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Personality and self-rated health across eight cohort studies

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ABSTRACT

Rationale: There is substantial evidence for the predictive value of single-item selfrated health measures for a range of health outcomes. Past research has found an association between personality traits and self-rated health. However, there has not been a multi-cohort large-scale study that has examined this link, and few studies have examined the association between personality and change in self-rated health.
Objective: To examine the concurrent and longitudinal association between personality and self-rated health.
Method: Participants were individuals aged from 16 to 107 years (N > 46,000) drawn from eight large longitudinal samples from the US, Europe, and Japan. Brief measures of the five-factor model of personality, a single item measure of self-rated health, and covariates (age, sex, and education, and race) were assessed at baseline and self-rated health was measured again 3–20 years later.
Results: In cross-sectional analyses, higher neuroticism was related to lower self-rated health whereas higher extraversion, openness, agreeableness and conscientiousness were associated with better self-rated health across most samples. A meta-analysis revealed that a one standard deviation higher neuroticism was related to more than 50% higher risk of fair to poor health, whereas a one standard deviation higher extraversion, openness, agreeableness and conscientiousness was associated with at least 15% lower risk of fair or poor health. A similar pattern was found in longitudinal analyses: personality was associated with risk of self-rated excellent/very good/good health at baseline becoming fair/poor at follow-up. In multilevel analyses, however, personality was weakly related to trajectories of self-rated health and in the opposite of the expected direction.
Conclusions: The present study shows replicable cross-sectional and small longitudinal associations between personality and self-rated health. This study suggests that lower neuroticism, higher extraversion, openness, agreeableness and conscientiousness are related to more favorable self-evaluations of health.

1. Introduction

There is substantial evidence for the predictive value of single-item self-rated health measures for a range of health outcomes. Poor self-rated health, for example, is related to a decline in independent activities of daily living (Tomioka et al., 2017), higher risk of incidence of chronic disease (Latham and Peek, 2013), steeper cognitive decline (Bendayan et al., 2017), higher risk of dementia (Montlahuc et al., 2011), and higher mortality risk in diverse populations (DeSalvo et al., 2006). Given these associations, there is interest in identifying determinants of how individuals rate their health (Jylhä, 2009). According to existing knowledge and conceptualizations (see Jylhä, 2009), self-rated health is a plurifactorial construct that reflects a range of influences, from genetic (Harris et al., 2017) to environmental (Meyer et al., 2014). The present study focused specifically on the association between personality and self-rated health.

Personality traits defined by the Five Factor Model (FFM, Digman, 1990) are associated consistently with health across adulthood (Strickhouser et al., 2017). This association is found across a range of health outcomes, including biological and functional markers (Stephan et al., 2018a,b; Sutin et al., 2019), mental health (Hakulinen et al., 2015a), incident disease such as Alzheimer's (Terracciano et al., 2014), and general mortality risk (Graham et al., 2017). Consistent with these studies, past research has found an association between personality traits and single-item measures of self-rated health. Neuroticism, which refers to a propensity to experience negative emotions and distress, is

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associated consistently with poor self-rated health in cross-sectional studies (Chapman et al., 2006; Goodwin and Engstrom, 2002; Kööts-Ausmees et al., 2016; Löckenhoff et al., 2012; Turiano et al., 2012; Quinn et al., 1999) and declines in health in longitudinal studies (Löckenhoff et al., 2012; Mund and Neyer, 2016). Conscientiousness, defined as a tendency to be organized and self-disciplined, is related to better concurrent self-rated health (Goodwin and Engstrom, 2002; Kitayama and Park, in press; Löckenhoff et al., 2012; Turiano et al., 2012). Furthermore, conscientiousness in childhood prospectively predicts self-rated health in midlife (Hampson et al., 2006) and the maintenance of good self-rated health across adulthood (Hampson et al., 2016). To a lesser extent, extraversion (a propensity to be energetic, sociable, and experience positive emotions) is associated cross-sectionally with more favorable health ratings (Goodwin and Engstrom, 2002; Löckenhoff et al., 2012; Turiano et al., 2012). There is more mixed evidence for agreeableness (the tendency to be altruistic and trusting) and openness (the tendency to be curious and unconventional). Agreeableness has been related to worse self-rated health in some studies (Turiano et al., 2012), better self-rated health in others (Goodwin and Ergstrom, 2002), and unrelated in still others (Löckenhoff et al., 2012). Although a cross-sectional association between openness and self-rated health has been reported in some studies (Goodwin and Ergstrom, 2002; Löckenhoff et al., 2012), most studies find no association between this trait and individuals' ratings of their health (Kööts-Ausmees et al., 2016; Mund and Neyer, 2016; Turiano et al., 2012). These mixed findings for some traits could be due, in part, to relatively small sample sizes of some of the previous studies. To our knowledge, there has not been a large-scale, multi-cohort study that has examined the association between personality and self-rated health.

