Personality, disability-free life years, and life expectancy: Individual-participant meta-analysis of 131,195 individuals from 10 cohort studies

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Abstract

Objective: We examined how personality traits of the Five Factor Model were related to years of healthy life years lost (mortality and disability) for individuals and the population.

Method: Participants were 131,195 individuals from 10 cohort studies from Australia, Germany, the United Kingdom, and the United States (n=43,935 from 7 cohort studies for the longitudinal analysis of disability, assessed using scales of Activities of Daily Living, ADL).

Results: Lower conscientiousness was associated with higher mortality and disability risk, but only when conscientiousness was below its median level. If the excess risk associated with low conscientiousness had been absent, population life expectancy would have been 1.3 years longer and disability-free life 1.0 years longer. Lower emotional stability was related to shorter life expectancy, but only among those in the lowest 15% of the distribution, and disability throughout the distribution: if the excess risk associated with low emotional stability had been absent, population life expectancy would have been 0.4 years longer and disability-free life 2.4 years longer.

Conclusions: Personality traits of low conscientiousness and low emotional stability are associated with reduced healthy life expectancy of individuals and population.

Keywords: Personality; Mortality; Disability; Longevity; Meta-analysis

Personality traits are related to individual differences in longevity (Graham et al., 2017; Jokela, Batty, et al., 2013). The most consistent evidence has supported low *conscientiousness* as the main personality trait associated with elevated risk of premature death: one standard deviation decrease in conscientiousness has been associated with a 14% higher mortality rate (Jokela, Batty, et al., 2013). Individuals with low conscientiousness tend to have low self-control, act spontaneously without planning, show little persistence in pursuing long-term goals, and not be driven by obligations of duty and responsibility (Roberts, Lejuez, Krueger, Richards, & Hill, 2014)—all characteristics that may lead to unhealthy life choices and risk taking (Hakulinen et al., 2015; Hakulinen, Elovainio, et al., 2015; Jokela et al., 2013; Sutin et al., 2016).

Higher mortality rate has also been associated with lower emotional stability (e.g., low liability to negative emotions and psychopathology), lower openness to experience (e.g., cognitive flexibility and preference for variety; Ferguson & Bibby, 2012), lower extraversion (e.g., sociability and positive emotionality), and lower agreeableness (e.g., empathy and trust in others; Graham et al., 2017). These traits have been weaker predictors of mortality compared to conscientiousness, with around 5% mortality-rate difference associated with one standard deviation of the trait (Graham et al., 2017), and their associations have been less consistent across studies than those reported for low conscientiousness (Jokela, Batty, et al., 2013).

The relative mortality risks associated with personality traits have now been fairly well documented. However, these associations have not been quantified using absolute population metrics, such as life expectancy. Absolute metrics are crucial because they provide a better basis for evaluating the public health significance of risk associations (Stringhini et al., 2017) and are easier to communicate with non-researchers. Moreover, there seems to be no previous studies on personality and disability-free life years. The concept of

disability-free life years extends the measurement of life expectancy by considering the years people can live without having any disabling conditions or morbidity that limits their ability to carry out daily activities (Stringhini et al., 2018). A long life is valuable, but a healthy and fully functional long life is even more valuable. The overall burden of different diseases in epidemiology is often assessed as lost disability-adjusted life years (Kyu et al., 2018), that is, the combined effects of how many life years are lost due to premature mortality and the disabling effects of the disease. Disabling conditions naturally increase the risk of premature mortality, so disability and mortality are not independent measures, but two individuals with the same lifespan can still differ in the number of healthy life years they have. Personality traits, low conscientiousness in particular, have been associated with frailty (Stephan, Sutin, Canada, & Terracciano, 2017) and many disabling chronic diseases, such as obesity (Jokela et al., 2013), type-2 diabetes (Jokela et al., 2014) and cardiovascular diseases (Jokela, Pulkki-Råback, Elovainio, & Kivimäki, 2014), so associations between personality traits and disability are to be expected.

We examined the associations of the five major personality traits (i.e., conscientiousness, emotional stability, extraversion, agreeableness, and openness to experience) with life expectancy and the loss of disability-free life years, as measured by limitations in daily activities. The longitudinal association with disability risk was assessed among those who did not report disabilities at baseline. To translate these associations into population-level metrics, we estimated how much longer the average population life expectancy would have been and how many disability-free life years would have been added if personality differences were not related to mortality and disability, that is, if all individuals had personality scores that were not associated with elevated mortality or disability. We also examined whether the personality associations were accounted for by educational level, smoking, alcohol consumption, physical inactivity, and body mass index.

Methods

We utilized individual-level data from 10 prospective cohort studies from Australia, Germany, UK, and USA with a total of 130,000 participants: the British Household Panel Survey (BHPS); the English Longitudinal Study of Aging (ELSA); the Health and Retirement Study (HRS; USA); the Household, Income, and Labour Dynamics of Australia (HILDA); the Midlife in the United States (MIDUS) study; the National Child Development Study (NCDS; UK); the German Socioeconomic Panel Study (SOEP); the UK Household Longitudinal Survey (UKHLS); and the Wisconsin Longitudinal Study graduate (WLSG) and sibling (WLSS) samples (USA).

The study-specific descriptions of the assessments are reported in **Supplementary Material**. Briefly, personality was assessed at baseline using questionnaires of the Big Five personality traits. Disability was measured using Activities of Daily Living (ADL) scales at baseline and again at a follow-up (range: 3-19 years). ADL data were collected for the survival analysis from multiple follow-ups, except for WLSG and WLSS in which there was only one follow-up for ADL. Mortality data were derived from national mortality registers, except for BHPS, HILDA, and UKHLS for which mortality information were collected at annual follow-ups.

We estimated associations of personality traits with mortality and disability using flexible parametric survival analysis with age as the timescale. The pooled hazard ratios were estimated using two-stage meta-analysis in which the survival models were first fitted in each cohort study separately, and then random-effect meta-analysis was used to pool the associations across studies. In order to test potential non-linear associations, we used one-stage meta-analysis (with study as a stratifying variable) in which we pooled the results across studies. Personality traits were first standardized (mean=0, standard deviation=1)

within each cohort study and then, in the pooled data, percentile scores were created and classified into groups (0-5, 5-15, 15-25, 25-40, 40-60, 60-75, 75-85, 85-95, and 95-100%).

Healthy life years lost associated with personality traits were determined from differences between survivor curves: To calculate years of life expectancy and disability-free life years, we first determined the model-predicted survivor curves for the different personality percentile groups, with confidence intervals calculated using bootstrapping with 500 repetitions. Life expectancy and disability-free life years were determined with the integrals of the area under the survivor curves. The years of life (and disability-free years) lost by individuals in a specific personality percentile group were then calculated as the difference between this group's integral compared to the integral of the reference group (e.g., life expectancy of individuals in the lowest 5 percentile compared to life expectancy of individuals in the highest 15 percentile). To determine how many life years and disability-free life years the overall population would gain, on average, if the personality traits were not associated with mortality and disability, we calculated the sum of lost life years and disability-free years across the personality percentile groups by weighting the sum by the relative proportions of the percentile groups in the population. Thus, the scenario in which personality trait is not associated with mortality or disability risk refers to calculations in which everybody is assumed to have personality scores of the reference group that are not associated with elevated mortality or disability risk. Participants with disability at baseline were excluded from the analysis of disability-free life years but were included in the analysis of mortality. Three studies (NCDS, SOEP, and UKHLS) were included only in analyses of life expectancy because these studies did not have repeated measurements of disability.

We also calculated the population attributable fractions using the formula for multi-category exposure assuming confounding (Rockhill, Newman, & Weinberg, 1998). Population attributable fraction indicates the proportional decrease in the prevalence or rate

of the outcome if the exposure variable was not associated with the outcome. For example, a population attributable risk of 10% for conscientiousness in predicting disability would indicate that the incidence of disability in the population would be 10% lower if low conscientiousness was not associated with higher risk of disability. For an exposure variable with multiple categories, the equation is: $1 - \sum_{i=0}^{k} \frac{pd_i}{RR_i}$, where pd_i is the proportion of cases (e.g., deaths) in category *i* of the exposure variable (e.g., personality percentile group), RR_i is the relative risk for the *i*th exposure level compared to the reference group, and *k* is the number of exposure variable levels.

We used linear regression to impute missing values for smoking (2.9% missing observations), heavy alcohol consumption (10.7%), physical inactivity (0.4%), body mass index (8.1%), and education (3.5%) using all the predictor variables and the outcome variable. The BHPS and UKHLS cohorts were not included in the multivariable-adjusted analysis owing to an absence of data for physical inactivity and alcohol consumption.

Results

The analysis of mortality was based on 10 cohort studies comprising 131,195 participants followed up on average of 7.2 years (range: 2 to 22 years) during which period there were 8,405 deaths. For the analysis of disability, there were 7 cohort studies with a total of 43,935 participants (after excluding 17,480 participants with disability at baseline) with an average follow-up of 5.5 years (range: 3 to 19 years) giving rise to 5,099 incident cases of disability. Detailed descriptive statistics are shown in **Supplementary Table 2**. The numbers of participants, deaths, and incident disability cases in each personality percentile categories are reported in **Figures 1** and **2**.

Associations with mortality and disability. Lower conscientiousness was associated with higher mortality risk in a dose-response manner below the median whereas no

association was observed for conscientiousness levels above the median (**Figure 1**). Lower emotional stability was also related to higher mortality risk but only in the lowest 15% of the distribution and not across the full distribution. Lower emotional stability was linearly related to higher risk of disability, with a dose-response association seen across the entire distribution, whereas the association of lower conscientiousness was again only observed below the median; the association of conscientiousness was weaker compared to the association of emotional stability (**Figure 2**). People in in top 25% for the openness to experience trait appeared to be have a higher disability risk but this association was induced by the mutual adjustment of all the personality trait percentiles in a single model, as openness to experience was unrelated to disability when examined alone (linear trend HR=0.99, CI=0.98, 1.00 when excluding other personality traits). No consistent associations were observed for extraversion or agreeableness in relation to disability risk.

