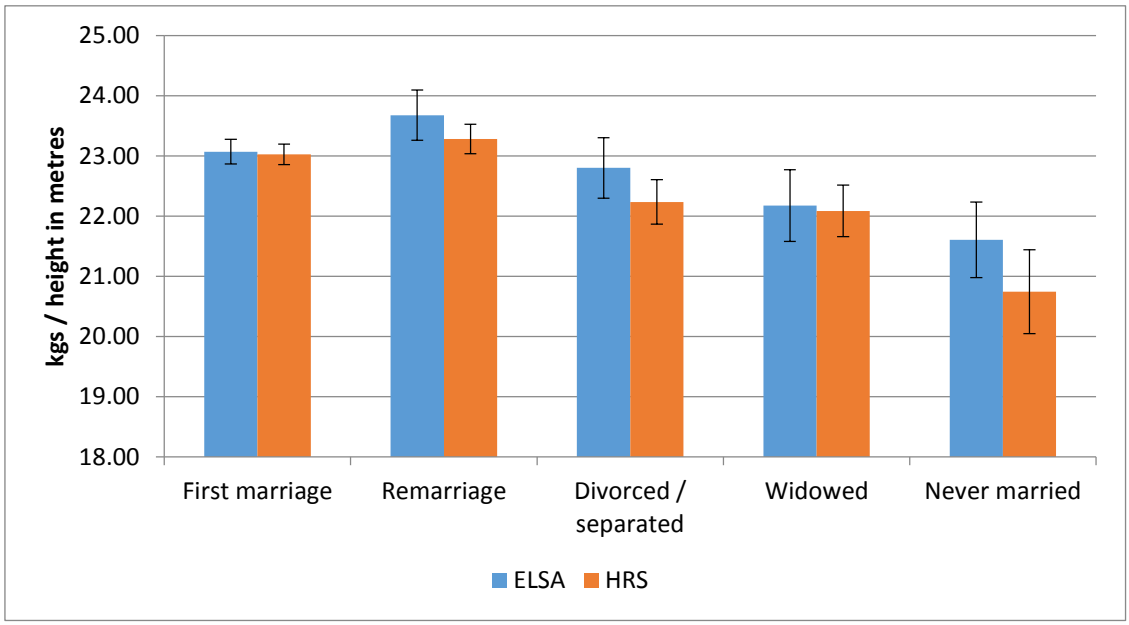


Figure 6.4: Age adjusted grip strength by current marital status, men

Among women in both ELSA and the HRS there was not so much variation in grip strength among the different marital statuses and only those who had transitioned out of marriage and not remarried had a weaker grip strength than women in their first marriage (Figure 6.5). In ELSA women who were divorced / separated or widowed had a weaker grip strength than women in their first marriage ($p<0.05$), 14.50 kgs for divorced women and 14.56 for widowed women, compared to 14.89 kgs for women in their first marriage, and in the HRS women who were

widowed had weaker grip strength than those in their first marriage (p<0.001), 14.81 kgs compared to 15.20 kgs.

There were similar associations between marital status and grip strength for men and women in ELSA and the HRS.

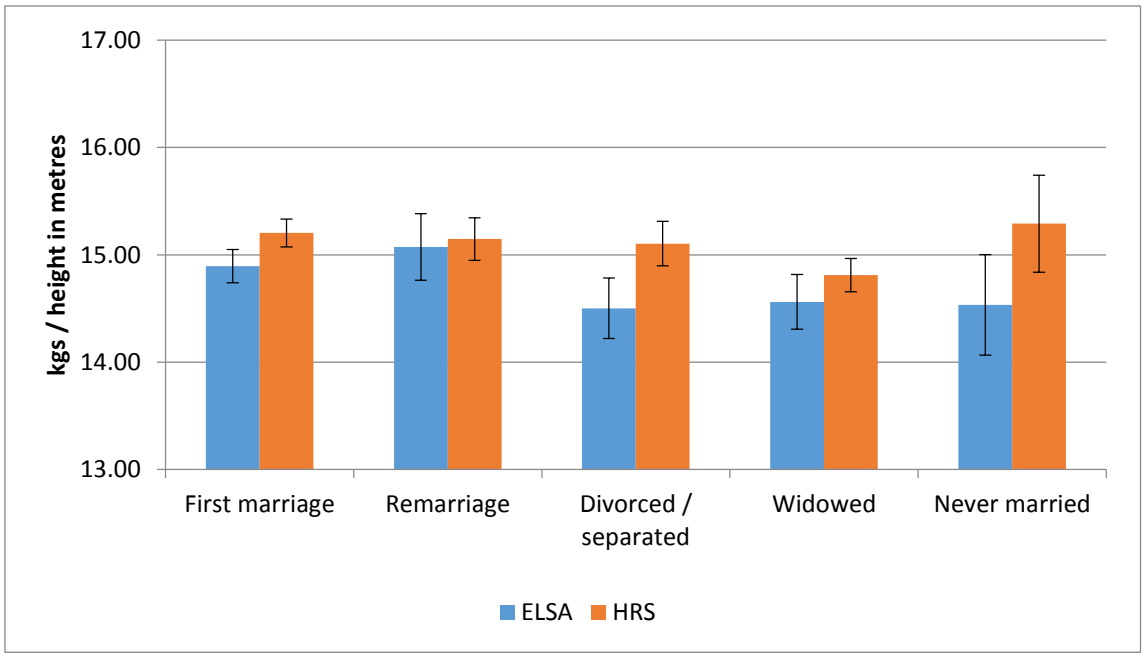


Figure 6.5: Age adjusted grip strength by current marital status, women

There was modification in the association by gender between marital status and grip strength for those who were remarried, widowed and never married in both ELSA and the HRS (shown in Table 6.8). Being a widowed or never married man was associated with a weaker grip strength than it was for widowed or never married women, whilst the reverse was seen for remarriage, with remarriage for men being associated with a stronger grip strength than it was for women.

Table 6.8: Interactions between marital status and gender for the measure of grip strength

	ELSA		HRS	
	Coef.	**SE**	**Coef.**	**SE**
marital status*gender (ref category first marriage*women)				
Remarried*women	-0.53	0.29	-0.46*	0.19
Divorced / separated*women	-0.31	0.31	0.38	0.23
Widowed*women	1.40**	0.31	1.30**	0.23
Never married* women	0.98*	0.42	2.04**	0.42
Constant	*25.19*	*0.12*	*25.97*	*0.10*

Adjusted for age
** p<0.05 ** p<0.001*

The age only models were investigated further and grip strength was modelled as a function of demographic and socio-economic characteristics, health behaviours, and physical health and psychological morbidity, firstly for men then for women.

6.3.1 Men

Table 6.9 for men in ELSA and Table 6.10 for men in the HRS show the results of the four models which were run.

The age adjusted models (model 1) had shown some interesting differences in grip strength by marital status. In ELSA never married and widowed men had a weaker grip strength than men in their first marriage whilst remarried men had a stronger grip strength compared to men who were in their first marriage. The weaker grip strength of widowed and never married men was attenuated once adjusting for the demographic and socio-economic measures (model 2). When looking at this in more detail wealth explained the weaker grip strength among widowed men and for never married men it was explained by both wealth and parental status. Widowed and never married men had lower levels of wealth in comparison to men in their first marriage, whilst never married men were also less likely to have had children than men in their first marriage.

In the HRS, although the addition of the demographic and socio-economic measures (model 2) partly attenuated the disparity in grip strength between those who were in their first marriage and those who were widowed or never married, widowed men still had a significantly weaker grip strength than those in their first marriage. For widowed men the association was attenuated by their poorer health behaviours (model 3) and physical health and higher levels of psychological morbidity (model 4), but for never married men the association remained after making all adjustments where never married men had a 0.97 kgs/m weaker grip strength than men in their first marriage.

In the age only models (model 1) remarried men in both ELSA and the HRS had a stronger grip strength than men in their first marriage and adjusting for the demographic and socio-economic measures did not attenuate the association, nor did adjusting for health behaviours, physical health and psychological morbidity. Remarried men's stronger grip strength than men in their first marriage was not explained by any of the investigated mediating pathways.

There were largely no differences in the association by country and there were similar patterns between grip strength and marriage among men in both ELSA and the HRS. The exception to this was borderline effect modification in model 4 among never married men (p=0.05): never married men in the HRS had comparably weaker grip strength than never married men in ELSA (shown in Table 6.11).

Table 6.9: Regression coefficients for grip strength (in kgs / height in m) for men in ELSA

.	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	0.61*	0.24	0.76*	0.23	0.71*	0.23	0.72*	0.23
Divorced / separated	-0.27	0.28	0.48	0.28	0.51	0.28	0.52	0.28
Widowed	-0.89*	0.32	-0.43	0.32	-0.39	0.31	-0.40	0.31
Never married	-1.46*	0.34	-0.26	0.39	-0.10	0.38	-0.13	0.38
Age (50-59 ref category)								
60-69	-2.11**	0.20	-1.60**	0.21	-1.59**	0.21	-1.59**	0.21
70-79	-4.82**	0.23	-3.80**	0.27	-3.69**	0.27	-3.65**	0.27
80+	-8.19**	0.34	-7.07**	0.36	-6.59**	0.37	-6.46**	0.37
Ethnicity (white ref category)								
Non-white			-2.13**	0.48	-1.64*	0.47	-1.51*	0.47
Education (low ref category)								
Medium			0.09	0.19	0.09	0.19	-0.02	0.19
High			-0.28	0.24	-0.19	0.24	-0.32	0.24
Wealth (lowest wealth quintile ref category)								
2nd			0.64*	0.29	0.46	0.28	0.35	0.28
3rd			1.47**	0.29	1.14**	0.28	0.90*	0.29
4th			1.77**	0.28	1.46**	0.29	1.20**	0.29
5th high wealth			1.94**	0.29	1.54**	0.30	1.20**	0.30
Work status (working ref category)								
Not working			-1.58**	0.20	-1.34**	0.20	-1.09**	0.20
Parental status (has children ref category)								
No children			-0.88**	0.26	-0.76*	0.25	-0.75*	0.25
Smoking status (never smoked ref category)								
Former smoker					0.20	0.18	0.27	0.18
Current smoker					0.02	0.28	0.15	0.27
Physical activity (moderate activity ref category)								
Sedentary					-2.22**	0.39	-1.64**	0.39
Low					-0.89*	0.22	-0.62*	0.23
High					0.79*	0.19	0.65*	0.19
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					1.19**	0.20	1.25**	0.20
Obese BMI (30+)					1.64**	0.23	1.86**	0.23
Self-rated health (excellent / v. good ref category)								
Good							-0.30	0.19
Fair / poor							-1.22**	0.24
Chronic health conditions (0 reported conditions ref category)								
Reported 1 condition							-0.08	0.20
Reported 2 conditions							-0.53	0.23
Reported 3+ conditions							-0.73*	0.28
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.22	0.24
Constant	*25.74*	*0.17*	*24.85*	*0.29*	*23.73*	*0.37*	*24.32*	*0.39*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table 6.10: Regression coefficients for grip strength (in kgs / height in m) for men in the HRS

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	0.26	0.15	0.30*	0.15	0.29	0.15	0.31*	0.14
Divorced / separated	-0.79*	0.21	-0.20	0.21	-0.08	0.21	-0.05	0.20
Widowed	-0.94*	0.24	-0.53*	0.23	-0.48*	0.23	-0.41	0.23
Never married	-2.28**	0.37	-1.07*	0.42	-0.99*	0.41	-0.97*	0.40
Age (50-59 ref category)								
60-69	-2.57**	0.18	-2.30**	0.18	-2.23**	0.18	-2.07**	0.18
70-79	-5.03**	0.18	-4.50**	0.20	-4.31**	0.20	-4.00**	0.20
80+	-8.54**	0.22	-7.92**	0.24	-7.16**	0.25	-6.82**	0.25
Ethnicity (white ref category)								
Hispanic			-1.22**	0.23	-1.25**	0.22	-1.22*	0.22
Black			-0.09	0.20	-0.05	0.20	-0.01	0.19
Other			-0.99	0.52	-0.97	0.50	-1.04	0.50
Education (low ref category)								
Medium			0.34*	0.16	0.26	0.16	0.22	0.16
High			-0.22	0.16	-0.25	0.15	-0.40	0.15
Wealth (lowest wealth quintile ref category)								
2nd			0.75**	0.22	0.49*	0.21	0.45*	0.21
3rd			1.44**	0.21	1.11**	0.21	0.91**	0.21
4th			1.73**	0.22	1.37**	0.21	1.10**	0.21
5th high wealth			1.92**	0.22	1.57**	0.22	1.26**	0.22
Work status (working ref category)								
Not working			-1.33**	0.15	-1.04**	0.15	-0.72**	0.15
Parental status (has children ref category)								
No children			-1.10**	0.30	-0.98*	0.29	-1.03**	0.29
Smoking status (never smoked ref category)								
Former smoker					-0.05	0.14	0.09	0.13
Current smoker					0.06	0.19	0.21	0.19
Physical activity (moderate activity ref category)								
Sedentary					-3.37**	0.27	-2.81**	0.27
Low					-1.01**	0.16	-0.79**	0.16
High					0.28	0.14	0.16	0.14
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					1.08**	0.15	1.18**	0.15
Obese BMI (30+)					1.68**	0.16	1.99**	0.16
Self-rated health (excellent / v. good ref category)								
Good							-0.27	0.14
Fair / poor							-0.90**	0.17
Chronic health conditions (0 reported conditions ref category)								
Reported 1 condition							-0.38	0.20
Reported 2 conditions							-1.06**	0.20
Reported 3+ conditions							-1.58**	0.21
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.46*	0.17
Constant	*26.74*	*0.15*	*26.00*	*0.24*	*25.25*	*0.29*	*26.09*	*0.31*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table 6.11: Marital status and country interactions for grip strength, men

	Model 1		Model 2		Model 3		Model 4	
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Marital status*survey (Ref category: First marriage*HRS)								
Remarried*HRS	-0.36	0.28	-0.45	0.27	-0.42	0.27	-0.41	0.26
Divorced / separated*HRS	-0.49	0.34	-0.59	0.33	-0.51	0.33	-0.53	0.32
Widowed*HRS	-0.08	0.38	-0.24	0.37	-0.14	0.36	-0.11	0.36
Never married*HRS	-0.76	0.49	-0.84	0.48	-0.87	0.47	-0.89*	0.47
Constant	*25.88*	*0.13*	*25.01*	*0.19*	*24.10*	*0.23*	*24.65*	*0.25*

** p<0.05 ** p<0.001*
Model 1: Age
Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)
Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)
Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

6.3.2 Women

Now turning to women, Table 6.12 and Table 6.13 show the regression models for grip strength for women in ELSA and the HRS, respectively. In the age only models (model 1) divorced and widowed women in ELSA and widowed women in the HRS had a weaker grip strength than women in their first marriage. In ELSA divorced and widowed women's weaker grip strength was attenuated once adjusting for the demographic and socio-economic measures, in particular wealth, which accounted for most of the attenuation. In the HRS although the disparity in grip strength between widowed women and women in their first marriage was reduced when adjusting for the demographic and socio-economic measures they didn't completely explain the association. Widowed women's weaker grip strength was also not altered by the addition of the health behaviours, however once physical health and psychological morbidity were adjusted for the association was attenuated. Never married women in the HRS had an estimated grip strength which was 0.24 kgs/m stronger than women in their first marriage in the fully adjusted model, however due to lack of sample power the association was not statistically significant.

There was no difference in the association between marital status and grip strength for women in ELSA and the HRS, as shown in Table 6.14.

Table 6.12: Regression coefficients for grip strength (in kgs / height in m) for women in ELSA

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	0.18	0.18	0.29	0.17	0.26	0.17	0.36*	0.17
Divorced / separated	-0.39*	0.16	-0.06	0.17	-0.08	0.17	0.04	0.17
Widowed	-0.33*	0.16	-0.08	0.16	-0.09	0.15	0.01	0.15
Never married	-0.36	0.25	-0.31	0.28	-0.32	0.27	-0.27	0.27
Age (50-59 ref category)								
60-69	-1.15**	0.14	-0.78**	0.15	-0.79**	0.15	-0.78**	0.15
70-79	-3.03**	0.16	-2.36**	0.18	-2.15**	0.18	-2.06**	0.18
80+	-5.48**	0.22	-4.79**	0.24	-4.14**	0.24	-3.97**	0.24
Ethnicity (white ref category)								
Non-white			-0.47	0.35	-0.32	0.35	-0.10	0.34
Education (low ref category)								
Medium			0.25*	0.12	0.24	0.12	0.15	0.12
High			0.65**	0.17	0.62**	0.17	0.46*	0.17
Wealth (lowest wealth quintile ref category)								
2nd			0.10	0.18	0.05	0.18	-0.05	0.17
3rd			0.51*	0.18	0.40*	0.18	0.20	0.18
4th			0.76**	0.19	0.61**	0.19	0.38*	0.18
5th high wealth			1.02**	0.19	0.88**	0.20	0.58**	0.19
Work status (working ref category)								
Not working			-0.82**	0.14	-0.70**	0.14	-0.43**	0.14
Parental status (has children ref category)								
No children			0.08	0.17	0.12	0.16	0.13	0.16
Smoking status (never smoked ref category)								
Former smoker					0.09	0.11	0.18	0.11
Current smoker					0.67**	0.17	0.82**	0.17
Physical activity (moderate activity ref category)								
Sedentary					-1.97**	0.25	-1.49**	0.25
Low					-0.88**	0.13	-0.63**	0.13
High					0.74**	0.15	0.58**	0.15
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					0.43**	0.13	0.46**	0.13
Obese BMI (30+)					0.71**	0.14	0.95**	0.14
Self-rated health (excellent / v. good ref category)								
Good							-0.53**	0.13
Fair / poor							-1.08**	0.16
Chronic health conditions (0 reported conditions ref category)								
Reported 1 condition							-0.11	0.14
Reported 2 conditions							-0.45**	0.16
Reported 3+ conditions							-0.74**	0.19
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.54**	0.13
Constant	*16.59*	*0.11*	*15.96*	*0.19*	*15.56*	*0.23*	*16.14*	*0.24*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table 6.13: Regression coefficients for grip strength (in kgs / height in m) for women in the HRS

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	-0.06	0.12	-0.04	0.12	-0.06	0.12	-0.01	0.11
Divorced / separated	-0.10	0.12	0.03	0.13	-0.05	0.13	0.04	0.13
Widowed	-0.39**	0.11	-0.24*	0.11	-0.27*	0.11	-0.20	0.10
Never married	0.09	0.24	0.30	0.26	0.17	0.26	0.24	0.26
Age (50-59 ref category)								
60-69	-1.54**	0.11	-1.33**	0.12	-1.30**	0.11	-1.22**	0.11
70-79	-3.17**	0.12	-2.75**	0.13	-2.57**	0.13	-2.41**	0.13
80+	-5.61**	0.15	-5.05**	0.16	-4.47**	0.16	-4.27**	0.16
Ethnicity (white ref category)								
Hispanic			-0.50*	0.14	-0.48*	0.14	-0.28*	0.14
Black			1.19**	0.12	1.17**	0.12	1.27**	0.12
Other			0.19	0.33	0.34	0.33	0.48	0.32
Education (low ref category)								
Medium			0.14	0.10	0.10	0.10	-0.01	0.10
High			0.12	0.11	0.12	0.11	-0.02	0.11
Wealth (lowest wealth quintile ref category)								
2nd			0.74**	0.12	0.64**	0.12	0.54**	0.12
3rd			0.93**	0.13	0.79**	0.13	0.56**	0.13
4th			1.07**	0.13	0.97**	0.13	0.70**	0.13
5th high wealth			1.07**	0.14	0.99**	0.14	0.65**	0.14
Work status (working ref category)								
Not working			-0.86**	0.10	-0.70**	0.10	-0.45**	0.10
Parental status (has children ref category)								
No children			-0.33	0.19	-0.25	0.18	-0.29	0.18
Smoking status (never smoked ref category)								
Former smoker					0.06	0.09	0.13	0.08
Current smoker					0.48**	0.12	0.60**	0.12
Physical activity (moderate activity ref category)								
Sedentary					-2.40**	0.19	-1.90**	0.19
Low					-0.66**	0.09	-0.45**	0.09
High					0.21*	0.10	0.10	0.10
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					0.55**	0.10	0.60**	0.10
Obese BMI (30+)					0.94**	0.10	1.18**	0.10
Self-rated health (excellent / v. good ref category)								
Good							-0.28*	0.09
Fair / poor							-0.98**	0.12
Chronic health conditions (0 reported conditions ref category)								
Reported 1 condition							-0.46*	0.14
Reported 2 conditions							-0.59**	0.14
Reported 3+ conditions							-1.16**	0.15
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.37**	0.10
Constant	*17.58*	*0.10*	*16.92*	*0.16*	*16.44*	*0.18*	*17.24*	*0.20*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table 6.14: Marital status and country interactions for grip strength, women

	Model 1		Model 2		Model 3		Model 4	
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Marital status*survey								
Ref category: First marriage*HRS								
Remarriage*HRS	-0.23	0.21	-0.27	0.21	-0.27	0.20	-0.32	0.20
Divorced / separated*HRS	0.31	0.20	0.10	0.20	0.00	0.20	-0.02	0.19
Widowed*HRS	-0.04	0.17	-0.14	0.17	-0.15	0.17	-0.18	0.16
Never married*HRS	0.50	0.35	0.33	0.34	0.21	0.34	0.21	0.33
Constant	*16.70*	*0.09*	*16.07*	*0.13*	*15.64*	*0.15*	*16.24*	*0.16*

** p<0.05 ** p<0.001*
Model 1: Age
Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)
Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)
Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

6.3.3 Key findings

In the age adjusted analysis all unmarried men had a weaker grip strength than men in their first marriage and much of the association was explained by wealth. Although, in the HRS widowed men's weaker grip strength was explained by their poorer health behaviours as well as their poorer physical and psychological health. There were some unexplained associations. For never married men in the HRS the association remained unexplained after all adjustments and remarried men in ELSA and the HRS had a stronger grip strength than men in their first marriage, which was also unexplained by the covariates. This association was not apparent among women.

Among women there were few differences in grip strength by marital status; divorced women in ELSA and widowed women in ELSA and the HRS had a weaker grip strength which was explained by their lower levels of wealth and for widowed women in the HRS was also explained by their physical health and psychological morbidity. There were greater differences in grip strength between widowed and never married men and men in their first marriage than what there was among their female counterparts.

There was one country difference; never married men in the HRS had relatively weaker grip strength than never married men in ELSA.

6.4 Walking speed

The same models were then run for the measure of walking speed (as outlined in Section 6.1.2). In the age adjusted models there were similar patterns between walking speed and marital status for men and women in ELSA and the HRS. Currently unmarried men and women had a slower walking speed than those who were currently married. Among men (Figure 6.6) the greatest

disparity in walking speed was between never married men and men in their first marriage. Never married men in ELSA had a walking speed which was 0.103 metres per second slower than men in their first marriage, whilst in the HRS never married men's walking speed was 0.081 metres per second slower than men in their first marriage.

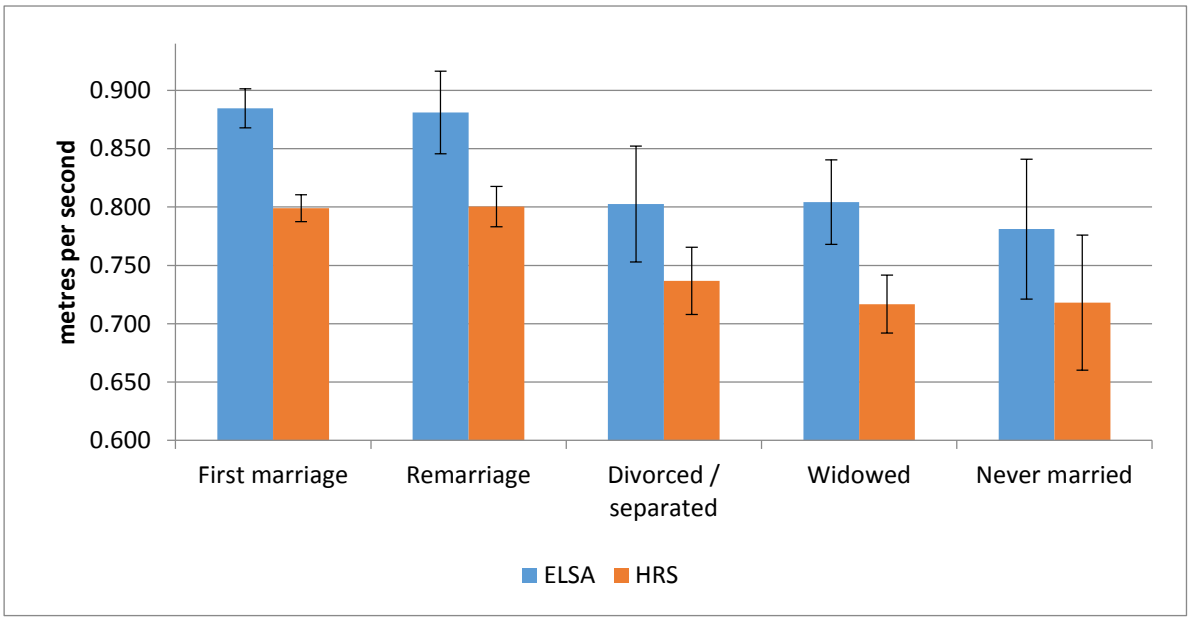


Figure 6.6: Age adjusted walking speed by current marital status, men

Among women (Figure 6.7) all unmarried women had slower walking speeds than women in their first marriage. There was no effect modification by gender in either country, and the association between marital status and walking speed was similar among men and women.

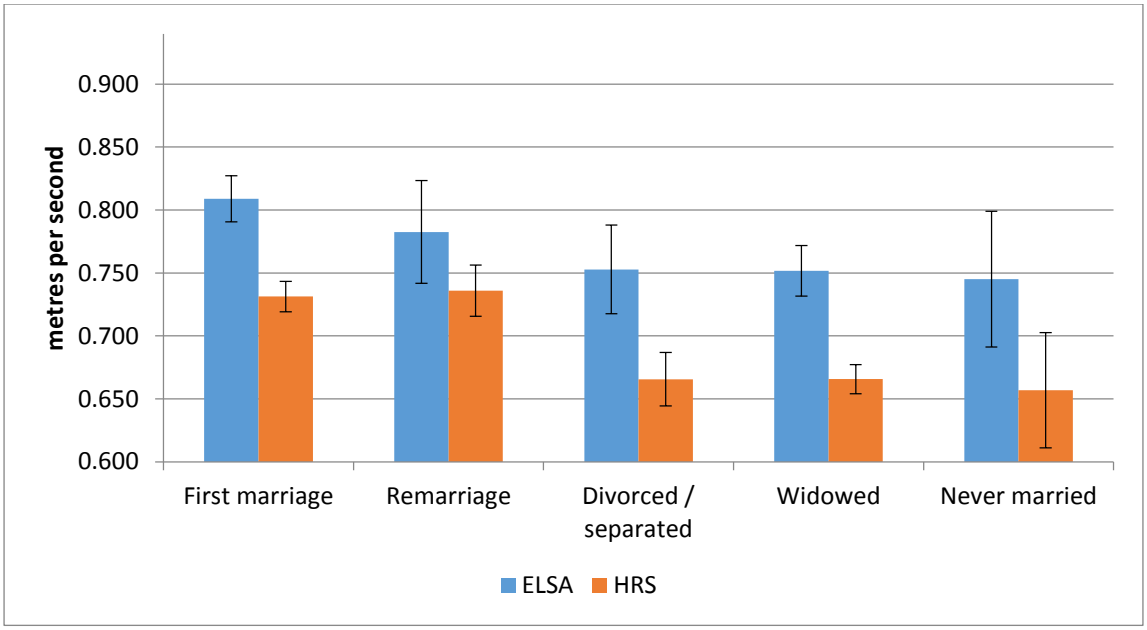


Figure 6.7: Age adjusted walking speed by current marital status, women

6.4.1 Men

The regression models were then run for men and women separately. The results for men are shown in Table 6.15 and Table 6.16 for ELSA and the HRS respectively.

Among men in ELSA the slower walking speed among divorced men compared to men in their first marriage, shown in the age adjusted models (model 1), was attenuated once adjusting for the demographic and socio-economic measures (model 2) and it was wealth which explained the association. In the HRS divorced and never married men's slower walking speed was also explained by the demographic and socio-economic measures and similarly to what was seen in ELSA it was largely wealth which mediated the association, although among never married men the association was also partly attenuated by parental status.

Among never married men in ELSA and widowed men in ELSA and the HRS there were different explanations for the association; whilst the demographic and socio-economic measures almost halved the discrepancy between their walking speed and men's in their first marriage walking speed it didn't completely explain their slower walking speed. In models adjusting for demographic and socio-economic factors (model 2) never married men in ELSA had a walking speed which was 0.080 m/s slower than men in their first marriage and widowed men in ELSA and the HRS had a walking speed which was 0.046 m/s and 0.043 m/s, respectively, slower than men in their first marriage. Adjusting for health behaviours (model 3) and physical health and psychological morbidity (model 4) attenuated the association a little but after all adjustments never married men in ELSA and widowed men in both ELSA and the HRS still had a slower walking speed than men in their first marriage.

Overall there were similar patterns observed in both ELSA and the HRS between marital status and walking speed and there was no modification in the association by country (as shown in Table 6.17).

Table 6.15: Regression coefficients for walking speed (in m/s) among men aged 65+, in ELSA

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	-0.003	0.020	0.011	0.019	0.013	0.018	0.014	0.017
Divorced / separated	-0.082*	0.027	-0.033	0.026	-0.015	0.024	-0.015	0.024
Widowed	-0.080**	0.020	-0.046*	0.020	-0.041*	0.018	-0.042*	0.018
Never married	-0.103*	0.032	-0.080*	0.036	-0.077*	0.034	-0.082*	0.033
Age (60-69 ref category)								
70-79	-0.087**	0.015	-0.068**	0.014	-0.070**	0.014	-0.066**	0.013
80+	-0.263**	0.020	-0.245**	0.020	-0.211**	0.019	-0.202**	0.019
Ethnicity (white ref category)								
Non-white			-0.250**	0.045	-0.209**	0.042	-0.179**	0.042
Education (low ref category)								
Medium			0.063**	0.015	0.058**	0.014	0.044*	0.014
High			0.098**	0.020	0.080**	0.01	0.065*	0.019
Wealth (lowest wealth quintile ref category)								
2nd			0.036	0.022	0.021	0.021	0.015	0.021
3rd			0.081**	0.022	0.035	0.021	0.021	0.020
4th			0.121**	0.022	0.070*	0.021	0.058*	0.021
5th high wealth			0.178**	0.023	0.116**	0.022	0.094**	0.022
Work status (Working ref category)								
Not working			-0.050*	0.021	-0.019	0.019	-0.002	0.019
Parental status (has children ref category)								
No children			0.004	0.023	-0.001	0.021	-0.002	0.021
Smoking status (never smoked ref category)								
Former smoker					-0.012	0.014	-0.003	0.013
Current smoker					-0.037	0.024	-0.023	0.023
Physical activity (moderate activity ref category)								
Sedentary					-0.263**	0.025	-0.204**	0.025
Low					-0.121**	0.016	-0.092**	0.016
High					0.080**	0.016	0.064**	0.016
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					-0.004	0.015	0.000	0.015
Obese BMI (30+)					-0.049*	0.018	-0.030	0.017
Self-rated health (excellent / v. good ref category)								
Good							-0.042*	0.014
Fair / poor							-0.121**	0.017
Chronic health conditions (0 reported conditions ref category)								
Reported 1 condition							0.004	0.016
Reported 2 conditions							-0.001	0.017
Reported 3+ conditions							-0.045*	0.019
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.031	0.018
Constant	*0.973*	*0.013*	*0.871*	*0.027*	*0.933*	*0.031*	*0.972*	*0.032*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table 6.16: Regression coefficients for walking speed (in m/s) among men aged 65+, in the HRS

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	0.001	0.011	0.012	0.010	0.014	0.010	0.016	0.010
Divorced / separated	-0.062**	0.016	-0.001	0.016	-0.003	0.015	-0.002	0.015
Widowed	-0.082**	0.014	-0.043*	0.014	-0.041*	0.013	-0.037*	0.013
Never married	-0.081*	0.030	-0.010	0.033	-0.027	0.032	-0.021	0.032
Age (65-69 ref category)								
70-79	-0.066**	0.010	-0.061**	0.010	-0.058**	0.009	-0.055**	0.009
80+	-0.188**	0.012	-0.182**	0.012	-0.158**	0.012	-0.152**	0.012
Ethnicity (white ref category)								
Hispanic			-0.071**	0.016	-0.073**	0.016	-0.065**	0.015
Black			-0.125**	0.014	-0.120**	0.013	-0.116**	0.013
Other			-0.030	0.038	-0.041	0.036	-0.044	0.036
Education (low ref category)								
Medium			0.050**	0.011	0.046**	0.011	0.043**	0.011
High			0.053**	0.011	0.044**	0.010	0.036**	0.010
Wealth (lowest wealth quintile ref category)								
2nd			0.035*	0.015	0.017	0.015	0.014	0.015
3rd			0.065**	0.015	0.037*	0.014	0.028	0.014
4th			0.110**	0.015	0.073**	0.015	0.059**	0.015
5th high wealth			0.123**	0.015	0.081**	0.015	0.064**	0.015
Work status (working ref category)								
Not working			-0.063**	0.011	-0.044**	0.011	-0.031*	0.010
Parental status (has children ref category)								
No children			-0.049*	0.022	-0.038	0.022	-0.039	0.021
Smoking status (never smoked ref category)								
Former smoker					-0.007	0.009	-0.001	0.009
Current smoker					-0.028	0.014	-0.019	0.014
Physical activity (moderate activity ref category)								
Sedentary					-0.215**	0.016	-0.178**	0.016
Low					-0.067**	0.010	-0.051**	0.010
High					0.036**	0.010	0.029*	0.010
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					0.009	0.010	0.010	0.009
Obese BMI (30+)					-0.015	0.011	-0.004	0.011
Self-rated health (excellent / v. good ref category)								
Good							-0.025*	0.010
Fair / poor							-0.079**	0.011
Chronic health conditions (0 reported conditions (ref category)								
Reported 1 condition							-0.014	0.016
Reported 2 conditions							-0.023	0.015
Reported 3+ conditions							-0.054**	0.015
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.027*	0.012
Constant	*0.873*	*0.009*	*0.828*	*0.017*	*0.865*	*0.020*	*0.918*	*0.023*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table 6.17: Marital status and country interactions for walking speed (m/s), men

	Model 1		Model 2		Model 3		Model 4	
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Marital status*survey								
Ref category: First marriage*HRS								
Remarriage*HRS	0.002	0.022	0.005	0.021	0.006	0.020	0.007	0.020
Divorced / separated*HRS	0.013	0.030	0.036	0.029	0.021	0.028	0.022	0.027
Widowed*HRS	0.017	0.024	0.025	0.022	0.024	0.021	0.027	0.021
Never married*HRS	0.019	0.043	0.029	0.041	0.018	0.039	0.031	0.039
Constant	0.958	0.010	0.890	0.016	0.934	0.018	0.976	0.019

** p<0.05 ** p<0.001*
Model 1: Age
Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)
Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)
Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

6.4.2 Women

Table 6.18 and Table 6.19 show the walking speed models for women in ELSA and the HRS. For all currently unmarried women in ELSA and in the HRS the addition of the demographic and socio-economic measures into the model (model 2) attenuated the difference between their walking speed and that of women in their first marriage, which had been seen in the age only model (model 1). Similarly to what was observed among men, it was largely wealth which explained unmarried women's slower walking speed in both countries.