Most previous studies have also used a cross-sectional design and few have examined longitudinal associations between personality traits and changes in self-rated health. Personality traits such as neuroticism and conscientiousness may be particularly relevant for changes in self-rated health over time (Hampson et al., 2016; Löckenhoff et al., 2012). Indeed, both traits are associated consistently with a range of behavioral, biological, physical and mental health factors implicated in subjective ratings of health. Higher neuroticism and lower conscientiousness are related to health-risk behaviors such as less physical activity and more sedentary behaviors (Sutin et al., 2016), smoking (Hakulinen et al., 2015b), and excessive alcohol use (Luchetti et al., 2018), which may lead to worse health over time. Also, individuals higher in neuroticism and lower in conscientiousness tend to have higher levels of inflammation (Luchetti et al., 2014), lower pulmonary function (Terracciano et al., 2017), are more likely to measure in the obese weight category (Jokela et al., 2013) and have greater physiological dysfunction (Sutin et al., 2019) that may contribute to worse health over time.

Based on eight large longitudinal samples of adults from several countries, the present study examined the association between personality and self-rated health. Based on the current literature, it was hypothesized that higher neuroticism would be related to lower concurrent and follow-up self-rated health, whereas extraversion and conscientiousness would be associated with higher concurrent and follow-up self-rated health. Moreover, it was expected that neuroticism would be associated with a decline in health ratings, whereas higher conscientiousness would be associated with maintaining higher self-rated health over time. Additional analyses tested age and education as moderators of the associations between personality traits and changes in self-rated health to examine whether any associations become stronger or weaker with age and/or education.

2. Method

2.1. Participants

Data were drawn from eight large longitudinal samples of adults: The Wisconsin Longitudinal Study graduate (WLSG) and sibling (WLSS) samples, the Midlife in the United States Survey (MIDUS), the Health and Retirement Study (HRS), the Midlife in Japan survey (MIDJA), the English Longitudinal Study of Ageing (ELSA), the Longitudinal Internet Studies for the Social Sciences (LISS), and the National Health and Aging Trends Study (NHATS). This study was based on publicly available de-identified datasets and therefore exempt from Institutional Review Board review. In each sample, all participants provided informed consent. Participants were included in the analytic sample when they had complete data on demographic factors (age, sex, education, race [available in MIDUS, ELSA, NHATS, and HRS]), personality traits, and self-rated health at baseline.

The WLS is a long-term study of a random sample of 10,317 men and women who graduated from Wisconsin high schools in 1957 (WLSG). WLS also included selected siblings (WLSS) of some of the graduates. The WLS sample is broadly representative of white, non-Hispanic American men and women who completed at least a high school education. In the WLSG, a total of 6661 participants provided complete baseline personality, demographic, and self-rated health data in 1992–1993. Of this sample, 5694 individuals also provided at least one measure of self-rated health at follow-up in 2003–2005 and/or 2011. In the WLSS, complete baseline data were obtained from 3407 individuals in 1993–1994. Of this sample, 2701 participants also provided at least one self-rated health measure in 2004–2007 and/or 2011.

The MIDUS is a longitudinal study of non-institutionalized, English-speaking US adults. The first (1994–1995, MIDUS I), second (2004–2006, MIDUS II), and third waves (2013–2014, MIDUS III) were used in the present study. Complete data on personality, demographic information, and self-rated health were obtained at baseline from a total of 6051 individuals. Among these participants, 3947 had at least one measure of self-rated health data at follow-up in 2004–2006 and/or 2013–2014.

The HRS is a national longitudinal study of Americans older than 50 years and their spouses. Personality, demographic factors, and self-rated health were assessed at baseline for half of the sample in 2006, and from the other half in 2008. Data from both waves were combined as baseline. Follow-up self-rated health were obtained from the 2010 and 2014 waves for participants in the 2006 sample and from the 2012 and 2016 waves for participants in the 2008 sample. A total of 12,534 participants provided complete personality, demographic data, and self-rated health at baseline. Of this sample, 11,627 participants had at least one self-rated health measure at follow-up.

The MIDJA is a parallel survey of the MIDUS conducted on randomly selected adults from the Tokyo metropolitan area. The present study used data from the first (2008) and second (2012) waves. In total, 1009 individuals provided complete baseline demographic, personality, and self-rated health data; 649 provided follow-up data.

ELSA is a representative cohort of men and women living in England aged 50 years and older. Personality traits were first assessed at Wave 5 (2010), which was considered the baseline for the present study. A total of 8112 individuals provided complete demographic, personality, and self-rated health data at baseline. At least one follow-up self-rated health measure was obtained from 7409 participants at Wave 6 (2012), Wave 7 (2014), and/or Wave 8 (2016).

LISS is a representative longitudinal sample of the Dutch population. Complete baseline personality, demographic, and self-rated health data were obtained from 5821 participants in 2008. Self-rated health was assessed every year up to 2017. Of the baseline participants, 5171 individuals provided at least one measure of self-rated health over the follow-up.