We conducted supplementary analysis of personality traits as continuous predictors, where models were first fitted in each cohort study separately and then pooled together using random-effect meta-analysis. One standard deviation increase in conscientiousness was related to a lower risk of mortality (HR=0.88, 95% CI=0.84, 0.91) and disability (HR=0.89, 95% CI=0.85, 0.94), and one standard deviation increase in emotional stability was related to lower mortality (HR=0.96, 95% CI=0.93, 0.99) and disability (HR=0.76, 95% CI=0.74, 0.79). Other continuously coded traits showed no associations with death (**Supplementary Figures 1** and **2**).

Years of life lost and years of disability-free life lost. With there being no difference in life expectancy between the highest 4 groups of conscientiousness (i.e., top 60%) these categories were collapsed (**Figure 1**). For disability-free life years, we used the highest 15% of conscientiousness as the reference group. We applied the same recodings for emotional stability. We then refitted the above survival models with these categorizations and calculated

the population-level indicators based on differences between survivor curves. Years of life lost and years of disability-free life lost associated with low conscientiousness and low emotional stability are shown in **Figures 3** and **4 (**see **Supplementary Table 3** for the confidence intervals). Compared to those in the highest 60% of conscientiousness, people in the lowest 5% had 6.2 (95% CI = 5.1, 7.1) years shorter life expectancy and 2.5 (1.5, 3.5) fewer disability-free life years. The corresponding figures for low emotional stability were 3.0 (1.8, 4.0) and 8.3 (7.3, 9.5).

Average healthy years lost in the population. We then estimated the average years of life lost and years of disability-free years lost in the population as the sum of years weighted by the population proportions of the personality percentile groups (**Figures 3** and **4**). Average population life expectancy was 1.3 (1.1, 1.4) years lower and disability-free life years 1.0 (0.4, 1.7) fewer due to the risks associated with low conscientiousness. With emotional stability, the corresponding numbers were 0.4 years (0.2, 0.6) for life expectancy and 2.4 (1.9, 3.0) for disability years. The population attributable fractions of conscientiousness were 12.0% (10.1, 13.7) for mortality and 11.4% (4.2, 18.1) for disability. For emotional stability, these were 3.3% (1.5, 5.0) and 27.9% (21.4, 31.9).

Multivariable-adjusted associations. In the cohort studies that had data on covariates, adjusting for education and health-related factors attenuated the average years of life lost associated with low conscientiousness from 1.23 to 0.91 years (25% reduction), and years with low emotional stability from 0.38 to 0.14 years (75% reduction). The average disability-free years lost was attenuated from 0.96 to 0.50 years (48% reduction) for low conscientiousness, and from 2.41 to 2.31 years (4% reduction) for low emotional stability (**Supplementary Table 4**). The reductions in the strength of these associations was mostly due to health-related factors, such as high body mass index, smoking and low physical activity, rather than educational attainment (**Supplementary Tables 5** and **6**). We also

examined whether baseline disability explained the personality associations with mortality in the cohorts that had data on baseline disability (n=60,831; 5,660 deaths). Adjusting for disability attenuated the average years of life lost associated with low conscientiousness by 10.5% (from 1.20 years to 1.07 years) and associated with low emotionality by 47.6% (from 0.41 to 0.22 years).

Sensitivity analyses. As the associations might have been confounded by reverse causality (i.e., poor health influencing conscientiousness and emotional stability), we carried out a sensitivity analysis in which the 3 or 5 first years were excluded from the analysis. The associations of conscientiousness and emotional stability remained largely the same as in the main analysis, except that the association between conscientiousness and mortality attenuated somewhat (**Supplementary Figures 3** and **4**).

Discussion

In this analysis of individual-level meta-analysis of 130,000 adults, individuals with low conscientiousness had up to 6 years shorter life expectancy and 2 years fewer disability-free life years compared to those with conscientiousness score above the median. If the excess risks associated with low conscientiousness had been absent, the average population life expectancy would have been 1.3 years longer, with an additional 1.0 disability-free life years. Lower emotional stability was related to shorter life expectancy, but only among those in the lowest 15% of the distribution, and especially to higher disability risk: the population life expectancy would have been 0.4 years longer, with an additional 2.4 disability-free life years, if the excess risk associated with low emotional stability had been absent. We observed no consistent associations with life expectancy or disability-free life years for extraversion, agreeableness, or openness to experience.

Our study benefits from a large multi-cohort sample and the measurement of personality using the Five Factor Model, which is the most widely used and validated models of personality (Widiger, 2017). We were also able to account for potential issue of reverse causality, that is, personality changes that might anticipate death and declining health; the associations did not change substantially when the first 3 or 5 follow-up years were excluded from the analysis.

Different cohort studies assessed the five personality traits with different instruments, which may have introduced heterogeneity in the analysis. This may not be a major methodological problem, however, because (1) some of the cohorts did use the same measures (five cohorts using the BFI and three cohorts the MIDUS inventory), and (2) different measures of the five personality traits show at least moderately high correlations: Previous studies have reported average correlations of 0.77 between corresponding traits assessed by the 44-item BFI and the 60-item NEO Five-Factor Inventory, and correlations of 0.80 between BFI and the 100-item Character Trait Descriptive Adjectives inventory (John, Naumann, & Soto, 2008). Two different IPIP measures (IPIP-NEO and IPIP-FFM) had average correlations of 0.63 between corresponding traits (Donnellan, Oswald, Baird, & Lucas, 2006), the BFI and IPIP had average correlations of 0.67 with Chinese translations of the questionnaires (Zheng et al., 2008), and the correlations between corresponding traits of BFI and MIDUS inventories was also 0.67 (Pozzebon et al., 2013). More detailed analyses with multiple cohorts are needed to test whether specific facets or items are particularly important for health outcomes (e.g., Vainik, Mõttus, Allik, Esko, & Realo, 2015). Moreover, our analysis did not consider the mean age differences between the cohorts when standardizing the personality scores (except for including age and study as covariates), so the same standardized score may not have had the same meaning in cohorts that differ in average

age. However, except for ELSA and HRS, the average baseline ages of the cohorts were quite similar (45 to 54 years), which probably did not confound the analysis substantially.

Major health risk factors, such as high blood pressure, dyslipidaemia, and diabetes, reduce life expectancy by 5 to 10 years (Bardenheier et al., 2016; Clarke et al., 2009). Thus, the 6-year shortening of life expectancy in individuals with very low conscientiousness is substantial—bearing in mind, of course, that the 6-year loss was observed only for those in the lowest 5% of the population; the 5%-15% percentile had 4 years and the 15%-25% percentile 2 years shorter life expectancy than those with average or high conscientiousness. Low conscientiousness has been associated with poorer health behaviors and higher risk of several chronic diseases, and these behaviors and diseases increase mortality risk (Hakulinen, Elovainio, et al., 2015; Hakulinen, Hintsanen, et al., 2015; Jokela, Hintsanen, et al., 2013). In this study, adjusting for education and baseline health variables (smoking, physical inactivity, heavy alcohol consumption, and body mass index) accounted for one-fourth of the years life lost associated with lower conscientiousness. Other mechanisms such as social relationships, physical changes or reactions to environmental circumstances might be important explanatory factors (Murray & Booth, 2015).

The mortality and disability risks associated with conscientiousness were observed only among those below the median level of conscientiousness, suggesting a threshold effect in which average level of conscientiousness is sufficient to avoid the mortality risk associated with low conscientiousness. Most previous studies have not examined potential non-linear health associations of conscientiousness, so there is not yet enough data to suggest possible mechanisms that would follow a similar non-linear association with conscientiousness. We hypothesize that multiple health risks and risky behaviors are more likely to accumulate at the low end of conscientiousness distribution, which might help to explain the shape of the association.

Low emotional stability was more strongly related to the loss of disability-free life years than with lost life years. Emotional stability is associated with poor health behaviors, and very low emotional stability is also a strong indicator of diagnosable mental disorders (Jeronimus, Kotov, Riese, & Ormel, 2016) that are associated with elevated mortality risk (Liu et al., 2017). In the present study, the mortality risk of low emotional stability was only observed for those in the lowest 15% of the distribution, suggesting that severe mental disorders might be one of the mediating mechanisms. In multivariable adjusted analyses, educational level, unhealthy life choices and lifestyle-related factors explained more than half of the association between emotional stability and mortality.

Education and health behaviors explained less than 10% of the association between low emotional stability and loss of disability-free life years. People with low emotional stability tend to be more sensitive to physical symptoms than those with high emotional stability (Vassend, Røysamb, & Nielsen, 2012). They may therefore be more likely to report limitations in daily activities even if they were physically capable of doing those activities. This might be considered as a source of reporting bias. On the other hand, even subjectively perceived limitations may have adverse consequences if these perceived limitations influence the person's behaviors, for example, if the person tends to avoid certain daily activities.

It is yet unclear whether personality traits are causal health risk factors or whether they are only non-causal risk markers for mortality and morbidity (Jokela, Airaksinen, Kivimäki, & Hakulinen, 2018). There might be common genetic or environmental factors that contribute to personality and health (Kim, 2016), in which case the associations might not be causal. The associations might also reflect reverse causality, as poor health behaviors, such as heavy alcohol consumption (Hakulinen & Jokela, 2019) and physical inactivity (Stephan, Sutin, & Terracciano, 2014), and the incidence of chronic diseases (Jokela, Hakulinen, Singh-Manoux, & Kivimäki, 2014) have been associated with decreasing levels

of conscientiousness and emotional stability over time (Allen, Vella, & Laborde, 2015). However, reverse causality did not seem to account for much of the associations with mortality and disability.

In conclusion, this multi-cohort study provides individual-level and population-level estimates for the years of life lost and years of disability-free years lost associated with individual differences in personality traits. Further data are needed to identify the mechanisms that account for these associations, as common health behaviors do not seem to explain them completely.