There were no differences in the association between marital status and walking speed by country, shown in Table 6.20.

Table 6.18: Regression coefficients for walking speed (in m/s) among women aged 65+, in ELSA

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	-0.026	0.023	-0.009	0.021	0.012	0.020	0.020	0.019
Divorced / separated	-0.056*	0.020	0.004	0.020	-0.009	0.018	-0.002	0.017
Widowed	-0.057**	0.014	-0.013	0.014	-0.008	0.013	0.000	0.012
Never married	-0.064*	0.029	-0.046	0.032	-0.044	0.029	-0.033	0.028
Age (60-69 ref category)								
70-79	-0.118**	0.014	-0.093**	0.013	-0.077**	0.012	-0.069**	0.012
80+	-0.308**	0.018	-0.282**	0.017	-0.235**	0.017	-0.220**	0.016
Ethnicity (white ref category)								
Non-white			-0.214**	0.044	-0.186**	0.041	-0.148**	0.038
Education (low ref category)								
Medium			0.059**	0.012	0.040**	0.011	0.028*	0.011
High			0.100**	0.020	0.077**	0.019	0.053*	0.018
Wealth (lowest wealth quintile ref category)								
2nd			0.033	0.018	0.010	0.017	0.007	0.016
3rd			0.100**	0.018	0.063**	0.017	0.046*	0.016
4th			0.147**	0.018	0.091**	0.017	0.067**	0.017
5th high wealth			0.192**	0.020	0.134**	0.019	0.103**	0.018
Work status (Working ref category)								
Not working			-0.105**	0.023	-0.079**	0.021	-0.050*	0.02
Parental status (has children ref category)								
No children			-0.001	0.018	0.001	0.017	-0.002	0.016
Smoking status (never smoked ref category)								
Former smoker					-0.009	0.011	0.004	0.01
Current smoker					-0.014	0.019	0.013	0.018
Physical activity (moderate activity ref category)								
Sedentary					-0.256**	0.02	-0.196**	0.019
Low					-0.139**	0.012	-0.107**	0.012
High					0.035*	0.016	0.009	0.016
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					-0.026*	0.013	-0.026*	0.012
Obese BMI (30+)					-0.084**	0.013	-0.058**	0.013
Self-rated health (excellent / v. good ref category)								
Good							-0.060**	0.012
Fair / poor							-0.167**	0.014
Chronic health conditions (0 reported conditions ref category)								
Reported 1 condition							-0.007	0.015
Reported 2 conditions							-0.021	0.015
Reported 3+ conditions							-0.061**	0.017
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.045**	0.012
Constant	*0.928*	*0.012*	*0.862*	*0.027*	*0.967*	*0.028*	*1.027*	*0.028*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table 6.19: Regression coefficients for walking speed (in m/s) for women aged 65+, in the HRS

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	0.005	0.012	0.013	0.011	0.011	0.011	0.015	0.011
Divorced / separated	-0.066**	0.012	-0.001	0.012	-0.005	0.012	0.001	0.011
Widowed	-0.066**	0.009	-0.014	0.009	-0.013	0.008	-0.008	0.008
Never married	-0.074*	0.024	-0.015	0.026	-0.033	0.024	-0.028	0.024
Age (65-69 ref category)								
70-79	-0.087**	0.009	-0.085**	0.008	-0.085**	0.008	-0.077**	0.008
80+	-0.228**	0.010	-0.228**	0.010	-0.214**	0.010	-0.204**	0.010
Ethnicity (white ref category)								
Hispanic			-0.076**	0.013	-0.069**	0.012	-0.049**	0.012
Black			-0.113**	0.010	-0.094**	0.010	-0.084**	0.010
Other			0.025	0.032	0.016	0.030	0.024	0.030
Education (low ref category)								
Medium			0.052**	0.009	0.044**	0.008	0.035**	0.008
High			0.050**	0.010	0.036**	0.010	0.025**	0.010
Wealth (lowest wealth quintile ref category)								
2nd			0.047**	0.011	0.031*	0.010	0.024*	0.010
3rd			0.100**	0.011	0.070**	0.011	0.055**	0.010
4th			0.132**	0.011	0.097**	0.011	0.077**	0.011
5th high wealth			0.137**	0.012	0.096**	0.012	0.072**	0.012
Work status (working ref category)								
Not working			-0.072**	0.010	-0.052*	0.010	-0.034**	0.010
Parental status (has children ref category)								
No children			-0.002	0.017	0.007	0.016	0.003	0.016
Smoking status (never smoked ref category)								
Former smoker					0.001	0.007	0.006	0.007
Current smoker					0.002	0.011	0.013	0.011
Physical activity (moderate activity ref category)								
Sedentary					-0.235**	0.014	-0.189**	0.014
Low					-0.082**	0.008	-0.062**	0.008
High					0.011	0.009	0.000	0.009
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					-0.001	0.008	0.002	0.008
Obese BMI (30+)					-0.053**	0.008	-0.038**	0.008
Self-rated health (excellent / v. good ref category)								
Good							-0.045**	0.008
Fair / poor							-0.101**	0.009
Chronic health conditions (0 reported conditions (ref category)								
Reported 1 condition							-0.004	0.014
Reported 2 conditions							-0.016	0.014
Reported 3+ conditions							-0.048*	0.014
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.034**	0.008
Constant	*0.829*	*0.008*	*0.781*	*0.014*	*0.842*	*0.016*	*0.893*	*0.019*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table 6.20: Marital status and country interactions for walking speed, women

	Model 1		Model 2		Model 3		Model 4	
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Marital status*survey								
Ref category: First marriage*HRS								
Remarriage*HRS	0.026	0.025	0.025	0.023	0.010	0.022	0.008	0.021
Divorced / separated*HRS	-0.010	0.023	0.011	0.022	0.019	0.021	0.019	0.020
Widowed*HRS	0.012	0.015	0.027	0.014	0.020	0.014	0.017	0.013
Never married*HRS	0.000	0.037	0.041	0.035	0.021	0.033	0.018	0.032
Constant	*0.911*	*0.010*	*0.844*	*0.015*	*0.925*	*0.015*	*0.980*	*0.016*

** p<0.05 ** p<0.001*
Model 1: Age
Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)
Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)
Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

6.4.3 Key findings

In the age adjusted models all unmarried men and women had a slower walking speed than men and women in their first marriage. Remarried men and women had comparable walking speeds to men and women in their first marriage. Much of the slower walking speed among unmarried men and women was explained by their lower levels of wealth. However, among widowed men in both ELSA and the HRS the association was not attenuated by wealth and remained after all adjustments had been made. There were no gender or country differences in the association.

6.5 Childhood circumstances and physical capability

There has been some evidence which has shown that childhood circumstances are associated with later life physical capability, additionally there is evidence showing that early life childhood circumstances are associated with entry into marriage, as discussed in detail the literature review, in Section 2.5. Given this evidence, further analysis was carried out to investigate whether the unexplained associations between marital status and physical capability, which were just shown, could be explained by childhood circumstances. A further regression model was run which additionally included the childhood measures (Model 5).

6.5.1 Measures of childhood circumstances

Four measures of childhood circumstances were used for this analysis: childhood health, father's education, mother's education and father's occupation. Father's unemployment was

included in the measure of father's occupation. More detail on each of these measures was provided in the methods chapter (in Section 4.2.3).

Analysis was run between childhood circumstances and grip strength and walking speed adjusting for age only, which are shown and discussed in Appendix H. Overall there was a crude association between the childhood measures and grip strength and walking speed for men and women in both ELSA and the HRS (shown in Table H.1 to Table H.4).

6.5.2 Analysis of childhood circumstances, marital status and physical capability

Table 6.21 through to Table 6.28 show the models for grip strength and walking speed which include the additional childhood measures in ELSA and the HRS. The first columns of the tables show the model which was adjusted for age, demographic and socio-economic measures, health behaviours and physical health and psychological morbidity (model 4 seen in the earlier analysis), the latter columns show the addition of the childhood circumstances into the model (model 5).

Grip strength

Whilst the analysis in Appendix H showed that there was an association between childhood circumstances and grip strength the introduction of the childhood measures did not contribute to explaining the association between marital status and grip strength among men in either ELSA or the HRS and the marital status coefficients changed very little when the childhood measures were added to the model (shown in Table 6.21 and Table 6.22). When the adjustments were made for the childhood measures remarried men still had a 0.75 kg/m stronger grip strength than men in their first marriage in ELSA and in the HRS 0.30 kg/m stronger than men in their first marriage. Never married men in the HRS also still had a weaker grip strength of 0.97 kgs/m than men in their first marriage.

Table 6.21: Regression analysis for grip strength with childhood circumstances, ELSA men

	Model 4		Model 5	
	Coef.	**SE**	**Coef.**	**SE**
Marital status (first marriage ref category)				
Remarried	0.72**	0.23	0.75**	0.23
Divorced / separated	0.52	0.28	0.54	0.28
Widowed	-0.40	0.31	-0.41	0.31
Never married	-0.13	0.38	-0.14	0.38
Age (50-59 ref category)				
60-69	-1.59**	0.21	-1.58**	0.21
70-79	-3.65**	0.27	-3.65**	0.27
80+	-6.46**	0.37	-6.46**	0.37
Ethnicity (white ref category)				
Non-white	-1.51**	0.47	-1.48	0.47
Education (low ref category)				
Medium	-0.02	0.18	0.01	0.19
High	-0.32	0.24	-0.23	0.25
Wealth (lowest wealth quintile ref category)				
2nd	0.35	0.28	0.33	0.28
3rd	0.90**	0.28	0.88**	0.28
4th	1.20**	0.29	1.18**	0.29
5th high wealth	1.20**	0.30	1.21**	0.30
Work status (working ref category)				
Not working	-1.09**	0.20	-1.09**	0.20
Parental status (has children ref category)				
No children	-0.75**	0.25	-0.71*	0.25
Smoking status (never smoked ref category)				
Former smoker	0.27	0.18	0.29	0.18
Current smoker	0.15	0.27	0.14	0.27
Physical activity (moderate activity ref category)				
Sedentary	-1.64**	0.39	-1.63**	0.39
Low	-0.62*	0.23	-0.63*	0.23
High	0.65**	0.19	0.66**	0.19
Body Mass Index (BMI<25 ref category)				
Overweight BMI (25 -29)	1.25**	0.20	1.25**	0.20
Obese BMI (30+)	1.86**	0.23	1.85**	0.23
Self-rated health (excellent / v. good ref category)				
Good	-0.30	0.19	-0.29	0.19
Fair / poor	-1.22**	0.24	-1.20**	0.24
Chronic health conditions (0 reported conditions ref category)				
Reported 1 condition	-0.08	0.20	-0.08	0.20
Reported 2 conditions	-0.53*	0.23	-0.53*	0.23
Reported 3+ conditions	-0.73*	0.28	-0.73*	0.28
CES-D (<3 reference category)				
CES-D≥3	-0.22	0.24	-0.22	0.24
Self-rated childhood health (excellent / good health ref category)				
Poor childhood health			-0.21	0.31
Father's education (<10 years ref category)				
10+ years education			-0.53	0.28
Mother's education (<10 years ref category)				
10+ years education			0.19	0.27
Father's occupation (Higher occupations ref category)				
Intermediate occupations			-0.12	0.21
Routine manual occupations			0.03	0.31
Unemployed/sick/retired/didn't live with father			-0.12	0.24
Other			-0.07	0.48
Constant	*24.32*	*0.38*	*24.44*	*0.43*

** p<0.05 **p<0.001*

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity

Model 5: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity + childhood circumstances (childhood health, parental education, Father's occupation)

Table 6.22: Regression analysis for grip strength with childhood circumstances, HRS men

	Model 4		Model 5	
	Coef.	**SE**	**Coef.**	**SE**
Marital status (first marriage ref category)				
Remarried	0.31*	0.14	0.30*	0.14
Divorced / separated	-0.05	0.20	-0.07	0.20
Widowed	-0.41	0.22	-0.42	0.22
Never married	-0.97*	0.40	-0.97*	0.40
Age (50-59 ref category)				
60-69	-2.07**	0.18	-2.10**	0.18
70-79	-4.00**	0.20	-4.03**	0.21
80+	-6.82**	0.25	-6.70**	0.26
Ethnicity (white ref category)				
Hispanic	-1.22**	0.22	-1.16**	0.23
Black	-0.01	0.19	-0.01	0.20
Other	-1.04*	0.50	-0.97	0.50
Education (low ref category)				
Medium	0.22	0.16	0.19	0.16
High	-0.40*	0.15	-0.40*	0.16
Wealth (lowest wealth quintile ref category)				
2nd	0.45*	0.21	0.47*	0.21
3rd	0.91**	0.21	0.91**	0.21
4th	1.10**	0.21	1.10**	0.21
5th high wealth	1.26**	0.22	1.26**	0.22
Work status (working ref category)				
Not working	-0.72**	0.15	-0.71**	0.15
Parental status (has children ref category)				
No children	-1.03**	0.29	-1.06**	0.29
Smoking status (never smoked ref category)				
Former smoker	0.09	0.13	0.09	0.13
Current smoker	0.21	0.19	0.21	0.19
Physical activity (moderate activity ref category)				
Sedentary	-2.81**	0.27	-2.80**	0.27
Low	-0.79**	0.16	-0.79**	0.16
High	0.16	0.14	0.15	0.14
Body Mass Index (BMI<25 ref category)				
Overweight BMI (25 -29)	1.18**	0.15	1.17**	0.15
Obese BMI (30+)	1.99**	0.16	1.99**	0.16
Self-rated health (excellent / v. good ref category)				
Good	-0.27	0.14	-0.28	0.14
Fair / poor	-0.90**	0.17	-0.91**	0.17
Chronic health conditions (0 reported conditions ref category)				
Reported 1 condition	-0.38	0.20	-0.36	0.20
Reported 2 conditions	-1.06**	0.20	-1.04**	0.20
Reported 3+ conditions	-1.58**	0.21	-1.56**	0.21
CES-D (CES-D<3 ref category)				
CES-D≥3	-0.46*	0.17	-0.44*	0.17
Self-rated childhood health (excellent / good reference category)				
poor childhood health			0.09	0.26
Father's education (<12 years reference category)				
Father -≥12 years education			-0.06	0.17
Mother's education (<12 years reference category)				
Mother -≥12 years education			0.32*	0.16
Father's occupation (higher occupations ref category)				
Intermediate occupations			0.36	0.22
Routine manual occupations			0.33	0.22
Other			0.88	0.64
Unemployed/sick/retired/didn't live with father			0.39	0.30
Constant	*26.09*	*0.31*	*25.60*	*0.38*

** p<0.05 **p<0.001*

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity

Model 5: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity + childhood circumstances (childhood health, parental education, Father's occupation)

Table 6.23: Regression analysis for grip strength with childhood circumstances, ELSA women

	Model 4		Model 5	
	Coef.	**SE**	**Coef.**	**SE**
Marital status (first marriage ref category)				
Remarried	0.36*	0.17	0.35*	0.17
Divorced / separated	0.04	0.17	0.03	0.17
Widowed	0.01	0.15	0.01	0.15
Never married	-0.27	0.27	-0.27	0.27
Age (50-59 ref category)				
60-69	-0.78**	0.14	-0.77**	0.15
70-79	-2.06**	0.18	-2.04**	0.18
80+	-3.97**	0.24	-3.95**	0.24
Ethnicity (white ref category)				
Non-white	-0.10	0.34	-0.14	0.34
Education (low ref category)				
Medium	0.15	0.12	0.12	0.12
High	0.46*	0.17	0.37	0.18
Wealth (lowest wealth quintile ref category)				
2nd	-0.05	0.17	-0.05	0.17
3rd	0.20	0.18	0.19	0.18
4th	0.38*	0.18	0.37	0.19
5th high wealth	0.58**	0.19	0.54*	0.20
Work status (working ref category)				
Not working	-0.43**	0.14	-0.43**	0.14
Parental status (has children ref category)				
No children	0.13	0.16	0.13	0.16
Smoking status (never smoked ref category)				
Former smoker	0.18	0.11	0.18	0.11
Current smoker	0.82**	0.17	0.82**	0.17
Physical activity (moderate activity ref category)				
Sedentary	-1.49**	0.25	-1.49**	0.25
Low	-0.63**	0.13	-0.63**	0.13
High	0.58**	0.15	0.57**	0.15
Body Mass Index (BMI<25 ref category)				
Overweight BMI (25 -29)	0.46**	0.13	0.46**	0.13
Obese BMI (30+)	0.95**	0.14	0.94**	0.14
Self-rated health (excellent / v. good ref category)				
Good	-0.53**	0.13	-0.52**	0.13
Fair / poor	-1.08**	0.16	-1.07**	0.16
Chronic health conditions (0 reported conditions ref category)				
Reported 1 condition	-0.11	0.14	-0.11	0.14
Reported 2 conditions	-0.45**	0.16	-0.45**	0.16
Reported 3+ conditions	-0.74**	0.19	-0.73**	0.19
CES-D (<3 reference category)				
CES-D≥3	-0.54**	0.13	-0.54**	0.13
Self-rated childhood health (excellent / good health ref category)				
Poor childhood health			-0.12	0.19
Father's education (<10 years ref category)				
10+ years education			0.00	0.18
Mother's education (<10 years ref category)				
10+ years education			0.17	0.18
Father's occupation (Higher occupations ref category)				
Intermediate occupations			-0.10	0.14
Routine manual occupations			-0.13	0.20
Unemployed/sick/retired/didn't live with father			-0.02	0.16
Other			-0.22	0.29
Constant	*16.14*	*0.24*	*16.21*	*0.27*

** p<0.05 **p<0.001*

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity

Model 5: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity + childhood circumstances (childhood health, parental education, Father's occupation)

Table 6.24: Regression analysis for grip strength with childhood circumstances, HRS women

	Model 4		Model 5	
	Coef.	**SE**	**Coef.**	**SE**
Marital status (first marriage ref category)				
Remarried	-0.01	0.11	0.00	0.11
Divorced / separated	0.04	0.13	0.06	0.13
Widowed	-0.20	0.10	-0.21	0.10
Never married	0.24	0.25	0.25	0.25
Age (50-59 ref category)				
60-69	-1.22**	0.11	-1.24**	0.12
70-79	-2.41**	0.13	-2.44**	0.13
80+	-4.27**	0.16	-4.34**	0.17
Ethnicity (white ref category)				
Hispanic	-0.28	0.14	-0.32*	0.15
Black	1.27**	0.12	1.25**	0.12
Other	0.48	0.32	0.46	0.32
Education (low ref category)				
Medium	-0.01	0.10	0.02	0.10
High	-0.02	0.11	0.02	0.12
Wealth (lowest wealth quintile ref category)				
2nd	0.54**	0.12	0.53**	0.12
3rd	0.56**	0.13	0.56**	0.13
4th	0.70**	0.13	0.70**	0.13
5th high wealth	0.65**	0.14	0.65**	0.14
Work status (has children ref category)				
Not working	-0.45**	0.10	-0.45**	0.10
Parental status (has children ref category)				
No children	-0.29	0.18	-0.27	0.18
Smoking status (never smoked ref category)				
Former smoker	0.13	0.08	0.14	0.08
Current smoker	0.60**	0.12	0.62**	0.12
Physical activity (moderate activity ref category)				
Sedentary	-1.90**	0.19	-1.90**	0.19
Low	-0.45**	0.09	-0.45**	0.09
High	0.10	0.10	0.10	0.10
Body Mass Index (BMI<25 ref category)				
Overweight BMI (25 -29)	0.60**	0.10	0.61**	0.10
Obese BMI (30+)	1.18**	0.10	1.18**	0.10
Self-rated health (excellent / v. good ref category)				
Good	-0.28**	0.09	-0.28**	0.09
Fair / poor	-0.98**	0.11	-1.00**	0.12
Chronic health conditions (0 reported conditions ref category)				
Reported 1 condition	-0.46**	0.14	-0.47**	0.14
Reported 2 conditions	-0.59**	0.14	-0.59**	0.14
Reported 3+ conditions	-1.16**	0.15	-1.16**	0.15
CES-D (CES-D<3 ref category)				
CES-D≥3	-0.37**	0.10	-0.36**	0.10
Self-rated childhood health (excellent / good reference category)				
Poor childhood health			-0.05	0.15
Father's education (<12 years reference category)				
Father -≥12 years education			-0.15	0.11
Mother's education (<12 years reference category)				
Mother -≥12 years education			0.05	0.11
Father's occupation (higher occupations ref category)				
Intermediate occupations			0.34*	0.14
Routine manual occupations			0.05	0.15
Other			0.24	0.45
Unemployed/sick/retired/didn't live with father			0.09	0.18
Constant	*17.24*	*0.20*	*17.14*	*0.25*

** p<0.05 **p<0.001*

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity

Model 5: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity + childhood circumstances (childhood health, parental education, Father's occupation)

Walking speed

Similarly to what was seen with grip strength, the addition of the childhood measures did not account for any of the differences in walking speed by marital status that were observed among men earlier in this chapter and the coefficients for walking speed did not change when adjusting for childhood circumstances. Widowed and never married men in ELSA (Table 6.25) and widowed men in the HRS (Table 6.26) still had a slower walking speed than men in their first marriage.

6.5.3 Key findings

Although, there was an association between childhood circumstances and physical capability among men and women in both ELSA and the HRS, childhood circumstances did not explain the differences in physical capability by marital status among men in either ELSA or the HRS.

Table 6.25: Regression coefficients for walking speed with childhood circumstances, ELSA men

	Model 4		Model 5	
	Coef.	**SE**	**Coef.**	**SE**
Marital status (first marriage ref category)				
Remarried	0.013	0.017	0.014	0.017
Divorced / separated	-0.014	0.024	-0.015	0.024
Widowed	-0.042*	0.018	-0.042*	0.018
Never married	-0.082*	0.033	-0.082*	0.033
Age (60-69 ref category)				
70-79	-0.066**	0.013	-0.065**	0.013
80+	-0.207**	0.019	-0.205**	0.019
Ethnicity (white ref category)				
Non-white	-0.181**	0.041	-0.185**	0.041
Education (low ref category)				
Medium	0.044*	0.014	0.043*	0.014
High	0.065*	0.019	0.066*	0.020
Wealth (lowest wealth quintile ref category)				
2nd	0.014	0.020	0.014	0.021
3rd	0.021	0.020	0.022	0.020
4th	0.057*	0.020	0.059*	0.021
5th high wealth	0.094**	0.021	0.094**	0.022
Work status (Working ref category)				
Not working	-0.002	0.019	-0.003	0.019
Parental status (has children ref category)				
No children	-0.003	0.021	-0.002	0.021
Smoking status (never smoked ref category)				
Former smoker	-0.003	0.013	-0.003	0.013
Current smoker	-0.023	0.023	-0.024	0.023
Physical activity (moderate activity ref category)				
Sedentary	-0.209**	0.025	-0.208**	0.025
Low	-0.092**	0.015	-0.092**	0.015
High	0.064**	0.015	0.065**	0.016
Body Mass Index (BMI<25 ref category)				
Overweight BMI (25 -29)	0.000	0.015	-0.001	0.015
Obese BMI (30+)	-0.029	0.017	-0.030	0.017
Self-rated health (excellent / v. good ref category)				
Good	-0.042*	0.014	-0.041*	0.014
Fair / poor	-0.121**	0.017	-0.121**	0.017
Chronic health conditions (0 reported conditions ref category)				
Reported 1 condition	0.004	0.016	0.004	0.016
Reported 2 conditions	0.000	0.017	0.000	0.017
Reported 3+ conditions	-0.045*	0.019	-0.045*	0.019
CES-D (<3 ref category)				
CES-D≥3	-0.033	0.018	-0.033	0.018
Self-rated childhood health (excellent / good health ref category)				
Poor childhood health			-0.005	0.022
Father's education (<12 years ref category)				
12+ years education			-0.012	0.023
Mother's education (<12 years ref category)				
12+ years education			0.026	0.023
Father's occupation (Higher occupations ref category)				
Intermediate occupations			0.005	0.017
Routine manual occupations			0.006	0.024
Unemployed/sick/retired/didn't live with father			0.019	0.018
Other			0.013	0.035
Constant	*0.972*	*0.032*	*0.963*	*0.036*

** p<0.05 **p<0.001*

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity

Model 5: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity + childhood circumstances (childhood health, parental education, Father's occupation)

Table 6.26: Regression coefficients for walking speed with childhood circumstances, HRS men

	Model 4		Model 5	
	Coef.	**SE**	**Coef.**	**SE**
Marital status (first marriage ref category)				
Remarried	0.016	0.010	0.015	0.010
Divorced / separated	-0.002	0.015	-0.004	0.015
Widowed	-0.037*	0.013	-0.037*	0.013
Never married	-0.021	0.031	-0.021	0.032
Age (60-69 ref category)				
70-79	-0.055**	0.009	-0.054**	0.009
80+	-0.152**	0.012	-0.148**	0.012
Ethnicity (white ref category)				
Hispanic	-0.065**	0.015	-0.065**	0.016
Black	-0.116**	0.013	-0.115**	0.013
Other	-0.044	0.036	-0.046	0.036
Education (low ref category)				
Medium	0.043**	0.011	0.040**	0.011
High	0.036**	0.010	0.032*	0.010
Wealth (lowest wealth quintile ref category)				
2nd	0.014	0.015	0.014	0.015
3rd	0.028	0.014	0.028	0.014
4th	0.059**	0.014	0.059**	0.014
5th high wealth	0.064**	0.015	0.063**	0.015
Work status (Working ref category)				
Not working	-0.031*	0.010	-0.030*	0.010
Parental status (has children ref category)				
No children	-0.039	0.021	-0.038	0.021
Smoking status (never smoked ref category)				
Former smoker	-0.001	0.009	-0.001	0.009
Current smoker	-0.019	0.014	-0.019	0.014
Physical activity (moderate activity ref category)				
Sedentary	-0.178**	0.016	-0.179**	0.016
Low	-0.051**	0.010	-0.052**	0.010
High	0.029*	0.010	0.028*	0.010
Body Mass Index (BMI<25 ref category)				
Overweight BMI (25 -29)	0.010	0.009	0.011	0.009
Obese BMI (30+)	-0.004	0.011	-0.004	0.011
Self-rated health (excellent / v. good ref category)				
Good	-0.025*	0.009	-0.025*	0.009
Fair / poor	-0.079**	0.011	-0.080**	0.011
Chronic health conditions (0 reported conditions ref category)				
Reported 1 condition	-0.014	0.016	-0.014	0.016
Reported 2 conditions	-0.023	0.015	-0.022	0.015
Reported 3+ conditions	-0.054**	0.015	-0.054**	0.015
CES-D (CES-D<3 ref category)				
CES-D≥3	-0.027*	0.012	-0.027*	0.012
Self-rated childhood health (excellent / good ref category)				
Poor childhood health			0.029	0.016
Father's education (<12 years ref category)				
Father -≥12 years education			0.014	0.012
Mother's education (<12 years ref category)				
Mother -≥12 years education			0.002	0.011
Father's occupation (higher occupations ref category)				
Intermediate occupations			-0.001	0.013
Routine manual occupations			-0.003	0.013
Other			0.013	0.044
Unemployed/sick/retired/didn't live with father			0.004	0.018
Constant	*0.918*	*0.023*	*0.912*	*0.026*

** p<0.05 **p<0.001*

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity

Model 5: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity + childhood circumstances (childhood health, parental education, Father's occupation)

Table 6.27: Regression coefficients for walking speed with childhood circumstances, ELSA women

	Model 4		Model 5	
	Coef.	**SE**	**Coef.**	**SE**
Marital status (first marriage ref category)				
Remarried	0.020	0.019	0.020	0.019
Divorced / separated	0.001	0.017	-0.001	0.017
Widowed	-0.001	0.012	0.000	0.012
Never married	-0.032	0.029	-0.037	0.029
Age (60-69 ref category)				
70-79	-0.069**	0.011	-0.065**	0.011
80+	-0.195**	0.016	-0.189**	0.016
Ethnicity (white ref category)				
Non-white	-0.150**	0.038	-0.150	0.038
Education (low ref category)				
Medium	0.031*	0.011	0.024*	0.011
High	0.059*	0.018	0.046*	0.019
Wealth (lowest wealth quintile ref category)				
2nd	0.008	0.016	0.007	0.016
3rd	0.045*	0.016	0.043*	0.016
4th	0.068**	0.017	0.064**	0.017
5th high wealth	0.100**	0.018	0.092**	0.019
Work status (has children ref category)				
No	-0.048*	0.020	-0.047*	0.020
Parental status (has children ref category)				
No children	0.010	0.016	0.008	0.016
Smoking status (never smoked ref category)				
Former smoker	0.003	0.010	0.002	0.010
Current smoker	0.015	0.018	0.016	0.018
Physical activity (moderate activity ref category)				
Sedentary	-0.188**	0.020	-0.188**	0.020
Low	-0.104**	0.012	-0.103**	0.012
High	0.009	0.016	0.012	0.015
Body Mass Index (BMI<25 ref category)				
Overweight BMI (25 -29)	-0.023	0.012	-0.021	0.012
Obese BMI (30+)	-0.057**	0.013	-0.058**	0.013
Self-rated health (excellent / v. good ref category)				
Good	-0.058**	0.012	-0.056**	0.012
Fair / poor	-0.169**	0.014	-0.168**	0.014
Chronic health conditions (0 reported conditions ref category)				
Reported 1 condition	-0.007	0.015	-0.008	0.015
Reported 2 conditions	-0.024	0.015	-0.022	0.015
Reported 3+ conditions	-0.067**	0.017	-0.068**	0.017
CES-D (<3 ref category)				
CES-D≥3	-0.039*	0.012	-0.040*	0.012
Self-rated childhood health (excellent / good health ref category)				
Poor childhood health			0.006	0.016
Father's education (<12 years ref category)				
12+ years education			0.017	0.020
Mother's education (<12 years ref category)				
12+ years education			0.048*	0.020
Father's occupation (Higher occupations ref category)				
Intermediate occupations			0.032*	0.013
Routine manual occupations			0.024	0.020
Unemployed/sick/retired/didn't live with father			0.010	0.015
Other			0.009	0.027
Constant	*1.020*	*0.028*	*0.994*	*0.030*

** p<0.05 **p<0.001*

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity

Model 5: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity + childhood circumstances (childhood health, parental education, Father's occupation)

Table 6.28: Regression coefficients for walking speed with childhood circumstances, HRS women

	Model 4		Model 5	
	Coef.	**SE**	**Coef.**	**SE**
Marital status (first marriage ref category)				
Remarried	0.015	0.010	0.015	0.010
Divorced / separated	0.001	0.011	0.000	0.011
Widowed	-0.008	0.008	-0.008	0.008
Never married	-0.028	0.024	-0.027	0.024
Age (60-69 ref category)				
70-79	-0.077**	0.008	-0.075**	0.008
80+	-0.204**	0.010	-0.199**	0.010
Ethnicity (white ref category)				
Hispanic	-0.049**	0.012	-0.046**	0.012
Black	-0.084**	0.010	-0.081**	0.010
Other	0.024	0.030	0.029	0.030
Education (low ref category)				
Medium	0.035**	0.008	0.032**	0.008
High	0.025*	0.010	0.020*	0.010
Wealth (lowest wealth quintile ref category)				
2nd	0.024*	0.010	0.024*	0.010
3rd	0.055**	0.010	0.055**	0.010
4th	0.077**	0.011	0.077**	0.011
5th high wealth	0.072**	0.012	0.070**	0.012
Work status (has children ref category)				
No	-0.034**	0.010	-0.034**	0.010
Parental status (has children ref category)				
No children	0.003	0.016	0.003	0.016
Smoking status (never smoked ref category)				
Former smoker	0.006	0.007	0.006	0.007
Current smoker	0.013	0.011	0.012	0.011
Physical activity (moderate activity ref category)				
Sedentary	-0.189**	0.014	-0.189**	0.014
Low	-0.062**	0.007	-0.062**	0.007
High	0.000	0.009	0.001	0.009
Body Mass Index (BMI<25 ref category)				
Overweight BMI (25 -29)	0.002	0.008	0.002	0.008
Obese BMI (30+)	-0.038**	0.008	-0.037**	0.008
Self-rated health (excellent / v. good ref category)				
Good	-0.045**	0.008	-0.045	0.008
Fair / poor	-0.101**	0.009	-0.099	0.009
Chronic health conditions (0 reported conditions ref category)				
Reported 1 condition	-0.004	0.014	-0.004	0.014
Reported 2 conditions	-0.016	0.014	-0.017	0.014
Reported 3+ conditions	-0.048*	0.014	-0.049*	0.014
CES-D (CES-D<3 ref category)				
CES-D≥3	-0.034**	0.008	-0.033**	0.008
Self-rated childhood health (excellent / good ref category)				
Poor childhood health			-0.014	0.013
Father's education (<12 years ref category)				
Father -≥12 years education			-0.007	0.010
Mother's education (<12 years ref category)				
Mother -≥12 years education			0.022*	0.009
Father's occupation (higher occupations ref category)				
Intermediate occupations			-0.005	0.011
Routine manual occupations			0.000	0.011
Other			-0.045	0.041
Unemployed/sick/retired/didn't live with father			-0.005	0.014
Constant	*0.893*	*0.019*	*0.891*	*0.022*

** p<0.05 **p<0.001*

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity

Model 5: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity + childhood circumstances (childhood health, parental education, Father's occupation)

6.6 Summary

The analysis presented in this chapter has shown that men and women who were married (either in a first or a subsequent marriage) had higher levels of physical capability than those who were unmarried. The findings reinforce those from two existing studies which also investigated the cross-sectional relationship between marital status and the physical performance measures (Guralnik et al., 2009) (Clouston et al., 2014). The analysis also showed that remarried men (and not remarried women) had stronger grip strength than men in a first marriage in both England and the USA, this was contrary to was expected given the existing evidence which suggests that prior transitions out of marriage, regardless of current marital status, were associated with poorer physical capability (Hughes and Waite, 2009).