The NHATS is a nationally representative longitudinal study of Medicare enrollees aged 65 years and older. Personality was assessed among two-thirds of the total sample. Specifically, it was first assessed in 2013 for one-third of the sample, and in 2014 for a second third. Data from the two waves were combined. A total of 2766 participants provided complete data on demographic factors, personality, and self-rated health at baseline. Follow-up self-rated health data were obtained in

2014, 2015, and 2016 for participants from the 2013 wave and in 2015, 2016, and 2017 for participants in the 2014 wave. Of the total baseline sample, 2389 individuals had at least one measure of self-rated health at follow-up.

2.2. Measures

2.2.1. Personality

Each sample used a validated FFM measure to assess the five personality traits (neuroticism, extraversion, openness, agreeableness, and conscientiousness). The Midlife Development Inventory (MIDI; Zimprich et al., 2012) was used in the MIDUS, MIDJA, HRS, ELSA, and NHATS. A 25-item version was used in the MIDUS and MIDJA, a 26-item version was used in the HRS and ELSA, and a 10-item version was used in NHATS. Participants were asked to indicate how much each adjective described them on a scale ranging from 1 (*not at all*) to 4 (*a lot*). A 29-item version of the Big Five Inventory (BFI; John et al., 1991) was used in the WLSG and the WLSS. A 6-point scale that ranged from 1 (*disagree strongly*) to 6 (*agree strongly*) was used to assess agreement or disagreement with descriptive statements. The International Personality Item Pool (IPIP, Goldberg et al., 2006) was used in the LISS. Participants were asked to rate 50 items on a scale from 1 (*Very inaccurate*) to 5 (*Very accurate*). Across the samples, Cronbach alpha ranged from 0.51 to 0.88 for neuroticism, 0.75 to 0.86 for extraversion, 0.57 to 0.84 for openness, 0.69 to 0.87 for agreeableness, and 0.56 to 0.77 for conscientiousness.

2.2.2. Self-rated health

A single-item self-rated health measure was used in each sample. For example, the following item was used in the HRS: "Would you say your health is excellent, very good, good, fair, or poor?" In the HRS, the ELSA, the NHATS, and the LISS, a scale from 1 (poor) to 5 (excellent) was used, whereas participants rated their health on a scale from 1 (very poor) to 5 (excellent) in the WLSG and WLSS. There were only slight variations in the wording of the item across these samples. In both the MIDUS and the MIDJA, participants were asked how they would rate their health these days on a scale ranging from 0 (*the worst possible health*) to 10 (*the best possible health*).

2.2.3. Covariates

In each sample, age, sex, and education were included as covariates. Race was controlled for in the MIDUS, the HRS, the ELSA and the NHATS. Education was reported in years in the WLSG, the WLSS, and the HRS. Education was measured on a scale ranging from 1 (No schooling completed) to 9 (Master's, professional or doctoral degree) in the NHATS, from 1 (no grade school) to 12 (doctoral-level degree) in the MIDUS, from 1 (8th-grade high school) to 8 (graduate school) in the MIDJA, from 1 (No qualification) to 7 (NVQ4/NVQ5/Degree or equivalent) in the ELSA, and from 0 (not yet completed any education) to 7 (other) in the LISS.

2.3. Statistical analysis

In each sample, baseline self-rated health was regressed on baseline personality, controlling for age, sex, education, and race (except the WLS, MIDJA, and LISS samples). Additional logistic regression analyses were conducted to examine whether personality traits were related to the likelihood of poor/fair self-rated health, controlling for the same demographic covariates. Ratings of fair and poor were combined (coded as 1) and contrasted against the three other response options (coded as 0). Logistic regression analyses were also conducted to test whether personality was related to the likelihood of poor/fair health at follow-up. In these analyses, individuals with poor/fair self-rated health at baseline were excluded, and the last wave of self-rated health assessment was used as the dependent variable in each sample. The MIDUS and MIDJA were excluded because the scale used to measure self-rated health ranged from *the worst possible health* (0) to *the best possible health* (10), without any reference attached to intermediate values. Personality traits were standardized in these analyses.

In each sample, the association between personality and changes in self-rated health was examined using Multilevel Modeling (MLM) analysis. The Linear Mixed Model with maximum likelihood estimation method was run in SPSS. Separate models were tested for each personality trait. Fixed effects were personality traits and demographic covariates entered as predictors of the intercept. Personality traits were also entered as predictors of the slope, as the interaction of the trait with time (in years from baseline). Random effects were estimated for the level of self-rated health to vary across individuals.

For each set of analyses, the effect estimates across samples were combined in a random-effect meta-analysis using the Comprehensive Meta-Analysis software. Heterogeneity was assessed with the I^2 and tau^2 statistics. Finally, supplemental analysis tested whether age and education moderated the association between personality and self-rated health at baseline and overtime in each sample.

3. Results

Table 1 reports descriptive statistics for the eight samples at baseline. Attrition analysis indicated that individuals without follow-up self-rated health data were older, more likely to be male, and had lower baseline self-rated health than those with at least one measure of self-rated health at follow-up (please refers to online supplementary material for details on these analyses). In addition, in most samples, individuals without the self-rated health measure at follow-up scored higher on neuroticism and lower on extraversion, openness, agreeableness, and conscientiousness.