Figure captions

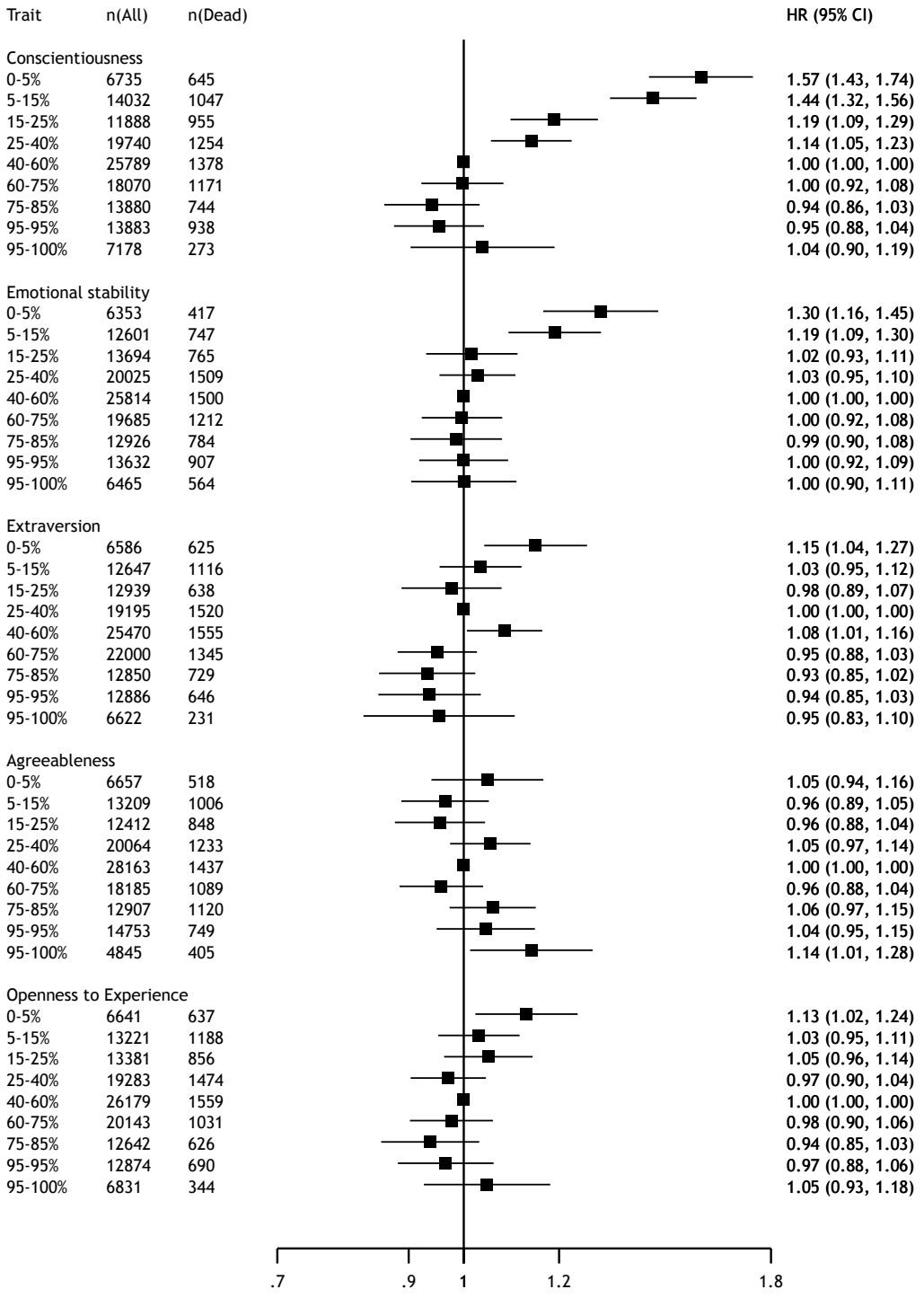

Figure 1. Mortality risk associated with percentile groups of personality traits in the pooled dataset of 131,195 individuals from 10 cohort studies.

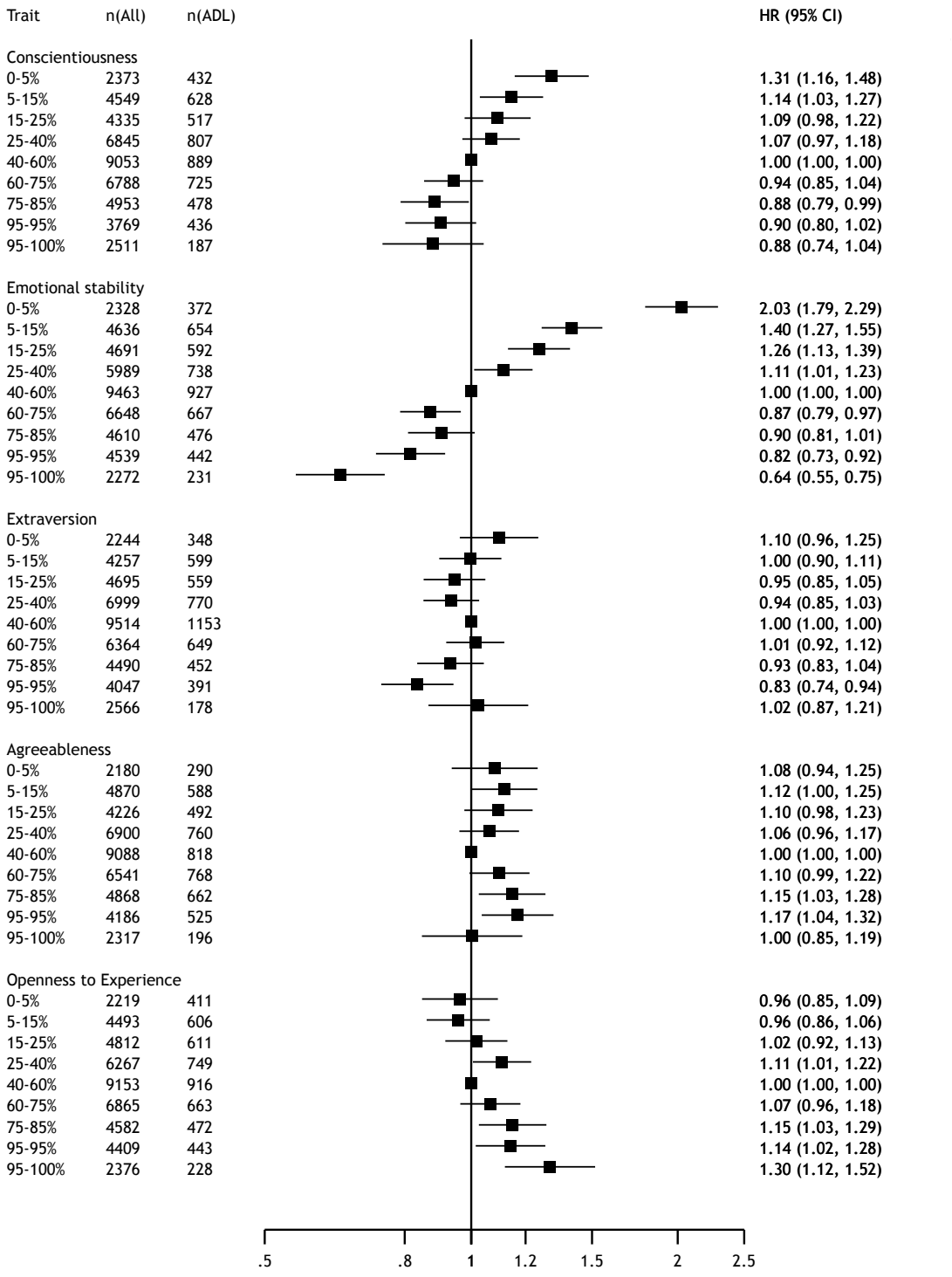

Figure 2. Disability risk (assessed with Activities of Daily Living scales) associated with percentile groups of personality traits in a pooled dataset of 43,935 individuals from 7 cohort studies.

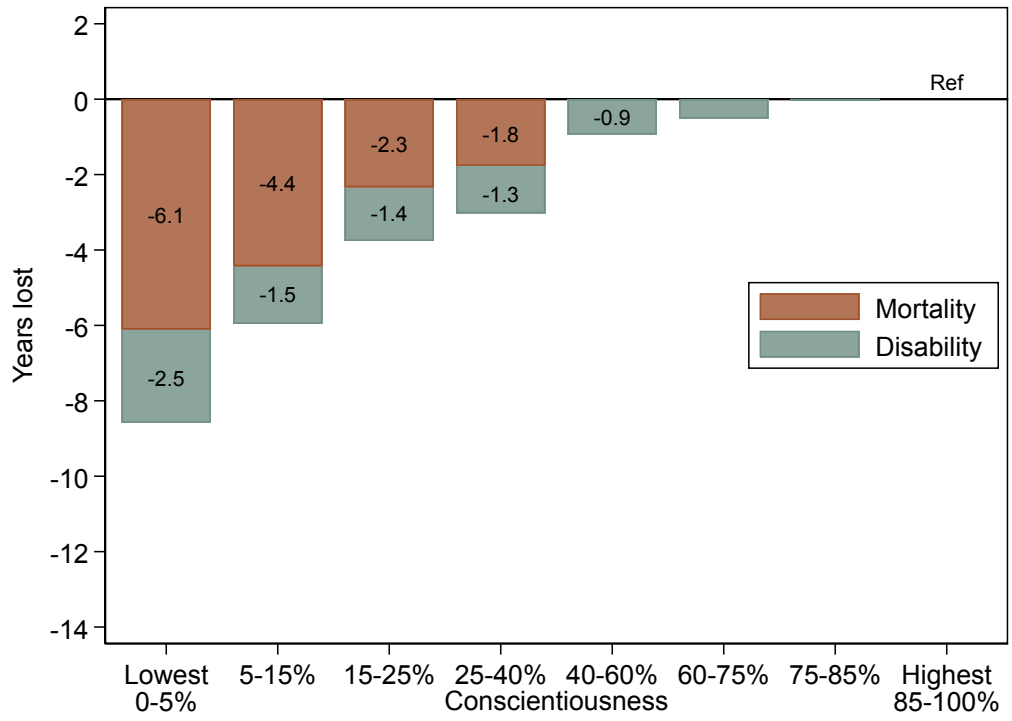

Figure 3. Estimated difference in life expectancy and disability-free life years associated with lower conscientiousness compared to the highest 15% (for disability) and highest 60% (for mortality) end of conscientiousness. Hazard ratios are reported in Supplementary Tables 5 and 6.