Much of the association between marital status and physical capability was explained by the greater wealth among those who were married. Evidence has shown that those who were married and who had remained married for much of their lives had higher levels of wealth than those who were unmarried (Vespa and Painter, 2011), or those who have previously transitioned out of marriage (Wilmoth and Koso, 2002). There were some unexplained associations including never married and widowed men's slower walking speed and remarried men's stronger grip strength in both England and the USA.

There were also some differences in the association by gender, but only in the measure of grip strength, and as hypothesised the difference in grip strength between never married men and men in their first marriage was greater than between never married women and women in their first marriage. Widowed men also had a relatively weaker grip strength than men in their first marriage and this association was not apparent among women, whilst remarried men had a relatively stronger grip strength than remarried women.

Overall, similar associations were observed in both England and the USA.

There was found to be few associations between childhood circumstances and physical capability at older ages in either England or the USA, which is in contrast to previous research, primarily carried out on the British birth cohorts using prospective data, which showed that childhood circumstances were associated with physical capability at older ages (Birnie et al., 2011). Childhood circumstances also did not explain any of the marital status variations in physical capability.

It is unclear why there was little association between the childhood measures and physical capability at older ages in either England or the USA, and also why they did not explain any variations by marital status in physical capability. The lack of association could possibly be

explained by the quality of the data, because the information on childhood circumstances in ELSA and the HRS was collected retrospectively (the limitations of which were discussed in Section 5.7.1). However, another study (Haas, 2008), which used the retrospective childhood measures in the HRS found an association between parental education and childhood health and trajectories in physical capability using self-reported mobility measures. It's possible that the study by Haas found an association as their analysis was longitudinal, covering changes in physical capability over a period of eight years. There could be a different association between childhood circumstances and trajectories in physical capability to childhood circumstances and cross-sectional physical capability. Or the differences could be because Haas was not constrained by a limited number of childhood measures which were comparable in ELSA and instead was able to use more measures to reflect childhood circumstances, such as measures on childhood material conditions.

6.6.1 Limitations

There was one limitation to this analysis which concerns the missing data, as the analysis was carried out only on cases which had complete data. Cases which contain missing data are often systematically different to those with complete data (known as missing not at random). Therefore, removing cases with missing data could lead to a biased analytic sample. Analysis comparing the analytic sample and the complete eligible sample showed that those cases which were dropped did overall have poorer physical capability than those cases in the analytic sample. Despite this, there was a similar association between marital status and physical capability in the analytic sample and the complete sample. This could suggest that the complete case analysis was not biased and similar estimates may have been obtained if the missing data had been imputed using multiple imputation. Although it can never be conclusively proved that the cases which contained missing data are no different to those which had complete data.

Overall, this chapter has shown that there is an association between marriage and current levels of physical capability, with similar associations in England and the USA. The next chapter will build upon this analysis by investigating marriage and longitudinal changes in physical capability over a ten year period. Unfortunately, this analysis could only be carried out in ELSA, as the HRS did not have enough waves of walking speed data to carry out comparable analysis.

Chapter 7: Marital status and subsequent changes in walking speed in England

The previous chapter showed that those who were married had better physical capability than those who were unmarried. The analysis was cross-sectional and only showed differences in physical capability at one particular point in time, not longer term changes in physical capability over a period of years. The literature review showed that there had been very little research which had investigated changes in physical capability specifically by marital status, instead many of the small number of longitudinal studies have looked at partnership status or living arrangements (which included marital status). This evidence shows that overall those who were partnered (including both married and unmarried partnerships) experienced slower declines in physical capability than those who were unpartnered (Goldman et al., 1995) (Zaninotto et al., 2010). There was some evidence of differences by gender in the association and unpartnered men had relatively greater declines in physical capability than unpartnered women who actually had comparable or slower declines in physical capability to their married counterparts (Michael et al., 2001) (Sarwari et al., 1998). This chapter extends this evidence by investigating whether there is any association between marital status measured at baseline and subsequent changes in walking speed over a ten year period among those aged 60 years and older in ELSA. Men and women were analysed separately, but tests of interaction were carried out to check for any modification in the association by gender, to fully investigate whether there were any differences in marital status and changes in subsequent physical capability between men and women, which had been shown in prior research.

This section includes firstly details of the analytic sample and method followed by a descriptive analysis of the sample and the longitudinal analysis of marital status and walking speed for men and then women.

7.1 Analytic sample and method

This chapter used data from Waves 1 to 6 of ELSA only. The HRS could not be used in this analysis as there were not enough waves of data for longitudinal analysis, as at each wave of the HRS walking speed is only collected for half the sample which means that two waves are needed to create a complete sample. As walking speed has only been collected on five waves of the HRS this only amounts to two time points per person.

7.1.1 Analytic sample

The analytic sample comprised sample members aged 60 years and over [13] who had not changed marital status between ELSA Wave 1 and Wave 6 and had at least two waves of walking speed data. Only those sample members who had not changed marital status were used so that any discrepancy in walking speed trajectories between marital status groups would not be due to any recent marital transitions, since transitions out of marriage have been shown to be associated with short term declines in physical capability (Bennett, 2006). Sample members who had a least two waves of walking speed data were included so their data was contributing to the slope as well as the intercept. This included Cohort 1 and Cohort 4 sample members, but not Cohort 3 or Cohort 6 sample members (the Wave 6 refreshment sample), as they only had one wave of walking speed data[14] (see Section 4.1.1 for information on the ELSA sample). As cohort 4 were introduced to ELSA at Wave 4 they only have walking speed data at Waves 4 to 6.

Figure 7.1 shows the number of cases which were removed from the analysis and the total number of cases included in the final analytic sample. Waves 1 to 6 consisted of a total of 12,343 eligible sample members from which 3,257 sample members were excluded as they did not have two or more waves of walking speed data. Out of the sample members who had at least two valid walking speed measures 950 had changed marital status between baseline interview and Wave 6, a further 984 men and 1,223 women were not included in the analysis as they were missing data on one or more of the covariates measured at their baseline wave. This left a total of 5,929 cases in the analytic sample: 2,747 men and 3,182 women. There were 503 individuals who had died between baseline interview and Wave 6 and had two waves of walking speed data, who were included in the analysis.

[13] The age eligibility for the walking speed measure in ELSA is 60 years and older.

[14] As the age eligibility for the walking speed measure is 60 years and older Cohort 3 became age eligible for the measure at Wave 6, so therefore they do not have two waves of walking speed data.

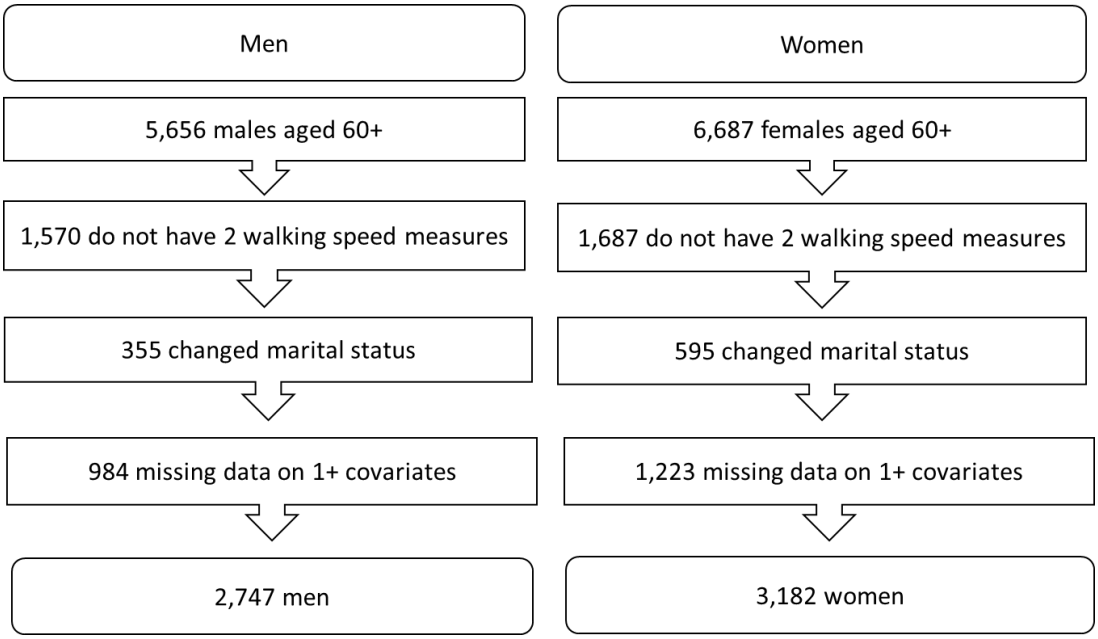


Figure 7.1: Analytic sample for the longitudinal analysis on marital status and changes in walking speed

A comparison of the mean walking speed at each wave between the analytic sample and the complete sample is shown in Appendix I. Overall, men and women in the analytic sample had a faster mean walking speed at Waves 1 to 6 than the complete sample (p<0.001), but there were few differences between the analytic sample and the complete sample by marital status for men and women.

7.1.2 Analytic method

For this analysis growth curve models, a form of multilevel modelling, were used to estimate the trajectories in walking speed. Growth curve models enable within person change to be modelled on repeated measures of walking speed as well as between person change in walking speed, to create person-specific trajectories over time.

An advantage of growth curve models is that cases do not need to have complete outcome data at every time point to be included in the analysis. With data in long form, each occasion for which outcome data is present contributes to the estimates. The equation for the growth curve model is given below in Equation 1 along with definitions of the notation used.

Equation 1: Growth curve model equation with random intercept and slope

$$y_{ij} = \beta_0 + \beta_1 t_{ij} + u_{0j} + u_{1j} t_{ij} + e_{ij}$$

i = occasion number

j = the individual

t = time point or measurement occasion

β_0 = the overall intercept averaged across individuals

β_1 = the slope of the regression of y on time t

u = individual specific random effect which represents the difference between an individual's value and the overall parameter estimate. u_{0j} represents the intercept residual and u_{1j} represents the slope residual.

e = an occasion specific residual, how much the occasion specific observation differs from the individual mean

A random intercept and slope growth curve model was fitted as it allowed for individual's initial walking speed (the intercept) to vary and for individual variation in the rate of change in walking speed (the slope). Tests were run to check whether a fixed or a random slope was a better fit to the data using likelihood ratio tests. Allowing the slope to be random proved to be a better fit to the data (p<0.001).

Time was included in the models as follow up time of interview at 2 year intervals which ranged from 0 at baseline (Wave 1) to 10 at Wave 6. Time was included as both a linear term and as a quadratic term (time^2), as this model was a better fit to the data due to the non-linear change in walking speed over time, indicating that walking speed declined faster at older ages.

To capture the trajectories of walking speed over time for the different marital statuses an interaction term between marital status and time was included. Tests were run to check whether the marital status and time interaction should be with linear time or also with quadratic time. Tests showed that quadratic time interacting with marital status did not significantly improve model fit.

The analysis included the same covariates used in the earlier analysis presented in this thesis, which were outlined in Section 4.2.3; age, demographic and socio-economic characteristics, health behaviours and physical health and psychological morbidity. Covariates were measured at baseline interview for this analysis. A sensitivity analysis was run in which the covariates were allowed to be time varying in order to adjust for any fluctuations in socio-economic circumstances, health behaviours or psychological morbidity and physical health, in the subset of participants with complete covariate data at all waves (this is shown in Appendix K). The results of the sensitivity analysis are discussed in Section 7.3.3. Age was included in the models, as both a continuous measure and a categorical measure in ten year age bands, because when both measures of age were included a likelihood ratio test showed the model was a better fit to the data than when only one measure of age was included (p<0.05). Four separate models were run sequentially which are detailed below in Table 7.1.

Cohort 1 and Cohort 4 were combined in the analysis. As mentioned above all covariates were measured at baseline interview, so for Cohort 1 this was at Wave 1 and for Cohort 4 this was at Wave 4. Time was measured for both cohorts from 0 (Wave 1) to 10 (Wave 6), even though Cohort 4 did not have any walking speed outcomes at Waves 1 to 3.

Table 7.1: Details of the models specified for the analysis on marital status and changes in walking speed

Model 1: Age

Age: Measured at Wave 1 was included twice once as a continuous measure, which has been centred at age 50, and also as a categorical variable (in ten year age bands). Both measures were included as the association between walking speed and age is non-linear and by just including ten year age bands there remained some differences in walking speed which could be controlled for by adjusting for age as a continuous measure.

Time: Measured as time of interview at 2 year intervals which ranged from 0 at baseline to 10 at Wave 6. Time as a quadratic term was also included.

Interaction term: Marital status * time

Model 2: Age + demographic and socio-economic measures

Age model (model 1) + ethnicity, education, wealth, work and parental status.

Model 3: Age + demographics and socio-economic + health behaviour measures

Age model (model 1) + demographic and socio-economic model (model 2) + smoking status, physical activity level and BMI.

Model 4: Age + demographic and socio-economic + health behaviours + physical health and psychological morbidity

Age model (model 1) + demographic and socio-economic model (model 2) + health behaviours (model 3) + self-rated health, health conditions and psychological morbidity.

All analysis was carried out using STATA 14. Tests were run for gender by marital status interactions to determine if there was any modification in the association by gender and analyses were stratified by gender.

Weights

For this analysis the longitudinal weights provided by the data depositors were not used as they only accounted for Cohort 1 sample members and this analysis included Cohort 4 sample members as well. In addition, the current analysis was on a sub-sample of the main sample (those aged 60 years and older) so the weights would not be appropriate as they are designed to be used on the whole sample. Instead the analysis has been adjusted for factors which are known to be associated with attrition. The following variables have shown to be indicative of attrition between waves of

ELSA and were used to create the publicly available longitudinal survey weights (Bridges et al., 2015):

- Age (at wave 1) by sex
- Government Office Region
- White/non-white ethnicity
- Highest educational qualifications
- Housing tenure
- Self-assessed health
- Number of people living in the household
- National Statistics Socio-Economic Classification (NS-SEC)

Associations between these variables, which were measured at baseline interview, and the likelihood of attrition between waves in the walking speed sample were estimated. A variable was created which differentiated between those who had timed walk data for all possible waves of ELSA and those who were missing data for one or more waves. The analysis was carried out on all age eligible sample members who had not changed marital status (including those who had only one walking speed measure). The analysis showed that age, government office region, housing tenure, self-assessed health and number of people in the household significantly predicted whether the individual had complete walking speed data on all waves (as shown in Table 7.2). Those who were older, lived in the North-West of England or in London, were a tenant, had poorer self-rated health and lived with a larger number of people were less likely to have walking speed data on all waves. As self-assessed health and age were already to be included in the models as covariates, government office region, housing tenure and number in the household were additionally adjusted for in each model to reduce possible bias in the estimates due to attrition between study waves.

Table 7.2: Logistic regression model predicting complete walking speed data at Waves 1 to 6 in ELSA

	Coef.	SE
Age	0.024**	0.003
Government Office Region (ref category: North-East)		
North West	-0.401*	0.139
Yorkshire and The Humber	-0.041	0.138
East Midlands	-0.124	0.142
West Midlands	-0.131	0.141
East of England	-0.022	0.135
London	-0.377*	0.152
South East	-0.227	0.132
South West	-0.148	0.138
Ethnicity (ref category: White)		
Non-white	0.196	0.221
Education (ref category: low)		
Medium	-0.086	0.069
High	-0.013	0.100
Tenure (ref. category: home owner)		
Rents	-0.547**	0.089
Self-rated health (ref category: Excellent / very good)		
Good	-0.208*	0.066
Fair / Poor	-0.644**	0.081
Number in the household	-0.268**	0.041
NS-SEC (ref category: managerial / professional occupations)		
Intermediate occupations	-0.018	0.080
Routine and manual occupations	-0.129	0.078
Gender (ref category: male)		
Female	0.046	0.060
Constant	*-1.719*	0.291

**p<0.05 **p<0.001*

All variables measured at baseline interview, either Wave 1 for Cohort 1 or Wave 4 for Cohort 4.

7.2 Sample characteristics

The remainder of this chapter describes the results of the analysis, firstly describing the characteristics of the analytic sample and then the longitudinal analysis.

Table 7.3 shows the characteristics of the analytic sample for this analysis and all the covariates in the table are measured at baseline (either Wave 1 or Wave 4 depending on when the sample member entered the study).

Three fifths of men (63.7%) and just under half of women (48.2%) were in their first marriage, a higher percentage of women were divorced or widowed than men, whilst similar percentage of men and women were never married (5.6% of men and 4.6% of women).

Half of the sample had low education. The sample was more skewed towards those with higher wealth than those with lower levels of wealth and the majority of the sample were not working and were parents (p<0.05). There were some gender differences. Men were more highly educated, had higher levels of wealth and were more likely to be in paid work than women (p<0.05).

A larger percentage of women than men had never smoked (45.7% compared to 28.4% of men), and a larger percentage of men were former smokers than women (56.8% compared to 39.7% of women). There were similar proportions of men and women who were current smokers. Women were less physically active than men (p<0.001) and the majority of both men and women were either overweight or obese with a greater percentage of men in these categories than women (67.4% of men compared to 59.9% of women).

Around 75.0% of men and women rated their health positively (either good, very good or excellent). The majority of men and women had reported having at least one doctor diagnosed health condition and a greater percentage of women reported having one or more health conditions than men (66.0% of women compared to 60.5% of men). The majority of men and women reported fewer than 3 depressive symptoms (CES-D <3) and women were more likely than men to report 3 or more depressive symptoms (p<0.001).

Table 7.3: Sample characteristics for the longitudinal analysis of marital status and walking speed, ELSA

	Men	Women
	%	%
Marital status		
First marriage	63.7	48.2**
Remarried	14.1	9.7**
Divorced	8.3	12.0**
Widowed	8.3	25.5**
Never married	5.6	4.6
Mean age (years)	63.9	64.5*
Ethnicity		
White	98.1	98.5
Non-white	1.9	1.5
Education		
Low	52.2	50.3
Medium	32.1	37.6**
High	15.7	12.1**
Wealth		
1 Low wealth	12.9	16.5**
2	16.8	17.3
3	20.8	21.0
4	24.0	22.2
5 High wealth	25.5	23.0*
Work status		
Not in work	59.0	69.9**
In work	41.0	30.1**
Parental status		
No children	11.1	10.3
Has at least one child	88.9	89.7
Smoking status		
Never smoked	28.4	45.7**
Former smoker	56.8	39.7**
Current smoker	14.8	14.6
Physical activity		
Sedentary	3.7	4.4
Low	18.0	25.8**
Moderate	53.6	51.5
High	24.6	18.3**
BMI		
Underweight to normal weight, BMI 0 - 25	32.5	40.1**
Overweight BMI 26-29	42.8	31.6**
Obese BMI 30+	24.6	28.3*
Self-rated health		
Excellent / v. good	46.6	44.5
Good	31.4	32.8
Fair / Poor	22.0	22.7
Number of Dr diagnosed health conditions		
No conditions	39.5	34.0**
1 condition	34.6	35.4
2 conditions	18.5	21.2*
3+ conditions	7.4	9.3*
CES-D		
<3 CESD	84.9	75.5**
3+ CESD	15.1	24.5**
Total (N)	*2,747*	*3,182*

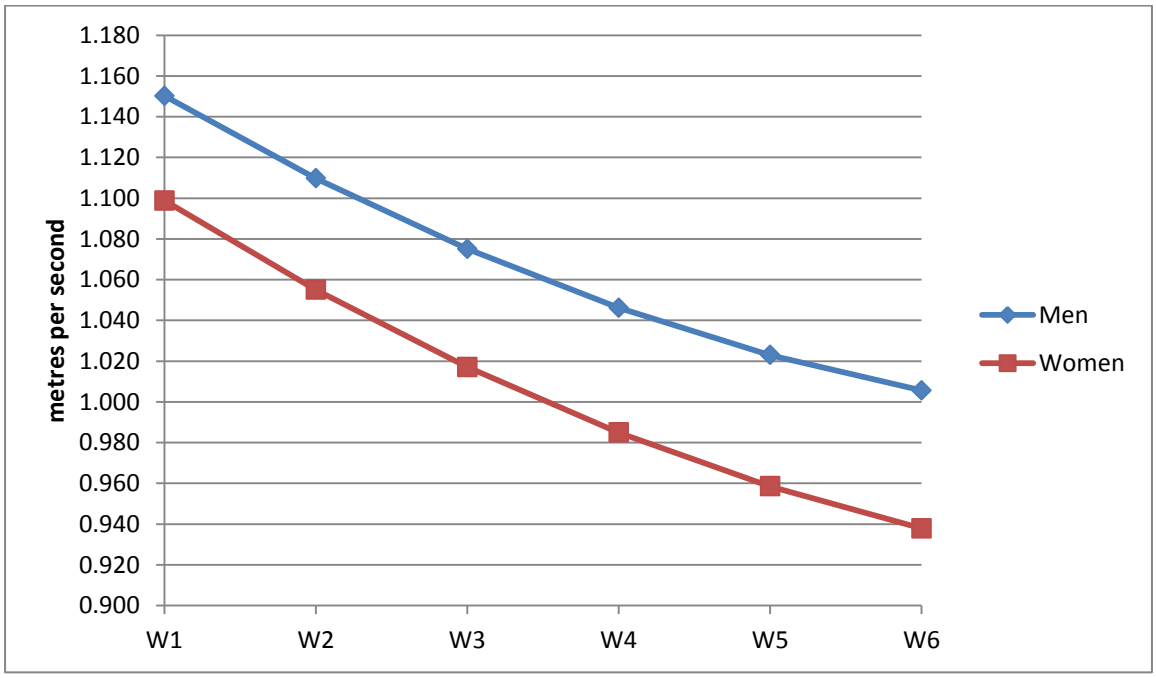
** p<0.05 **p<0.001 men v women*

7.3 Longitudinal (or within-person) walking speed trajectories

This section describes the results from the growth curve models which analysed within and between person change in mean walking speed over time.

Firstly, age adjusted growth curve models were run by gender to investigate any differences in the walking speed trajectories between men and women. Men had a faster initial walking speed than women, on average. For both men and women walking speed declined with time. Walking speed declined at a rate of 0.020m/s per year for men and declined slightly faster for women than it did for men, as shown in Figure 7.2 and Table 7.4. On average women experienced a 0.002 m/s greater decline each year over the 10 year period than men (p<0.05), which could be because, whilst women live longer than men, they are more likely to spend their later years living with a physical disability including mobility problems (Fried and Guralnik, 1997).

The next sections detail the results in changes in walking speed by marital status for men and women separately.



Adjusted for age only

Figure 7.2: Age adjusted walking speed trajectory between Waves 1 to 6 for men and women

Table 7.4: Coefficients for walking speed in m/s including gender * time interactions

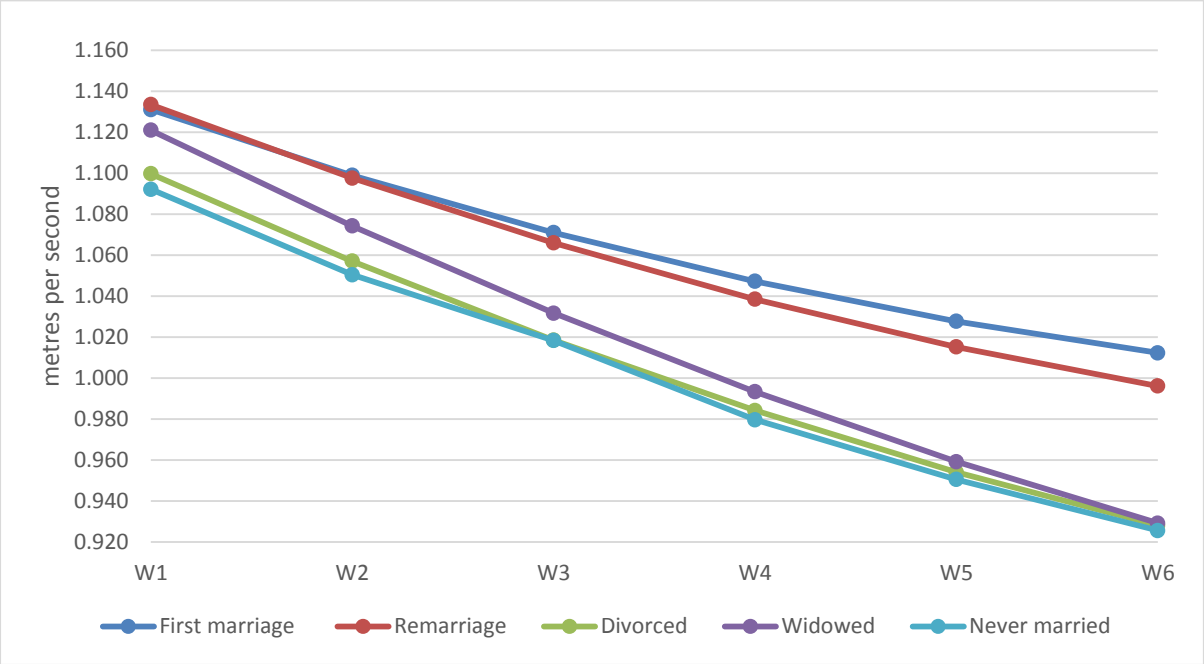
	Coef.	SE
Gender (male ref category)		
Female	-0.049**	0.007
Time in years	-0.020**	0.001
Time^2 in years	0.001**	0.000
Age	-0.015**	0.001
Age in categories (50-59 ref category)		
60 -69 years	0.014	0.011
70-79 years	-0.002	0.021
80+ years	-0.022	0.031
Gender * time interaction (Male *time ref category)		
Female	-0.002*	0.001
Constant	*1.145*	*0.017*

* $p<0.05$ ** $p<0.001$

7.3.1 Marital status differentials in walking speed trajectories

Men

Differences in walking speed over the 10 year period by marital status for men are summarised in Table 7.5. The age adjusted models (model 1) showed widowed men had a more rapid decline in walking speed than men in their first marriage (also shown in Figure 7.3). Widowed men's walking speed declined by 0.007 m/s per wave more than those it their first marriage. Divorced and never married men also had a greater decline in walking speed of 0.005 m/s more per wave than men in their first marriage, although for never married this failed to reach significance due to the smaller numbers of never married men.



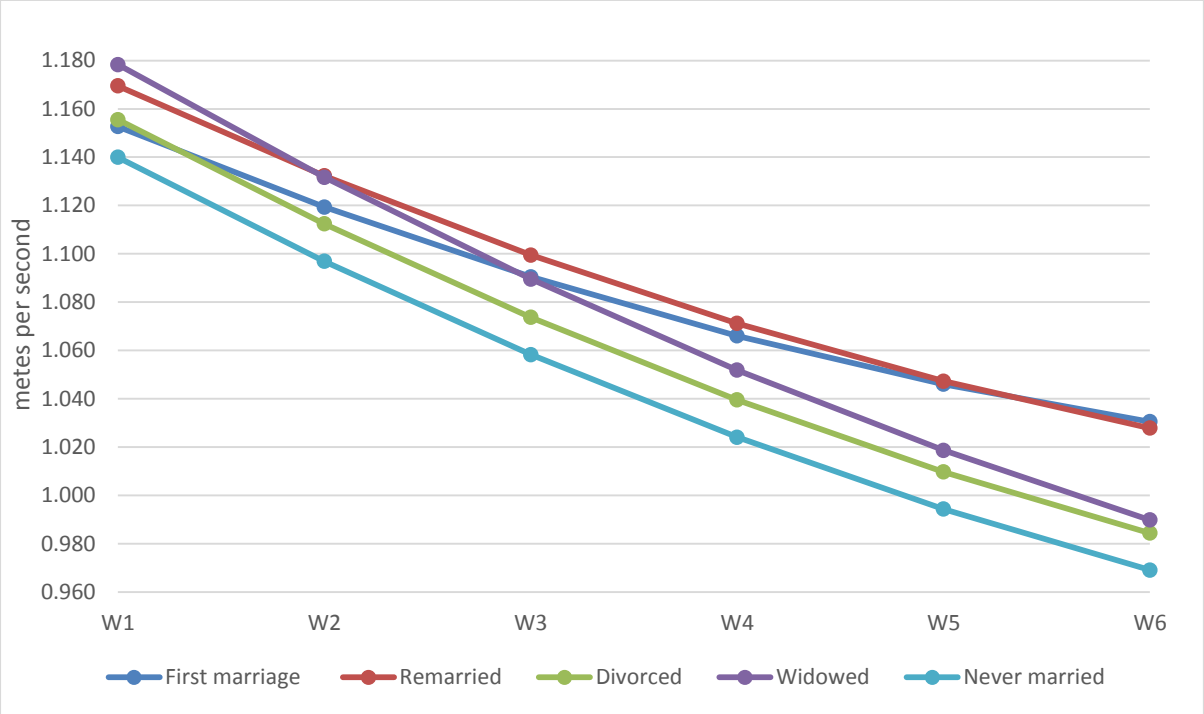
Adjusted for age only

Figure 7.3: Age adjusted walking speed trajectories, Waves 1 to 6 by marital status, men

When adjusting for the demographic and socio-economic measures (model 2) divorced and widowed men's greater decline in walking speed seen in model 1 remained. Divorced and widowed men's more rapid decline in walking speed also remained when adjusting for the health behaviour measures (model 3), and the physical health and psychological morbidity measures (model 4). In the fully adjusted model (model 4 and also shown in Figure 7.4) widowed men still had a greater biennial decline in walking speed of 0.007 m/s more than men in their first marriage, whilst for divorced and never married men it was 0.005 m/s each wave. Never married men had the same decline in walking speed as divorced men, but this failed to reach significance due to the

smaller numbers of never married men in the sample (154 never married men compared to 228 divorced men).

Remarried men had comparable walking speed trajectories to men in their first marriage.