3.1. Cross-sectional associations

Consistent with the hypotheses, the cross-sectional analysis indicated that higher neuroticism was related to lower self-rated health, whereas higher extraversion and conscientiousness were related to better ratings of health at baseline in all samples (see Table 2). Furthermore, although not expected, higher agreeableness and openness were also associated with more favorable self-rated health in most samples. This overall pattern of association was supported by the meta-analysis (Table 2). Based upon Cohen's *d* (see Table 2), medium differences were observed between individuals who scored 1 *SD* above versus 1 *SD* below the mean of neuroticism, extraversion, and conscientiousness. Small differences were found in most samples between individuals scoring 1 *SD* above the mean on openness and agreeableness compared to those scoring 1 *SD* below the mean.

The logistic regression analysis indicated that for each standard deviation higher neuroticism, there was a 50–90% higher likelihood to report fair/poor health (see Table 3). In addition, every *SD* higher extraversion, openness, agreeableness, and conscientiousness was related to about a 20–45%, 15–25%, 15–20%, and 20–40% lower probability of fair/poor health, respectively (see Table 3). The meta-analysis supported this overall pattern of associations (see Table 3).

3.2. Longitudinal associations

The pattern of associations observed in the cross-sectional analyses was supported in longitudinal logistic regression analyses (see Table 4). The meta-analysis indicated that a one *SD* higher neuroticism was related to a higher risk of fair/poor health at follow-up, whereas a one *SD* higher in either extraversion, openness, and conscientiousness was associated with a lower risk of fair/poor health at follow-up (Table 4). No association was found with agreeableness in the meta-analysis.

The results of the longitudinal analyses using MLM are presented in Table 5. Consistent with expectations and the cross-sectional results, higher scores on neuroticism and lower scores on the other four traits were associated with a lower mean level (intercept) of self-rated health over time. In contrast to the hypotheses, however, neuroticism was

Table 1
Baseline characteristics of the samples.

Variables	WLSG (*N* = 6661)		WLSS (*N* = 3407)		MIDUS (*N* = 6051)		HRS (*N* = 12,534)		MIDJA (*N* = 1009)		ELSA (*N* = 8112)		LISS (*N* = 5821)		NHATS (*N* = 2766)	
	M/%	SD	M/%	SD	M/%	SD	M/%	SD	M/%	SD	M/%	SD	M/%	SD	M/%	SD
Age (Years)	53.21	0.63	53.52	7.38	46.82	12.89	68.64	9.90	54.13	14.03	66.10	8.69	45.76	15.67	79.49	7.52
Sex (% women)	54%		53%		53%		58%		51%		55%		54%		59%	
Race (% White)	100%		100%%		92%		85%		0%		98%		100%		73%	
Education	13.71	2.30	13.78	2.54	6.87	2.47	12.80	2.97	4.48	2.08	4.17	2.23	3.60	1.64	5.20	2.26
Neuroticism	3.21	0.98	3.22	0.95	2.24	0.66	2.05	0.61	2.11	0.56	2.10	0.59	2.58	0.68	2.22	0.86
Extraversion	3.84	0.89	3.76	0.90	3.20	0.56	3.19	0.56	2.43	0.68	3.15	0.56	3.29	0.63	3.13	0.76
Openness	3.64	0.80	3.60	0.75	3.01	0.52	2.94	0.55	2.19	0.61	2.88	0.55	3.51	0.50	2.81	0.84
Agreeableness	4.75	0.75	4.69	0.74	3.49	0.49	3.53	0.48	2.63	0.63	3.51	0.48	3.91	0.49	3.57	0.56
Conscientiousness	4.87	0.68	4.78	0.71	3.42	0.44	3.36	0.48	2.69	0.55	3.30	0.49	3.73	0.52	3.20	0.75
Baseline self-rated health	4.15	0.67	4.11	0.68	7.46	1.61	3.19	1.09	6.22	1.97	3.26	1.09	3.15	0.76	3.22	1.04

Note. WLSG= Wisconsin Longitudinal Study graduate sample. WLSS= Wisconsin Longitudinal Study sibling sample. MIDUS = Midlife in the United States Survey. HRS= Health and Retirement Study. MIDJA = Midlife in Japan survey. ELSA = English Longitudinal Study of Ageing (ELSA). LISS = Longitudinal Internet Studies for the Social Sciences, NHATS=National Health and Aging Trends Study.

Table 2
Summary of regression analysis predicting baseline self-rated health from baseline personality traits.