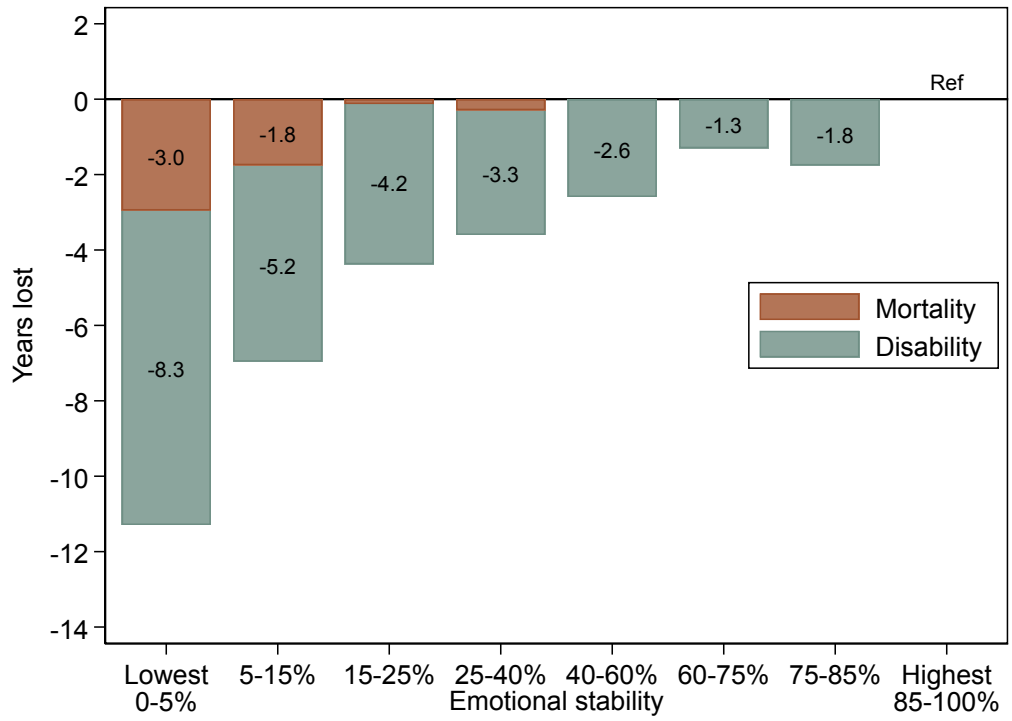

Figure 4. Estimated difference in life expectancy and disability-free life years associated with lower emotional stability compared to the highest 15% (for disability) and highest 60% (for mortality) end of emotional disability. Hazard ratios are reported in Supplementary Tables 5 and 6.

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Supplementary Material

Personality, disability-free life years, and life expectancy: Individual-participant meta-analysis of 131,195 individuals from 10 cohort studies

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British Household Panel Survey (BHPS) and the UK Household Longitudinal Survey (UKHLS)

The British Household Panel Survey (BHPS) is a longitudinal survey of a nationally representative sample of over 5000 British households with annual follow-ups. The original cohort included 10,264 individuals aged 16-97 at baseline in 1991, and was based on a clustered, stratified sample of addresses throughout Great Britain south of the Caledonian Canal (excluding North of Scotland and Northern Ireland). New participants have been included in the sample over the years if they are born to original sample member, if they have moved into a household in the original sample, or if a member of the original sample moves into a new household with one or more new people. In addition, the sample was enriched with additional recruitment of participants at waves 9 and 11, from Scotland and Wales, and from Northern Ireland, respectively, so extending the sample to cover the whole UK. The most recent (18th) follow-up of the BHPS was carried out in 2008-2009.

After 2008-2009, the BHPS became merged with the larger UK Household Longitudinal Survey (UKHLS), also known as the Understanding Society study. The original sample for the UKHLS were from approximately 40,000 household in the United Kingdom, including participants from the BHPS, interviewed in 2009–2011. The overall purpose of Understanding Society is to provide high quality longitudinal data about subjects such as health, work, education, income, family, and social life to help understand the long- term effects of social and economic change, as well as policy interventions designed to impact upon the general well-being of the UK population.

Personality was assessed in the 15th data collection wave of the BHPS in 2005 and in the the third study wave of UKHLS in 2010-2012 using the 15-item version of the Big Five Inventory (BFI) with three items assessing each personality trait, rated on a 7-point scale. Personality scales were calculated for individuals with no missing items in the scale. Cronbach alphas were 0.54 for extraversion, 0.68 for emotional stability, 0.53 for agreeableness, 0.51 for conscientiousness, and 0.67 for openness to experience.

Data on **race/ethnicity** was based on participants' self-reports and was coded as a dichotomous variable (0=white; 1=other). **Height** and **weight** were self-reported by the participants in the 16th data collection wave in 2006. **Smoking** status and **number of cigarettes** smoked were self-reported. **Educational level** was determined on the basis of the highest achieved grade and coded into three groups (0=primary education, 1=secondary education, 3=tertiary education).

Study websites:
http://www.understandingsociety.org.uk/
http://www.esds.ac.uk/longitudinal/access/bhps/L33196.asp

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Data references: University of Essex. Institute for Social and Economic Research, NatCen Social Research and Kantar Public, [producers]: Understanding Society: Waves 1-6, 2009-2015 [computer file]. 8th Edition. Colchester, Essex: UK Data Service [distributor], November 2016. SN: 6614

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The English Longitudinal Study of Ageing (ELSA)

The English Longitudinal Study of Ageing (ELSA) is a panel study of a representative cohort of men and women living in England aged ≥50 years. It was designed as a sister study to the Health and Retirement Study in the USA and is multidisciplinary in orientation, involving the collection of economic, social, psychological, cognitive, health, biological and genetic data. The study commenced in 2002, and the sample has been followed up every 2 years. Data are collected using computer-assisted personal interviews and self-completion questionnaires, with additional nurse visits for the assessment of biomarkers every 4 years. The original sample consisted of 11 391 members ranging in age from 50 to 100 years. Ethical approval was obtained from the London Multicentre Research and Ethics Committee. Participants gave written informed consent.

Personality was assessed at the fifth wave in 2010–2011 using the 26-item personality inventory developed for MIDUS and also used in HRS. Cronbach alphas were 0.76 for extraversion, 0.80 for agreeableness, 0.68 for neuroticism, 0.67 for conscientiousness, and 0.79 for openness to experience.

Frequencies of moderate and vigorous physical activity were both reported on a 4-point scale (0=Hardly ever or never, 1=1-3 times a month, 2=once a week, 3=more than once a week). **Physical inactivity** was defined as participating in moderate and vigorous activity hardly ever or never. Otherwise the participant was considered physically active. **Number of alcoholic drinks per week** was determined on the basis of how often and how much the person reported drinking alcohol, with **heavy alcohol consumption** defined as 21 or more units for men and 14 or more units for women per week. **Smoking** status and **number of cigarettes** smoked were self-reported. **Educational level** was determined on the basis of the highest achieved grade and coded into three groups (0=primary education, 1=secondary education, 3=tertiary education).

Study website:
http://www.elsa-project.ac.uk/

Acknowledgements: Funding for English Longitudinal Study of Ageing is provided by the National Institute of Aging in the United States, and a consortium of UK government departments coordinated by the Office for National Statistics. The data are available from the UK Data Service (http://ukdataservice.ac.uk). Neither the original collectors of the data nor the distributors of the data bear any responsibility for the analyses or interpretations presented here.

Household, Income and Labour Dynamics in Australia (HILDA) Survey

The Household, Income and Labour Dynamics in Australia (HILDA) Survey is a household-based panel study which began in 2001, developed particularly to collects information about economic and subjective well-being, labour market dynamics and family dynamics. The survey began with a large national probability sample of Australian households occupying private dwellings (n=7,682 households with 19,914 individuals at baseline). All members of the households providing at least one interview in wave 1 form the basis of the panel to be pursued in each subsequent wave. Interviews are conducted annually with all adult members of each household. The sample has been gradually extended to include any new household members resulting from changes in the composition of the original households. From wave 9, new household members that arrived in Australia for the first time after 2001 were also added to the sample.

Personality was assessed in study wave 5 in 2005 using a 36-item Five Factor Personality self-reported inventory based on the Saucier's and Goldberg's Big Five Markers Scale, with 8 items for extraversion (α=0.77), 7 items for neuroticism (α=0.79), 7 items for agreeableness (α=0.77), 7 items for conscientiousness (α=0.79), and 6 items for openness to experience (α=0.73; the original item "traditional" was omitted from the scale because of a very low factor loading of 0.03 and a very low correlation of 0.02 between the item and a scale constructed from the rest of the items). The participants rated the items on a 7-point scale (1=Does not describe me at all, 7=Describes me very well). Personality sum scales were calculated for individuals with no more than 1 missing item in the scale.

Data on **race/ethnicity** was based on participants' self-reports and was coded as a dichotomous variable (0=white, non-Hispanic; 1=other). **Physical inactivity** was assessed as how often the person participates in physical activity (Physically inactive = Not at all / Less than once a week; Physically active = Every day / More than 3 times a week / 3 times a week / 1-2 times a week). **Number of alcoholic drinks per week** was determined on the basis of how often and how much the person reported drinking alcohol, with **heavy alcohol consumption** defined as 21 or more units for men and 14 or more units for women per week. **Smoking** status and **number of cigarettes** smoked were self-reported. **Educational level** was determined on the basis of the highest achieved grade and coded into three groups (0=primary education, 1=secondary education, 3=tertiary education).

Study website: http://www.melbourneinstitute.com/hilda/

Acknowledgements: This paper uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services (DSS) and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views reported in this paper, however, are those of the author and should not be attributed to either DSS or the Melbourne Institute.

Health and Retirement Study (HRS)

The HRS is a nationally representative longitudinal study of more than 30,000 individuals representing the U.S. population older than 50 years. Telephone or in-person interviews are conducted every 2 years, administered under the NIA and the University of Michigan's Institute for Social Research. As of 1998, the HRS consists of 4 sources of data collection: (1) The original HRS began as two distinct surveys that were merged in 1998. The original HRS was initially administered in 1992 to a nationally representative sample of Americans born in the years 1931 through 1941. In the case of married couples, both spouses (including spouses who were younger than 51 or older than 61) were also interviewed; (2) The second survey, originally referred to as the Study of Assets and Health Dynamics Among the Oldest Old (AHEAD), was first administered in 1993 to a nationally representative sample of Americans born in 1923 or earlier (n=8,000) and merged with the HRS in 1998. In the case of married couples, interviews were conducted with both spouses; (3) In 1998, a subsample of individuals born between 1924 and 1930, referred to as Children of the Depression Age (CODA) was added to HRS; (4) Another subsample consisting of people born between 1942 and 1947 (War Baby cohort) was added to replenish the sample of people in their early 50s as the original HRS cohort aged. The Health Sciences Institutional Review Board at the University of Michigan approved the HRS.