Adjusted for age, demographic and socio-economic characteristics, health behaviours and physical health and psychological morbidity

Figure 7.4: Fully adjusted walking speed trajectories, Waves 1 to 6 by marital status, men

Table 7.5: Growth curve models for changes in walking speed between Waves 1 to 6 in ELSA, men

	Model 1:		Model 2		Model 3		Model 4	
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Marital status at baseline (first marriage ref category)								
Remarried	0.002	0.015	0.013	0.014	0.013	0.014	0.017	0.013
Divorced	-0.031	0.020	-0.004	0.020	0.003	0.019	0.003	0.019
Widowed	-0.010	0.019	0.017	0.018	0.026	0.017	0.026	0.017
Never married	-0.039	0.024	-0.014	0.026	-0.006	0.025	-0.013	0.024
Marital status X time								
Remarried X time	-0.002	0.002	-0.002	0.002	-0.002	0.002	-0.002	0.002
Divorced X time	-0.005*	0.002	-0.005*	0.002	-0.005*	0.002	-0.005*	0.002
Widowed X time	-0.007**	0.002	-0.007*	0.002	-0.007*	0.002	-0.007*	0.002
Never married X time	-0.005	0.003	-0.005	0.003	-0.005	0.003	-0.005	0.003
Time	-0.017**	0.002	-0.017**	0.002	-0.017**	0.002	-0.018**	0.002
Time^2	0.001*	0.000	0.001*	0.000	0.001*	0.000	0.001*	0.000
Age (centered at age 50)	-0.013**	0.002	-0.010**	0.002	-0.010**	0.001	-0.011**	0.001
Age categories (50 -59 years ref category)								
60-69 years	0.009	0.017	0.016	0.016	0.013	0.015	0.016	0.015
70-79 years	-0.005	0.030	-0.002	0.028	-0.007	0.027	0.000	0.026
80+ years	-0.022	0.046	-0.055	0.044	-0.057	0.042	-0.049	0.040
Ethnicity (White ref category)								
Non-white			-0.132**	0.030	-0.100**	0.028	-0.077*	0.027
Education (low ref category)								
Medium			0.073**	0.009	0.062**	0.009	0.051**	0.008
High			0.103**	0.012	0.088**	0.012	0.076**	0.011
Wealth (low wealth ref category)								
2			0.038	0.021	0.021	0.020	0.011	0.019
3			0.071*	0.022	0.044*	0.021	0.027	0.020
4			0.104**	0.022	0.071*	0.021	0.051*	0.021
High wealth			0.146**	0.023	0.111**	0.022	0.087**	0.021
Work status (Currently working ref category)								
Not working			-0.054**	0.010	-0.033**	0.009	-0.008	0.009
Parental status (has child(ren) ref category)								
No children			-0.003	0.016	-0.013	0.015	-0.012	0.015
Smoking status (Never smoked ref category)								
Former smoker					-0.017	0.009	-0.009	0.008
Current smoker					-0.063**	0.012	-0.054**	0.012
Physical activity (moderate ref category)								
Sedentary					-0.202**	0.020	-0.141**	0.020
Low					-0.098**	0.010	-0.069**	0.010
High					0.031*	0.009	0.021*	0.009
BMI (Underweight to normal weight BMI<26 ref category)								
Overweight BMI 26-29					-0.030*	0.009	-0.024*	0.008
Obese BMI 30+					-0.069**	0.010	-0.047**	0.010
Self-rated health (Excellent / very good ref category)								
Good							-0.022*	0.009
Fair / Poor							-0.098**	0.011
Dr diagnosed health conditions (no conditions ref category)								
1 condition							-0.023*	0.009
2 conditions							-0.043**	0.011
3+ conditions							-0.095**	0.015
CES-D (CES-D<3 ref category)								
3+ CESD							-0.045**	0.011
Constant	*1.131*	*0.026*	*1.015*	*0.033*	*1.098*	*0.033*	*1.153*	*0.032*

** p<0.05 **p<0.001*

Model 1: Age

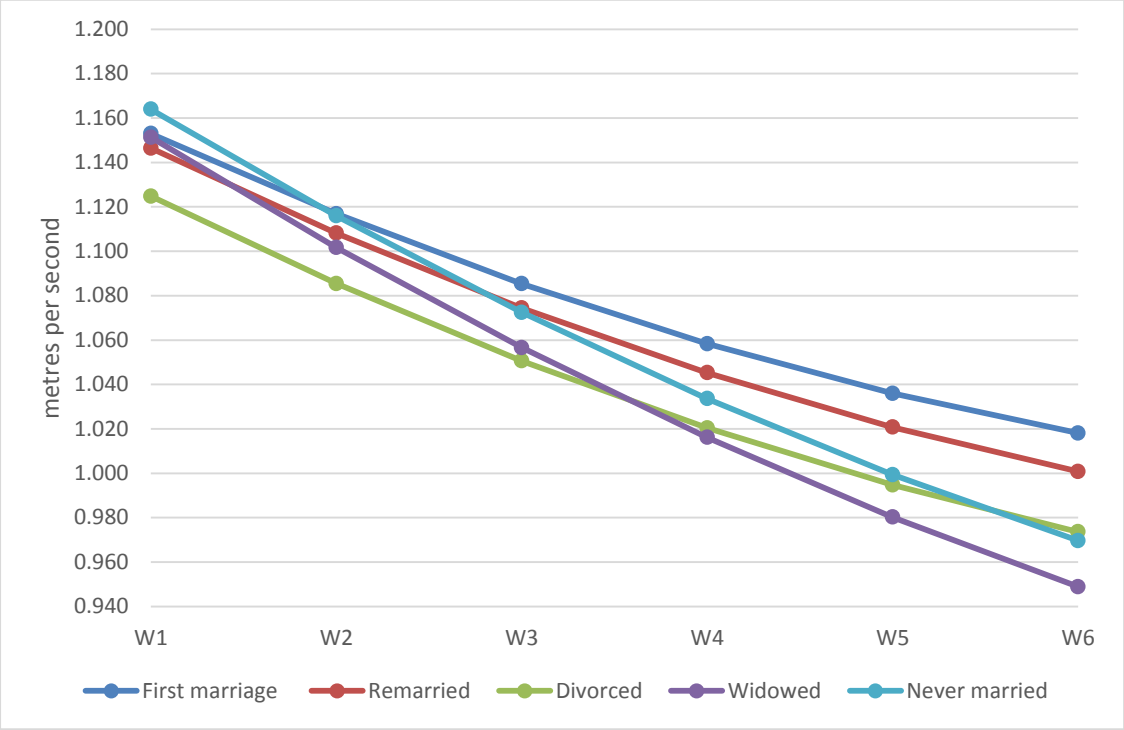
Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Women

Among women the age adjusted models (model 1 in Table 7.6) showed some interesting differences by marital status. In the age adjusted model (model 1) both widowed and never married women had a greater decline in walking speed over the ten year period than women in their first marriage (Figure 7.5). Widowed women's walking speed was 0.007 m/s slower each wave than women in their first marriage, whilst for never married women it was 0.006 m/s slower each wave.



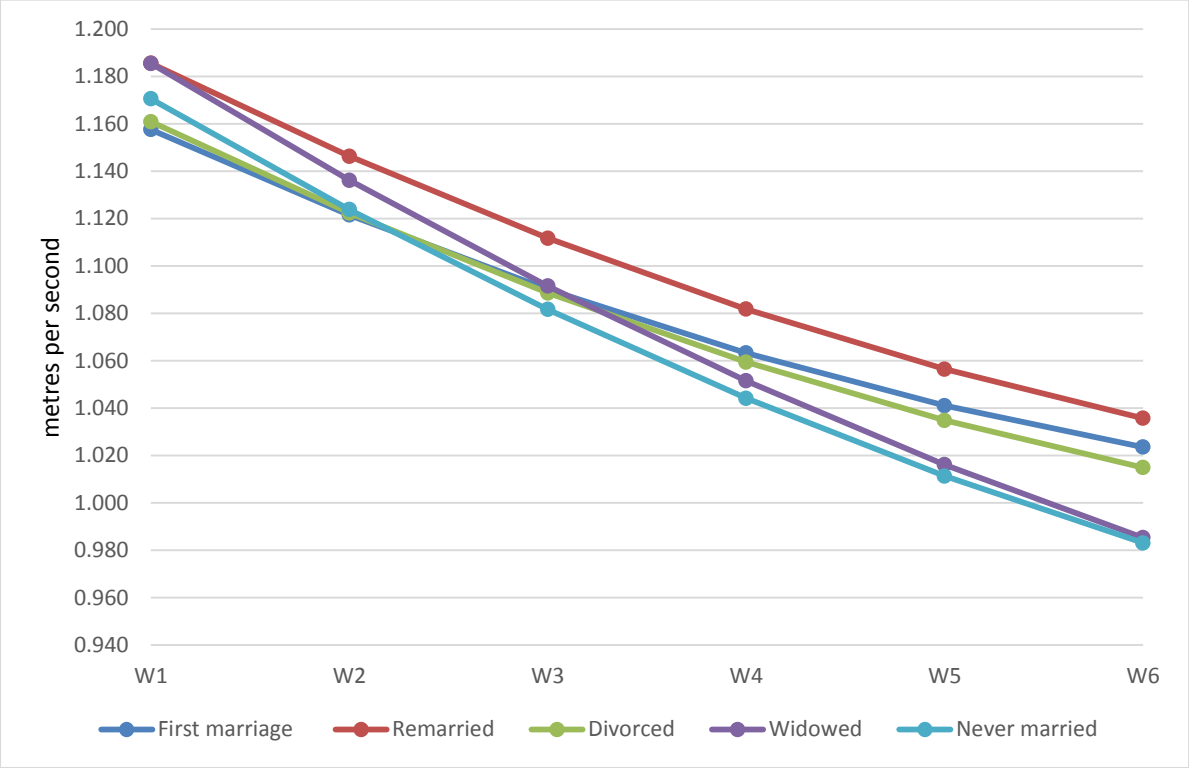
Adjusted for age only

Figure 7.5: Age adjusted walking speed trajectories between Waves 1 to 6 by marital status, women

When the demographic and socio-economic measures were added to the model (model 2), widowed women's greater decline in walking speed compared to women in their first marriage remained. It was also not explained by their health behaviours (model 3) or their physical health and psychological morbidity (model 4). In the fully adjusted model (model 4) widowed women had a walking speed which declined by 0.007 m/s more per wave than women in their first marriage. Although never married women's greater annual decline in walking speed was attenuated a little by their poorer physical health and greater psychological morbidity (model 4), they also still had a greater decline in walking speed of 0.005 m/s per wave more than women in their first marriage once making all adjustments (model 4).

Remarried and divorced women had a comparable walking speed trajectory to women in their first marriage. The walking speed trajectories from model 4 are shown graphically in Figure 7.6.

There were no differences in the association between men and women in their baseline marital status and changes in walking speed over the 6 waves.



Adjusted for age, demographic and socio-economic characteristics, health behaviours and physical health and psychological morbidity

Figure 7.6 : Fully adjusted declines in walking speed between Waves 1 to 6 by marital status, women

Table 7.6: Growth curve models for changes in walking speed between Waves 1 to 6 in ELSA, women

	Model 1		Model 2		Model 3		Model 4	
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Marital status at baseline (first marriage ref category)								
Remarried	-0.007	0.018	0.012	0.017	0.020	0.016	0.028	0.016
Divorced	-0.028	0.016	-0.003	0.016	-0.005	0.015	0.003	0.015
Widowed	-0.002	0.013	0.025*	0.012	0.025*	0.012	0.028*	0.011
Never married	0.011	0.023	0.001	0.025	0.010	0.023	0.013	0.022
Marital status X time								
Remarried X time	-0.001	0.002	-0.001	0.002	-0.001	0.002	-0.002	0.002
Divorced X time	-0.002	0.002	-0.001	0.002	-0.001	0.002	-0.001	0.002
Widowed X time	-0.007**	0.001	-0.007**	0.001	-0.007**	0.001	-0.007**	0.001
Never married X time	-0.006*	0.003	-0.006*	0.003	-0.006*	0.003	-0.005*	0.003
Time	-0.019**	0.002	-0.019**	0.002	-0.019**	0.002	-0.019**	0.002
Time^2	0.001**	0.000	0.001**	0.000	0.001**	0.000	0.001**	0.000
Age (centered at age 50)	-0.016**	0.001	-0.013**	0.001	-0.013**	0.001	-0.012**	0.001
Age categories (50 -59 years ref category)								
60-69 years	0.022	0.016	0.029	0.015	0.022	0.014	0.012	0.013
70-79 years	0.003	0.028	0.000	0.027	-0.002	0.025	-0.008	0.024
80+ years	-0.006	0.042	-0.040	0.040	-0.037	0.037	-0.054	0.035
Ethnicity (White ref category)								
Non-white			-0.125**	0.030	-0.113**	0.028	-0.091*	0.027
Education (low ref category)								
Medium			0.055**	0.008	0.045**	0.008	0.034**	0.007
High			0.107**	0.012	0.082**	0.012	0.070**	0.011
Wealth (low wealth ref category)								
2			0.062*	0.019	0.033	0.018	0.038*	0.017
3			0.095**	0.020	0.057*	0.019	0.050*	0.018
4			0.127**	0.020	0.074**	0.019	0.067**	0.018
High wealth			0.170**	0.021	0.106**	0.020	0.093**	0.019
Work status (Currently working ref category)								
Not working			-0.056**	0.010	-0.034**	0.009	-0.013	0.009
Parental status (has child(ren) ref category)								
No children			0.016	0.014	0.005	0.013	0.000	0.012
Smoking status (Never smoked ref category)								
Former smoker					-0.013	0.007	-0.007	0.007
Current smoker					-0.061**	0.011	-0.048**	0.010
Physical activity (moderate ref category)								
Sedentary					-0.191**	0.017	-0.145**	0.016
Low					-0.103**	0.008	-0.072**	0.008
High					0.024*	0.009	0.010	0.009
BMI (Underweight to normal weight BMI<26 ref category)								
Overweight BMI 26-29					-0.034**	0.008	-0.029**	0.008
Obese BMI 30+					-0.099**	0.008	-0.075**	0.008
Self-rated health (Excellent / very good ref category)								
Good							-0.054**	0.008
Fair / Poor							-0.127**	0.010
Dr diagnosed health conditions (no conditions ref category)								
1 condition							-0.019*	0.008
2 conditions							-0.042**	0.009
3+ conditions							-0.072**	0.013
CES-D (CES-D<3 ref category)								
3+ CESD							-0.037**	0.008
Constant	*1.153*	*0.024*	*1.004*	*0.031*	*1.105*	*0.030*	*1.158*	*0.029*

** p<0.05 **p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

7.3.2 Key findings

The longitudinal analysis showed that men and women who were married had the slowest declines in walking speed, compared to all unmarried men and widowed and never married women. There was no difference in the walking speed trajectories between remarried men and women and divorced women and men and women in their first marriage. The greater decline in walking speed over the ten year period for divorced men and widowed and never married men and women was not explained by their baseline demographic and socio-economic characteristics, their health behaviours, or their physical health and psychological morbidity.

7.3.3 Sensitivity analysis with time varying covariates

A total of 2,758 cases which were eligible for this analysis were missing data on one or more covariates across the six waves, which would have resulted in a much reduced sample size (3,171 cases, instead of 5,929, which amounted to 1,444 men and 1,727 women). This amount of missing data led to the decision to measure the covariates at baseline rather than having them time varying and consequently the role of fluctuations in socio-economic, health behaviour and health on changes in physical capability could not be measured.

A sensitivity analysis was carried out to investigate whether having the covariates as time varying would alter the associations. The results are presented in Appendix K, which are the same growth curve models presented in this chapter, but with the covariates as time varying. The covariates which varied with time were wealth, work status, all the health behaviour measures and physical health and psychological morbidity. The results in Appendix K showed that there were very few associations between marital status and changes in walking speed. Although, widowed men and women still had a greater annual decline in walking speed than those in their first marriage which did not really change with the addition of the time varying covariates in models 2 to 4. The reason that there was little association between marital status and changes in walking speed when the covariates were time varying could be because of lack of sample power, due to the smaller sample size, or possibly because those who had a greater decline in walking speed over the 10 year period were also more likely to have missing data on one or more of the covariates between Waves 1 to 6.

7.4 Summary

The analysis set out to investigate whether marital status measured at baseline was associated with subsequent changes in walking speed over a ten year period; no previous study had

investigated marital status and changes in the walking speed over a similar period. It was hypothesised that men and women in their first marriage would experience the least decline in walking speed over the 10 year period and the evidence from this analysis supports this hypothesis as men and women who were in their first marriage did show the shallowest decline in walking speed, compared to their unmarried counterparts. Among those who were unmarried it was hypothesised that never married men and divorced women would have greater declines in walking speed than those in their first marriage. Overall the analysis found that this was not apparent for divorced women who had comparable declines in walking speed to those in their first marriage, but there is evidence that it was apparent for never married men. Although, never married men did not have a statistically significant greater change in walking speed than their married counterparts, this could be due to lack of sample power as never married men had comparable declines in walking speed to divorced men. The analysis also showed that widowed men and women and never married women also showed greater declines in walking speed over the period than those who had remained in their first marriage.

These findings are both partly consistent and contrary to a previous study (Goldman et al., 1995), they are consistent in that it was found that widowed men experienced greater declines in physical capability than those who were married. However, the study found conversely, to the results of this analysis, that divorced men and never married women were less likely to report physical limitations than those who were married. The different findings could possibly be explained by the different outcomes used as the study used a self-reported measure of disability which included both physical and cognitive limitations, which could have resulted in dissimilarities in the association. Also the Goldman *et al* study only measured physical capability at two time points, used a slightly different age group – those aged 70 years and older - and was conducted on nationally representative data from the USA which could also account for the differences in findings.

The findings from this analysis were partly consistent with findings from previous studies which have looked at cohabitation (rather than marital status, although at older ages the majority of those who were cohabiting were married). These studies found that men who were not cohabiting at older ages experienced greater declines in physical capability than those who were cohabiting (Zaninotto et al., 2010) (Nilsson et al., 2008). However, among women the findings from this analysis are contrary to previous research on cohabitation and living arrangements and physical capability. This analysis found that women who were widowed or never married had greater declines in walking speed than women in their first marriage, but previous research has suggested that women who were not living with a spouse or anyone else had comparable declines in walking

speed to women living with a spouse (Michael et al., 2001) (Hughes and Waite, 2002). Although these studies adjusted for marital status in their analyses the differential findings between those and the current analysis could be due to the difference in exposure as living alone is not the same as being unmarried, although the majority of those who were unmarried in the analysis in this thesis were not cohabiting and most probably were living on their own. The differences could also be because these studies used a shorter time period of four years, or because additionally the Michael et al study was based upon a sample of female nurses, and nurses who lived alone may have been healthier than the women in the national population. Although, the Hughes and Waite found similar findings using the HRS, which is a nationally representative survey.

However, the findings from this chapter are much more consistent with a study which looked at trends in physical capability using cross-sectional time series data from the USA (Liu and Zhang, 2013), which also found that never married men and women and divorced men experienced the greatest decline in physical capability over a 12 year period.

7.4.1 Limitations

There are a number of limitations to this analysis which need to be raised. The main limitations surround the missing data. As multilevel modelling was used the analysis included those who did not provide data at all waves and missing data present on the outcome was dealt with by maximum likelihood estimation, but there remained much missing data on the covariates across the 6 waves of data. The current analysis used covariate data captured at baseline and did not account for changes in covariates through follow-up. However, the sensitivity analysis which was discussed earlier (Section 7.3.3) showed there were few differences between this analysis and the analysis with the time varying covariates.

This analysis also did not investigate whether early life circumstances explain some of the marital status variations in changes in physical capability. The childhood measures were omitted largely because of the additional missing data and reduced analytic sample that this would have created. Also, the previous analysis on cross-sectional associations between marital status and physical capability (Chapter 6) found that childhood circumstances did not explain any of the marital status differences in physical capability, therefore it could be expected that they would not explain any of the differences in changes in walking speed over the 10 year period.

The final limitation with this analysis was that marital status was only measured at baseline and those who had changed marital status across the course of the 10 year period were omitted from the analysis. Any changes in physical capability associated with changes in marital status transitions were not the focus of the current study.

Overall the analysis presented in this chapter has shown that married men and women were more likely to maintain their good levels of physical capability than their unmarried counterparts. Much of the association though remained unexplained.

The results of the analysis presented in this thesis will be discussed in detail in the next chapter.

Chapter 8: Discussion

This chapter discusses the results of the analyses presented in the previous three chapters in light of the current evidence on marriage and physical capability, which was discussed in the literature review (Section 2.1). The strengths and more general limitations of the research are also considered along with recommendations for future research, the policy implications of the findings and concluding remarks.

8.1 The marriage advantage

The analyses in this thesis have shown that there certainly seems to be a "marriage advantage", in both England and the USA. Married men and women displayed both better cross-sectional physical capability and less rapid declines in physical capability than unmarried men and women. This reinforces findings from two cross-sectional studies (Guralnik et al., 2009) (Clouston et al., 2014), which also found that those who were married had better physical capability, measured through the physical performance measures, than their unmarried counterparts. The longitudinal findings are partly consistent with findings from previous studies which have looked at cohabitation at older ages and found that men who were not cohabiting experienced greater declines in physical capability than those who were cohabiting (Zaninotto et al., 2010) (Nilsson et al., 2008).

The descriptive analysis on the demography of marriage (Chapter 5) also showed evidence for a marriage advantage as women and particularly men, who have remained in their first marriage, were more advantaged than their unmarried counterparts, not just in adulthood, but throughout the life course. Those who had remained in their first marriage had a more advantageous childhood, having more highly educated parents, particularly compared to those who were unmarried. Men and women in their first marriage also had higher adult SEP, through higher levels of education and wealth. This is in accordance with previous research which found that those who were married had higher childhood SEP (Bumpass et al., 1991a), higher adult SEP measured through education (Shafer and Qian, 2010) and higher levels of wealth (Zagorsky, 2005).

Men and women in their first marriage also had overall better health behaviours than their unmarried counterparts, particularly with respect to smoking behaviour. In line with previous research the analysis found that those who were in their first marriage were much less likely to have smoked than unmarried men and women (Nystedt, 2006). However, the analysis also showed that they were also less likely to have ever smoked, which suggests that marriage doesn't change smoking behaviour, but would point to marriage being selective of and retaining those who have never smoked.

One indicator related to health behaviour where there were some stark gender differences and where those who were married were not healthier than their unmarried counterparts was with BMI. The analysis showed that men who were in their first marriage were more likely to be overweight or obese, compared to unmarried men, but this wasn't the case for women, where women who were in their first marriage were more likely to have a BMI which was normal or underweight, particularly in the USA. There is evidence showing that marriage for men is associated with weight gain (Wilson, 2012). It is thought that marriage promotes weight gain for men due to either married men eating more regular and nutrition rich meals than their unmarried counterparts (Conklin et al., 2014), or because they are less likely to smoke and to exercise (Sobal et al., 1992). The gender difference in marital status and body size could also be due to selective factors into marriage with different gender preferences surrounding partner body size (Wilson, 2012).

Whilst there were not so many differences in physical health between those in a first marriage and all other marital statuses there were differences in their levels of psychological morbidity. Both men and women who were in their first marriage had much lower levels of psychological morbidity, particularly compared to those who were unmarried. This is in accordance with previous research (Yan et al., 2011), which showed that those who were married have a much lower risk of depression than their unmarried counterparts. The association between marriage and good psychological health can be in part explained by the protective qualities of marriage, particularly the social support provided by marriage, which protects its incumbents from psychological morbidity (Umberson and Montez, 2010). Although, it is also recognised that the observed psychological morbidity differences could be due to marriage selecting and retaining those with the best psychological health in the first instance (Whisman et al., 2007) (Hope et al., 1999).

Despite those in a first marriage having better health behaviours and physical and psychological health than those who were unmarried much of the cross-sectional association between marriage and physical capability was explained by the greater wealth among those who were married. Previous evidence has demonstrated a strong association between marriage and wealth, as those who have remained married for much of their lives are able to accrue more wealth than those who are unmarried (Vespa and Painter, 2011), or those who had remarried (Wilmoth and Koso, 2002). Marriage generates more wealth partly through the ability to pool resources more effectively and also partly because married men have shown to earn more money than unmarried men (Pollmann-Schult, 2011). Wealth reflects a household's socio-economic experience across the life course (Mohd Hairi et al., 2010), which is why it is sensitive to changes in marital status.

There is a growing body of evidence which shows a strong positive association between wealth and physical capability at older ages, and those who had higher levels of wealth also had higher levels of physical capability (Gjonca et al., 2009) (Tabassum et al., 2009) (Mohd Hairi et al., 2010). Greater wealth is associated with lower risk of adverse factors across the life course, which can negatively impact on physical capability at older ages, such as lack of adequate housing, healthcare (particularly in the USA) (Kim and Richardson, 2012), nutritious food (Pollack et al., 2007), poor health behaviours (Koster et al., 2006) and poorer physical and mental health (Mohd Hairi et al., 2010). At older ages wealth would become even more important as it can protect against any loss of income experienced in retirement.

The analysis also showed that wealth was particularly important for women's physical capability, as once wealth was adjusted for the majority of the discrepancies in the cross-sectional physical capability between married and unmarried women disappeared. This too is in line with previous research which has found the improved health of married women compared to their unmarried counterparts is due to the economic advantages of marriage (Hahn, 1993) (Lillard and Waite, 1995). It is thought that women gain more economically from marriage because they earn less on average than men and are more often the main childcare provider, which limits their opportunities to participate in the labour market and accrue wealth (Holden and Smock, 1991).

8.1.1 A remarriage advantage?

There has been surprisingly little research on remarriage and what evidence that does exist focusses on the health benefits of remarriage, which have shown to be weaker than the health benefits of a first marriage (Carr and Springer, 2010) (Hughes and Waite, 2009). Although, it is still largely unknown why remarriage doesn't provide the same health benefits as a first marriage, it is thought that stress related to more challenging relationships which remarriage brings, such as with an ex-spouse and step-children, may dilute any health benefits (Carr and Springer, 2010) (Hiyoshi et al., 2015).

The analyses presented in this thesis has countered the existing evidence on remarriage somewhat, particularly for men, as it has shown how advantaged remarried men in both England and the USA were not only in terms of their physical capability, but also in other aspects across the life course. Remarried men came from advantageous family backgrounds with highly educated parents, and more highly educated fathers than men who were in a first marriage. Remarried men (but not so much women) were also highly educated themselves, which is in line with the current understanding on education and remarriage, as marriage and remarriage for men has shown to be positively associated with education (Shafer and James, 2013). Whilst remarried men and women

had lower levels of wealth than those who were in their first marriage, they had higher levels than those who remained unmarried. This aligns with other work indicating that remarriage offsets some of the deleterious effects of transitions out of marriage on wealth (Wilmoth and Koso, 2002).

Remarried men and women also had comparable physical health and physical capability to those who had remained in their first marriage and in some instances better physical capability. Remarried men had a stronger grip strength than men in their first marriage. Could the better physical capability of remarried men provide some support for a remarriage advantage? These findings might suggest that remarriage not only ameliorates any negative effects of a transition out of marriage, but may also provide additional unobserved benefits for physical capability. The remarried advantage in grip strength for men was not explained by selection into remarriage, based upon childhood circumstances or education, despite remarried men having a more advantaged childhood than those who were in their first marriage. However, the relatively stronger grip strength of remarried men compared to men in their first marriage and remarried women could be explained by selective factors, which were not accounted for in the analysis. It is possible that men who are physically stronger may be more likely to be selected into marriage in the first instance and then back into marriage after a transition, as muscle mass could be seen as a desirable feature for male partners to have. This possible explanation could also account for why remarried women were not as advantaged in their grip strength as remarried men, as upper body strength may not be considered to be as attractive an attribute for women to have as it is for men. It could also explain why widowed and never married women were not as disadvantaged in their grip strength relative to their male counterparts. Interestingly, walking speed was not higher among remarried men compared with men in their first marriage. If the strength and distribution of muscle required for high grip strength differs from that required for fast walking speed then this could be seen as evidence supporting selection into remarriage, though this remains highly speculative.

These are only suppositions at present and further research into remarried men and women's physical capability needs to be undertaken to unpick the factors which account for the remarriage advantage in grip strength.

8.1.2 Transitions out of marriage

Previous research has shown that transitions out of marriage through divorce or widowhood are associated with a range of negative outcomes including lower levels of wealth (Wilmoth and Koso, 2002), poorer health behaviours (Nystedt, 2006) (Lee et al., 2005) and poorer physical (Williams and Umberson, 2004) and psychological health (Blekesaune, 2008) than their married counterparts.

The analysis presented in this thesis supported these previous findings. Those who had transitioned out of marriage were found to have a lower adult SEP, through lower levels of wealth and education. Divorced and widowed men and women were also found to have poorer health behaviours than those who had remained in their first marriage. It is thought that the poorer health behaviours of those who have transitioned out of marriage are a consequence of the loss of social control, which spouses had previously provided (Williams, 2004). The analysis also showed that those who were widowed or divorced had much poorer psychological health than those who were in their first marriage. This has also been found in previous research (Yan et al., 2011), with evidence that the association is modified by gender, with a stronger association between divorce and psychological morbidity for women than for men (Willitts et al., 2004), whilst for men there was a stronger association between psychological morbidity and widowhood (Carr and Utz, 2001). It is thought that divorce is more adverse for women due to the financial loss, which can affect psychological health, whilst widowhood is worse for men's psychological health due to the loss of social support, and also as widowhood for this generation is not such a normative experience for men as it is for women (Umberson et al., 1992), which could affect their psychological health. The analysis found no gender differences in the association and divorce and widowhood were associated with equally high psychological morbidity for both men and women.

Divorce and physical capability

The analysis also showed that divorced men and women had poorer physical capability than those who were married, which is in accordance with prior evidence (Clouston et al., 2014) (Pienta et al., 2000) (Hughes and Waite, 2009). Divorced men and women's poorer cross-sectional physical capability compared to those who were married was largely explained by their lower levels of wealth. The descriptive analysis showed that divorced men and women were over three times more likely to be in the lowest wealth quintile than men and women in their first marriage. Divorced women in the USA were also relatively less wealthy than divorced men, although this wasn't so apparent in England. This is unsurprising given that there is much evidence showing that divorce is associated with lower wealth and income, particularly for women (Zagorsky, 2005) (Vespa and Painter, 2011) (Brewer and Nandi, 2014). What cannot be determined from this analysis is whether divorcee's lower wealth is the result of the divorce or whether they had lower wealth prior to the divorce. Most evidence suggests that divorcee's lower wealth is due to the substantial financial cost of transitioning out of marriage through the splitting up of assets and the legal costs encountered to obtain a divorce. These financial costs disproportionately affect women more than men, as women on average earn less money than men and they are also more likely

than men to have spent periods of time out of the labour market providing care for children, or if they do work they are more likely to do so part time (Brewer and Nandi, 2014) (Waldfogel, 1997).

However, part of the explanation for the lower levels of wealth seen among those who were divorced, compared to those who were married, could be due to their poorer socio-economic position prior to marriage. Over the course of the twentieth century the characteristics of those who divorce has changed. As divorce became more accessible with the liberalising of the divorce laws and availability of legal aid, divorce became more negatively socio-economically graded with those who had a lower SEP being more likely to divorce than those from higher SEPs (de Graaf and Kalmijn, 2006) (Kiernan and Mueller, 1998). Therefore, the poorer financial circumstances of those who are divorced may not be a result of the divorce itself, but instead a continuation of their lower SEP prior to divorce.

The longitudinal analysis also showed that divorced men had a greater decline in walking speed over the 10 year period than men in their first marriage, whilst this was not apparent for divorced women (although there was no statistically significant modification by gender which could be due to lack of sample power). Divorced men's greater decline in walking speed remained unexplained in all the models. It's possible that the faster decline in walking speed among divorced men in comparison to men in their first marriage could be a result of selection. The demographic analysis showed that remarriage after a divorce is selective of men who are more educated and have had better childhood circumstances than those men who remained divorced. Whilst among women though those who remained divorced tended to have both a higher childhood and adult SEP than divorced men, which has also been shown in a previous study (Shafer and James, 2013)(Shafer and James 2013)(Shafer and James 2013b). Childhood SEP, in turn, has been shown to be associated with longitudinal trajectories in physical capability (Haas, 2008). However, the cross-sectional analysis showed that childhood circumstances were not associated with physical capability at older ages, so in this instance they may not explain divorced men's changes in physical capability. Another, but less plausible, explanation for the disparities in physical capability among divorced men and women could be social support. Divorced women could possibly be more socially integrated than divorced men and therefore receive higher levels of social support from a variety of different people. Whilst there is some evidence that divorcees have more frequent contact with friends than married people, there were no gender differences and both divorced men and women have equally as frequent contact with friends (Kalmijn and van Groenou, 2005).

Widowhood and physical capability

Widowed men and women also had poor physical capability compared to those who were married and their lower levels of wealth also explained some of widowed men's and women's poorer physical capability relative to men and women who were in their first marriage. A death of a spouse is detrimental to financial resources (Zick and Smith, 1991). Similarly to divorce widowhood was more detrimental to women's economic resources than men's, which has been shown in previous research (Hurd and Wise, 1989). Some of widowed men's and women's poorer physical capability was also explained by their poorer physical health and greater psychological morbidity, which could be a reflection of the bereavement effect. The bereavement effect refers to the much higher risk in mortality for the surviving partner in the immediate years following a death of a spouse (Espinosa and Evans, 2008) (Shor et al., 2012). The bereavement effect could be a direct consequence of a loss of a spouse, the stress of which could directly lead to poorer psychological and physical health (Carr and Utz, 2001), or an indirect consequence through a lapse in beneficial health behaviours, as the main provision of social control, through their spouse, has gone (Williams, 2004).

Whilst widowed men's and women's weaker grip strength was explained by their lower levels of wealth and their poorer physical and psychological health their slower walking speed and longer term decline in walking speed was not explained by any of the potential pathways between marriage and physical capability. Their poorer cross-sectional physical capability was also not explained by their relatively disadvantaged childhood circumstances, but perhaps other disadvantages widowed men and women have been exposed to earlier in the life course have accumulated manifesting in poorer physical capability in mid to later life.

Another possible explanation for widowed men's slower walking speed and widowed men and women's greater long-term decline in walking speed could be explained by lack of social support, which has been linked to physical capability (Lund et al., 2010). However, it is unclear whether social support is a plausible explanation as the evidence is inconsistent as to whether social support benefits physical capability or not. Whilst those who have larger social networks have been found to have better current levels of physical capability (de Leon et al., 2003), it is unclear whether increased social networks are associated with a slower decline in physical capability (Michael et al., 2001), and there is evidence that receipt of social support in itself is associated with poorer physical capability (Avlund et al., 2004) (Litwin and Stoeckel, 2013). The inconsistency could be because those who receive social support could have poorer physical capability in the first instance. Also this explanation may not be so strong as widowed people still receive social support, but from other sources, as research shows that they have as much contact with friends and family as those

who are married (Kalmijn, 2012) (Hurlbert and Acock, 1990), which could to an extent compensate for some of the loss of social support provided by a spouse.

8.1.3 The effect of never marrying

For this generation of people those who never marry are a selective group of people. Up until the 1970s and 80s marriage was ubiquitous with approximately 95% of people marrying at some point in their lives in the USA (Cherlin, 2005) and 90% in England and Wales (ONS, 2014).

There has been little research on those who have never married, which is partly because they are small in numbers (Carr and Springer, 2010). What has though been highlighted from prior research is the stark gender differences among those who are never married, which are thought to be due to the genderisation of marriage (Cherlin, 2009) and different selective factors into marriage for men and women (which will be discussed in detail in the following section, Section 8.2). The demographic analysis in this thesis showed gender differences in the socio-economic circumstances in childhood and adulthood of never married men and women, with never married women having a relatively more advantaged childhood and adult SEP than never married men, as they had highly educated parents (particularly their mothers) and they themselves were highly educated, more so that married women. In contrast never married men tended to come from a poorer family SEP and have lower levels of education. This has also been shown in prior research using the British NSHD (Kiernan, 1988b).

Despite these differences in the socio-economic circumstances of never married men and women the analysis found that there were few gender differences in the physical and mental health of those who never marry. Both never married men and women in England and the USA had equally poorer physical and psychological health than those who were in their first marriage. This is contrary to prior evidence which shows that never married women were as physically (Cwikel et al., 2006) and mentally (Pudrovska et al., 2006) healthy as married women and that never married men were physically unhealthier than married men (Molloy et al., 2009). It is unclear why the findings from this thesis differ to this prior research, but it could be due to different study samples.

Existing evidence has also shown that gender differences exist in physical capability as never married men have found to have poorer physical capability than their married counterparts (Guralnik et al., 2009) (Pienta et al., 2000), but this wasn't the case for never married women who have shown to have comparable physical capability to married women (Guralnik et al., 2009). The gender difference in physical capability among never married men and women is thought either to be due to the differences in SEP between never married men and women, or because the health

benefits which marriage provides may disproportionally protect men's physical capability more than women's (Guralnik et al., 2009).