	Neuroticism β	*d*	Extraversion β	*d*	Openness β	d	Agreeableness β	d	Conscientiousness β	*d*
WLSG[a]	−0.20***	0.58	0.13***	0.43	0.09***	0.22	0.12***	0.32	0.16***	0.40
WLSS [a]	−0.18***	0.49	0.11***	0.32	0.06*	0.15	0.11***	0.37	0.19***	0.53
MIDUS [b]	−0.25***	0.73	0.23***	0.65	0.13***	0.36	0.12***	0.30	0.24***	0.77
HRS [b]	−0.24***	0.64	0.22***	0.65	0.14***	0.43	0.09***	0.23	0.22***	0.63
MIDJA [a]	−0.26***	0.72	0.19***	0.60	0.12***	0.29	0.14***	0.37	0.15***	0.37
ELSA [b]	−0.22***	0.59	0.29***	0.90	0.17***	0.52	0.08***	0.15	0.24***	0.70
LISS [a]	−0.28***	0.83	0.09***	0.27	0.07***	0.19	0.03	0.08	0.11***	0.30
NHATS [b]	−0.18***	0.56	0.13***	0.37	0.10***	0.36	0.09***	0.22	0.15***	0.43
Random Effect	−0.23*** (−0.25; −0.20)		0.18*** (0.13; 0.23)		0.11*** (0.08; 0.14)		0.09*** (0.07; 0.12)		0.19*** (0.15; 0.22)	
Heterogeneity I^2	83.98		97.14		88.89		82.28		93.28	
Heterogeneity Tau^2	0.000		0.006		0.001		0.000		0.003	

Note. WLSG: *N* = 6661; WLSS: *N* = 3407; MIDUS: *N* = 6051; HRS: *N* = 12,534; MIDJA: *N* = 1009; ELSA: *N* = 8112; LISS: *N* = 5821; NHATS: *N* = 2766; β = Standardized regression coefficient, d = Cohen's d, computed by comparing individuals one standard deviation above and below the mean of each personality traits on self-rated health, controlling for demographic factors. Values in parentheses are 95% confidence intervals.
*$p < .05$, **$p < .01$, ***$p < .001$.
[a] Adjusted for age, sex, education.
[b] Adjusted for age, sex, education, and race.

Table 3
Summary of logistic regression analysis predicting baseline fair/poor self-rated health from baseline personality traits.

	WLSG[a]	WLSS[a]	HRS[b]	ELSA[b]	LISS[a]	NHATS[b]	Random Effect	Heterogeneity I^2	Heterogeneity Tau^2
Neuroticism	1.55*** (1.43–1.68)	1.55*** (1.39–1.72)	1.67*** (1.59–1.74)	1.57*** (1.49–1.66)	1.92*** (1.78–2.07)	1.49*** (1.36–1.64)	1.62*** (1.72–1.52)	81.46	0.005
Extraversion	0.76*** (0.71–0.83)	0.77*** (0.70–0.86)	0.66*** (0.64–0.69)	0.55*** (0.52–0.58)	0.81*** (0.75–0.87)	0.76*** (0.70–0.83)	0.71*** (0.63–0.81)	94.93	0.023
Openness	0.86*** (0.80–0.94)	0.86** (0.77–0.96)	0.80** (0.77–0.84)	0.74** (0.70–0.78)	0.96 (0.89–1.03)	0.80 (0.73–0.88)	0.83*** (0.77–0.90)	85.55	0.008
Agreeableness	0.80*** (0.75–0.87)	0.80*** (0.72–0.88)	0.84*** (0.81–0.88)	0.86*** (0.82–0.91)	0.98 (0.91–1.06)	0.81*** (0.74–0.88)	0.85*** (0.80–0.90)	73.29	0.003
Conscientiousness	0.72*** (0.67–0.77)	0.69*** (0.62–0.76)	0.66*** (0.64–0.69)	0.61*** (0.58–0.65)	0.77*** (0.71–0.83)	0.71*** (0.65–0.78)	0.69*** (0.65–0.75)	80.35	0.005

Note. WLSG: *N* = 6661; WLSS: *N* = 3407; HRS: *N* = 12,534; ELSA: *N* = 8112; LISS: *N* = 5821; NHATS: *N* = 2766.
Coefficients are standardized coefficients. Values in parentheses are 95% confidence intervals.
*$p < .05$, **$p < .01$, ***$p < .001$.
[a] Adjusted for age, sex, education.
[b] Adjusted for age, sex, education, and race.

related positively to change in self-rated health. This finding suggests that lower neuroticism was related to more decline in self-rated health over time. This association was found in six out of eight samples. In addition, and also in contrast to expectations, conscientiousness was related negatively to changes in self-rated health in five out of eight samples, extraversion was related negatively to changes in self-rated health in four samples, and openness and agreeableness were related negatively to changes in self-rated health in three samples (Table 5). The meta-analysis supported these associations (Table 5). As an example, Fig. 1 presents changes in self-rated health related to high (1 *SD* above

Table 4
Summary of logistic regression analysis predicting fair/poor self-rated health at follow-up from baseline personality traits.