Personality was measured using a self-reported instrument adapted from the MIDUS study with 5 items for extraversion (α=0.74), 4 items for emotional stability (α=0.63), 5 items for agreeableness (α=0.78), 5 items for conscientiousness (α=0.63), and 7 items for openness to experience (α=0.79), rated on a 4-point rating scale. The personality instrument was administered to half of the sample in 2006 and to the other half in 2008. Mean scores for personality scales were calculated for individuals with a maximum of 1 missing item in the scale.

Data on **race/ethnicity** was based on participants' self-reports and was coded as a dichotomous variable (0=white, non-Hispanic; 1=other). Frequencies of moderate and vigorous physical activity were both reported on a 5-point scale (0=Hardly ever or never, 1=1-3 times a month, 2=once a week, 3=more than once a week, 4=every day). **Physical inactivity** was defined as participating as moderate activity less than once a week (values 0 and 1) *and* vigorous activity less than 1-3 times a month (value 0). Otherwise the participant was considered physically active. **Number of alcoholic drinks per week** was determined on the basis of how often and how much the person reported drinking alcohol, with **heavy alcohol consumption** defined as 21 or more units for men and 14 or more units for women per week. **Smoking** status and **number of cigarettes** smoked were self-reported. **Educational level** was determined on the basis of the highest achieved grade and coded into three groups (0=primary education, 1=secondary education, 3=tertiary education).

Study website: http://hrsonline.isr.umich.edu

Acknowledgements: The HRS (Health and Retirement Study) is sponsored by the National Institute on Aging (grant number NIA U01AG009740) and is conducted by the University of Michigan. The Health and Retirement Study public use dataset (Ann Arbor, MI, 2016) is produced and distributed by the University of Michigan.

Midlife Development in the United States (MIDUS)

The MacArthur Foundation Survey of Midlife Development in the United States (MIDUS) is based on a nationally representative random-digit-dial sample of non-institutionalized, English-speaking adults, aged 25 to 74 years, selected from working telephone banks in the coterminous United States in 1995-1996. The total original sample (n=7108) includes main respondents (n=3487), their siblings (n=950), a city oversample (n=757), and a twin subsample (n=1914). Data were collected in a telephone interview and with a mail questionnaire. A follow-up study of the original cohort was conducted in 2004-2005.

Personality was assessed at baseline with a model based on the Five Factor Model, including 5 items of extraversion (α=0.78), 4 items for neuroticism (α=0.75), 5 items for agreeableness (α=0.81), 4 items for conscientiousness (α=0.56), and 7 items for openness to experience (α=0.78). Items were rated using a 4-point rating scale on how well different adjectives described them (1=not at all, 4=a lot).

Data on **race/ethnicity** was based on participants' self-reports and was coded as a dichotomous variable (0=white, non-Hispanic; 1=other). Frequencies of moderate and vigorous activity were reported on 6-point scales (0=never, 1=less than once a month, 2=about once a month, 3=several times a month, 4=about once a week, 5=several times a week or more). **Physical inactivity** was determined as moderate activity less than at least several times a week (values 0, 1, 2, 3 and 4) *and* vigorous activity less than once a week (values 0 and 1). Otherwise the participant was considered physically active. **Alcohol consumption** was determined on the basis of how often and how much the person reported drinking alcohol, with **heavy alcohol consumption** defined as 21 or more units for men and 14 or more units for women per week. **Smoking** status and **number of cigarettes** smoked were self-reported. **Educational level** was determined on the basis of the highest achieved grade and coded into three groups (0=primary education, 1=secondary education, 3=tertiary education).

Study website: http://www.midus.wisc.edu/

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Data references: Brim, Orville G., et al. NATIONAL SURVEY OF MIDLIFE DEVELOPMENT IN THE UNITED STATES (MIDUS), 1995-1996 [Computer file]. ICPSR02760-v4. Ann Arbor, MI: DataStat, Inc./Boston, MA: Harvard Medical School, Dept. of Health Care Policy [producers], 2007. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2007-04-16.

National Child Development Study (NCDS)

The British National Child Development Study (also known as the 1958 British Birth Cohort Study) is a nationally representative multidisciplinary study. The participants were 17,634 individuals born in England, Wales, and Scotland during one week in March 1958. Data have been collected in follow-up phases at ages 7, 11, 16, 23, 33, 42, 46, and 50. Written informed consent was obtained from the parents for childhood measurements and ethical approval for the study was obtained from the South East Multi-Centre Research Ethics Committee.

Personality was assessed at age 50 using the 50-item Big Five model of the International Personality Item Pool (IPIP) with 10 items per personality trait rated on a 5-point rating scale. The Cronbach alphas were 0.87 for extraversion, 0.88 for neuroticism, 0.81 for agreeableness, 0.77 for conscientiousness, and 0.78 for openness to experience. A mean score for each personality trait was calculated if no more than two items in the scale were missing.

Height and **weight** were self-reported by the participants in the interview, and **body mass index (BMI)** was calculated from these data with the standard formula of BMI=weight in kilograms divided by squared height in meters. **Physical inactivity** was determined based on a question of how often the participant exercised, with '2-3 times a month' and 'less often' categorized as physical inactivity, and once a week or more often categorized as physically active. **Number of alcoholic drinks per week** was determined on the basis of how often and how much the person reported drinking alcohol, with **heavy alcohol consumption** defined as 21 or more units for men and 14 or more units for women per week. **Smoking** status and **number of cigarettes** smoked were self-reported. **Educational level** was determined on the basis of the highest achieved grade and coded into three groups (0=primary education, 1=secondary education, 3=tertiary education).

Study website:
http://www.esds.ac.uk/longitudinal/access/ncds/l33004.asp

Socio-Economic Panel Study (SOEP)

The German Socio-Economic Panel Study (SOEP) is a longitudinal study of private households. The study started in 1984 in West Germany with two subsamples: Sample A, the main sample, covering the population of private households, and Subsample B, which oversampled the "guest worker households" with Turkish, Spanish, Italian, Greek and Yugoslavian household heads. The original sample included 5921 households and 12,245 individual respondents. Several additional samples have subsequently been integrated in the study, including a sample of Germans from the late East Germany in 1990 (2,179 households; 4,453 individuals), an immigrant sample in 1994/1995 (522 households; 1,078 individuals), a refreshment sample of existing subsamples in 1998 (1,056 households; 1,910 individuals), an "innovation" subsample again covering all existing subsamples in 2000 (6,043 households; 10,880 individuals), a high-income subsample of households with net earnings more than 4500 euros/month in 2002 (1,224 households; 2,671 individuals), a second refreshment sample covering all existing subsamples in 2006 (1,506 households; 2,616 individuals), and an "incentive" sample covering all existing subsamples in 2009 (1,531 households; 2,509 individuals). All household members aged 17 years or older are invited for interview, which are carried out annually. Altogether, a total of 34,881 individuals have participated in the study at least in one study wave.

Personality was assessed in 2005 using the 15-item version of the Big Five Inventory (BFI). Data on **race/ethnicity** was based on participants' self-reports and was coded as a dichotomous variable (0=white, non-Hispanic; 1=other). **Height** and **weight** were self-reported by the participants in the 23rd data collection wave in 2006. **Physical inactivity** was defined as never or almost never participating in sports or exercise reported on a 4-point scale (0=Almost never or never, 1=Several times a year, 2=At least once a month, 3=At least once a week). Alcohol consumption was reported as the frequency of drinking (1) beer, (2) wine, (3) spirits, and (4) cocktail drinks, each reported separately using a 4-point scale (0=Never, 1=Seldom, 2=Once in a while, 3=Regularly). **Heavy alcohol consumption** was defined by the sum of the four items being 6 or higher. **Smoking** status and **number of cigarettes** smoked were self-reported. **Educational level** was determined on the basis of the highest achieved grade and coded into three groups (0=primary education, 1=secondary education, 3=tertiary education).

Study website: http://www.diw.de/en/soep

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Wisconsin Longitudinal Study (WLS), Graduate and Sibling Samples

Graduate sample. The Wisconsin Longitudinal Study has followed a random sample of 10317 participants (5326 women, 4991 men) who were born between 1937 and 1940 and who graduated from Wisconsin high schools in 1957. After baseline data collection in 1957, survey data have been collected from the participants or their parents in 1964, 1975, 1992/3, 2003/5, and 2011. The present study used data from the 1993 follow-up. The WLS sample is broadly representative of white, non-Hispanic American men and women who have completed at least a high school education (among Americans aged 50 to 54 in 1990 and 1991, approximately 66 percent were non-Hispanic white persons who completed at least 12 years of schooling). It is estimated that about 75 percent of Wisconsin youth graduated from high school in the late 1950s – everyone in the primary WLS sample graduated from high school.

Sibling sample. In addition to the main sample of the 1957 high school graduates, the WLS has also collected data on a selected sibling of a sample of the graduates. The data collection in adulthood has been very similar although not entirely identical for the siblings as for the graduates. For the present purposes, the sibling sample was analyzed separately from the graduate sample, because the sampling frame of the individuals for the graduate cohort and sibling cohort was considered to sufficiently to justify the decision of not combining the samples.

Personality data were collected in 1992-1994 via mail questionnaire including a 29-version of the Big Five Inventory (BFI). Participants were asked whether they agreed or disagreed that certain personality descriptions fitted themselves using a 6-point rating scale. The Cronbach alpha reliabilities were 0.76 for extraversion in graduates (0.65 in siblings) for extraversion, 0.78 (0.63) for neuroticism, 0.69 (0.70) for agreeableness, 0.64 (0.70) for conscientiousness, and 0.61 (0.70) for openness to experience. A mean score for a trait was calculated if no more than 2 items of the scale were missing.