The cross-sectional analysis in this thesis supported this existing evidence to an extent as never married men in England and the USA had a weaker grip strength and slower walking speed than men in their first marriage. But, the analysis found little support for never married women having more similar physical capability to women in their first marriage than never married men did to men in their first marriage. There was some gender modification for the measure of grip strength, with never married men having relatively weaker grip strength to men in their first marriage than never married women did to women in their first marriage, but besides that never married women had similarly poor levels of physical capability as never married men. This was contrary to what was expected given the previous evidence, as well as the demographic analysis in this thesis, which showed that never married women had a more advantaged childhood and adult SEP (displayed by their high levels of education), in comparison to never married men.

Never married men and women's lower cross-sectional levels of physical capability were largely explained by their lower levels of wealth. Evidence shows that those who never marry have similarly low levels of wealth to those who transition out of marriage (Wilmoth and Koso, 2002). This is because although they don't experience the loss of wealth from marital transitions, they tend to have lower wealth, as women tend to be lower paid than men and never married men tend to be more poorly educated than married men and consequently having lower skilled jobs and a lower income (Cherlin, 2009).

However, never married men's and women's more rapid decline in walking speed than those who were married for the large part remained unexplained, after taking wealth into account. Similarly to those who were widowed, one possible explanation could be lack of social support. There is evidence that at older ages never married individuals receive less social support and are less socially integrated than those who are married (Barrett, 1999). Although, as discussed, it is unclear whether social support is a possible explanation as the evidence is inconsistent as to whether social support benefits physical capability or not.

It would seem that there are other unobserved explanations for the faster decline in walking speed seen among never married men and women.

8.1.4 Differences between England and the USA in the association between marriage and physical capability

There were few differences in the association between marital status and physical capability between England and the USA and there was generally consistency in the associations across the two countries. This was in some respects unexpected as there are differences in the social and policy context between the two countries.

Both marriage and divorce are more prevalent in the USA than in England (Cherlin, 2009). Marriage is seen as a very important social institution and cultural ideal in the USA, which has been promoted by various US governments, something that is not so apparent in England (Cherlin, 2009). For instance, during the late 1990s the Bush administration attempted to stem the rising divorce rate through the introduction of Covenant Marriage, which made divorce harder to obtain (as detailed in Table 1.1). Despite the high importance placed upon marriage in the USA, compared to England, divorce is more prevalent in the USA than England and also divorce was for a period of time more accessible in the USA than in England. When the no-fault divorce was first introduced, in England couples had to wait three years before obtaining a divorce, but in many of the US states couples could obtain a divorce within a year (Cherlin, 2009). In England, in 1984, this was later changed to one year.

There are also differences in welfare provision between the two counties, with provision being more generous in England than in the USA, which may protect those who are divorced from the detrimental economic consequences of divorce somewhat more. Additionally, in the USA health care is private, whereas in England it is publicly funded, and a transition out of marriage through divorce could result in a loss of health insurance (which may have been provided by the spouse). In turn lack of private health insurance has been linked with poorer physical capability (Kim and Richardson, 2012). There are also differences between the two countries in their levels of physical capability, with older people in England having better physical capability than their US counterparts (Wahrendorf et al., 2013) (Clarke and Smith, 2011).

With this in mind it would be expected that the association between marital status and physical capability would be different in England than the USA, with possibly the gap in physical capability between those who are married and those who are not being greater in the USA than in England. However, despite these social and legal differences the characteristics of the different marital statuses and the associations between marriage and physical capability were overall similar.

There were a couple of exceptions though. There were differences in the education levels of divorced men and never married men and women, which will be discussed in detail in the following

section (Section 8.2). The other notable difference was in BMI among women. Never married women in the USA were more likely to be overweight or obese than never married women in England. These differences could be due to different selective factors into marriage between the two countries, with body size being a more important selective factor (Wilson, 2012) in the USA than it is in England. With regard to marriage and physical capability there was one country difference; never married men in the USA had a relatively weaker grip strength than their counterparts in England. Their relative disadvantage could be because of lower welfare provision and lack of universal healthcare coverage in the USA, or due to different selection mechanisms, or degrees of selection into marriage between the two countries. Given that marriage is more prevalent in the USA than in England those who remain never married in the USA could be a more adversely selective group of people relative to their counterparts in England.

Overall though, the findings from this thesis show that the association between marriage and physical capability is a robust association that is unaltered by the different societal contexts of these two countries. Although, it is possible that England and the USA are too similar in their culture, political and economic systems and attitudes towards marriage and divorce, which could account for the lack of divergence in the association. Perhaps there would be more marked differences in the association if a society which had more traditional attitudes towards marriage and a different cultural and political system was compared with either England or the USA.

8.2 Childhood and early adult factors and entry into and exit out of marriage

Although childhood circumstances did not explain any of the cross-sectional variations in physical capability by marital status, as mentioned there were differences in childhood and early adult circumstances between the different marital statuses at aged 50 years and older, with some differences in the association between men and women and between England and the USA. These differences in childhood and early adulthood circumstances provide some support that entry into and exit out of marriage is selective for both men and women, although there were different selective factors for each gender.

8.2.1 Childhood SEP, education and marriage

The association of childhood SEP and education with entry into and exit out of marriage was markedly different for men than it was for women. Men who had the highest childhood SEP and the highest levels of education were either in their first marriage or in a subsequent marriage, while unmarried men were all found to have poorer childhood SEP and lower education, which is

suggestive of selection into both a first and a subsequent marriage. This is in accordance with previous evidence showing that men who divorce or never marry have lower levels of education to those who remain married or remarry (Shafer and James, 2013) (Kiernan and Mueller, 1998).

Among women to some extent the reverse was apparent. Women in their first marriage did have advantageous childhood circumstances and high levels of education, but their childhood SEP was not as advantageous and they were not as highly educated as never married women. Never married women in both England and the USA were highly educated and were also relatively more highly educated than never married men, which has been shown in previous research from Britain (Kiernan, 1988b). There was also a different association for women than what was seen among men between exits out of marriage, through divorce, and entry into remarriage and childhood circumstances and education. Divorced women in England and the USA had relatively better childhood SEP and education than divorced men, whilst remarried men had relatively higher childhood SEP than remarried women. This in accordance with previous research which has shown that remarriage for women is negatively associated with education and that more highly educated women don't tend to remarry after a divorce, whilst the reverse is apparent for men (Shafer and James, 2013) (Coleman et al., 2000).

Why the stark gender differences in the association between early life factors and marital status? The answer lies in the norms surrounding the gender roles within marriage which were prevalent for this generation of men and women. Up until the 1970s the male breadwinner family predominated in which men provided the economic resources and women the homemaking (Lewis, 2001). Becker theorised that people enter into marriage if they expect to gain economically from marriage (Becker, 1981), therefore men who were highly educated and had the potential to be high earners made attractive candidates for marriage, whilst men with low education and poor job prospects made less attractive candidates, as they wouldn't be adequately able to provide the economic resources expected of them within marriage. Conversely women with lower levels of education may have decided to marry during this period as they had limited opportunities in the labour market and were able (and possibly more willing) instead to fulfil the role of a homemaker. The economic gains from marriage for highly educated women, who also may have had a higher family SEP, were not so great as they were for less educated women as they were able to support themselves financially (Cherlin, 2009) (Becker, 1981). Additionally, highly educated women had the educational resources to possibly question societal expectations surrounding marriage and to decide to remain single. With the expansion of female employment and the ensuing move away from the male breadwinner marriage to the dual earner marriage the negative association in particular between education and entry into marriage for women changed. Research has shown

that in countries which have maintained traditional gender roles better educated women are still less likely to marry than less educated women (Kalmijn, 2013). Since the 1970s in the USA and in Britain, when the traditional gender roles within marriage began to dissolve, the association between education and entry into marriage changed for women and now, similarly to men, there is a positive association between education and entry into marriage (Torr, 2011). However, this analysis shows that for the majority of men and women in this generation, who would have entered marriage from the late 1940s to the late 1980s in England and the USA, marriage was still positively associated with SEP for men and negatively associated for women.

One other interesting finding to emerge from this analysis was that remarried men in both England and the USA had more highly educated fathers, than men in their first marriage. Whilst there is no or little evidence of the effect of childhood circumstances on the propensity to remarry, there is evidence on family structure and SEP and divorce, which is relevant here as the majority of men who were remarried had previously been divorced. During times when divorce was not prevalent, which would have been during the sample members early years in England and the USA (prior to the 1960s), evidence shows that those who had a higher SEP were more likely to divorce, as they not only had the material resources to divorce (as there was no legal aid during this period), but also more liberal attitudes and were therefore more likely to reject traditional norms (Goode, 1962). It's possible that as remarried men's parents had a high SEP they were also more likely to have been divorced and experiencing parental divorce is in turn strongly associated with a higher risk of divorce later on in adulthood (Amato and Deboer, 2001) (Lyngstad and Jalovaara, 2010). Unfortunately, this possible explanation could not be investigated further in this analysis as the HRS did not include a measure of parental divorce.

8.2.2 Childhood SEP, education and widowhood

The discussion so far has focussed on the differentials in childhood circumstances and education between those who are married and those who are either divorced or never married. The analysis also showed that widowed men and women had poorer childhood SEP and lower levels of education than those who had remained in their first marriage, which could suggest that widowhood is also a selective experience. This could be due to assortative mating; the concept that people tend to marry people with similar attributes to themselves (see Section 2.5.1). Those who are widowed would have selected spouses who had equally low childhood SEP (Kalmijn, 1998) as themselves and therefore would be at risk of a higher rate of mortality (Galobardes et al., 2004). There is substantial evidence showing the social gradient of health and mortality with those from a lower SEP, not just in childhood but across the life course, facing greater risks of poorer health and

higher mortality than those with a higher SEP (Marmot, 2006) (Bartley, 2004). People also select spouses who exhibit similar health behaviours (Agrawal et al., 2006), levels of psychological wellbeing (Mathews and Reus, 2001) and physical health. Given the evidence on assortative mating and on health concordance among couples (Meyler et al., 2007) it is unsurprising that this analysis showed that those who were widowed were more socio-economically disadvantaged throughout the life course than their married peers, although their poorer childhood circumstances did not explain their poorer physical capability.

8.2.3 Differences between England and the USA in the association between childhood SEP, education and marital status

There were a couple of differences between England and the USA in the association between childhood SEP and education and marital status for both men and women. Divorced men in England had relatively lower levels of education than divorced men in the USA which may suggest that divorce is more adversely selective of education in England than it is in the USA. This finding is not a result of men with relatively higher levels of education being selected into remarriage in England and not the USA, therefore leaving those with lower levels of education divorced, as remarried men in the two countries had comparable levels of education. There is no prior research on this particular topic and at present it is uncertain what could be explaining this difference.

The second difference between the two countries was amongst never married women. Never married women in England were more likely to have had a highly educated mother and they themselves were also relatively more highly educated than never married women in the USA. There is no previous research which has compared the educational attainment of those who never marry in England to the USA, but perhaps women in England had to make the choice between a family or a career, whilst in the USA women were more able to combine both. Or perhaps because marriage was more normative in the USA than it was in England - Cherlin cites that marriage has always been a major part of American life since the colonial era more so than in Europe (Cherlin, 2009) - that remaining single may not have been a viable option for many American women. Whereas in England, perhaps highly educated mothers encouraged their daughters to pursue their education over marriage since marriage was less prevalent and therefore remaining unmarried was possibly less stigmatised. Whilst these are plausible propositions more research is needed to explain the possible explanations for this difference. Such research could look a selection into marriage in countries which have differing attitudes towards gender roles within marriage to help understand the role of societal context in selection into marriage. For instance prior research has found that associations between education and selection into marriage varies between countries,

with lower educated women being selected into marriage in more gender unequal countries whilst in more gender equal countries highly educated women were more likely to be selected into marriage (Kalmijn, 2013).

Overall, the analysis in this thesis has highlighted some interesting differences between the various marital statuses and for this generation of people the strong association between marriage and health remains, despite the great changes in marriage which occurred during their lifetimes.

8.3 Strengths and limitations of the research

There are a number of strengths and limitations to this analysis presented in this thesis. The limitations discussed in this section are general limitations which are applicable for all the analyses, whilst specific limitations for each of the analyses are discussed in the relevant chapters (see Sections 5.7.1, 6.6.1 and 7.4.1).

8.3.1 Strengths

The analysis used two large nationally representative datasets of older people in England and the USA, which meant that marriage and physical capability could be studied within an international context and the results could be extrapolated to the national population. Using datasets with a large number of participants also meant that the different legal marital statuses could be investigated independently for men and women. This included being able to separate out those who were in their first marriage and those in a subsequent marriage. ELSA and the HRS are sister studies which share many of the same measures and almost identical physical performance protocols. Consequently, most of the measures did not need to be harmonised as they were identical, which leads to more reliable estimates and less bias caused by measurement error.

Another strength of this research is the use of the physical performance measures as outcomes of physical capability. The physical performance measures are not prone to inconsistencies in interpretation, unlike self-reported measures of physical capability (Daltroy et al., 1999). Different interpretations of the self-reported measures could be due to differing levels of education and cognitive functioning or cultural differences between the two countries in how physical capability is viewed (Guralnik et al., 1989). As described in the earlier methods section (Section 4.2.2), evidence suggests that Americans have a better sense of control (which is the belief that one is able to control one's life chances, also known as mastery), at older ages than their counterparts in England (Clarke and Smith, 2011), which has been shown to be associated with answering the ADLs more positively (Kempen et al., 2006). Relying upon ADLs could lead to an inaccurate reflection of country differences in physical capability and possibly its association with marriage. In using the

physical performance measures these biases are reduced. Additionally, there is also far less research which has investigated marital status and physical capability using the physical performance measures, particularly within an international context.

The third strength of this analysis is that the physical capability of remarried men and women was explored in detail. There is little previous research which has examined the physical capability of those who are remarried compared to those who are in a first marriage. Instead many prior studies have treated the married as a homogenous group, not differentiating between those who have remained in one marriage throughout the life course and those who are in subsequent marriages. At older ages those who are married may have experienced very different relationship trajectories to one another, which could have comprised multiple marital transitions. The evidence on remarriage and physical capability presented in this thesis is novel and has shown that, contrary to the existing evidence (Hughes and Waite, 2009), for men remarriage is associated with higher physical capability and also that their prior transitions out of marriage do not seem to affect their physical capability. Similarly, in using a measure of marital status which also differentiated between divorce and widowhood transitions out of marriage the research could compare the effects on physical capability of the different types of transitions out of marriage. There is only one previous study which has looked at the differences in divorced and widow(er)s' physical performance (Clouston et al., 2014). This research builds on this scant evidence.

The final strength of the analysis is that, since walking speed is collected at every wave of ELSA, the analysis was able to use trajectories of walking speed, measured biennially over a ten year period. There has been no prior research which has looked into marital status and changes in physical capability using physical performance measures measured at two year time points over such a substantial period of time, as previous studies had only looked at two time points over 6 years (Goldman et al., 1995) or 10 years (van den Brink et al., 2004). With time, this analysis could be developed further as more waves of ELSA become available.

8.3.2 Limitations

Whilst the analysis has many strengths there are also limitations which need to be borne in mind when interpreting the findings.

The first general limitation surrounded the use of longitudinal data. All longitudinal datasets are subject to attrition of study members so that over time the remaining study sample becomes less representative of the target population. Attrition in ELSA has been shown to be associated with lower levels of educational attainment and poorer cognitive abilities, and on the HRS with lower levels of wealth (Banks et al., 2011). However, the paper also showed that despite attrition on

these two surveys the estimates of disease prevalence was unaltered, which could suggest that attrition may not affect the physical capability estimates. The paper also found that those who were divorced and aged between 70 and 80 years were more likely to drop out from ELSA, but not from the HRS, which could mean that the results of divorced men and women in ELSA presented in this analysis are biased. However, the analyses in this thesis did control for attrition by either using the cross-sectional sample weights (used in Chapter 5), or by adjusting for factors which are associated with the propensity to drop out (used in Chapters 6 and 7).

Another limitation to the analysis is that the role of social support in the relationship between marital status and physical capability was not investigated. Social support was not included for a number of reasons. The evidence on the relationship between social support and physical capability is mixed, with some evidence showing that receipt of social support is associated with poorer physical capability (Avlund et al., 2004), whilst other evidence shows social support from a spouse has little or no association with physical capability (Litwin and Stoeckel, 2013). Additionally, it could also be argued that social support was measured in the analysis as marital status is often used as a proxy for social support (Barrera, 1986), although this assumes that all those who are married receive social support from their spouse, which may not be the case. Finally, social support was not included as on both ELSA and the HRS measures of social support are collected in the self-completion questionnaire, which is more prone to non-response than the main interview leading to a further reduced analytic sample.

As detailed in the methods chapter (Chapter 4) the analysis did not separate out the participants who were cohabiting from the other unmarried statuses. This decision was made because there were too few cohabiting people for a sufficiently well powered statistical analysis. The analysis contained in Appendix B showed that the cohabiters were a distinct group from both those who were married and those who were unmarried and not cohabiting. However, due to the small numbers of cohabiters, the sensitivity analysis also showed that either including the cohabiters in with the married categories or within the unmarried categories did not alter the physical capability effect estimates significantly.

Additionally, the analysis presented here did not adjust for living arrangements and whether those who were unmarried but living with others (who was not a partner) had different levels of physical capability than those who were unmarried and living on their own. Research has shown that those who were living with people, other than their spouse or partner, had poorer physical capability than those who were living on their own (Hughes and Waite, 2002). Living arrangements were not included as they were not the main focus of the analysis. If these were included the direction of the association would be unclear: whether those who live with others may do so

because they have poorer physical capability and need help with certain tasks, or whether living arrangements may affect physical capability.

Another limitation to the analysis is that it may not be generalisable to later generations and the findings may only be specific to this particular cohort of people. The change in marriage and divorce patterns, the rise of cohabitation and the "deinstitutionalisation of marriage" (Cherlin, 2004), could mean that the observed association between marriage and physical capability may change or not even exist for later born cohorts, as other forms of partnerships and remaining single become more acceptable and more normative experiences. Also, given that different countries experience distinct marriage and divorce patterns and hold differing attitudes towards marriage (Soons and Kalmijn, 2009) the associations found in this analysis may not be generalisable to other countries.

The analysis was also not able to investigate any of the differences that were found in the association between marriage and physical capability between England and the USA, but could only speculate. However, overall there were few differences between England and the USA which suggests that there is consistency in the association between marriage and physical capability between these two countries.

Finally, the original aim of this thesis was to investigate marital history as well as current marital status and physical capability. Marital history would comprise the number of transitions out of marriage and the duration spent in each marital status. However, this was not possible with the data. There were too few participants, particularly in ELSA, who had experienced multiple transitions out of marriage (47 men and 111 women in ELSA, and 135 men and 454 women in the HRS had experienced more than one transition out of marriage). Only investigating one transition out of marriage was the viable option and this was captured by using the current marital status measure used in the analyses.

Analysis was also carried out to investigate the association between the duration spent married and physical capability (see Appendix J). However the analysis showed that there was not a significant association between duration spent married and physical capability. This could be because the majority of the ELSA and the HRS samples had been married for a long period of time (in ELSA the mean number of years spent in a first marriage was 26.93 years whilst on the HRS it was 45.13 years). Also, duration of time spent in marriage is dependent upon age of entry into marriage, which is known to be associated with SEP with those from a higher SEP getting married at an older age (Hughes and Waite, 2009). Because of this it would be hard to disentangle the effects of higher SEP from the effect of an accumulation of time spent married, as well as to disentangle

age effects as older people would have been married for longer and also have poorer physical capability.

8.4 Further research

This thesis has identified a number of areas for future research. This research showed that men who were remarried had better physical capability than men who had remained in their first marriage. This was surprising given the current evidence (Carr and Springer, 2010). More research is needed to investigate remarried men and women's physical capability and the role of selective factors into remarriage.

There could be more research to explain some of the education differentials in certain unmarried statuses between England and the USA. Why were never married women relatively more educated in England than they were in the USA? Could it be, as suggested in this thesis, that as marriage was more prevalent in the USA highly educated women were possibly able to combine having a career with being married and raising a family more than similarly educated women were in England? Likewise, more research is needed to investigate why divorced men in England had relatively less education than divorced men in the USA. Could this be due to different selective factors out of marriage in England and the USA? Linked to this, further research could look at selection into marriage using studies in Britain and the USA, which collected data on childhood and early adult circumstances prospectively, so that more detailed analysis could be carried out on which factors early in the life course predict entry into marriage and whether there are any differences between the two countries.

Future research could also extend the longitudinal analysis on marital status and physical capability by investigating whether selective factors earlier in the life course, such as childhood SEP, or whether diminished social networks in adulthood, explain widowed and never married men's and women's greater decline in walking speed. Further research in this area could also use time-varying covariates and look into dealing with missing data possibly through using multiple imputation.

Finally, a growing body of research has investigated marital quality and whether being in any marriage, even a bad one, is better than no marriage for both physical and psychological health, with evidence showing that marital quality is important for health (Umberson et al., 2006) (Kiecolt-Glaser and Newton, 2001). There, however was not any research identified, which had investigated the association between marital quality and physical capability and future research could address this gap.

8.5 Policy implications

Although, this thesis shows that marriage is good for maintaining physical capability, it is not proposed that marriage be promoted for all, as has been done the US government in recent years (Cherlin, 2009). Not only because some of the "marriage advantage" could be attributable to selective factors into marriage, but also because marriage may not be a suitable or desired option for many unmarried people.

Given the strong association between marriage and wealth, the main policy implication of this research is that the poorer physical capability of those who are unmarried could potentially be reduced or alleviated by improving the economic situation of those who never marry, or experience marital dissolution, so that by middle to older ages they are not so materially disadvantaged.

Those who were widowed were shown to be particularly disadvantaged in terms of their physical capability. It would therefore be recommended to improve the circumstances of those who experience widowhood by improving their access to economic resources and possibly consider them a target group for monitoring their physical capability, or providing support to help improve their physical capability.

8.6 Conclusions

This thesis set out to investigate the relationship between marriage and both current levels and changes in physical capability, at older ages. The main conclusions which can be drawn from this thesis are that marriage is associated with both better current levels of physical capability and maintaining good levels of physical capability over the longer term, whilst being unmarried is associated with somewhat poorer current levels of physical capability, and for those who were widowed or never married, more rapid declines in physical capability over the longer term. Much of the association between marriage and physical capability was explained by wealth. Those who were married have accrued more wealth by the time they had reached mid to later life than those who were unmarried and wealth has been shown to be strongly associated with physical capability (Gjonca et al., 2009). One unexpected finding, given the existing evidence (Carr and Springer, 2010) was that remarried men had a stronger grip strength than men who had remained in their first marriage, which was not explained by any of the observed pathways. It is possible that unobserved selective factors into marriage could explain remarried men's higher grip strength, but this needs to be investigated further.

Childhood circumstances did not explain unmarried men and women's poorer cross-sectional physical capability. However, evidence contained in this thesis did show that there were

differences in early life factors between married and unmarried men and women. Those who were married had a higher childhood SEP and were more educated than those who had either remained divorced or widowed or (for men only) had never married in the first instance. These differences could point to an element of selection into and out of marriage, with different selective factors operating for men and women.

There were also few differences between the USA and England and both countries showed similar associations between marriage and physical capability, even though the two countries have different marriage and divorce patterns, with some evidence of different selective factors into marriage, as well as different levels of welfare provision and different levels of physical capability.

To conclude, this thesis has shown that marriage is still an important social institution today for maintaining physical capability among the older population, despite this particular group of people experiencing great changes in marriage and divorce which occurred from the 1970s onwards. It will be interesting to see in decades to come whether the association between marriage and physical capability remains for later born cohorts who have witnessed the rise in cohabitation and further changes to the institution of marriage.

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Appendix A: Cleaning the marital status variable in ELSA

An exercise to clean the marital status variable was conducted in ELSA to ensure that the measure of marital status used at Wave 4 was accurate. As the life history interview collected marital history from early adulthood through to 2007, which was between ELSA Wave 3 and Wave 4, marital status data collected during the core interviews, at Waves 1, 2 and 3, could be checked against the relationship history recalled in the life history interview and vice versa. Additionally, marital status collected at each wave of ELSA was checked against the surrounding waves to ensure it was plausible. This did not need to be executed in the HRS as RAND had already created cleaned marriage variables at each wave of the HRS.[15]

The first step in the cleaning process was checking the life history marriage data against marital status collected at Waves 1 to 3. There was found to be a number of cases whose core data did not match up with the marital history that they have recalled in the life history data. The table below (Table A.1) shows how many cases were affected at each wave.

Table A.1: Inconsistencies between marriage data in the ELSA life history and in the ELSA core data Waves 1 to 3

	Wave 1	Wave 2	Wave 3
In first marriage in the core data but not in first marriage in the life history data	72	128	130
Remarried in the core data but not remarried in the life history data	17	12	26
Divorced in the core data but not divorced in the life history data	10	19	31
Widowed in the core data but not widowed in the life history data	35	26	36
Never married in the core data but have been married in the life history data	18	9	17
Total (N)	*152*	*194*	*240*

The next step was to check the marital status data collected at each wave of ELSA. Marital status at each wave was checked against the subsequent waves and implausible marital status changes were flagged up, for example if a participant said they had been married at Wave 1 but by Wave 2 they said they were never married. Table A.2 shows the implausible marital status changes between Waves 1 and 2, highlighted in bold. The same checks were carried out between Wave 2 and Wave 3, between Wave 3 and Wave 4, Wave 4 and Wave 5 and Wave 5 and Wave 6.

[15] See https://www.g2aging.org/ for more information.

Table A.2: Implausible marital status changes between Wave 1 and Wave 2 of ELSA

	Wave 2				
Wave 1	**Married, first and only marriage**	**Remarried, second or later marriage**	**Divorced / separated**	**Widowed**	**Never married**
Married, first and only marriage	5,011	50	34	151	**1**
Remarried, second or later marriage	**128**	900	27	27	0
Divorced / separated	17	56	898	**33**	**7**
Widowed	**1**	11	**18**	1,451	**3**
Never married	10	0	**4**	**3**	481
Total (N)	*5,167*	*1,017*	*981*	*1,665*	*492*

After all the problematic cases had been identified, the next step was to resolve the problem cases. This was done through looking at other information available in ELSA including:

- Checking marital status at all waves of ELSA to see what had been recorded.
- Checking the household grid to see if there was a spouse present.
- Occasionally checking their partner's relationship history in the life history data.

Final decisions on what the correct marital status was likely to be were made on a case by case basis. Table A.3 shows the number of cases for men and women who had their marital status changed as well as a comparison of the original and the cleaned marital status variables.

Table A.3: Marital status changes as a result of cleaning for men and women in ELSA

	Men				
	Cleaned Wave 4 marital status variable				
	First marriage	Remarried	Divorced / separated	Widowed	Never married
Original Wave 4 marital status variable					
First marriage	0	47	10	1	6
Remarried	5	0	0	0	0
Divorced	2	0	0	2	0
Widowed	0	0	8	0	1
Never married	0	0	5	1	0
Total (N)	*7*	*47*	*23*	*4*	*7*
	Women				
	Cleaned Wave 4 marital status variable				
	First marriage	Remarried	Divorced / separated	Widowed	Never married
Original Wave 4 marital status variable					
First marriage	0	44	4	1	1
Remarried	4	0	1	0	1
Divorced	0	2	0	5	0
Widowed	0	0	24	0	2
Never married	0	0	3	2	0
Total (N)	*4*	*46*	*32*	*8*	*4*

Appendix B: Cohabitation analysis

The purpose of this analysis was to investigate whether those who were unmarried and were cohabiting (from here on in called cohabiters) differed in their demographic, socio-economic characteristics, their health behaviours, their health and their physical capability to those who were not cohabiting and to those who were married. This analysis was carried out in order to assess whether cohabiters should remain in their legal marital status category or whether they should be included in the one of the marriage categories.

Methods

For this analysis the same analytic sample was used as for the cross-sectional analysis on current marital status and physical capability which was drawn from Waves 4 of ELSA and Waves 8 and 9 of the HRS. A variable was created which differentiated between those who were married, those who were cohabiting, and those were unmarried and not cohabiting. Table B.1 shows the numbers who were married, cohabiting, and unmarried and not currently cohabiting among men and women in ELSA or the HRS. The majority of those who were unmarried were not cohabiting among both men and women in ELSA and the HRS.

Table B.1: Numbers cohabiting in ELSA and the HRS

	ELSA				HRS			
	Men		Women		Men		Women	
Married	75.4%	2,557	59.7%	2,463	76.9%	4,239	52.7%	4,000
Unmarried - cohabiting	3.8%	129	3.8%	158	3.8%	207	2.5%	193
Unmarried - not cohabiting	20.8%	705	36.5%	1,508	19.3%	1,066	44.8%	3,398
Total (N)	*3,391*		*4,129*		*5,512*		*7,591*	

Analytic methods

Firstly, descriptive analysis was run to show whether those who cohabit differ in their demographic and socio-economic characteristics (including previous marital status), their health behaviours and their physical health and psychological morbidity to both those who do not cohabit and those who are married. Logistic regression was carried out to check for significant differences.

A sensitivity analysis was then run to investigate whether including the unmarried cohabiters in with the married categories altered the results of the cross-sectional analysis on current marital status and physical capability analysis, shown in Chapter 6.

Results: descriptive analysis

The analysis which follows was age adjusted although cohabiters tended to be younger than unmarried non-cohabiters. The analysis was also stratified by gender, although men were more

likely to cohabit than women, and interactions were run to check whether there were any differences in the associations by gender.

Men

Table B.2 shows the results for men. In ELSA cohabiting men had comparable grip strength and walking speed to married men and unmarried men had weaker grip strength and slower walking speed to married men. In the HRS there were some differences between cohabiting men and married and unmarried men. Cohabiting men in the HRS had a weaker grip strength than those who were married (22.37 kgs/m compared to 23.10 kgs/m for married men) and a more comparable grip strength to those who were unmarried, whilst for the measure of walking speed cohabiting men had a similar walking speed to those who were married, but a faster walking speed to those who were unmarried. There was no modification in the association by country. The majority of those who were cohabiting were divorced on both ELSA (63.6%) and the HRS (67.6%), however double the percentage of cohabiters in the HRS were widowed than they were in ELSA (10.1% in ELSA compared to 22.1% in the HRS).

On the demographic and socio-economic measures those who were cohabiting had different characteristics to those who were married, but also to those who were unmarried. Overall cohabiters had lower levels of wealth compared to those who were married, but higher levels than those who were unmarried. They also had lower levels of education than their married counterparts and had more similar levels of education to those who remained unmarried. In ELSA a lower percentage of cohabiters had children compared to those who were married (75.7% in comparison to 90.5% of married men), but this was a higher percentage than those who were unmarried. This was not apparent in the HRS where cohabiters were just as likely to have children as those who were married and more likely than those who remained unmarried.

Overall in their health behaviours cohabiters were more similar to those who were married than they were to those who were unmarried. Cohabiters were as physically active and had a comparable BMI to married men, but with smoking they were more similar to unmarried men and were just as likely to be current smokers as unmarried men. On both ELSA and the HRS those who were cohabiting reported similar self-rated health and psychological morbidity to those who were married.

To summarise, men who cohabited had lower SEP than married men, but a higher SEP than unmarried men. However, in their health behaviours and physical health and psychological morbidity cohabiting men were more similar to married men than they were to unmarried men.

Table B.2: Comparison of married, cohabiting and unmarried men, ELSA and the HRS, adjusted for age

	ELSA			HRS		
	Married	**Cohabiting**	**Unmarried**	**Married**	**Cohabiting**	**Unmarried**
Mean grip strength (kgs/m)	23.19	22.72	22.18**	23.10	22.37*	21.96**
Mean walking speed (m/s)	0.921	0.871	0.844**	0.798	0.788	0.722**
	%	**%**	**%**	**%**	**%**	**%**
Current marital status						
Married	100.0	0.0	0.0	100.0	0.0	0.0
Divorced / separated	0.0	63.6	37.0	0.0	67.6	44.8
Widowed	0.0	10.1	36.5	0.0	22.1	41.0
Never married	0.0	26.4	26.5	0.0	10.3	14.2
Ethnicity						
White	97.0	98.7	97.9	81.1	70.7**	70.7**
Non-white (ELSA only)	3.0	1.3	2.1			
Hispanic (HRS only)				8.3	7.9	7.8
Black (HRS only)				9.2	18.7**	20.4**
Other (HRS only)				1.4	2.4	0.8
Education						
Low	42.8	50.4	53.3**	50.0	60.7*	56.8**
Medium	36.2	35.3	31.0*	19.6	16.1	22.5*
High	20.1	14.0	14.7*	30.1	23.3*	20.4**
Wealth						
Low	9.3	21.7**	31.8**	10.2	23.0**	34.8**
2	16.9	17.4	21.6*	17.8	20.3	19.2
3	21.1	15.0	17.3*	22.0	18.1	18.4*
4	25.2	14.9*	17.1**	23.8	18.0*	14.2**
High	27.5	30.8	12.2**	25.7	18.9	13.4*
Employment status						
Currently working	34.9	34.9	18.3**	31.4	25.4	22.6**
Not working	65.1	65.1	81.7**	68.6	74.6	77.4**
Parental status						
Has children	90.5	75.7**	63.6**	97.1	95.6	82.0**
No children	9.5	24.3**	36.4**	2.9	4.4	18.0**
Smoking						
Never smoked	33.4	22.1*	29.1*	32.7	23.8*	29.8
Former smoker	56.9	61.6	47.8**	54.2	49.1	46.4**
Current smoker	9.2	15.2*	21.9**	11.9	23.8**	21.9**
Physical activity						
Sedentary	3.9	6.3	5.6*	4.7	4.7	5.7
Low	15.4	12.2	22.6**	19.4	24.1	26.0*
Moderate	53.9	49.8	49.8	41.3	33.7*	36.2*
High	25.3	28.9	19.3*	33.0	35.4	29.4*
BMI						
Underweight / normal weight BMI<26	20.3	26.0	26.2*	24.7	33.1*	33.4**
Overweight BMI 26-29	50.8	42.7	44.8*	41.7	39.9	38.7
Obese BMI 30+	28.8	31.0	28.7	33.0	26.8*	27.0**
Self-rated health						
Excellent - very good	45.6	47.1	37.8**	42.3	38.0	36.9**
Good	31.9	28.2	30.2	32.1	28.3	28.0*
Fair - poor	22.2	24.2	31.2**	25.4	33.5*	34.6**
Health conditions						
No health conditions	31.7	29.3	30.1	11.8	14.4	11.8
1 health condition	31.7	33.8	29.4	24.0	20.7	25.2
2 health conditions	20.9	18.2	21.4	27.1	23.9	24.4
3+ health conditions	12.4	13.9	14.0	33.5	36.2	34.0
Psychological morbidity						
CES-D<3	88.4	85.2	74.4**	86.8	83.0	71.3**
CES-D 3+	11.6	14.8	25.6**	13.2	17.0	28.7**
Total (N)	*2,557*	*129*	*705*	*4,239*	*207*	*1,066*

** p<0.05 ** p<0.001 married v cohabiting or unmarried and not cohabiting*

Women

Table B.3 shows the descriptive analysis for women. Cohabiting women in ELSA and the HRS had a comparable grip strength and walking speed to married women, whilst unmarried women had poorer physical capability to married women. In ELSA cohabiting women were similar to married women in their demographic and socio-economic characteristics and they were just as likely to be white, have comparable levels of education and wealth and were just as likely to be working as married women. In ELSA there was also some modification by gender for wealth and cohabiting women were relatively less likely to have lower levels of wealth than cohabiting men. However, in the HRS cohabiting women were less similar to married women as they had lower levels of wealth (which was also relatively lower levels of wealth than cohabiting women in ELSA) and lower levels of education than married women.