	WLSG[a]	WLSS[a]	HRS[b]	ELSA[b]	LISS[a]	NHATS[b]	Random Effect	Heterogeneity I^2	Heterogeneity Tau^2
Neuroticism	1.37*** (1.25–1.50)	1.34*** (1.16–1.55)	1.27*** (1.19–1.36)	1.38*** (1.27–1.50)	1.47*** (1.27–1.69)	1.30*** (1.12–1.51)	1.34*** (1.28–1.39)	0	0
Extraversion	0.89* (0.81–0.98)	0.84* (0.73–0.98)	0.82*** (0.77–0.87)	0.76*** (0.70–0.82)	0.93 (0.81–1.08)	0.87 (0.75–1.00)	0.84*** (0.79–0.89)	49.02	0.002
Openness	0.96 (0.87–1.06)	0.88 (0.75–1.03)	0.87*** (0.82–0.93)	0.90* (0.83–0.98)	0.94 (0.82–1.09)	0.93 (0.80–1.08)	0.90*** (0.86–0.93)	0	0
Agreeableness	0.90* (0.83–0.99)	0.79** (0.68–0.91)	0.93* (0.87–1.00)	1.03 (0.95–1.12)	1.02 (0.87–1.19)	0.98 (0.85–1.14)	0.94 (0.88–1.01)	59.67	0.004
Conscientiousness	0.86** (0.79–0.95)	0.71*** (0.62–0.82)	0.79*** (0.74–0.84)	0.81*** (0.75–0.88)	0.83* (0.72–0.96)	0.80** (0.70–0.93)	0.80*** (0.77–0.84)	6.39	0.0002

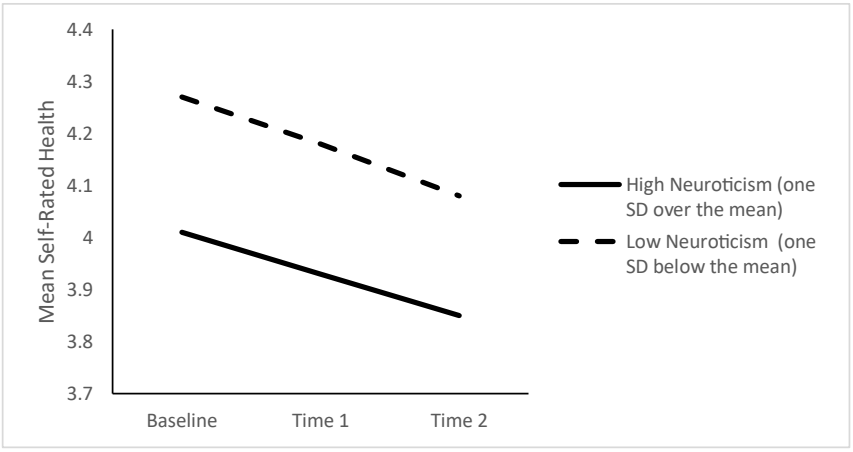
Note. Coefficients are standardized coefficients. Values in parentheses are 95% confidence intervals. WLSG: $N = 4088$; WLSS: $N = 1847$; HRS: $N = 6730$; ELSA: $N = 4615$; LISS: $N = 1877$; NHATS: $N = 1518$.
*$p < .05$, **$p < .01$, ***$p < .001$.
[a] Adjusted for age, sex, education.
[b] Adjusted for age, sex, education, and race.

Table 5
Summary of multilevel analysis predicting change in self-rated health from baseline personality traits.