Height and **weight** were self-reported by the participants. **Smoking** status and **number of cigarettes** smoked were self-reported. Frequencies of moderate and vigorous activity were each reported on a 4-point scale (0=less than once a month, 1=about one to three times per month, 2=once or twice a week, 3=three or more time per week), and **physical inactivity** was defined as moderate activity less than once or twice a week (values 0 and 1) *and* vigorous activity less than once or twice a week (values 0 and 1). Otherwise the participant was considered physically active. **Number of alcoholic drinks per week** was calculated based on how often and how much the participant reported drinking alcohol during the last month, with **heavy alcohol consumption** defined as 21 or more units for men and 14 or more units for women per week. **Educational level** was determined on the basis of the highest achieved grade and coded into three groups (0=primary education, 1=secondary education, 3=tertiary education).

Study website: http://www.ssc.wisc.edu/wlsresearch/

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Supplementary Table 1. Items of disability measurements in the cohort studies.

BHPS	Health hinders doing the housework
	Health hinders climbing the stairs
	Health hinders getting dressed
	Health hinders walking more than 10 mins
	Health no hindrance to listed activities
ELSA	Difficulty dressing, including putting on shoes and socks
	Difficulty walking across a room
	Difficulty bathing or showering
	Difficulty eating, such as cutting up food
	Difficulty getting in and out of bed
	Difficulty using the toilet, including getting up or down
HILDA	Lifting or carrying groceries
	Climbing several flights of stairs
	Climbing one flight of stairs
	Bending kneeling or stooping
	Walking more than one kilometre
	Walking half a kilometre
	Walking 100 metres
	Bathing or dressing yourself
HRS	Difficulty bathing
	Difficulty eating
	Difficulty dressing
	Difficulty walking
	Difficulty get in/out bed
MIDUS	Lifting or carrying groceries
	Bathing or dressing yourself
	Climbing stairs
	Bending, kneeling, stooping
	Walking more than a mile
	Walking several blocks
	Walking one block
WLSG & WLSS	Dressing Self
	Walking Across a Room
	Bathing or Showering
	Eating
	Getting In/Out of Bed
	Using the Toilet

Supplementary Table 2. Descriptive statistics

	BHPS	ELSA	HRS	MIDUS	NCDS	UKHLS	WLSG	WLSS	SOEP	HILDA
Categorical variables (%, n)										
Gender										
Men	45.4 (6259)	44.5 (3398)	40.8 (5669)	47.5 (2971)	48.5 (3443)	44.0 (17771)	46.2 (3080)	46.6 (1844)	47.9 (9789)	46.7 (5181)
Women	54.6 (7521)	55.5 (4246)	59.2 (8228)	52.5 (3288)	51.5 (3649)	56.0 (22602)	53.8 (3588)	53.4 (2117)	52.1 (10642)	53.3 (5909)
Ethnic background										
White	97.8 (11783)	97.7 (7466)	78.0 (10839)	90.8 (5567)	98.2 (6964)	87.2 (34753)	–	–	92.8 (18954)	–
Other/Unknown	2.2 (260)	2.3 (178)	22.0 (3058)	9.2 (561)	1.8 (128)	12.8 (5108)	–	–	7.2 (1477)	–
Mortality status										
Alive	97.9 (13492)	98.6 (7535)	80.4 (11171)	82.7 (5177)	99.0 (7019)	98.6 (39816)	84.2 (5613)	82.0 (3249)	94.3 (19260)	94.3 (10458)
Deceased	2.1 (288)	1.4 (109)	19.6 (2726)	17.3 (1082)	1.0 (73)	1.4 (557)	15.8 (1055)	18.0 (712)	5.7 (1171)	5.7 (632)
ADL at baseline										
No	89.6 (10834)	91.0 (6375)	91.8 (11133)	90.5 (3794)	–	–	97.1 (4862)	96.4 (2642)	–	79.9 (5423)
Yes	10.4 (1251)	9.0 (632)	8.2 (1001)	9.5 (396)	–	–	2.9 (146)	3.6 (98)	–	20.1 (1368)
ADL at follow-up										
No	91.2 (8826)	90.3 (5754)	82.3 (9161)	81.4 (3090)	–	–	91.1 (4429)	90.8 (2320)	–	95.2 (5161)
Yes	8.8 (855)	9.7 (621)	17.7 (1972)	18.6 (704)	–	–	8.9 (433)	9.2 (234)	–	4.8 (262)

Smoking										
Non-smoker	75.5 (10398)	88.0 (6726)	86.9 (12015)	78.2 (4894)	80.7 (5712)	63.3 (12821)	82.3 (5397)	82.8 (3228)	71.0 (13169)	79.1 (8680)
Current smoker	24.5 (3382)	12.0 (918)	13.1 (1814)	21.8 (1364)	19.3 (1369)	36.7 (7433)	17.7 (1164)	17.2 (669)	29.0 (5370)	20.9 (2299)
Physical activity										
At least minimally active	–	85.8 (6557)	64.8 (9005)	63.5 (3968)	71.0 (5030)	–	81.1 (5347)	84.7 (3317)	59.8 (12143)	73.4 (8112)
Inactive	–	14.2 (1086)	35.2 (4890)	36.5 (2278)	29.0 (2051)	–	18.9 (1250)	15.3 (601)	40.2 (8179)	26.6 (2938)
Alcohol consumption										
No or moderate consumption	–	93.0 (6992)	97.5 (11134)	91.3 (5669)	92.0 (6527)	–	95.9 (3743)	97.3 (3318)	84.3 (15309)	89.6 (9868)
Heavy alcohol consumption	–	7.0 (526)	2.5 (284)	8.7 (538)	8.0 (565)	–	4.1 (159)	2.7 (92)	15.7 (2846)	10.4 (1147)
Body mass index										
<30kg/m2	76.2 (5897)	68.9 (4179)	69.1 (9484)	80.9 (4853)	76.5 (5213)	69.0 (3164)	81.8 (5322)	82.1 (3161)	84.0 (15443)	79.4 (7476)
>30kg/m2	23.8 (1845)	31.1 (1887)	30.9 (4237)	19.1 (1147)	23.5 (1604)	31.0 (1419)	18.2 (1188)	17.9 (688)	16.0 (2950)	20.6 (1937)
Continuous variables										
Baseline year (min, max)	2005–2006	2010–2011	2006–2009	1995–1996	2008–2009	2011–2013	1992–1994	1992–1994	2005–2005	2005–2006
Age at baseline (mean, sd)	45.5 (18.4)	65.9 (9.2)	68.2 (10.5)	46.8 (12.9)	50.3 (0.4)	47.2 (18)	54.1 (0.5)	53.1 (7.3)	47.1 (17.5)	43.8 (17.9)
Mortality follow-up time (max years)	3.5	2.1	9.1	20.3	5.8	4.3	22.1	21.1	9.1	10.2
Disability follow-up time (max years)	3.0	5.0	8.0	19.3	–	–	9.3	8.1	–	9.0

Supplementary Table 3. Estimated years of life lost and years of disability-free life lost associated with low conscientiousness and emotional stability.

	Conscientiousness		Emotional stability	
	Mortality	**Disability**	**Mortality**	**Disability**
Highest 85%-100%	(reference)	(reference)	(reference)	(reference)
75-85%	(reference)	-0.03 (-1.09, 0.94)	(reference)	-1.76 (-2.72, -0.73)
60-75%	(reference)	-0.51 (-1.35, 0.37)	(reference)	-1.30 (-2.18, -0.50)
40-60%	(reference)	-0.94 (-1.78, -0.20)	(reference)	-2.59 (-3.43, -1.78)
25-40%	-1.73 (-2.37, -1.09)	-1.26 (-2.16, -0.32)	-0.31 (-0.97, 0.32)	-3.31 (-4.14, -2.45)
15-25%	-2.26 (-3.07, -1.47)	-1.43 (-2.35, -0.40)	-0.21 (-1.08, 0.73)	-4.25 (-5.23, -3.20)
5-15%	-4.39 (-5.17, -3.60)	-1.53 (-2.50, -0.70)	-1.78 (-2.59, -0.93)	-5.21 (-6.13, -4.22)
Lowest 0-5%	-6.15 (-7.11, -5.14)	-2.47 (-3.52, -1.45)	-2.99 (-4.01, -1.77)	-8.34 (-9.52, -7.27)

N=131,195 (8,405 deaths) for analysis of mortality and n=43,935 (5,099 incident cases of disability) for analysis of disability. The values are plotted in Figures 3 and 4 of the main manuscript.

Supplementary Table 4. Average years of life lost and years of disability-free lost in adjusted models

Mortality (n=77,042 with 7,560 incident deaths)		
	Conscientiousness	**Emotional stability**
Minimally adjusted	-1.25 (-1.43, -1.08)	-0.38 (-0.57, -0.19)
+ Education	-1.15 (-1.35, -0.93)	-0.30 (-0.52, -0.08)
+ Health-related factors	-0.91 (-1.15, -0.67)	-0.14 (-0.31, 0.11)
Disability (n=34,254 with 4,244 incident disability cases)		
	Conscientiousness	**Emotional stability**
Minimally adjusted	-0.96 (-1.65, -0.40)	-2.41 (-2.96, -1.85)
+ Education	-0.95 (-1.54, -0.35)	-2.43 (-2.99, -1.83)
+ Health-related factors	-0.50 (-1.10, 0.04)	-2.31 (-2.84, -1.74)

See details in Supplementary Tables 5 and 6

Supplementary Table 5. Mortality risk associated with conscientiousness and emotional stability in adjusted models (n=77,042 with 7,560 incident deaths)