In their health behaviours overall cohabiting women had more similar health behaviours to unmarried women on both ELSA and the HRS. A similar percentage of cohabiting and unmarried women were current smokers, which was a higher percentage than among married women (around 18% of cohabiting and unmarried women in ELSA and the HRS currently smoked compared to 9% of married women). There were no differences among women in their levels of physical activity or in their BMI. In their physical health cohabiting women had comparable self-rated health to married women and were less likely to report poor health than unmarried women. However, a higher proportion of cohabiting women on both ELSA and the HRS reported 3 or more depressive symptoms than married women, although this was a lower percentage than unmarried women.

Overall cohabiting women were different to married women particularly in the HRS. Cohabiting women in ELSA had comparable SEP to married women, but in the HRS cohabiting women had lower SEP than married women. Cohabiting women on both ELSA and the HRS overall had poorer health behaviours and higher levels of psychological morbidity than married women.

Table B.3: Comparison of married, cohabiting and unmarried women, ELSA and the HRS, adjusted for age

	ELSA			HRS		
	Married	**Cohabiting**	**Unmarried**	**Married**	**Cohabiting**	**Unmarried**
Mean grip strength (kgs/m)	14.92	14.62	14.55*	15.14	15.56	14.95*
Mean walking speed (m/s)	0.857	0.801	0.795*	0.729	0.693	0.667**
	%	**%**	**%**	**%**	**%**	**%**
Current marital status						
Married	100.0	0.0	0.0	100.0	0.0	0.0
Divorced / separated	0.0	59.7	33.1	0.0	54.0	29.8
Widowed	0.0	24.5	54.5	0.0	36.6	63.9
Never married	0.0	15.7	12.4	0.0	9.4	6.3
Ethnicity						
White	98.4	99.6	96.8*	82.3	74.1*	65.1**
Non-white (ELSA only)	1.6	0.4	3.2*			
Hispanic (HRS only)	-	-	-	7.9	10.2	9.6*
Black (HRS only)	-	-	-	8.6	13.6*	23.5**
Other (HRS only)	-	-	-	1.2	1.9	1.5
Education						
Low	44.3	45.4	45.8	56.8	67.4*	63.3**
Medium	40.7	39.1	38.0	23.2	18.4	20.8*
High	14.0	14.1	14.8	19.6	14.2*	15.5**
Wealth						
Low	9.4	12.0	30.5**	9.2	19.8**	36.9**
2	16.5	23.7*	24.4**	17.7	24.8*	25.1**
3	21.4	15.5	19.4	22.8	16.4*	16.2**
4	24.7	21.5	14.8**	24.2	19.2	13.4**
High	28.0	26.7	10.7**	26.7	19.6*	8.9**
Work status						
Currently working	18.8	21.8	17.8	19.8	22.8	21.7
Not working	81.2	78.2	82.2	80.2	77.2	78.3
Parental status						
Has children	90.8	78.5**	75.9**	97.2	93.7*	90.7**
No children	9.2	21.5**	24.1**	2.8	6.3*	9.3**
Smoking						
Never smoked	50.3	34.4**	40.6**	56.3	41.3**	47.9**
Former smoker	39.9	44.3	40.6	34.5	37.7	32.7
Current smoker	9.3	18.8**	18.0**	8.8	18.4**	18.1**
Physical activity						
Sedentary	3.7	6.0	4.8	3.1	2.9	5.1**
Low	24.9	22.0	29.7*	30.0	29.3	32.8*
Moderate	51.1	56.9	47.0*	40.4	39.7	39.3
High	17.9	12.7	15.1*	24.3	24.8	19.7**
BMI						
Underweight / normal weight BMI<26	29.5	33.9	33.2*	35.2	32.9	30.9**
Overweight BMI 26-29	37.8	37.2	32.2*	33.0	36.7	29.7*
Obese BMI 30+	32.6	29.0	34.6	31.2	29.7	38.5**
Self-rated health						
Excellent - very good	44.2	42.9	36.9**	44.5	38.5	33.9**
Good	33.6	34.3	31.6	32.3	30.7	31.0
Fair - poor	21.6	21.9	30.5**	22.9	30.6*	34.9**
Health conditions						
No health conditions	26.6	29.3	24.5	9.7	9.6	8.2*
1 health condition	34.1	30.4	30.3*	26.3	26.2	22.2**
2 health conditions	22.3	23.4	21.5	31.5	30.0	27.7*
3+ health conditions	12.6	10.5	17.6**	29.5	30.4	38.6**
Psychological morbidity						
CES-D<3	80.7	71.2*	66.2**	82.0	74.3*	69.2**
CES-D 3+	19.3	28.8*	33.8**	18.0	25.7*	30.8**
Total (N)	*2,463*	*158*	*1,508*	*4,000*	*193*	*3,398*

** p<0.05 ** p<0.001*

Results: sensitivity analysis

A sensitivity analysis was run to examine whether the addition of those who were cohabiting into the marriage categories altered the grip strength and walking speed estimates. Those who were cohabiting were included in the marriage categories. Those who were never married and cohabiting were placed in the first marriage category and those who had previously been married and were now cohabiting were placed in the remarried category (shown in Table B.4 and Table B.5).

Table B.4: Marital status by marital status plus cohabitation in ELSA

	First marriage	Remarried	Divorced / separated	Widowed	Never married
First marriage / never married but cohabiting	4,039	0	0	0	59
Remarried / cohabiting but previously been married	0	981	176	52	0
Divorced and not cohabiting	0	0	759	0	0
Widowed and not cohabiting	0	0	0	1,081	0
Never married and not cohabiting	0	0	0	0	373
Total (N)	*4,039*	*981*	*935*	*1,133*	*432*

Table B.5: Marital status by marital status plus cohabitation in the HRS

	First marriage	Remarried	Divorced	Widowed	Never married
First marriage / never married but cohabiting	5,659	0	0	0	39
Remarried / cohabiting but previously been married	0	2,580	242	119	0
Divorced and not cohabiting		0	1,473	0	0
Widowed and not cohabiting	0	0	0	2,633	0
Never married and not cohabiting	0	0	0	0	358
Total (N)	*5,656*	*2,580*	*1,715*	*2,752*	*397*

Grip strength and walking speed models were run with the new marital status categories, which included those who were cohabiting, and compared them to the models where the exposure was legal marital status. First of all age adjusted models were run followed by the fully adjusted models – adjusted for age, demographic and socio-economic, health behaviour and physical health and psychological morbidity measures.

Men

Table B.6 shows the age only models for grip strength for the two different exposures and Table B.7 shows a comparison of the fully adjusted models for the two exposures. Overall the estimates with the cohabiters included in with the married categories were similar to the estimates when they were included in their legal marital status category.

Table B.6: Comparison of age adjusted grip strength for men in ELSA

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Legal marital status (ref category: First marriage)**		
Remarried/ cohabiting but previously been married	0.58*	0.22	Remarried	0.61*	0.24
Divorced and not cohabiting	-0.49	0.31	Divorced / separated	-0.27	0.28
Widowed and not cohabiting	-0.85*	0.33	Widowed	-0.89*	0.32
Never married and not cohabiting	-1.44**	0.36	Never married	-1.46**	0.34
Age (ref category: 50-59 years)			**Age (ref category: 50-59 years)**		
60-69 years	-2.07**	0.20	60-69 years	-2.11**	0.20
70-79 years	-4.78**	0.23	70-79 years	-4.82**	0.23
80+ years	-8.17**	0.34	80+ years	-8.19**	0.34
Constant	*25.69*	*0.17*	***Constant***	*25.74*	*0.17*

** p<0.05 ** p<0.001*

Table B.7: Comparison of full regression model for grip strength for men in ELSA

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Marital status (first marriage ref category)**		
Remarried / previously married and cohabiting	0.69*	0.21	Remarried	0.72*	0.23
Divorced / separated	0.49	0.31	Divorced / separated	0.52	0.28
Widowed	-0.34	0.32	Widowed	-0.40	0.31
Never married	0.12	0.41	Never married	-0.13	0.38
Age (50-59 ref category)					
60-69	-1.58**	0.21		-1.59**	0.21
70-79	-3.65**	0.27		-3.65**	0.27
80+	-6.47**	0.37		-6.46**	0.37
Ethnicity (white ref category)					
Non-white	-1.50*	0.47		-1.51*	0.47
Education (low ref category)					
Medium	-0.01	0.19		-0.02	0.19
High	-0.31	0.24		-0.32	0.24
Wealth (lowest wealth quintile ref category)					
2nd	0.36	0.28		0.35	0.28
3rd	0.92*	0.29		0.90*	0.29
4th	1.21**	0.29		1.20**	0.29
5th high wealth	1.20**	0.30		1.20**	0.3
Work status (working ref category)					
Not working	-1.09**	0.20		-1.09**	0.2
Parental status (has children ref category)					
No children	-0.84*	0.25		-0.75*	0.25
Smoking status (never smoked ref category)					
Former smoker	0.27	0.18		0.27	0.18
Current smoker	0.15	0.27		0.15	0.27
Physical activity (moderate activity ref category)					
Sedentary	-1.63**	0.39		-1.64**	0.39
Low	-0.62*	0.23		-0.62*	0.23
High	0.65*	0.19		0.65*	0.19
Body Mass Index (BMI<25 ref category)					
Overweight BMI (25 -29)	1.25**	0.20		1.25**	0.2
Obese BMI (30+)	1.87**	0.23		1.86**	0.23
Self-rated health (excellent / v. good ref category)					
Good	-0.30	0.19		-0.30	0.19
Fair / poor	-1.21*	0.24		-1.22**	0.24
Chronic health conditions (0 reported conditions ref category)					
Reported 1 condition	-0.09	0.20		-0.08	0.2
Reported 2 conditions	-0.53*	0.23		-0.53	0.23
Reported 3+ conditions	-0.73*	0.28		-0.73*	0.28
CES-D (CES-D<3 ref category)					
CES-D≥3	-0.23	0.24		-0.22	0.24
Constant	*24.29*	*0.39*		*24.32*	*0.39*

** p<0.05 ** p<0.001*

Moving onto men in the HRS, Table B.8 shows the age only models and Table B.9 shows the fully adjusted models for the two exposures. The grip strength estimates for the two exposures were slightly different particularly in the fully adjusted model. The difference in grip strength between remarried men and men in their first marriage was not so large with the inclusion of those who were cohabiting in the married categories. This was largely because those who had previously been married and were cohabiting had a weaker grip strength than those who had remarried, which reduced the stronger grip strength seen among remarried men. Including the cohabiters in with the married categories also changed the estimates for never married men. When cohabiters were included in the married categories never married men had an even weaker grip strength compared to men in their first marriage, than when cohabiters remained in their legal marital status. This could be because never married men who were cohabiting had comparable grip strength to men in their first marriage.

Table B.8: Comparison of age adjusted grip strength for men in the HRS

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Legal marital status (ref category: First marriage)**		
Remarried/ cohabiting but previously been married	0.13	0.14	Remarried	0.26	0.15
Divorced and not cohabiting	-0.73*	0.23	Divorced / separated	-0.79**	0.21
Widowed and not cohabiting	-1.05**	0.24	Widowed	-0.94**	0.24
Never married and not cohabiting	-2.74**	0.39	Never married	-2.28**	0.37
Age (ref category: 50-59 years)			**Age (ref category: 50-59 years)**		
60-69 years	-2.54**	0.18	60-69 years	-2.57**	0.18
70-79 years	-4.98**	0.18	70-79 years	-5.03**	0.18
80+ years	-8.48**	0.22	80+ years	-8.54**	0.22
Constant	*26.71*	*0.15*	***Constant***	*26.74*	*0.15*

** p<0.05 ** p<0.001*

Table B.9: Comparison of full model for grip strength for men in the HRS

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Marital status (first marriage ref category)**		
Remarried / previously married and cohabiting	0.22	0.14	Remarried	0.31*	0.14
Divorced / separated	0.08	0.23	Divorced / separated	-0.05	0.20
Widowed	-0.48*	0.23	Widowed	-0.41	0.23
Never married	-1.55**	0.43	Never married	-0.97*	0.40
Age (50-59 ref category)					
60-69	-2.05**	0.18		-2.07**	0.18
70-79	-3.98**	0.20		-4.00**	0.20
80+	-6.79**	0.25		-6.82**	0.25
Ethnicity (white ref category)					
Hispanic	-1.23**	0.22		-1.22**	0.22
Black	-0.02	0.19		-0.01	0.19
Other	-1.06*	0.50		-1.04*	0.50
Education (low ref category)					
Medium	0.23	0.16		0.22	0.16
High	-0.40*	0.15		-0.40*	0.15
Wealth (lowest wealth quintile ref category)					
2nd	0.47*	0.21		0.45*	0.21
3rd	0.92**	0.21		0.91**	0.21
4th	1.11**	0.21		1.10**	0.21
5th high wealth	1.27**	0.22		1.26**	0.22
Work status (working ref category)					
Not working	-0.72**	0.15		-0.72**	0.15
Parental status (has children ref category)					
No children	-0.84*	0.29		-1.03**	0.29
Smoking status (never smoked ref category)					
Former smoker	0.09	0.13		0.09	0.13
Current smoker	0.19	0.19		0.21	0.19
Physical activity (moderate activity ref category)					
Sedentary	-2.81**	0.27		-2.81**	0.27
Low	-0.80**	0.16		-0.79**	0.16
High	0.15	0.14		0.16	0.14
Body Mass Index (BMI<25 ref category)					
Overweight BMI (25 -29)	1.18**	0.15		1.18**	0.15
Obese BMI (30+)	2.00**	0.16		1.99**	0.16
Self-rated health (excellent / v. good ref category)					
Good	-0.27	0.14		-0.27	0.14
Fair / poor	-0.90**	0.17		-0.90**	0.17
Chronic health conditions (0 reported conditions ref category)					
Reported 1 condition	-0.38	0.20		-0.38	0.20
Reported 2 conditions	-1.05**	0.20		-1.06**	0.20
Reported 3+ conditions	-1.58**	0.21		-1.58**	0.21
CES-D (CES-D<3 ref category)					
CES-D≥3	-0.45*	0.17		-0.46*	0.17
Constant	26.08	0.31		*26.09*	*0.31*

** p<0.05 ** p<0.001*

Table B.10 and Table B.11 show the comparative models for walking speed for men in ELSA. Including those who were cohabiting in with the married categories did not change the walking speed estimates from what they were when those who were cohabiting remained in their legal marital status.

Table B.10: Comparison of age adjusted walking speed for men in ELSA

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Legal marital status (ref category: First marriage)**		
Remarried/ cohabiting but previously been married	-0.013	0.019	Remarried	-0.003	0.020
Divorced and not cohabiting	-0.087*	0.029	Divorced / separated	-0.082*	0.027
Widowed and not cohabiting	-0.075**	0.021	Widowed	-0.080**	0.020
Never married and not cohabiting	-0.105*	0.033	Never married	-0.103*	0.032
Age (ref category: 60-69 years)			**Age (ref category: 60-69 years)**		
70-79 years	-0.087**	0.015	70-79 years	-0.087**	0.015
80+ years	-0.265**	0.021	80+ years	-0.263**	0.020
Constant	*0.973*	*0.013*	***Constant***	*0.973*	*0.013*

** p<0.05 ** p<0.001*

Table B.11: Comparison of full model for walking speed for men in ELSA

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Marital status (first marriage ref category)**		
Remarried / previously married and cohabiting	0.004	0.017	Remarried	0.014	0.017
Divorced / separated	-0.007	0.025	Divorced / separated	-0.015	0.024
Widowed	-0.037*	0.018	Widowed	-0.042*	0.018
Never married	-0.082*	0.034	Never married	-0.082*	0.033
Age (60-69 ref category)					
70-79	-0.066**	0.013		-0.066**	0.013
80+	-0.204**	0.019		-0.202**	0.019
Ethnicity (white ref category)					
Non-white	-0.177**	0.042		-0.179**	0.042
Education (low ref category)					
Medium	0.044*	0.014		0.044*	0.014
High	0.064*	0.019		0.065*	0.019
Wealth (lowest wealth quintile ref category)					
2nd	0.015	0.021		0.015	0.021
3rd	0.022	0.020		0.021	0.02
4th	0.059*	0.021		0.058*	0.021
5th high wealth	0.096**	0.022		0.094**	0.022
Work status (Working ref category)					
Not working	-0.002	0.019		-0.002	0.019
Parental status (has children ref category)					
No children	-0.005	0.021		-0.002	0.021
Smoking status (never smoked ref category)					
Former smoker	-0.004	0.013		-0.003	0.013
Current smoker	-0.024	0.023		-0.023	0.023
Physical activity (moderate activity ref category)					
Sedentary	-0.206**	0.025		-0.204**	0.025
Low	-0.092**	0.016		-0.092**	0.016
High	0.065**	0.016		0.064**	0.016
Body Mass Index (BMI<25 ref category)					
Overweight BMI (25 -29)	0.000	0.015		0.000	0.015
Obese BMI (30+)	-0.031	0.017		-0.030	0.017
Self-rated health (excellent / v. good ref category)					
Good	-0.042*	0.014		-0.042*	0.014
Fair / poor	-0.120**	0.017		-0.121**	0.017
Chronic health conditions (0 reported conditions (ref category)					
Reported 1 condition	0.004	0.016		0.004	0.016
Reported 2 conditions	-0.001	0.017		-0.001	0.017
Reported 3+ conditions	-0.045*	0.019		-0.045*	0.019
CES-D (CES-D<3 ref category)					
CES-D≥3	-0.032	0.018		-0.031	0.018
Constant	0.971	0.032		*0.972*	*0.032*

** p<0.05 ** p<0.001*

In the HRS, similarly to what was seen in ELSA, the inclusion of men who were cohabiting in the married categories did not alter the estimates significantly (shown in Table B.12 and Table B.13).

Table B.12: Comparison of age adjusted walking speed for men in the HRS

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Legal marital status (ref category: First marriage)**		
Remarried/ cohabiting but previously been married	0.000	0.010	Remarried	0.001	0.011
Divorced and not cohabiting	-0.078**	0.017	Divorced / separated	-0.062**	0.016
Widowed and not cohabiting	-0.086**	0.014	Widowed	-0.082**	0.014
Never married and not cohabiting	-0.086*	0.031	Never married	-0.081*	0.030
Age (ref category: 60-69 years)			**Age (ref category: 60-69 years)**		
70-79 years	-0.066**	0.010	70-79 years	-0.066**	0.010
80+ years	-0.188**	0.012	80+ years	-0.188**	0.012
Constant	*0.873*	*0.009*	***Constant***	*0.873*	*0.009*

** p<0.05 ** p<0.001*

Table B.13: Comparison of full model for walking speed for men in the HRS

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Marital status (first marriage ref category)**		
Remarried / previously married and cohabiting	0.014	0.009	Remarried	0.016	0.010
Divorced / separated	-0.010	0.016	Divorced / separated	-0.002	0.015
Widowed	-0.036*	0.013	Widowed	-0.037*	0.013
Never married	-0.030	0.032	Never married	-0.021	0.032
Age (65-69 ref category)					
70-79	-0.055**	0.009		-0.055**	0.009
80+	-0.153**	0.012		-0.152**	0.012
Ethnicity (white ref category)					
Hispanic	-0.065**	0.015		-0.065**	0.015
Black	-0.116**	0.013		-0.116**	0.013
Other	-0.045	0.036		-0.044	0.036
Education (low ref category)					
Medium	0.043**	0.011		0.043**	0.011
High	0.036**	0.010		0.036**	0.01
Wealth (lowest wealth quintile ref category)					
2nd	0.013	0.015		0.014	0.015
3rd	0.027	0.014		0.028	0.014
4th	0.058**	0.015		0.059**	0.015
5th high wealth	0.063**	0.015		0.064**	0.015
Work status (working ref category)					
Not working	-0.031*	0.010		-0.031*	0.010
Parental status (has children ref category)					
No children	-0.036	0.021		-0.039	0.021
Smoking status (never smoked ref category)					
Former smoker	-0.001	0.009		-0.001	0.009
Current smoker	-0.019	0.014		-0.019	0.014
Physical activity (moderate activity ref category)					
Sedentary	-0.179**	0.016		-0.178**	0.016
Low	-0.051**	0.010		-0.051**	0.01
High	0.029*	0.010		0.029*	0.01
Body Mass Index (BMI<25 ref category)					
Overweight BMI (25 -29)	0.010	0.009		0.01	0.009
Obese BMI (30+)	-0.005	0.011		-0.004	0.011
Self-rated health (excellent / v. good ref category)					
Good	-0.025*	0.010		-0.025*	0.01
Fair / poor	-0.079**	0.011		-0.079**	0.011
Chronic health conditions (0 reported conditions (ref category)					
Reported 1 condition	-0.014	0.016		-0.014	0.016
Reported 2 conditions	-0.023	0.015		-0.023	0.015
Reported 3+ conditions	-0.054**	0.015		-0.054**	0.015
CES-D (CES-D<3 ref category)					
CES-D≥3	-0.027*	0.012		-0.027*	0.012
Constant	*0.919*	*0.023*		*0.918*	*0.023*

** p<0.05 ** p<0.001*

Women

Among women on both ELSA and the HRS there was little difference in the grip strength estimates for the two exposures and the estimates were comparable when those who were cohabiting were included with the married categories to when they were included in their legal marital status (as shown in Table B.14 through to Table B.17).

Table B.14: Comparison of age adjusted grip strength women in ELSA

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Legal marital status (ref category: First marriage)**		
Remarried/ cohabiting but previously been married	0.05	0.16	Remarried	0.18	0.18
Divorced and not cohabiting	-0.38*	0.17	Divorced / separated	-0.39*	0.16
Widowed and not cohabiting	-0.36*	0.16	Widowed	-0.33*	0.16
Never married and not cohabiting	-0.51	0.27	Never married	-0.36	0.25
Age (ref category: 50-59 years)			**Age (ref category: 50-59 years)**		
60-69 years	-1.14**	0.14	60-69 years	-1.15**	0.14
70-79 years	-3.01**	0.16	70-79 years	-3.03**	0.16
80+ years	-5.45**	0.22	80+ years	-5.48**	0.22
Constant	*16.59*	*0.11*	***Constant***	*16.59*	*0.11*

** p<0.05 ** p<0.001*

Table B.15: Comparison of the full model grip strength for women in ELSA

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Marital status (first marriage ref category)**		
Remarried / previously married and cohabiting	0.24	0.15	Remarried	0.36	0.17
Divorced / separated	0.12	0.18	Divorced / separated	0.04	0.17
Widowed	0.02	0.16	Widowed	0.01	0.15
Never married	-0.31	0.29	Never married	-0.27	0.27
Age (50-59 ref category)					
60-69	-0.78**	0.15		-0.78**	0.15
70-79	-2.07**	0.18		-2.06**	0.18
80+	-3.97**	0.24		-3.97**	0.24
Ethnicity (white ref category)					
Non-white	-0.11	0.34		-0.1	0.34
Education (low ref category)					
Medium	0.15	0.12		0.15	0.12
High	0.45*	0.17		0.46*	0.17
Wealth (lowest wealth quintile ref category)					
2nd	-0.04	0.18		-0.05	0.17
3rd	0.21	0.18		0.20	0.18
4th	0.40*	0.19		0.38*	0.18
5th high wealth	0.60**	0.20		0.58*	0.19
Work status (working ref category)					
Not working	-0.43**	0.14		-0.43*	0.14
Parental status (has children ref category)					
No children	0.13	0.16		0.13	0.16
Smoking status (never smoked ref category)					
Former smoker	0.18	0.11		0.18	0.11
Current smoker	0.81**	0.17		0.82**	0.17
Physical activity (moderate activity ref category)					
Sedentary	-1.49**	0.25		-1.49**	0.25
Low	-0.62**	0.13		-0.63**	0.13
High	0.59**	0.15		0.58**	0.15
Body Mass Index (BMI<25 ref category)					
Overweight BMI (25 -29)	0.46**	0.13		0.46**	0.13
Obese BMI (30+)	0.95**	0.14		0.95**	0.14
Self-rated health (excellent / v. good ref category)					
Good	-0.53**	0.13		-0.53	0.13
Fair / poor	-1.08**	0.16		-1.08	0.16
Chronic health conditions (0 reported conditions (ref category)					
Reported 1 condition	-0.11	0.14		-0.11	0.14
Reported 2 conditions	-0.45**	0.16		-0.45*	0.16
Reported 3+ conditions	-0.74**	0.19		-0.74**	0.19
CES-D (CES-D<3 ref category)					
CES-D≥3	-0.54**	0.13		-0.54**	0.13
Constant	*16.12*	*0.24*		*16.14*	*0.24*

** p<0.05 ** p<0.001*

Table B.16: Comparison of age adjusted grip strength for women in the HRS

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Legal marital status (ref category: First marriage)**		
Remarried/ cohabiting but previously been married	-0.02	0.11	Remarried	-0.06	0.12
Divorced and not cohabiting	-0.21	0.13	Divorced / separated	-0.10	0.12
Widowed and not cohabiting	-0.40**	0.11	Widowed	-0.39**	0.11
Never married and not cohabiting	-0.06	0.25	Never married	0.09	0.24
Age (ref category: 50-59 years)			**Age (ref category: 50-59 years)**		
60-69 years	-1.55**	0.11	60-69 years	-1.54**	0.11
70-79 years	-3.17**	0.12	70-79 years	-3.17**	0.12
80+ years	-5.61**	0.15	80+ years	-5.61**	0.15
Constant	*17.60*	*0.10*	***Constant***	*17.58*	*0.10*

** p<0.05 ** p<0.001*

Table B.17: Comparison of the full model for grip strength for women in the HRS

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Marital status (first marriage ref category)**		
Remarried / previously married and cohabiting	0.01	0.11	Remarried	-0.01	0.11
Divorced / separated	-0.05	0.13	Divorced / separated	0.04	0.13
Widowed	-0.22*	0.11	Widowed	-0.20	0.1
Never married	0.01	0.27	Never married	0.24	0.26
Age (50-59 ref category)					
60-69	-1.22**	0.11		-1.22**	0.11
70-79	-2.41**	0.13		-2.41**	0.13
80+	-4.27**	0.16		-4.27**	0.16
Ethnicity (white ref category)					
Hispanic	-0.28	0.14		-0.28	0.14
Black	1.29**	0.12		1.27**	0.12
Other	0.48	0.32		0.48	0.32
Education (low ref category)					
Medium	0.00	0.10		-0.01	0.1
High	-0.01	0.11		-0.02	0.11
Wealth (lowest wealth quintile ref category)					
2nd	0.52**	0.12		0.54**	0.12
3rd	0.54**	0.13		0.56**	0.13
4th	0.67**	0.13		0.70**	0.13
5th high wealth	0.62**	0.14		0.65**	0.14
Work status (working ref category)					
Not working	-0.46**	0.10		-0.45**	0.1
Parental status (has children ref category)					
No children	-0.21	0.18		-0.29	0.18
Smoking status (never smoked ref category)					
Former smoker	0.13	0.08		0.13	0.08
Current smoker	0.61**	0.12		0.60**	0.12
Physical activity (moderate activity ref category)					
Sedentary	-1.91**	0.19		-1.90**	0.19
Low	-0.45**	0.09		-0.45**	0.09
High	0.10	0.10		0.10	0.10
Body Mass Index (BMI<25 ref category)					
Overweight BMI (25 -29)	0.60**	0.10		0.60**	0.10
Obese BMI (30+)	1.18**	0.10		1.18**	0.10
Self-rated health (excellent / v. good ref category)					
Good	-0.27*	0.09		-0.28**	0.09
Fair / poor	-0.99**	0.12		-0.98**	0.12
Chronic health conditions (0 reported conditions (ref category)					
Reported 1 condition	-0.46*	0.14		-0.46*	0.14
Reported 2 conditions	-0.59**	0.14		-0.59**	0.14
Reported 3+ conditions	-1.16**	0.15		-1.16**	0.15
CES-D (CES-D<3)					
CES-D≥3	-0.36**	0.10		-0.37**	0.10
Constant	*17.27*	*0.20*		*17.24*	*0.20*

** p<0.05 ** p<0.001*

Turning now to walking speed for women. For women on both ELSA and the HRS there were no differences between the estimates for the two exposures in either the age only model (Table B.18 for ELSA and Table B.20 for the HRS) or the fully adjusted model (Table B.19 for ELSA and Table B.21 for the HRS).

Table B.18: Comparison of age adjusted walking speed women in ELSA

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Legal marital status (ref category: First marriage)**		
Remarried/ cohabiting but previously been married	-0.034	0.021	Remarried	-0.026	0.023
Divorced and not cohabiting	-0.056*	0.021	Divorced / separated	-0.056*	0.020
Widowed and not cohabiting	-0.057**	0.014	Widowed	-0.057**	0.014
Never married and not cohabiting	-0.066*	0.029	Never married	-0.064*	0.029
Age (ref category: 60-69 years)			**Age (ref category: 60-69 years)**		
70-79 years	-0.118**	0.014	70-79 years	-0.118**	0.014
80+ years	-0.308**	0.018	80+ years	-0.308**	0.018
Constant	*0.928*	*0.012*	***Constant***	*0.928*	*0.012*

** p<0.05 ** p<0.001*

Table B.19: Comparison of full model of walking speed for women in ELSA

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Marital status (first marriage ref category)**		
Remarried / previously married and cohabiting	0.010	0.017	Remarried	0.020	0.019
Divorced / separated	0.001	0.018	Divorced / separated	-0.002	0.017
Widowed	0.002	0.012	Widowed	0.000	0.012
Never married	-0.030	0.028	Never married	-0.033	0.028
Age (60-69 ref category)					
70-79	-0.070**	0.012		-0.069**	0.012
80+	-0.221**	0.016		-0.220**	0.016
Ethnicity (white ref category)					
Non-white	-0.147**	0.038		-0.148**	0.038
Education (low ref category)					
Medium	0.028*	0.011		0.028*	0.011
High	0.053*	0.018		0.053*	0.018
Wealth (lowest wealth quintile ref category)					
2nd	0.007	0.016		0.007	0.016
3rd	0.047	0.016		0.046*	0.016
4th	0.068**	0.017		0.067**	0.017
5th high wealth	0.104**	0.018		0.103**	0.018
Work status (Working ref category)					
Not working	-0.050*	0.020		-0.050*	0.02
Parental status (has children ref category)					
No children	-0.003	0.016		-0.002	0.016
Smoking status (never smoked ref category)					
Former smoker	0.004	0.010		0.004	0.01
Current smoker	0.013	0.018		0.013	0.018
Physical activity (moderate activity ref category)					
Sedentary	-0.196**	0.019		-0.196**	0.019
Low	-0.106**	0.012		-0.107**	0.012
High	0.009	0.016		0.009	0.016
Body Mass Index (BMI<25 ref category)					
Overweight BMI (25 -29)	-0.025*	0.012		-0.026*	0.012
Obese BMI (30+)	-0.058**	0.013		-0.058**	0.013
Self-rated health (excellent / v. good ref category)					
Good	-0.060**	0.012		-0.060**	0.012
Fair / poor	-0.166**	0.014		-0.167**	0.014
Chronic health conditions (0 reported conditions ref category)					
Reported 1 condition	-0.007	0.015		-0.007	0.015
Reported 2 conditions	-0.021	0.015		-0.021	0.015
Reported 3+ conditions	-0.062**	0.017		-0.061**	0.017
CES-D (CES-D<3 ref category)					
CES-D≥3	-0.045**	0.012		-0.045**	0.012
Constant	*1.026*	*0.028*		*1.027*	*0.028*

** p<0.05 ** p<0.001*

Table B.20: Comparison of age adjusted walking speed women in the HRS

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Legal marital status (ref category: First marriage)**		
Remarried/ cohabiting but previously been married	0.000	0.011	Remarried	0.005	0.012
Divorced and not cohabiting	-0.071**	0.013	Divorced / separated	-0.066**	0.012
Widowed and not cohabiting	-0.065**	0.009	Widowed	-0.066**	0.009
Never married and not cohabiting	-0.077*	0.025	Never married	-0.074*	0.024
Age (ref category: 60-69 years)			**Age (ref category: 60-69 years)**		
70-79 years	-0.087**	0.009	70-79 years	-0.087**	0.009
80+ years	-0.228**	0.010	80+ years	-0.228**	0.010
Constant	*0.829*	*0.008*	***Constant***	*0.829*	*0.008*

** p<0.05 ** p<0.001*

Table B.21: Comparison of full model of walking speed for women in HRS

Marital status including cohabiting status			Legal marital status		
	Coeff	**SE**		**Coeff**	**SE**
Marital status including cohabitation (ref category: First marriage / cohabiting never married)			**Marital status (first marriage ref category)**		
Remarried / previously married and cohabiting	0.009	0.010	Remarried	0.015	0.011
Divorced / separated	0.001	0.012	Divorced / separated	0.001	0.011
Widowed	-0.006	0.008	Widowed	-0.008	0.008
Never married	-0.027	0.024	Never married	-0.028	0.024
Age (65-69 ref category)					
70-79	-0.077**	0.008		-0.077**	0.008
80+	-0.205**	0.010		-0.204**	0.01
Ethnicity (white ref category)					
Hispanic	-0.050**	0.012		-0.049**	0.012
Black	-0.084**	0.010		-0.084**	0.01
Other	0.023	0.030		0.024	0.03
Education (Low ref category)					
Medium	0.035**	0.008		0.035**	0.008
High	0.025*	0.010		0.025*	0.01
Wealth (lowest wealth quintile ref category)					
2nd	0.024*	0.010		0.024*	0.01
3rd	0.056**	0.010		0.055**	0.01
4th	0.078**	0.011		0.077**	0.011
5th high wealth	0.072**	0.012		0.072**	0.012
Work status (working ref category)					
Not working	-0.034**	0.010		-0.034**	0.01
Parental status (has children ref category)					
No children	0.002	0.016		0.003	0.016
Smoking status (never smoked ref category)					
Former smoker	0.006	0.007		0.006	0.007
Current smoker	0.012	0.011		0.013	0.011
Physical activity (moderate activity ref category)					
Sedentary	-0.188**	0.014		-0.189**	0.014
Low	-0.062**	0.008		-0.062**	0.008
High	0.001	0.009		0.000	0.009
Body Mass Index (BMI<25 ref category)					
Overweight BMI (25 -29)	0.002	0.008		0.002	0.008
Obese BMI (30+)	-0.038**	0.008		-0.038**	0.008
Self-rated health (excellent / v. good ref category)					
Good	-0.045**	0.008		-0.045**	0.008
Fair / poor	-0.101**	0.009		-0.101**	0.009
Chronic health conditions (0 reported conditions (ref category)					
Reported 1 condition	-0.004	0.014		-0.004	0.014
Reported 2 conditions	-0.016	0.014		-0.016	0.014
Reported 3+ conditions	-0.048*	0.014		-0.048*	0.014
CES-D (CES-D<3 ref category)					
CES-D≥3	-0.034**	0.008		-0.034**	0.008
Constant	*0.893*	*0.019*		*0.893*	*0.019*

** p<0.05 ** p<0.001*

Overall the sensitivity analysis showed that there did not seem to be any large differences between the estimates for men and women when those who were cohabiting were included in the marriage categories and the estimates when they were included in the legal marital status category.