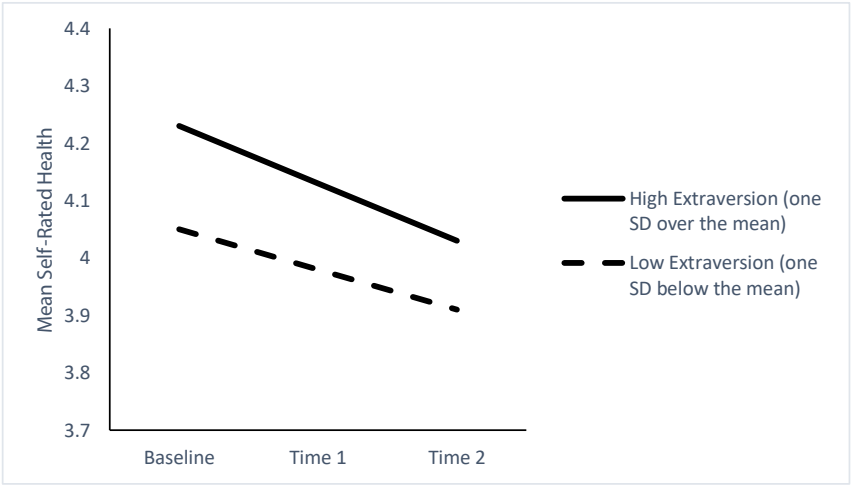
	Neuroticism		Extraversion		Openness		Agreeableness		Conscientiousness	
	Intercept[a]	Slope[b]	Intercept[a]	Slope[b]	Intercept[a]	Slope[b]	Intercept[a]	Slope[b]	Intercept[a]	Slope[b]
WLSG[a]	-.13 (.01)***	.001 (.0005)*	.10 (.01)***	-.002 (.0006)***	.07 (.01)***	-.002 (.0007)*	.10 (.01)***	-.002 (.0007)**	.15 (.012)***	-.002 (.001)**
WLSS [a]	-.13 (.012)***	.001 (.001)	.08 (.012)***	-.000 (.00)	.055 (.02)***	.001 (.001)	.098 (.015)***	-.00 (.00)	.17 (.016)***	-.003 (.001)**
MIDUS [b]	-.60 (.03)***	.009 (.002)***	.64 (.035)***	-.015 (.003)***	.38 (.04)***	-.004 (.003)	.39 (.04)***	-.014 (.003)***	.85 (.045)***	-.01 (.004)****
HRS [b]	-.44 (.014)***	.012 (.002)***	.42 (.015)***	-.009 (.002)***	.27 (.016)***	-.005 (.002)**	.20 (.019)***	-.002 (.002)	.48 (.018)***	-.009 (.002)***
MIDJA [a]	-.93 (.11)***	.06 (.03)*	.54 (.09)***	.034 (.026)	.35 (.11)**	-.002 (.03)	.44 (.10)***	.000 (.027)	.49 (.11)***	-.04 (.03)
ELSA [b]	-.41 (.019)***	.007 (.003)*	.56 (.019)***	-.014 (.003)***	.33 (.02)***	-.01 (.003)***	.16 (.024)***	-.014 (.004)***	.51 (.022)***	-.012 (.004)**
LISS [a]	-.32 (.01)***	.003 (.001)*	.11 (.01)***	.003 (.001)	.09 (.018)***	-.00 (.00)	.05 (.018)*	.002 (.002)	.16 (.017)***	-.003 (.002)
NHATS [b]	-.21 (.02)***	.006 (.007)	.18 (.023)***	-.004 (.008)	.13 (.021)***	-.013 (.007)	.16 (.032)***	-.010 (.011)	.22 (.023)***	-.015 (.009)
Random Effect	−0.33***	0.005***	0.33***	−0.005**	0.20***	−0.003*	0.17***	−0.004*	0.37***	−0.005***
	(−0.43; −0.23)	(0.002; 0.008)	(0.22; 0.44)	(−0.009; −0.001)	(0.12; 0.28)	(−0.005; −0.0003)	(0.12; 0.22)	(−0.007; −0.0004)	(0.26; 0.47)	(−0.008; −0.003)
Heterogeneity I^2	99.33	85.98	99.08	90.67	97.23	68.20	92.14	79.92	98.23	67.57
Heterogeneity Tau^2	0.023	0.000	0.030	0.000	0.014	0.000	0.005	0.000	0.027	0.000

Note. Coefficients are unstandardized coefficients (standard errors in parentheses). [a] Relationship between personality traits and average mean-level of self-rated health over time. [b] Effect of the interaction between time and personality trait on self-rated health.
*$p < .05$, **$p < .01$, ***$p < .001$.
[a] Adjusted for age, sex, education.
[b] Adjusted for age, sex, education, and race.

A.



B.



C.

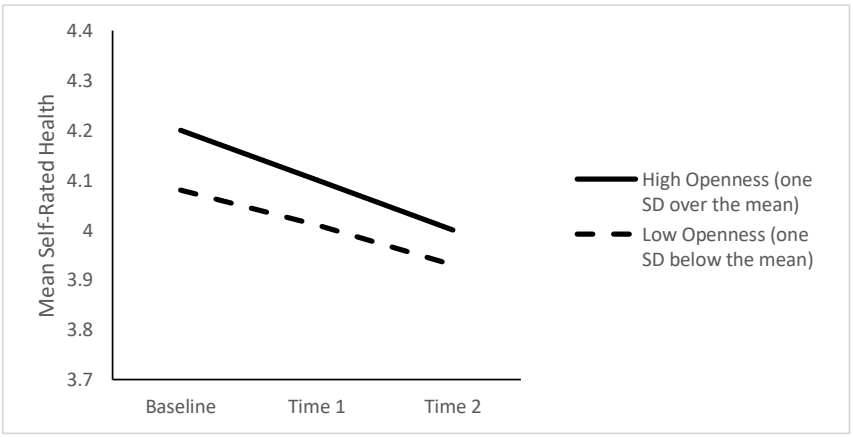
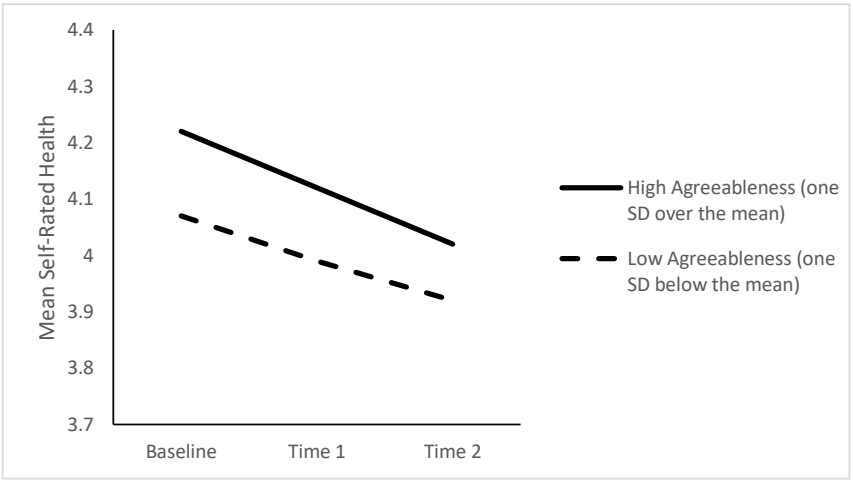