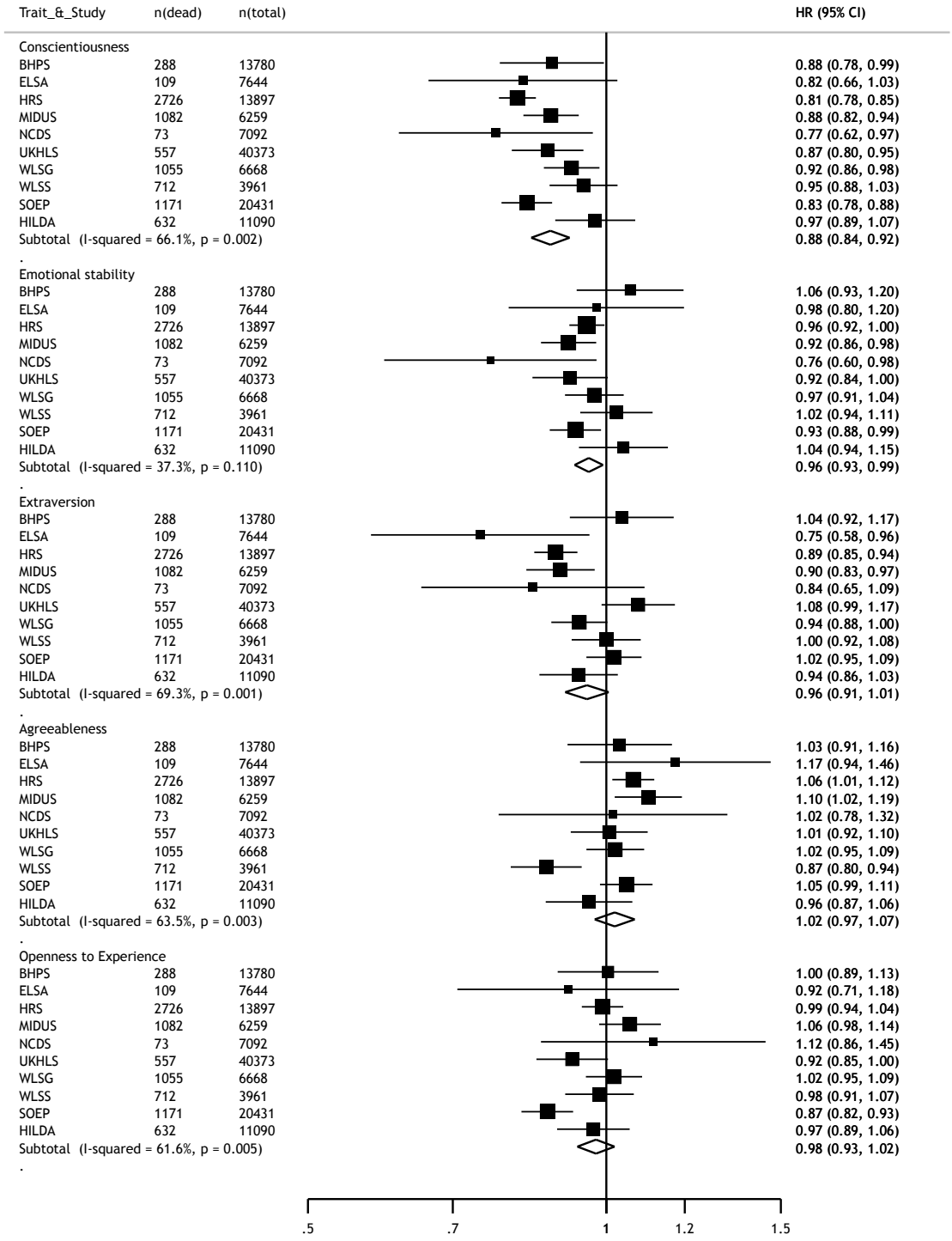
	Model 1	**Model 2**	**Model 3**
Conscientiousness			
Highest 40% – 100%	(reference)	(reference)	(reference)
25% – 40%	1.16 (1.09, 1.24)	1.15 (1.07, 1.23)	1.12 (1.04, 1.19)
15% – 25%	1.24 (1.15, 1.33)	1.22 (1.13, 1.31)	1.16 (1.08, 1.25)
5% – 15%	1.52 (1.41, 1.64)	1.48 (1.37, 1.59)	1.39 (1.29, 1.49)
Lowest 0% – 5%	1.78 (1.62, 1.94)	1.69 (1.55, 1.85)	1.53 (1.40, 1.68)
Emotional stability			
Highest 40% – 100%	(reference)	(reference)	(reference)
25% – 40%	1.02 (0.96, 1.09)	1.01 (0.95, 1.07)	0.99 (0.93, 1.06)
15% – 25%	1.02 (0.94, 1.10)	1.00 (0.92, 1.08)	0.96 (0.89, 1.04)
5% – 15%	1.19 (1.09, 1.29)	1.15 (1.06, 1.25)	1.10 (1.02, 1.20)
Lowest 0% – 5%	1.31 (1.18, 1.46)	1.26 (1.13, 1.40)	1.17 (1.06, 1.31)
Education			
Primary		(reference)	(reference)
Secondary		0.77 (0.73, 0.82)	0.82 (0.77, 0.87)
Tertiary		0.55 (0.51, 0.60)	0.66 (0.61, 0.71)
BMI category			
<18.5			2.04 (1.75, 2.37)
18.5 to 25			(reference)
25 to 30			0.98 (0.93, 1.03)
>30			1.11 (1.04, 1.18)
Smoking			1.97 (1.86, 2.09)
Physical inactivity			1.69 (1.61, 1.78)
Heavy alcohol consumption			0.98 (0.88, 1.09)

Values are hazard ratios (and 95% confidence intervals). All models are adjusted for gender and ethnic background (with age as the timescale).

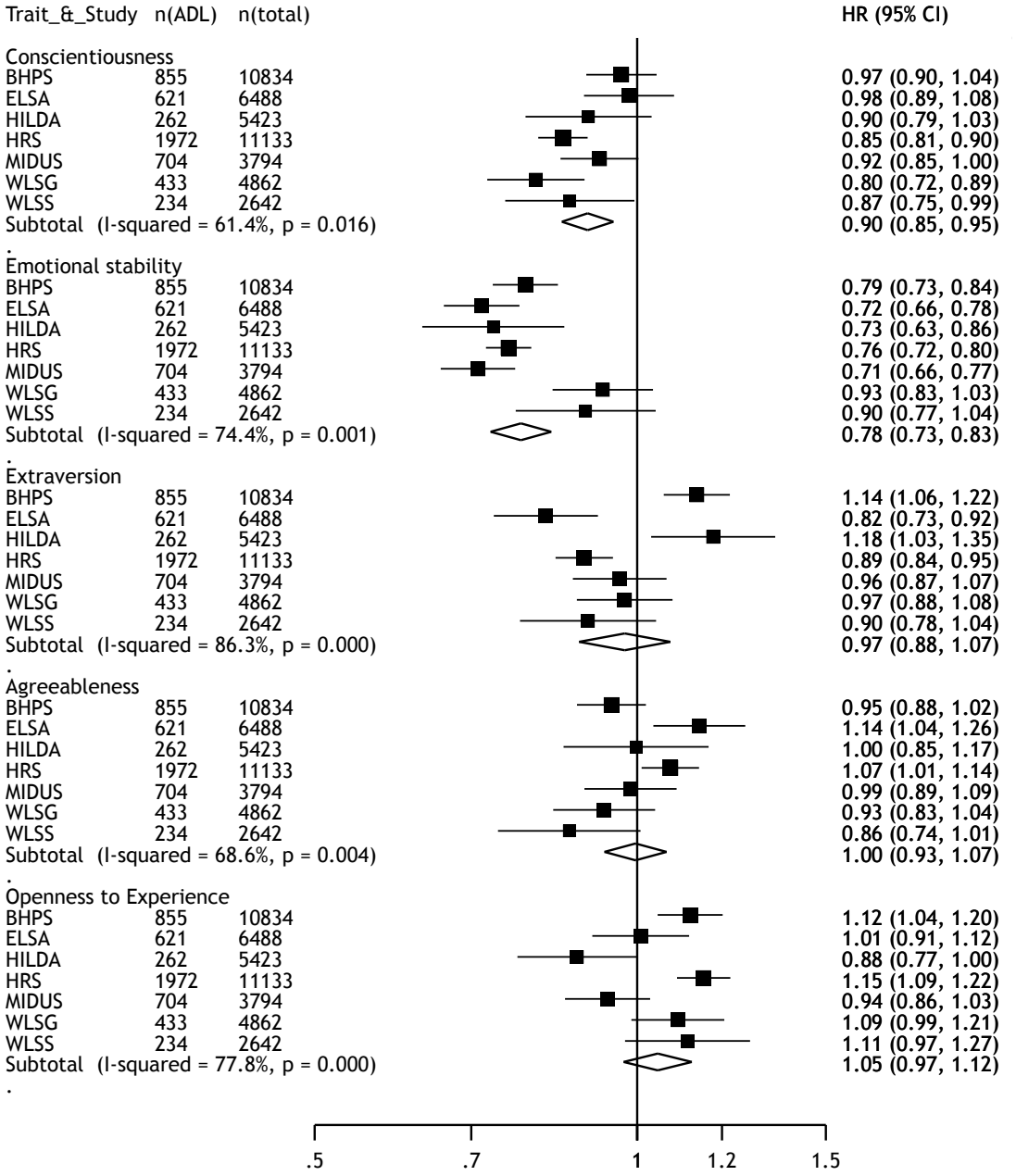
Supplementary Table 6. Disability risk associated with conscientiousness and emotional stability in adjusted models (n=34,254 with 4,244 incident deaths)