Appendix C: Checking for outliers in the measure of walking speed and grip strength

Checks were run to see if there were any outliers in either the measure of grip strength or walking speed.

Grip strength

In both ELSA and the HRS there were no obvious outliers in grip strength. The minimum and maximum values are given in Table C.1, which are the crude values that have not been adjusted for height. In ELSA the grip strength measures were rounded in the original archived dataset to no decimal places. Figure C.1 and Figure C.2 show the distribution of grip strength by age in ELSA and the HRS, respectively.

Table C.1: Minimum and maximum grip strength values in kgs on ELSA and the HRS

	ELSA kgs	HRS kgs
Minimum value	0.00	0.38
Maximum value	70.00	72.50

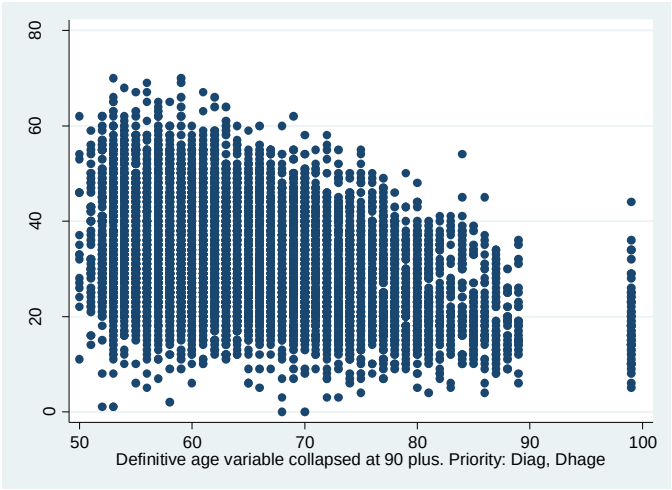

Figure C.1: Scatter plot of grip strength by age, ELSA Wave 4

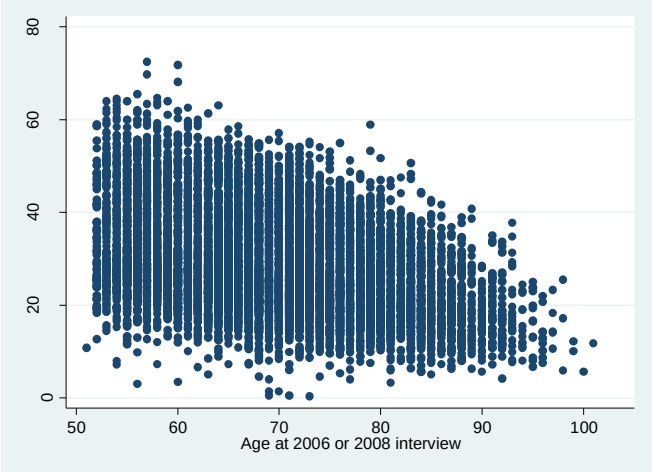

Figure C.2: Scatter plot of grip strength by age, HRS Waves 8 and 9

Walking speed

The derived measure of walking speed, which has been derived on the publicly archived dataset, was used on ELSA, which was the mean walking speed out of the two walks in metres per second. The derived measure discounted speeds which were extreme. The cutoffs for extreme speeds were speeds of 30 seconds or above and 0.54 seconds or below, which translated into 0.080 m/s and below and 4.52 m/s or above.

Although, the HRS did not have a derived measure of walking speed in metres per second on the publicly archived dataset the walking speed measure was created using the same derivation syntax provide in the ELSA Wave 2 user guide. The syntax is shown in Table C.4. The syntax was adjusted to take into account the length of the walking speed course, which was slightly longer than in ELSA, 2.5 metres compared to 2.44 metres. Therefore, the HRS walking speed measure also had the extreme speeds removed.

The tables below (Table C.2 and Table C.3) show the maximum and minimum walking speed values for ELSA, from Waves 1 to 4, and for the HRS.

Table C.2: Minimum and maximum walking speeds (metres per second) in ELSA

	Wave 1 (m/s)	Wave 2 (m/s)	Wave 3 (m/s)	Wave 4 (m/s)	Wave 5 (m/s)	Wave 6 (m/s)
Minimum	0.082	0.091	0.088	0.088	0.087	0.083
Maximum	2.112	2.348	2.206	2.268	2.279	2.438

Table C.3: Minimum and maximum walking speeds (metres per second) in the HRS

	Waves 8 or 9 (m/s)
Minimum	0.084
Maximum	2.500

The two scatter plots show the distribution of walking speed by age for ELSA Wave 4 (Figure C.3) and the HRS Waves 8 and 9 (Figure C.4).

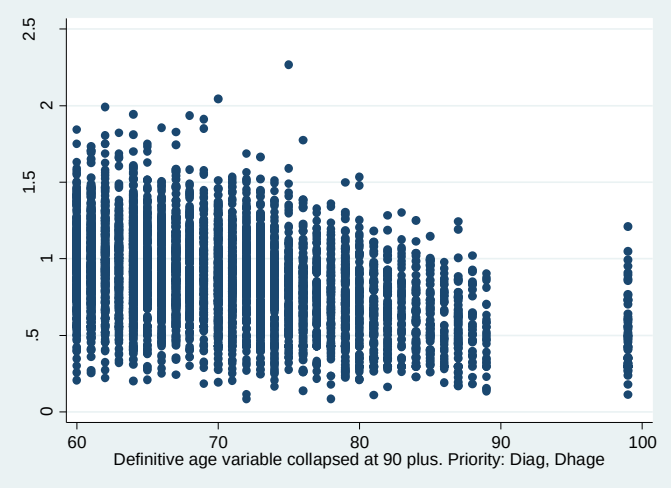

Figure C.3: Scatter plot of walking speed by age, ELSA Wave 4

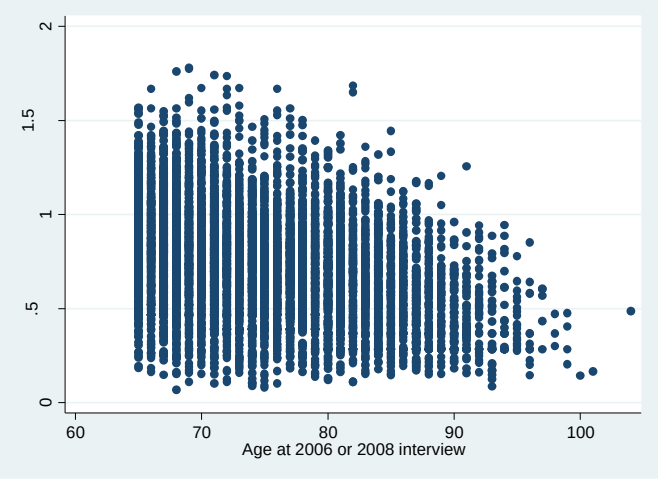

Figure C.4:Scatter plot of walking speed by age, HRS Waves 8 and 9

Table C.4: ELSA mean walking speed derivation syntax

```
NUMERIC gtspd_av (F8.4).
DO IF indager < 60.
COMPUTE gtspd_av = -98.
END IF.
EXECUTE.
DO IF SYSMIS(gtspd_av) AND (w2indout = 13 OR w2indout = 23).
COMPUTE gtspd_av = -97.
END IF.
EXECUTE.
DO IF (SYSMIS(gtspd_av) AND mmschs = -1 AND mmalone = -1 AND mmhss = -
1 AND mmwill = -1 AND mmsaf = -1 AND mmavsp = -1 AND mmwala = -1 AND
mmtrya = -1 AND mmwlka = -1 AND mmtryb = -1 AND mmwlkb = -1).
COMPUTE gtspd_av = -96.
END IF.
EXECUTE.
DO IF (SYSMIS(gtspd_av) AND (mmschs=-9 OR mmalone = -9 OR mmhss = -9
OR mmwill = -9 OR mmwala = -9 OR mmtrya=-9 OR mmtrya=4 OR mmwlka=-9)).
COMPUTE gtspd_av = -95.
END IF.
EXECUTE.
DO IF (SYSMIS(gtspd_av) AND (mmalone = -8 OR mmwala=-8 OR mmhss=-8 OR
mmwill=-8)).
COMPUTE gtspd_av = -94.
END IF.
EXECUTE.
DO IF SYSMIS(gtspd_av) AND mmalone = 3.
COMPUTE gtspd_av = -93.
END IF.
EXECUTE.
DO IF SYSMIS(gtspd_av) AND mmalone = 2.
COMPUTE gtspd_av = -92.
END IF.
EXECUTE.
DO IF SYSMIS(gtspd_av) AND (mmhss = 2 OR mmhss = 3 OR mmhss = 4).
COMPUTE gtspd_av = -91.
END IF.
EXECUTE.
DO IF SYSMIS(gtspd_av) AND mmwill = 2.
COMPUTE gtspd_av = -90.
END IF.
EXECUTE.
DO IF (SYSMIS(gtspd_av) AND (mmsaf = -9 OR mmavsp=-9)).
COMPUTE gtspd_av = -89.
END IF.
EXECUTE.
DO IF (SYSMIS(gtspd_av) AND (mmsaf = -8 OR mmavsp=-8)).
COMPUTE gtspd_av = -88.
END IF.
EXECUTE.
DO IF SYSMIS(gtspd_av) AND mmsaf = 2.
COMPUTE gtspd_av = -87.
END IF.
EXECUTE.
DO IF SYSMIS(gtspd_av) AND mmavsp = 2.
COMPUTE gtspd_av = -86.
END IF.
EXECUTE.
DO IF SYSMIS(gtspd_av) AND mmwala = 2.
COMPUTE gtspd_av = -85.
END IF.
EXECUTE.
DO IF (SYSMIS(gtspd_av) AND (mmtrya = 2 OR mmtrya=3)).
COMPUTE gtspd_av = -84.
END IF.
EXECUTE.
DO IF (SYSMIS(gtspd_av) AND (mmwlka >= 30 OR (mmwlka>0 AND mmwlka <=
```

```
0.54)) AND (mmwlkb >= 30 OR (mmwlkb>0 AND mmwlkb <= 0.54))).
COMPUTE gtspd_av = -83.
END IF.
EXECUTE.
DO IF (SYSMIS(gtspd_av) AND (mmwlka >= 30 OR mmwlka <= 0.54) AND
mmwlkb < 0).
COMPUTE gtspd_av = -82.
END IF.
EXECUTE.
DO IF SYSMIS(gtspd_av) AND mmwlka < 30 AND mmwlka > 0.54 AND mmwlkb <
30 AND mmwlkb > 0.54.
COMPUTE gtspd_av = ((2.4384/mmwlka) + (2.4384/mmwlkb))/2.
END IF.
EXECUTE.
DO IF SYSMIS(gtspd_av) AND mmwlka < 30 AND mmwlka > 0.54.
COMPUTE gtspd_av = 2.4384/mmwlka.
END IF.
EXECUTE.
DO IF SYSMIS(gtspd_av) AND mmwlkb < 30 AND mmwlkb > 0.54.
COMPUTE gtspd_av = 2.4384/mmwlkb.
END IF.
EXECUTE.
VAR LAB gtspd_av "(D) Mean gait speed (m/s)".
VAL LAB gtspd_av
-98 "Under 60 years of age"
-97 "Proxy interview"
-96 "Not applicable throughout"
-95 "Participant refused at some stage"
-94 "Participant gave 'don't know' response at some stage"
-93 "Unable to walk alone"
-92 "Able to walk alone but no aid available"
-91 "Health restriction"
-90 "Unwilling to do test"
-89 "Interviewer refused to answer"
-88 "Interviewer gave DK response"
-87 "Interviewer felt not safe"
-86 "No available space"
-85 "Participant felt unsafe"
-84 "Walk A not completed or stopped"
-83 "No speed - both times extreme"
-82 "No speed - A extreme, B not completed or refused".
```

Taken from (Nunn, 2008)

Appendix D: Father's occupation harmonisation

Table D.1 for ELSA and Table D.2 for the HRS show the original father's occupation categories (in the left hand column) and how they were coded into the derived variable which contained five categories (in the right hand column): Higher managerial / Intermediate / Routine or manual / Other / Unemployed, sick or retired. The HRS changed their standard occupational classification (SOC) coding in 2012 and Table C.2 provides detail on how the pre 2012 and the 2012 coding was harmonised.

Table D.1: ELSA father's occupation original categories and new categories

Original variable categories	Derived 5 categories occupation variable
Armed Forces	Other
Manager or senior official in someone else's business	Higher managerial admin
Running his own business	Higher managerial admin
Professional or technical	Higher managerial admin
Administrative, clerical or secretarial	Intermediate
Skilled trade	Intermediate
Caring, leisure, travel or personal services	Intermediate
Sales or customer service	Intermediate
Plant, process or machine drivers or operators	Routine and manual
Other jobs	Other
Something else	Other
Casual jobs	Routine and manual
Retired	Unemployed / sick / retired
Unemployed	Unemployed / sick / retired
Sick / disabled	Unemployed / sick / retired
Refusal	Missing
Don't Know	Missing
Not applicable	Missing

Table D.2: HRS father's occupation original categories and new categories

Pre 2012 SOC coding	2012 SOC coding	Derived 5 categories occupation variable
Professional, technical workers (023-024, 026-027, 034-036,038- 235)	01. Management Occupations (000-044) 02 Business Operations Specialists (050-073) 03. Financial Specialists (080-095) 04. Computer and Mathematical Occupations (100-124) 05. Architecture and Engineering Occupations (130-156) 06. Life, Physical, and Social Science Occupations (160-196) 07. Community and Social Services Occupations (200-206) 08. Legal Occupations (210-215) 09. Education, Training, and Library Occupations (220-255)	**Higher managerial admin**
Managers, officials and proprietors (003-019, 025, 028-033,037)	11 Healthcare Practitioners and Technical Occupations (300-354)	**Higher managerial admin**
Clerical and kindred workers (303-389)	18 Office and Administrative Support Occupations (500-593) 12. Healthcare Support Occupations (360-365) 13. Protective Service Occupations (370-395) 24. Transportation and Material Moving Occupations (900-975) 16 Personal care and service operations	**Intermediate**
Sales workers (243-285)	10. Arts, Design, Entertainment, Sports, and Media Occupations (260-296)	**Intermediate**
Craftsmen, foremen and kindred workers (413-414, 416-425, 503-699, 803, 843, 863)	14. Food Preparation and Serving Occupations (400-416)	**Intermediate**
Service workers (403-407, 415, 426-469)	17. Sales Occupations (470-496)	**Intermediate**
Operatives and kindred workers (703-799, 804-834, 844-859)	15. Building and Grounds Cleaning and Maintenance Occupations (420-425) 20. Construction Trades (620-676) 21. Extraction Workers (680-694)	**Routine and manual**
Laborers and farm foremen (477-484, 486-489, 495-499, 864-889)	22. Installation, Maintenance, and Repair Workers (700-762) 23. Production Occupations (770-896)	**Routine and manual**
Farmers and farm managers (473-476)	19. Farming, Fishing, and Forestry Occupations (600-613)	**Routine and manual**
DK (don't know); NA (not ascertained)		**Missing**

Appendix E: Analysis of cases which were unable to do the physical performance tests due to health reasons

Table E.1 and Table E.2 compares the age adjusted grip strength and walking speed estimates by marital status for the sample which included those who were unable to do the tests for health reasons and the sample where they were excluded. The overall mean grip strength and walking speed was higher when those who were unable to do the test for health reasons were excluded from the analysis in both ELSA and the HRS. However, there were no differences by marital status in the mean grip strength and walking speed estimates between the two samples.

Table E.1: Comparison of age adjusted mean grip strength (kgs / m) for samples including and excluding those unable to do the test for health reasons

Men								
	ELSA				**HRS**			
	Including unables		**Excluding unables**		**Including unables**		**Excluding unables**	
	Mean	**SE**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**
Overall mean	22.99	0.07	23.00	0.07	22.83	0.05	22.92	0.05
First marriage	23.07	0.10	23.13	0.10	23.02	0.09	23.09	0.09
Remarried	23.68	0.21	23.79	0.21	23.28	0.12	23.34	0.12
Divorced / separated	22.80	0.26	22.84	0.26	22.23	0.19	22.43	0.19
Widowed	22.17	0.30	22.28	0.31	22.08	0.22	22.15	0.22
Never married	21.60	0.32	21.68	0.32	20.74	0.36	20.80	0.36
Total (N)	*3,382*		*3,350*		*5,406*		*5,339*	
Women								
	ELSA				**HRS**			
	Including unables		**Excluding unables**		**Including unables**		**Excluding unables**	
	Mean	**SE**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**
Overall mean	14.80	0.06	14.88**	0.06	15.08	0.05	15.27**	0.05
First marriage	14.89	0.08	14.95	0.08	15.20	0.07	15.36	0.07
Remarried	15.07	0.16	15.14	0.16	15.15	0.10	15.32	0.10
Divorced / separated	14.50	0.14	14.57	0.14	15.10	0.11	15.32	0.11
Widowed	14.56	0.13	14.67	0.13	14.81	0.08	15.04	0.08
Never married	14.53	0.24	14.60	0.24	15.29	0.23	15.46	0.23
Total (N)	*4,096*		*4,402*		*7,345*		*7,063*	

** p<0.05 ** p<0.001*

Tests of significance were carried out by running a linear regression on grip strength, adjusted for age and a variable which flagged whether cases were able or unable to do the grip strength test due to health reasons.

Table E.2: Comparison of age adjusted mean walking speed (m/s) for samples including and excluding those unable to do the test for health reasons

	Men							
	ELSA				HRS			
	Including unables		Excluding unables		Including unables		Excluding unables	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Overall mean	0.858	0.007	0.878**	0.007	0.780	0.004	0.800**	0.004
First marriage	0.885	0.009	0.901	0.009	0.799	0.006	0.814	0.006
Remarried	0.881	0.018	0.907	0.018	0.800	0.009	0.822	0.009
Divorced / separated	0.803	0.025	0.823	0.026	0.737	0.015	0.767	0.015
Widowed	0.804	0.018	0.820	0.019	0.717	0.013	0.744	0.013
Never married	0.781	0.031	0.800	0.031	0.718	0.030	0.728	0.029
Total (N)	*1,630*		*1,556*		*3,541*		*5,339*	
	Women							
	ELSA				HRS			
	Including unables		Excluding unables		Including unables		Excluding unables	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Overall mean	0.781	0.006	0.810**	0.006	0.699	0.004	0.724**	0.004
First marriage	0.809	0.009	0.834	0.009	0.731	0.006	0.814	0.006
Remarried	0.783	0.021	0.811	0.021	0.736	0.010	0.822	0.009
Divorced / separated	0.753	0.018	0.791	0.018	0.666	0.011	0.767	0.015
Widowed	0.752	0.010	0.783	0.011	0.666	0.006	0.744	0.013
Never married	0.745	0.028	0.781	0.028	0.657	0.023	0.728	0.029
Total (N)	*2,015*		*1,866*		*4,796*		*7,063*	

** p<0.05 ** p<0.001*

Tests of significance were carried out by running a linear regression on walking speed test, adjusted for age and a variable which flagged whether cases were able or unable to do the grip strength test due to health reasons.

Appendix F: Weighted cross-sectional analysis on marital status and physical capability

Analysis was run both with and without the cross sectional weights to check whether or not weighting the data gave different estimates to the unweighted analysis presented in Chapter 6. The weighted tables are presented below (Table F.1 to Table F.8). Adding the weights to the analysis did change some of the marital status estimates for grip strength and walking speed in both ELSA and the HRS, but not substantially. Overall the weighted analysis was similar to the unweighted analysis presented in Chapter 6.

Grip strength

Table F.1: Weighted grip strength coefficients, ELSA men

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	0.68*	0.25	0.85*	0.25	0.80*	0.24	0.81*	0.24
Divorced / separated	-0.44	0.33	0.41	0.33	0.47	0.32	0.48	0.32
Widowed	-0.88*	0.32	-0.38	0.31	-0.29	0.31	-0.28	0.31
Never married	-1.34**	0.38	0.02	0.43	0.13	0.42	0.14	0.42
Age (50-59 ref category)								
60-69	-2.12**	0.23	-1.61**	0.25	-1.61**	0.24	-1.63**	0.24
70-79	-4.93**	0.24	-3.89**	0.31	-3.84**	0.30	-3.86**	0.30
80+	-8.11**	0.32	-6.98**	0.38	-6.56**	0.39	-6.48**	0.39
Ethnicity (white ref category)								
Non-white			-2.38**	0.60	-1.90*	0.59	-1.74*	0.56
Education (low ref category)								
Medium			0.03	0.21	0.02	0.20	-0.09	0.20
High			-0.38	0.26	-0.27	0.26	-0.44	0.26
Wealth (lowest wealth quintile ref category)								
2nd			0.67*	0.33	0.45	0.33	0.32	0.33
3rd			1.58**	0.32	1.25**	0.32	0.99*	0.32
4th			1.73**	0.32	1.41**	0.32	1.14**	0.32
5th high wealth			2.03**	0.32	1.63**	0.33	1.23**	0.33
Work status (working ref category)								
Not working			-1.62**	0.24	-1.34**	0.23	-1.03**	0.22
Parental status (has children ref category)								
No children			-1.05**	0.28	-0.92*	0.27	-0.93*	0.27
Smoking status (never smoked ref category)								
Former smoker					0.18	0.19	0.26	0.19
Current smoker					-0.11	0.31	0.06	0.30
Physical activity (moderate activity ref category)								
Sedentary					-2.38**	0.49	-1.73**	0.50
Low					-0.76*	0.26	-0.45	0.26
High					0.68*	0.20	0.53*	0.20
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					1.35**	0.22	1.38**	0.22
Obese BMI (30+)					1.70**	0.25	1.91**	0.25
Self-rated health (excellent / v. good ref category)								
Good							-0.34	0.20
Fair / poor							-1.24*	0.27
Chronic health conditions (0 reported conditions ref category)								
Reported 1 condition							-0.04	0.21
Reported 2 conditions							-0.40	0.24
Reported 3+ conditions							-0.78*	0.33
CES-D								
CES-D≥3							-0.52	0.29
Constant	*25.60*	*0.20*	*24.83*	*0.34*	*23.70*	*0.40*	*24.33*	*0.42*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table F.2: Weighted grip strength coefficients, HRS men

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	0.29	0.19	0.37*	0.18	0.40*	0.18	0.43*	0.18
Divorced / separated	-0.78**	0.25	-0.18	0.24	-0.02	0.24	0.00	0.24
Widowed	-1.11**	0.32	-0.61	0.32	-0.55	0.31	-0.46	0.31
Never married	-2.33**	0.47	-1.04	0.54	-0.96	0.54	-0.99	0.53
Age (50-59 ref category)								
60-69	-2.21**	0.20	-2.00**	0.21	-1.98**	0.21	-1.83**	0.21
70-79	-5.06**	0.19	-4.48**	0.22	-4.32**	0.22	-4.02**	0.23
80+	-8.82**	0.25	-8.14**	0.29	-7.41**	0.29	-7.04**	0.30
Ethnicity (white ref category)								
Hispanic			-1.16**	0.29	-1.18**	0.28	-1.12**	0.28
Black			0.00	0.29	-0.02	0.29	0.03	0.29
Other			-0.90	0.59	-0.80	0.59	-0.84	0.58
Education (low ref category)								
Medium			0.37	0.20	0.28	0.20	0.20	0.19
High			-0.10	0.19	-0.15	0.19	-0.36	0.19
Wealth (lowest wealth quintile ref category)								
2nd			0.89**	0.28	0.69*	0.27	0.66*	0.27
3rd			1.67**	0.27	1.41**	0.27	1.16**	0.27
4th			1.86**	0.28	1.55**	0.28	1.24**	0.27
5th high wealth			2.08**	0.28	1.82**	0.28	1.48**	0.28
Work status (ref: working)								
Not working			-1.39**	0.19	-1.13**	0.19	-0.77**	0.18
Parental status (ref: has children)								
No children			-1.14**	0.36	-1.06**	0.36	-1.06**	0.35
Smoking status (never smoked ref category)								
Former smoker					-0.12	0.17	0.04	0.17
Current smoker					-0.05	0.23	0.12	0.23
Physical activity (moderate activity ref category)								
Sedentary					-3.21**	0.37	-2.68**	0.38
Low					-0.82**	0.20	-0.63**	0.20
High					0.23	0.17	0.08	0.17
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					1.09	0.18**	1.20**	0.17
Obese BMI (30+)					1.68	0.20**	2.03**	0.20
Self-rated health (excellent / v. good ref category)								
Good							-0.43*	0.17
Fair / poor							-1.01**	0.22
Chronic health conditions (0 reported conditions ref category)								
Reported 1 condition							-0.41	0.23
Reported 2 conditions							-1.01**	0.23
Reported 3+ conditions							-1.53**	0.26
CES-D								
CES-D≥3							-0.43	0.22
Constant	*26.81*	*0.17*	*25.82*	*0.29*	*25.08*	*0.35*	*25.99*	*0.37*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table F.3: Weighted grip strength coefficients, ELSA women

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	0.10	0.20	0.25	0.19	0.25	0.18	0.34	0.18
Divorced / separated	-0.44*	0.21	-0.01	0.20	-0.01	0.20	0.12	0.20
Widowed	-0.26	0.17	0.01	0.18	0.01	0.17	0.14	0.17
Never married	-0.36	0.24	-0.21	0.28	-0.20	0.28	-0.13	0.28
Age (50-59 ref category)								
60-69	-1.03**	0.15	-0.66**	0.17	-0.67**	0.16	-0.69**	0.16
70-79	-3.06**	0.17	-2.35**	0.21	-2.12**	0.21	-2.07**	0.21
80+	-5.56**	0.25	-4.84**	0.27	-4.15**	0.26	-4.04**	0.26
Ethnicity (white ref category)								
Non-white			-0.76	0.49	-0.56	0.47	-0.32	0.46
Education (low ref category)								
Medium			0.12	0.13	0.13	0.13	0.05	0.13
High			0.65**	0.18	0.64**	0.18	0.47*	0.18
Wealth (lowest wealth quintile ref category)								
2nd			0.25	0.20	0.16	0.19	0.08	0.19
3rd			0.68*	0.21	0.54*	0.20	0.37	0.20
4th			0.97**	0.21	0.80**	0.20	0.61*	0.20
5th high wealth			1.18**	0.22	1.03**	0.21	0.77**	0.21
Work status (ref: working)								
Not working			-0.89**	0.17	-0.73**	0.16	-0.47*	0.16
Parental status (ref: has children)								
No children			0.06	0.19	0.11	0.17	0.11	0.17
Smoking status (never smoked ref category)								
Former smoker					0.06	0.12	0.14	0.12
Current smoker					0.64*	0.20	0.79**	0.19
Physical activity (moderate activity ref category)								
Sedentary					-2.07**	0.32	-1.66**	0.33
Low					-0.92**	0.14	-0.69**	0.14
High					0.67**	0.15	0.52**	0.15
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					0.46*	0.14	0.48**	0.14
Obese BMI (30+)					0.79**	0.15	0.98**	0.15
Self-rated health (excellent / v. good ref category)								
Good							-0.50**	0.13
Fair / poor							-0.89**	0.18
Chronic health conditions (0 reported conditions ref category)								
Reported 1 condition							-0.04	0.15
Reported 2 conditions							-0.47*	0.17
Reported 3+ conditions							-0.60*	0.20
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.66**	0.15
Constant	*16.49*	*0.13*	*15.85*	*0.21*	*15.44*	*0.24*	*15.97*	*0.25*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table F.4: Weighted grip strength coefficients, HRS women

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	-0.10	0.14	-0.06	0.14	-0.07	0.14	0.00	0.14
Divorced / separated	-0.28	0.15	-0.02	0.16	-0.10	0.16	0.01	0.15
Widowed	-0.52**	0.13	-0.28*	0.13	-0.28*	0.13	-0.21	0.13
Never married	-0.04	0.31	0.39	0.34	0.31	0.34	0.39	0.33
Age (50-59 ref category)								
60-69	-1.48**	0.13	-1.25**	0.14	-1.23**	0.14	-1.15**	0.14
70-79	-3.38**	0.13	-2.93**	0.15	-2.76**	0.15	-2.60**	0.15
80+	-5.67**	0.17	-5.09**	0.19	-4.53**	0.19	-4.35**	0.19
Ethnicity (white ref category)								
Hispanic			-0.69**	0.20	-0.70**	0.19	-0.52*	0.19
Black			0.96**	0.16	0.95**	0.16	1.05**	0.16
Other			0.12	0.40	0.25	0.40	0.40	0.37
Education (low ref category)								
Medium			0.16	0.12	0.13	0.12	0.02	0.12
High			0.22	0.14	0.25	0.14	0.11	0.14
Wealth (lowest wealth quintile ref category)								
2nd			0.62**	0.16	0.54**	0.16	0.43*	0.16
3rd			1.03**	0.16	0.91**	0.16	0.66**	0.16
4th			1.06**	0.16	1.00**	0.16	0.72**	0.16
5th high wealth			1.01**	0.18	0.96**	0.18	0.62**	0.18
Work status (ref: working)								
Not working			-0.90**	0.12	-0.74**	0.12	-0.47**	0.12
Parental status (ref: has children)								
No children			-0.47*	0.22	-0.41	0.22	-0.46*	0.22
Smoking status (never smoked ref category)								
Former smoker					0.03	0.10	0.08	0.10
Current smoker					0.39*	0.15	0.51**	0.15
Physical activity (moderate activity ref category)								
Sedentary					-2.32**	0.23	-1.84**	0.24
Low					-0.58**	0.11	-0.38**	0.11
High					0.24*	0.12	0.13	0.12
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					0.49**	0.11	0.54**	0.11
Obese BMI (30+)					0.96**	0.12	1.19**	0.12
Self-rated health (excellent / v. good ref category)								
Good							-0.19	0.11
Fair / poor							-0.97**	0.14
Chronic health conditions (0 reported conditions ref category)								
Reported 1 condition							-0.42*	0.16
Reported 2 conditions							-0.55**	0.16
Reported 3+ conditions							-1.09**	0.18
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.34*	0.12
Constant	*17.73*	*0.12*	*17.09*	*0.19*	*16.59*	*0.21*	*17.31*	*0.23*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Walking speed

Table F.5: Weighted walking speed regression coefficients, ELSA men

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	-0.008	0.021	0.007	0.019	0.010	0.018	0.010	0.017
Divorced / separated	-0.071*	0.034	-0.024	0.032	-0.008	0.030	-0.009	0.030
Widowed	-0.079**	0.021	-0.046*	0.020	-0.039*	0.018	-0.039*	0.017
Never married	-0.088*	0.033	-0.057	0.040	-0.055	0.036	-0.063	0.037
Age (60-69 ref category)								
70-79	-0.088**	0.016	-0.068**	0.015	-0.071**	0.014	-0.068**	0.014
80+	-0.257**	0.020	-0.237**	0.019	-0.208**	0.018	-0.201**	0.019
Ethnicity (white ref category)								
Non-white			-0.235*	0.050	-0.194**	0.042	-0.162**	0.040
Education (low ref category)								
Medium			0.057**	0.015	0.052**	0.014	0.038*	0.014
High			0.091**	0.022	0.072**	0.021	0.056*	0.021
Wealth (lowest wealth quintile ref category)								
2nd			0.030	0.024	0.013	0.022	0.009	0.021
3rd			0.072*	0.022	0.026	0.021	0.014	0.021
4th			0.118**	0.023	0.067*	0.022	0.058*	0.022
5th high wealth			0.174**	0.024	0.110**	0.023	0.089**	0.023
Work status (ref: working)								
Not working			-0.058*	0.020	-0.021	0.020	-0.007	0.020
Parental status (ref category: has children)								
No children			-0.001	0.024	-0.010	0.022	-0.013	0.022
Smoking status (never smoked ref category)								
Former smoker					-0.009	0.014	-0.001	0.013
Current smoker					-0.045*	0.022	-0.029	0.022
Physical activity (moderate activity ref category)								
Sedentary					-0.248**	0.022	-0.188**	0.022
Low					-0.128**	0.016	-0.096**	0.016
High					0.084**	0.017	0.069**	0.017
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					-0.001	0.016	0.001	0.015
Obese BMI (30+)					-0.045*	0.017	-0.028	0.017
Self-rated health (excellent / v. good ref category)								
Good							-0.051**	0.014
Fair / poor							-0.121**	0.016
Chronic health conditions (0 reported conditions ref category)								
Reported 1 condition							0.009	0.016
Reported 2 conditions							0.000	0.018
Reported 3+ conditions							-0.039*	0.019
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.038*	0.017
Constant	*0.956*	*0.013*	*0.877*	*0.026*	*0.935*	*0.030*	*0.978*	*0.032*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table F.6: Weighted walking speed regression coefficients, HRS men

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	0.008	0.012	0.017	0.011	0.018	0.011	0.021	0.011
Divorced / separated	-0.053*	0.018	0.007	0.017	0.004	0.016	0.005	0.016
Widowed	-0.077**	0.014	-0.040*	0.014	-0.038*	0.013	-0.033**	0.013
Never married	-0.076*	0.036	-0.014	0.041	-0.035	0.039	-0.028	0.039
Age (65-69 ref category)								
70-79	-0.078**	0.011	-0.066**	0.011	-0.063**	0.011	-0.058**	0.010
80+	-0.209**	0.014	-0.194**	0.013	-0.166**	0.013	-0.157**	0.013
Ethnicity (white ref category)								
Hispanic			-0.060*	0.019	-0.062*	0.018	-0.055*	0.018
Black			-0.119**	0.015	-0.112**	0.014	-0.110**	0.014
Other			-0.012	0.039	-0.030	0.040	-0.038	0.039
Education (low ref category)								
Medium			0.051**	0.012	0.045**	0.012	0.041**	0.012
High			0.061**	0.012	0.049**	0.012	0.039*	0.011
Wealth (lowest wealth quintile ref category)								
2nd			0.038*	0.017	0.019	0.016	0.018	0.016
3rd			0.069**	0.017	0.035*	0.016	0.027	0.016
4th			0.114**	0.017	0.072**	0.016	0.058**	0.016
5th high wealth			0.132**	0.017	0.088**	0.017	0.070**	0.017
Work status (ref: working)								
No			-0.062**	0.012	-0.040*	0.012	-0.028*	0.012
Parental status (ref: has children)								
No children			-0.050*	0.025	-0.037	0.023	-0.036	0.024
Smoking status (never smoked ref category)								
Former smoker					-0.011	0.010	-0.004	0.010
Current smoker					-0.025	0.016	-0.015	0.016
Physical activity (moderate activity ref category)								
Sedentary					-0.223**	0.016	-0.184**	0.016
Low					-0.075**	0.011	-0.059**	0.011
High					0.036*	0.011	0.029*	0.011
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					0.000	0.011	0.002	0.011
Obese BMI (30+)					-0.016	0.011	-0.005	0.011
Self-rated health (excellent / v. good ref category)								
Good							-0.035*	0.011
Fair / poor							-0.082**	0.012
Chronic health conditions (0 reported conditions (ref category)								
Reported 1 condition							-0.011	0.018
Reported 2 conditions							-0.018	0.017
Reported 3+ conditions							-0.054*	0.017
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.031*	0.012
Constant	*0.890*	*0.010*	*0.820*	*0.019*	*0.869*	*0.022*	*0.922*	*0.027*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table F.7: Weighted walking speed regression coefficients, ELSA women

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	-0.046	0.025	-0.021	0.022	0.001	0.019	0.011	0.018
Divorced / separated	-0.061*	0.021	0.007	0.020	-0.007	0.020	0.001	0.019
Widowed	-0.054**	0.015	-0.011	0.014	-0.006	0.013	0.005	0.012
Never married	-0.073	0.027	-0.042	0.030	-0.032	0.029	-0.017	0.026
Age (60-69 ref category)								
70-79	-0.131**	0.015	-0.103**	0.014	-0.083**	0.013	-0.076**	0.012
80+	-0.309**	0.018	-0.283**	0.018	-0.236**	0.017	-0.223**	0.016
Ethnicity (white ref category)								
Non-white			-0.251**	0.042	-0.212**	0.035	-0.161**	0.031
Education (low ref category)								
Medium			0.054**	0.013	0.035*	0.012	0.022	0.011
High			0.097**	0.019	0.071**	0.018	0.045*	0.018
Wealth (lowest wealth quintile ref category)								
2nd			0.031	0.018	0.008	0.016	0.006	0.015
3rd			0.109**	0.018	0.070**	0.017	0.055*	0.016
4th			0.151**	0.019	0.093**	0.018	0.072**	0.016
5th high wealth			0.200**	0.021	0.14**4	0.020	0.115**	0.019
Work status (ref category: working)								
No			-0.104**	0.021	-0.072*	0.022	-0.044*	0.022
Parental status (ref: has children)								
No children			-0.002	0.019	-0.007	0.017	-0.012	0.016
Smoking status (never smoked ref category)								
Former smoker					-0.007	0.011	0.006	0.010
Current smoker					-0.019	0.020	0.010	0.019
Physical activity (moderate activity ref category)								
Sedentary					-0.246**	0.019	-0.190**	0.018
Low					-0.143**	0.012	-0.112**	0.012
High					0.040*	0.018	0.013	0.017
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					-0.030	0.013	-0.028*	0.012
Obese BMI (30+)					-0.079**	0.014	-0.054**	0.013
Self-rated health (excellent / v. good ref category)								
Good							-0.059**	0.013
Fair / poor							-0.162**	0.015
Chronic health conditions (0 reported conditions (ref category)								
Reported 1 condition							-0.006	0.016
Reported 2 conditions							-0.020	0.016
Reported 3+ conditions							-0.056*	0.018
CES-D (CES-D<3 ref category)								
CES-D≥3							-0.054**	0.012
Constant	*0.917*	*0.013*	*0.853*	*0.026*	*0.955*	*0.028*	*1.015*	*0.029*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table F.8: Weighted walking speed regression coefficients, HRS women

	Model 1		Model 2		Model 3		Model 4	
	Coeff	**SE**	**Coeff**	**SE**	**Coeff**	**SE**	**Coeff**	**SE**
Marital status (first marriage ref category)								
Remarried	-0.005	0.014	0.005	0.013	0.005	0.013	0.009	0.012
Divorced / separated	-0.074**	0.014	-0.017	0.014	-0.020	0.013	-0.012	0.013
Widowed	-0.072**	0.010	-0.025*	0.010	-0.022*	0.009	-0.016	0.009
Never married	-0.058*	0.026	-0.013	0.027	-0.023	0.026	-0.019	0.024
Age (65-69 ref category)								
70-79	-0.099**	0.010	-0.090**	0.010	-0.089**	0.009	-0.079**	0.009
80+	-0.240**	0.012	-0.228**	0.012	-0.211**	0.012	-0.200**	0.012
Ethnicity (white ref category)								
Hispanic			-0.065**	0.014	-0.055**	0.014	-0.036*	0.013
Black			-0.112**	0.011	-0.090**	0.011	-0.079**	0.011
Other			0.012	0.049	0.010	0.047	0.022	0.044
Education (low ref category)								
Medium			0.053**	0.010	0.043**	0.010	0.032*	0.009
High			0.047**	0.012	0.032*	0.012	0.021	0.011
Wealth (lowest wealth quintile ref category)								
2nd			0.047**	0.012	0.034*	0.011	0.026*	0.011
3rd			0.098**	0.013	0.068**	0.012	0.052**	0.012
4th			0.134**	0.013	0.098**	0.013	0.077**	0.012
5th high wealth			0.131**	0.014	0.089**	0.014	0.062**	0.013
Work status (ref category: working)								
Not working			-0.073**	0.013	-0.049**	0.012	-0.031*	0.012
Parental status (ref category: has children)								
No children			-0.004	0.019	-0.002	0.018	-0.007	0.017
Smoking status (never smoked ref category)								
Former smoker					0.003	0.008	0.009	0.008
Current smoker					0.016	0.012	0.029*	0.012
Physical activity (moderate activity ref category)								
Sedentary					-0.258**	0.012	-0.206**	0.012
Low					-0.091**	0.009	-0.068**	0.008
High					0.007	0.011	-0.002	0.010
Body Mass Index (BMI<25 ref category)								
Overweight BMI (25 -29)					-0.004	0.009	-0.002	0.009
Obese BMI (30+)					-0.058**	0.010	-0.042**	0.009
Self-rated health (excellent / v. good ref category)								
Good							-0.050**	0.009
Fair / poor							-0.115**	0.010
Chronic health conditions (0 reported conditions (ref category)								
Reported 1 condition							0.006	0.018
Reported 2 conditions							-0.007	0.017
Reported 3+ conditions							-0.041*	0.017
CES-D (CES-D<3 ref category								
CES-D≥3							-0.031**	0.009
Constant	*0.849*	*0.009*	*0.788*	*0.017*	*0.852*	*0.019*	*0.898*	*0.024*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Appendix G: UK Office for National Statistics and US Census Bureau marital status estimates

Table G.1 shows the official statistics for marital status among people aged 50 years and older in England and Wales and the USA.

Table G.1: Population estimates for marital status in England and Wales and the USA

	England and Wales		USA	
	Men	**Women**	**Men**	**Women**
	%	**%**	**%**	**%**
Married	70.0	56.8	72.8	55.9
Divorced	11.0	13.0	13.1	16.2
Widowed	9.0	23.3	7.9	23.1
Never married	10.3	7.3	8.0	6.8

Source: ONS 2008 data and US Census Bureau 2010 data

Appendix H: Childhood circumstances and physical capability

Regression analysis was run to investigate the association between childhood circumstances and physical capability. There was found to be some association between childhood circumstances and physical capability on both ELSA and the HRS.

Grip strength

On ELSA having poor childhood health was associated with weaker grip strength for both men and women (shown in Table H.1). For men on ELSA having a more highly educated father was associated with weaker grip strength, but this wasn't apparent for women.

Table H.1: Regression analysis for grip strength (kgs/m) and childhood circumstances adjusted for age, ELSA

	Men		Women	
	Coef.	**SE**	**Coef.**	**SE**
Self-rated childhood health (excellent / good health ref category)				
Poor childhood health	-0.57*	0.32	-0.52*	0.20
Father's education (<10 years ref category)				
10+ years education	-0.54*	0.29	0.17	0.19
Mother's education (<10 years ref category)				
10+ years education	0.42	0.28	0.38*	0.18
Father's occupation (Higher occupations ref category)				
Intermediate occupations	-0.26	0.22	-0.24	0.14
Routine manual occupations	-0.43	0.32	-0.51*	0.21
Unemployed/sick/retired/didn't live with father	-0.36	0.25	-0.27	0.16
Other	-0.82	0.50	-0.40	0.30
Age (50-59 ref category)				
60-69	-2.03**	0.20	-1.08**	0.14
70-79	-4.79**	0.23	-2.94**	0.15
80+	-8.34**	0.32	-5.50**	0.20
Constant	25.95	0.25	16.58	0.16

** p<0.05 ** p<0.001*

On the HRS there was some notable associations between childhood circumstances and grip strength (shown in Table H.2). Women who had poor childhood health had a weaker grip strength than those who reported excellent or good childhood health. This association was not so apparent among men, although there was no interaction by gender. Among men there was an association between maternal education and grip strength and those who had more highly educated mothers had a stronger grip strength than those who had less educated mothers. This association was not present among women.

Table H.2: Regression analysis for grip strength (kgs/m) and childhood circumstances adjusted for age, HRS

	Men		Women	
	Coef.	**SE**	**Coef.**	**SE**
Self-rated childhood health (excellent / good health ref category)				
Poor childhood health	-0.32	0.28	-0.51**	0.16
Father's education (<10 years ref category)				
10+ years education	0.17	0.17	0.10	0.11
Mother's education (<10 years ref category)				
10+ years education	0.80**	0.16	0.19	0.10
Father's occupation (Higher occupations ref category)				
Intermediate occupations	0.09	0.19	0.27*	0.12
Routine manual occupations	0.13	0.19	0.02	0.12
Unemployed/sick/retired/didn't live with father	0.27	0.66	0.22	0.46
Other	-0.24	0.27	0.05	0.16
Age (50-59 ref category)				
60-69	-2.37**	0.20	-1.60**	0.12
70-79	-4.78**	0.21	-3.27**	0.13
80+	-8.21**	0.24	-5.79**	0.15
Constant	*25.94*	*0.17*	*17.37*	*0.11*

** p<0.05 ** p<0.001*

Walking speed

There was also an association between childhood circumstances and walking speed in both ELSA and the HRS.

In ELSA among both men and women having excellent or good childhood health, a more highly educated father and mother and a father in a higher occupation was associated with a faster walking speed (Table H.3). In the HRS there was also a similar association between childhood circumstances and walking speed as in ELSA (Table H.4), although there was no association between father's occupation and walking speed.

There was some modification by gender in the estimates, but only in the HRS, where there was a stronger association between childhood health and walking speed among women than among men.

Table H.3: Regression analysis for walking speed (m/s) and childhood circumstances adjusted for age, ELSA

	Men		Women	
	Coef.	**SE**	**Coef.**	**SE**
Self-rated childhood health (excellent / good health ref category)				
Poor childhood health	-0.006	0.025	-0.038*	0.019
Father's education (<10 years ref category)				
10+ years education	0.017	0.027	0.052*	0.023
Mother's education (<10 years ref category)				
10+ years education	0.067*	0.027	0.093**	0.023
Father's occupation (Higher occupations ref category)				
Intermediate occupations	-0.036	0.019	-0.003	0.016
Routine manual occupations	-0.063*	0.027	-0.055*	0.023
Unemployed/sick/retired/didn't live with father	-0.049*	0.021	-0.047*	0.017
Other	-0.046	0.041	-0.042	0.032
Age (60-69 ref category)				
70-79	-0.083**	0.015	-0.108**	0.013
80+	-0.272**	0.020	-0.312**	0.017
Constant	*0.972*	*0.021*	*0.896*	*0.017*

** p<0.05 ** p<0.001*

Table H.4: Regression analysis for walking speed (m/s) and childhood circumstances adjusted for age, HRS

	Men		Women	
	Coef.	**SE**	**Coef.**	**SE**
Self-rated childhood health (excellent / good health ref category)				
Poor childhood health	0.008	0.018	-0.046*	0.015
Father's education (<10 years ref category)				
10+ years education	0.050**	0.012	0.030*	0.010
Mother's education (<10 years ref category)				
10+ years education	0.044**	0.011	0.065**	0.010
Father's occupation (Higher occupations ref category)				
Intermediate occupations	-0.008	0.013	-0.016	0.011
Routine manual occupations	-0.006	0.013	-0.009	0.011
Unemployed/sick/retired/didn't live with father	-0.026	0.048	-0.036	0.046
Other	-0.041*	0.019	-0.062**	0.014
Age (60-69 ref category)				
70-79	-0.062**	0.010	-0.085**	0.008
80+	-0.176**	0.012	-0.221**	0.010
Constant	*0.830*	*0.014*	*0.785*	*0.012*

** p<0.05 ** p<0.001*

Appendix I: Analytic sample for the longitudinal analysis of marital status and walking speed

Table I.1: Comparison of mean walking speed (m/s) between the analytic sample and the complete eligible sample for ELSA Waves 1 to 6

	Men				Women			
	Analytic sample		Complete sample		Analytic sample		Complete sample	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Wave 1								
Overall Mean	*0.905*	*0.007*	*0.836***	*0.005*	*0.840*	*0.006*	*0.775***	*0.005*
First marriage	0.921	0.009	0.854	0.006	0.850	0.010	0.788	0.007
Remarried	0.930	0.018	0.868	0.014	0.836	0.025	0.788	0.018
Divorced / separated	0.864	0.026	0.792	0.019	0.815	0.020	0.735	0.015
Widowed	0.881	0.021	0.821	0.014	0.824	0.011	0.750*	0.008
Never married	0.893	0.030	0.783	0.022	0.809	0.029	0.770	0.019
Total (N)	*1,488*		*3,028*		*1,784*		*3,652*	
Wave 2								
Overall Mean	*0.894*	*0.006*	*0.860***	*0.005*	*0.826*	*0.006*	*0.793***	*0.005*
First marriage	0.915	0.008	0.881	0.006	0.834	0.009	0.807	0.007
Remarried	0.927	0.017	0.894	0.014	0.810	0.021	0.785	0.016
Divorced / separated	0.839	0.023	0.794	0.019	0.810	0.017	0.759*	0.015
Widowed	0.861	0.020	0.835	0.016	0.806	0.010	0.771*	0.009
Never married	0.822	0.027	0.794	0.023	0.833	0.025	0.780	0.021
Total (N)	*1,708*		*2,612*		*2,031*		*3,274*	
Wave 3								
Overall Mean	*0.883*	*0.006*	*0.858***	*0.005*	*0.813*	*0.006*	*0.787***	*0.005*
First marriage	0.904	0.008	0.885	0.007	0.817	0.009	0.797	0.007
Remarried	0.896	0.017	0.876	0.015	0.805	0.022	0.788	0.016
Divorced / separated	0.846	0.023	0.802	0.019	0.798	0.017	0.763	0.015
Widowed	0.846	0.021	0.838	0.018	0.796	0.011	0.761	0.010
Never married	0.833	0.029	0.770	0.024	0.820	0.027	0.762	0.021
Total (N)	*1,630*		*2,420*		*1,928*		*3,038*	
Wave 4								
Overall Mean	*0.894*	*0.006*	*0.872***	*0.005*	*0.831*	*0.005*	*0.806***	*0.004*
First marriage	0.919	0.007	0.896	0.006	0.856	0.008	0.823	0.006
Remarried	0.901	0.016	0.888	0.013	0.820	0.017	0.808	0.014
Divorced / separated	0.852	0.021	0.822	0.017	0.771	0.015	0.751	0.013
Widowed	0.842	0.021	0.824	0.018	0.807	0.011	0.786	0.010
Never married	0.832	0.025	0.797	0.020	0.806	0.024	0.776	0.020
Total (N)	*1,989*		*2,930*		*2,347*		*3,633*	
Wave 5								
Overall Mean	*0.913*	*0.006*	*0.891***	*0.005*	*0.848*	*0.005*	*0.823***	*0.004*
First marriage	0.935	0.007	0.914	0.006	0.875	0.008	0.842	0.006
Remarried	0.933	0.015	0.906	0.013	0.844	0.016	0.826	0.013
Divorced / separated	0.860	0.019	0.836	0.015	0.803	0.014	0.785	0.012
Widowed	0.866	0.022	0.860	0.019	0.803	0.012	0.788*	0.011
Never married	0.830	0.023	0.799	0.020	0.827	0.024	0.794*	0.020
Total (N)	*2,050*		*2,950*		*2,426*		*3,697*	
Wave 6								
Overall Mean	*0.913*	*0.006*	*0.899**	*0.005*	*0.857*	*0.006*	*0.838***	*0.005*
First marriage	0.932	0.008	0.919	0.007	0.875	0.008	0.854	0.006
Remarried	0.923	0.016	0.926	0.014	0.844	0.017	0.839	0.014
Divorced / separated	0.823	0.021	0.807	0.017	0.821	0.015	0.801	0.012
Widowed	0.874	0.028	0.860	0.024	0.830	0.014	0.819	0.012
Never married	0.843	0.026	0.819	0.021	0.877	0.027	0.822	0.023
Total (N)	*1,808*		*2,536*		*2,098*		*3,115*	

**p<0.05 **p<0.001 analytic sample v complete sample*

Tests of significance were carried out by running a linear regression on walking speed at each wave and marital status adjusted for age with interactions between marital status and a variable which flagged whether cases were in the analytic sample or not.

Appendix J: Marital history and physical capability

The original aim of this thesis was to investigate the association between marital history and physical capability. Marital history would comprise the number and type of transitions out of marriage, the duration spent married and the duration spent transitioned out of marriage. However, due largely to data restrictions this was not possible. The data, particularly ELSA, did not contain enough people who had experienced multiple transitions out of marriage for meaningful analysis. Table J.1 shows the number of men and women in ELSA and the HRS who had experienced transitions out of marriage. In ELSA only 202 men and 289 women had experienced more than one transition out of marriage, which would not have been enough to reach statistical significance. Alternatively the measure could have been dichotomised into whether experienced a transition out of marriage or not, but this overlapped with the current marital status variable which showed that those who were remarried, divorced or widowed have experienced a prior transition out of marriage. This analysis was therefore not carried out.

Table J.1: Numbers of men and women in ELSA and the HRS who have transitioned out of marriage

	ELSA		HRS	
	Men	**Women**	**Men**	**Women**
0 transitions out of marriage	2,245	2,335	3,214	3,273
1	975	1,799	1,813	3,437
2	178	250	476	887
3	23	31	123	194
4	1	8	16	43
5 transitions out of marriage	0	0	1	2
Total (N)	*3,422*	*4,423*	*5,643*	*7,836*

It was decided not to analyse whether the duration of time spent married was associated with physical capability because much of the ELSA and HRS samples had remained in their first marriage and therefore this analysis would be picking up on age of entry into marriage, which is known to be positively associated with SEP, along with age of the respondent. Also, initial age adjusted analysis just on the ELSA sample showed that there was not an association between duration spent married and physical capability (as shown in Table J.2).

Table J.2: Age adjusted regression analysis of time spent married and physical capability, ELSA

Grip strength				
	Men		**Women**	
	Coef.	**SE**	**Coef.**	**SE**
Time married (years)	-0.01	0.01	0.00	0.01
Age (ref: 50-59 years)				
60 – 69 years	-2.02**	0.28	-0.93**	0.18
70-79 years	-4.78**	0.34	-3.01**	0.21
80+	-8.41**	0.45	-5.42**	0.27
Constant	*26.29*	*0.36*	*16.53*	*0.23*
Walking speed				
	Men		**Women**	
	Coef.	**SE**	**Coef.**	**SE**
Time married (years)	0.000	0.001	0.001	0.001
Age (ref: 60-69 years)				
70 – 79 years	-0.104	0.016**	-0.148**	0.014
80+ years	-0.305	0.022**	-0.363**	0.018
Constant	*0.970*	*0.026*	*0.906*	*0.021*

** p<0.05 ** p<0.001*

The third element of marital history which was going to be included was the length of time since a transition out of marriage, as there was some evidence that more recent transitions were associated with poorer physical capability (Bennett, 2006). Initial regression analysis was run for those who had experienced a prior transition out of marriage (those remarried, divorced or widowed). The analysis also adjusted for current marital status, the results of which are shown in Table J.3 to Table J.6. The analysis showed that there was largely no association between time since a transition out of marriage and physical capability, when adjusting for age and current marital status, apart from for walking speed for women in ELSA and the HRS where there was a negative association (Table J.6). Women who had spent a longer amount of time transitioned out of marriage had a slower walking speed than those who had spent a shorter time out of marriage. The association was explained by the demographic and socio-economic measures, particularly wealth, as the longer the period of time spent out of marriage the lower the levels of wealth. However, as overall no association was found it was decided not to take this analysis any further.

Table J.3: Age adjusted regression analysis of time since transition out of marriage and grip strength, men

	ELSA		HRS	
	Coef.	**SE**	**Coef.**	**SE**
Time in years since transition out of marriage	0.00	0.02	-0.02	0.01
Marital status (ref: unmarried)				
Married	0.42**	0.47	1.59**	0.27
Age (Ref: 50-59 years)				
60-69 years	-2.72**	0.52	-2.71**	0.34
70-79 years	-6.43**	0.55	-4.93**	0.36
80+ years	-9.45**	0.64	-8.75**	0.40
Constant	*26.31*	*0.49*	*25.77*	*0.33*

** p<0.05 ** p<0.001*

Table J.4: Age adjusted regression analysis of time since transition out of marriage and grip strength, women

	ELSA		HRS	
	Coef.	**SE**	**Coef.**	**SE**
Time in years since transition out of marriage	0.00	0.01	0.00	0.01
Marital status (ref: unmarried)				
Married	0.58	0.29	0.57*	0.21
Age (Ref: 50-59 years)				
60-69 years	-0.62*	0.30	-1.64**	0.23
70-79 years	-2.79**	0.32	-2.97**	0.23
80+ years	-4.99**	0.36	-5.65**	0.24
Constant	*15.80*	*0.29*	*16.83*	*0.20*

** p<0.05 ** p<0.001*

Table J.5: Age adjusted regression analysis of time since transition out of marriage and walking speed, men

	ELSA		HRS	
	Coef.	**SE**	**Coef.**	**SE**
Time in years since transition out of marriage	0.001	0.001	0.000	0.001
Marital status (ref: unmarried)				
Married	0.077*	0.033	0.090	0.022**
Age (Ref: 60-69 years)				
70-79 years	-0.118**	0.030	-0.063	0.025**
80+ years	-0.317**	0.036	-0.195	0.027**
Constant	*0.937*	*0.031*	*0.751*	*0.025*

** p<0.05 ** p<0.001*

Table J.6: Age adjusted regression analysis of time since transition out of marriage and walking speed, women

	ELSA		HRS	
	Coef.	**SE**	**Coef.**	**SE**
Time in years since transition out of marriage	0.002*	0.001	-0.002**	0.000
Marital status (ref: unmarried)				
Married	0.079*	0.03	0.112**	0.021
Age (Ref: 60-69 years)				
70-79 years	-0.118**	0.02	-0.092**	0.016
80+ years	-0.333**	0.03	-0.246**	0.017
Constant	*0.884*	*0.02*	*0.775*	*0.015*

** p<0.05 ** p<0.001*

Appendix K: Marital status and longitudinal changes in walking speed with time varying covariates

Growth curve analysis was run with some of the covariates varying across the 6 Waves of ELSA. The covariates which were time varying were: wealth; work status; smoking status; physical activity; BMI; self-rated health; number of doctor diagnosed health conditions; and psychological morbidity. As the covariates were time varying the analysis was conducted on a reduced sample: 1,444 men and 1,727 women. The total number of men and women in each marital status category included in the analysis are shown in Table K.1.

Table K.1: Sample numbers for men and women in each marital status with complete data on the covariates Waves 1 to 6

	Men	Women
First marriage	968	911
Remarriage	207	195
Divorced	112	215
Widowed	82	333
Never married	75	73
Total (N)	*1,444*	*1,727*

Table K.2 and Table K.3 show the results of the growth curve models with time varying covariates for men and women.

Table K.2: Growth curve models for changes in walking speed with time varying covariates, men

	Model 1		Model 2		Model 3		Model 4	
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Marital status at baseline (first marriage ref category)								
Remarried	0.035	0.020	0.045*	0.020	0.047*	0.019	0.045*	0.019
Divorced	-0.024	0.029	-0.015	0.028	-0.010	0.027	-0.009	0.027
Widowed	-0.022	0.030	0.003	0.028	0.018	0.027	0.025	0.027
Never married	-0.043	0.034	-0.031	0.037	-0.033	0.035	-0.022	0.035
Marital status X time								
Remarried X time	-0.004	0.002	-0.004	0.002	-0.004	0.002	-0.004	0.002
Divorced X time	-0.005	0.003	-0.004	0.003	-0.003	0.003	-0.002	0.003
Widowed X time	-0.007*	0.003	-0.007*	0.003	-0.007*	0.003	-0.006	0.003
Never married X time	-0.002	0.004	-0.001	0.004	-0.001	0.004	-0.002	0.003
Time	-0.011**	0.003	-0.009**	0.003	-0.008*	0.003	-0.007*	0.003
Time^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Age (centered at age 50)	-0.012**	0.002	-0.010**	0.002	-0.010**	0.002	-0.009**	0.002
Age categories (50 -59 years ref category)								
60-69 years	0.009	0.022	0.016	0.021	0.013	0.020	0.011	0.019
70-79 years	0.014	0.041	0.021	0.038	0.020	0.036	0.009	0.035
80+ years	0.131	0.077	0.091	0.072	0.096	0.068	0.078	0.066
Ethnicity (White ref category)								
Non-white			-0.149**	0.040	-0.134**	0.038	-0.119*	0.036
Education (low ref category)								
Medium			0.081**	0.012	0.069**	0.011	0.056**	0.011
High			0.113**	0.015	0.096**	0.015	0.081**	0.014
Wealth (low wealth ref category)								
2			0.064**	0.016	0.058**	0.016	0.054*	0.016
3			0.061**	0.017	0.053*	0.017	0.046*	0.016
4			0.096**	0.018	0.085**	0.017	0.076**	0.017
High wealth			0.126**	0.018	0.114**	0.018	0.105**	0.018
Work status (currently working ref category)								
Not working			-0.023*	0.008	-0.014	0.008	0.009	0.008
Parental status (has child(ren) ref category)								
No children			-0.003	0.021	-0.009	0.020	0.011	0.019
Smoking status (never smoked ref category)								
Former smoker					-0.036*	0.011	-0.029*	0.010
Current smoker					-0.060**	0.016	-0.054*	0.015
Physical activity (moderate ref category)								
Sedentary					-0.135**	0.015	-0.112**	0.016
Low					-0.055**	0.007	-0.045**	0.007
High					0.034**	0.007	0.031**	0.007
BMI (Underweight to normal weight BMI<26 ref category)								
Overweight BMI 26-29					-0.017*	0.008	-0.015	0.008
Obese BMI 30+					-0.040**	0.011	-0.032*	0.010
Self-rated health (Excellent / very good ref category)								
Good							-0.011	0.006
Fair / Poor							-0.066**	0.009
Dr diagnosed health conditions (no conditions ref category)								
1 condition							-0.001	0.009
2 conditions							-0.021	0.010
3+ conditions							-0.051*	0.013
CES-D (CES-D<3 ref category)								
3+ CESD							-0.046**	0.009
Constant	*1.106*	*0.035*	*0.984*	*0.037*	*1.029*	*0.037*	*1.027*	*0.039*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

Model 3: Age + demographic and socio-economic measures + health behaviours (smoking status, physical activity and BMI)

Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)

Table K.3: Growth curve models for changes in walking speed with time varying covariates, women

	Model 1		Model 2		Model 3		Model 4	
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Marital status at baseline (first marriage ref category)								
Remarried	-0.007	0.023	0.003	0.022	0.014	0.021	0.023	0.021
Divorced	-0.024	0.022	-0.008	0.021	0.000	0.020	0.015	0.019
Widowed	0.011	0.018	0.029	0.018	0.029	0.017	0.032*	0.016
Never married	-0.001	0.032	-0.033	0.034	-0.027	0.033	-0.024	0.031
Marital status X time								
Remarried X time	-0.002	0.002	-0.002	0.002	-0.002	0.002	-0.002	0.002
Divorced X time	-0.001	0.002	-0.001	0.002	-0.001	0.002	-0.002	0.002
Widowed X time	-0.007**	0.002	-0.008**	0.002	-0.007**	0.002	-0.006**	0.002
Never married X time	-0.003	0.003	-0.003	0.003	-0.003	0.003	-0.002	0.003
Time	-0.013**	0.002	-0.012**	0.002	-0.010**	0.002	-0.006*	0.002
Time^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Age (centered at age 50)	-0.014**	0.002	-0.012**	0.002	-0.011**	0.002	-0.010**	0.002
Age categories (50 -59 years ref category)								
60-69 years	0.025	0.020	0.021	0.019	0.019	0.018	0.018	0.016
70-79 years	0.023	0.038	0.010	0.035	0.008	0.033	0.002	0.031
80+ years	0.022	0.065	-0.011	0.061	-0.016	0.057	-0.027	0.053
Ethnicity (White ref category)								
Non-white			-0.121*	0.038	-0.131**	0.036	-0.105*	0.033
Education (low ref category)								
Medium			0.063**	0.010	0.054**	0.010	0.040**	0.009
High			0.131**	0.015	0.108**	0.014	0.092**	0.013
Wealth (low wealth ref category)								
2			-0.001	0.013	0.000	0.013	0.004	0.013
3			0.029*	0.014	0.027	0.014	0.026	0.013
4			0.048*	0.015	0.041*	0.014	0.040*	0.014
High wealth			0.076**	0.016	0.065**	0.015	0.064**	0.015
Work status (Currently working ref category)								
Not working			-0.026*	0.008	-0.024*	0.008	-0.020*	0.008
Parental status (has child(ren) ref category)								
No children			0.015	0.019	0.008	0.017	0.001	0.016
Smoking status (Never smoked ref category)								
Former smoker					-0.025*	0.009	-0.017*	0.008
Current smoker					-0.055**	0.013	-0.043*	0.013
Physical activity (moderate ref category)								
Sedentary					-0.105**	0.014	-0.091**	0.014
Low					-0.058**	0.006	-0.049**	0.006
High					0.022*	0.007	0.015*	0.006
BMI (Underweight to normal weight BMI<26 ref category)								
Overweight BMI 26-29					-0.026**	0.007	-0.024*	0.007
Obese BMI 30+					-0.078**	0.009	-0.064**	0.009
Self-rated health (Excellent / very good ref category)								
Good							-0.035**	0.005
Fair / Poor							-0.102**	0.007
Dr diagnosed health conditions (no conditions ref category)								
1 condition							-0.003	0.008
2 conditions							-0.031*	0.009
3+ conditions							-0.055**	0.011
CES-D (CES-D<3 ref category)								
3+ CESD							-0.033**	0.006
Constant	*1.119*	*0.033*	*1.036*	*0.035*	*1.085*	*0.034*	*1.104*	*0.032*

** p<0.05 ** p<0.001*

Model 1: Age

Model 2: Age + demographic and socio-economic measures (education, ethnicity, wealth, work and parental status)

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Model 4: Age + demographic and socio-economic measures + health behaviours + physical health and psychological morbidity (self-rated health, chronic health conditions and psychological morbidity)