	Model 1	**Model 2**	**Model 3**
Conscientiousness			
Highest 85% – 100%	(reference)	(reference)	(reference)
75% – 85%	1.01 (0.89, 1.16)	1.02 (0.90, 1.17)	0.99 (0.87, 1.13)
60% – 75%	1.04 (0.92, 1.17)	1.04 (0.92, 1.17)	1.01 (0.90, 1.14)
40% – 60%	1.11 (0.99, 1.25)	1.12 (1.00, 1.26)	1.04 (0.93, 1.17)
25% – 40%	1.24 (1.10, 1.40)	1.23 (1.09, 1.39)	1.14 (1.01, 1.29)
15% – 25%	1.27 (1.12, 1.45)	1.27 (1.11, 1.45)	1.17 (1.02, 1.33)
5% – 15%	1.30 (1.15, 1.48)	1.29 (1.14, 1.47)	1.22 (1.07, 1.38)
Lowest 0% – 15%	1.53 (1.33, 1.76)	1.50 (1.30, 1.73)	1.34 (1.16, 1.54)
Emotional stability			
Highest 85% – 100%	(reference)	(reference)	(reference)
75% – 85%	1.18 (1.03, 1.35)	1.19 (1.04, 1.36)	1.22 (1.07, 1.39)
60% – 75%	1.14 (1.01, 1.28)	1.15 (1.02, 1.29)	1.14 (1.01, 1.28)
40% – 60%	1.35 (1.20, 1.52)	1.35 (1.20, 1.51)	1.37 (1.22, 1.53)
25% – 40%	1.49 (1.33, 1.68)	1.49 (1.33, 1.67)	1.52 (1.36, 1.71)
15% – 25%	1.67 (1.48, 1.90)	1.66 (1.46, 1.88)	1.68 (1.49, 1.91)
5% – 15%	1.92 (1.70, 2.16)	1.89 (1.68, 2.12)	1.95 (1.73, 2.20)
Lowest 0% – 15%	3.03 (2.63, 3.50)	3.01 (2.61, 3.47)	3.01 (2.61, 3.47)
Education			
Primary		(reference)	(reference)
Secondary		0.96 (0.88, 1.03)	1.01 (0.93, 1.09)
Tertiary		0.75 (0.68, 0.83)	0.89 (0.81, 0.99)
BMI category			
<18.5			1.09 (0.82, 1.46)
18.5 to 25			(reference)
25 to 30			1.43 (1.33, 1.55)
>30			2.59 (2.38, 2.81)
Smoking			2.64 (2.43, 2.87)
Physical inactivity			1.07 (1.00, 1.14)
Heavy alcohol consumption			0.89 (0.83, 0.97)

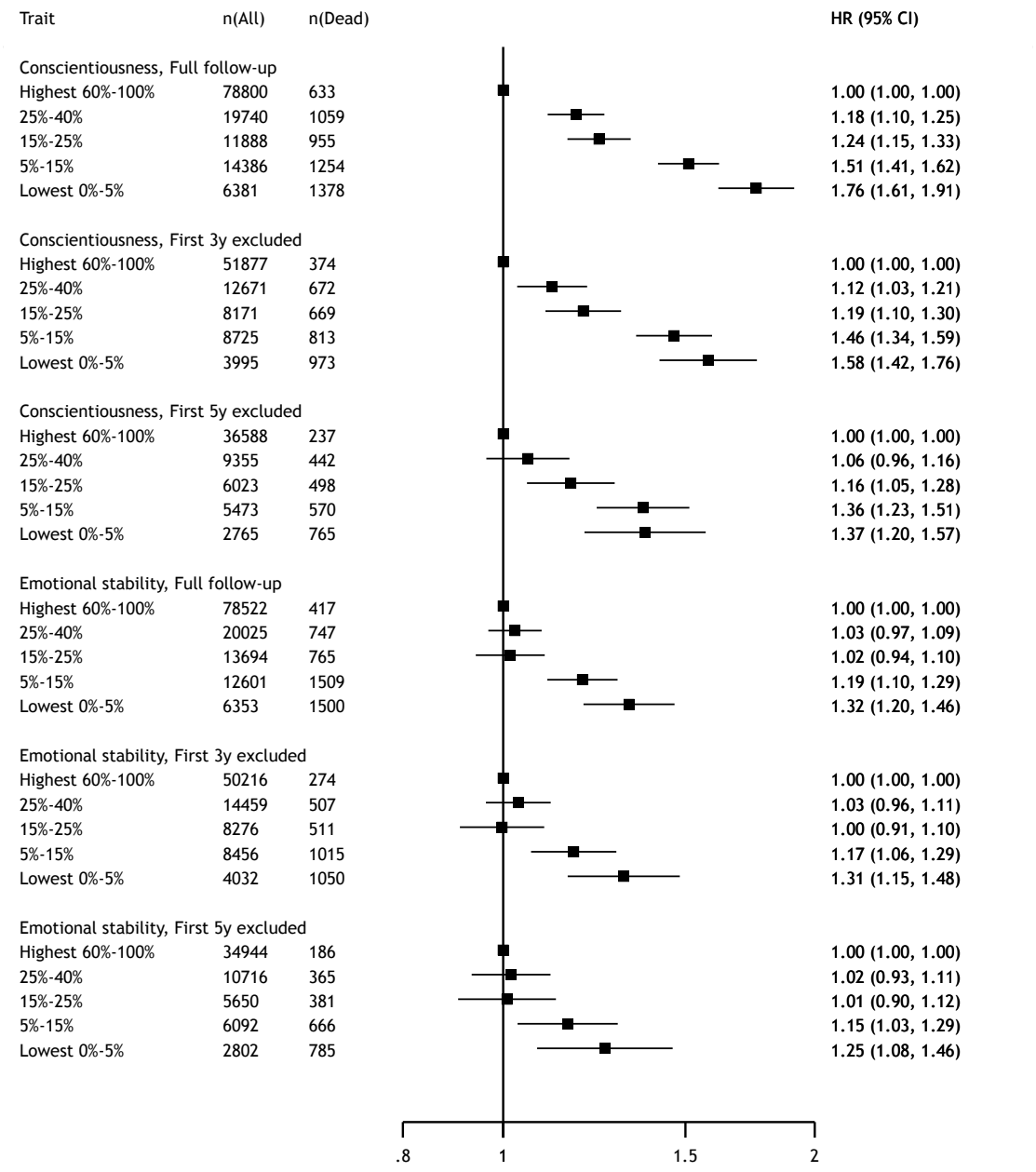
Values are hazard ratios (and 95% confidence intervals). All models are adjusted for gender and ethnic background (with age as the timescale).



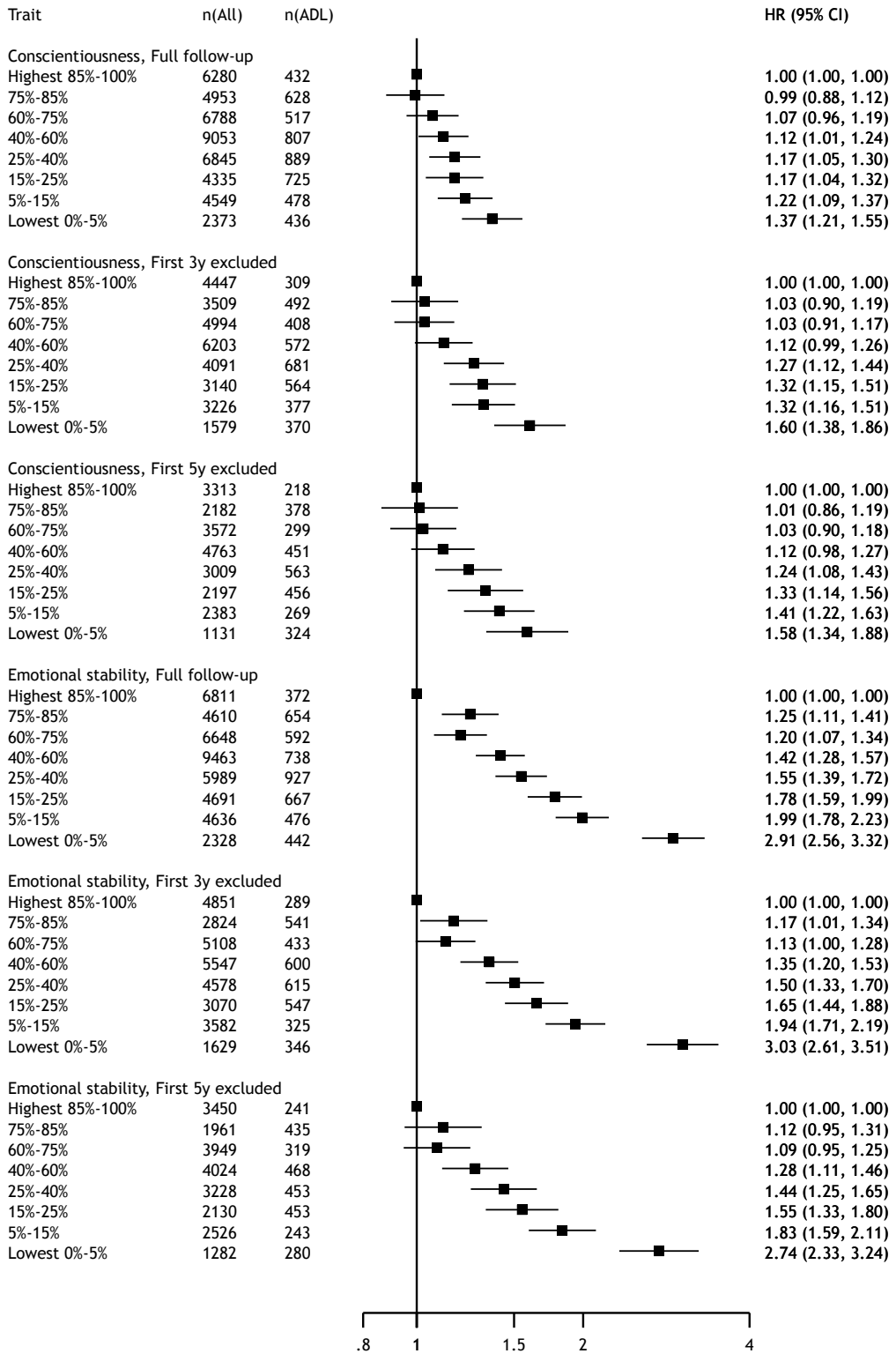
Supplementary Figure 1. Associations of continuous personality traits with mortality risk. Models were first fitted in each cohort study separately and then pooled together using random-effect meta-analysis. Values are hazard ratios (and 95% confidence intervals) associated with 1 standard deviation in personality trait.



Supplementary Figure 2. Associations of continuous personality traits with disability risk. Models were first fitted in each cohort study separately and then pooled together using random-effect meta-analysis. Values are hazard ratios (and 95% confidence intervals) associated with 1 standard deviation in personality trait.



Supplementary Figure 3. Associations of conscientiousness and emotional stability with mortality risk in models of full follow-up, first 3 follow-up years excluded, and first 5 follow-up years excluded.



Supplementary Figure 4. Associations of conscientiousness and emotional stability with disability risk in models of full follow-up, first 3 follow-up years excluded, and first 5 follow-up years excluded.