Fig. 1. Changes in Self-Rated Health for Low and High Neuroticism (Panel A), Extraversion (Panel B), Openness (Panel C), Agreeableness (Panel D), and Conscientiousness (Panel E) in the WLSG. Note. Baseline assessment was conducted in 1992–1993, Time 1 assessment was conducted in 2003–2005, and Time 2 assessment was conducted in 2011.

the mean) versus low (1 *SD* above the mean) neuroticism, extraversion, openness, agreeableness, and conscientiousness in the WLSG.

Finally, age and education were tested as moderators of the association between personality traits and self-rated health. Overall there was no replicable moderating effect of age. Education moderated the link between personality and self-rated health at baseline in some but not all samples (Supplementary Material).

D.



E.

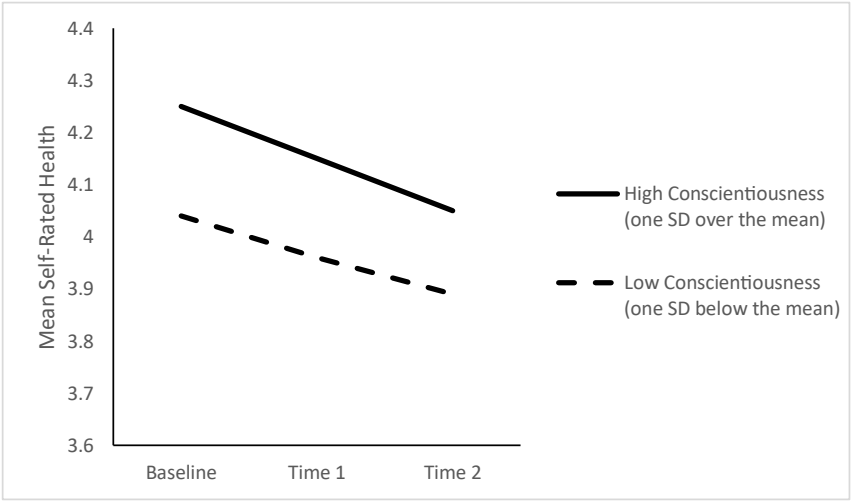


Fig. 1. (*continued*).

4. Discussion

Based upon eight large samples of adults, the present study examined the association between personality and a single-item self-rated health measure. This study found strong support for cross-sectional associations between higher extraversion, openness, agreeableness, and conscientiousness and higher self-rated health and between higher neuroticism and lower self-rated health (see Tables 2 and 3). In addition, higher emotional stability, extraversion, openness, and conscientiousness were related to lower likelihood of fair or poor self-rated health at follow-up (see Table 4). However, in contrast to the hypotheses, the MLM longitudinal results indicated that there were small but consistent associations between lower neuroticism and higher extraversion, openness, agreeableness, and conscientiousness and declines in subjective health over time (see Table 5). The contrast between the longitudinal logistic regression analysis and the MLM analysis suggests that personality is most predictive of substantial changes toward worse self-rated health rather than more subtle shifts in self-rated health over time (i.e., the MLM analyses indicated weak and unexpected associations) (see Fig. 1). This study provides the largest and the longest evidence to date of an association between personality and self-rated health in adulthood.

Neuroticism was the strongest and most consistent personality correlate of self-rated health (see Tables 2 and 3) and is consistent with existing cross-sectional findings (Kööts-Ausmees et al., 2016; Löckenhoff et al., 2012; Turiano et al., 2012). A direct explanation for this association suggests that individuals higher on neuroticism have worse health, which is reflected in their self-rated health. Higher neuroticism is not only associated with subjective ratings of health, but it is also related to behavioral markers, such as walking speed (e.g., Stephan et al., 2018a,b) and biological dysfunction (Sutin et al., 2019), and is a pervasive predictor of poor health outcomes, such as chronic respiratory diseases, major depression, and dementia (Hakulinen et al., 2015a; Terracciano et al., 2014, 2017). In addition to worse objective health, processes associated with Neuroticism may also contribute to perceptions of health. Individuals higher in neuroticism, for example, have a tendency to perceive the world in negative ways and may be naturally inclined to evaluate negatively their own health even worse than their actual health (Sutin and Terracciano, 2016). Finally, shared genetics could also explain the consistent association between neuroticism and self-rated health. Harris et al. (2017), for example, found that a higher polygenic score for neuroticism was related to lower self-rated health.

As expected, the results also indicated that conscientiousness was related to better concurrent self-rated health (see Tables 2 and 3). This study thus adds to a substantial body of evidence on the health benefits of conscientiousness (Friedman and Kern, 2014; Kern et al., 2014;

Strickhouser et al., 2017). Higher conscientiousness is related to health-promoting behaviors, such as physical activity (Kroenke et al., 2019; Sutin et al., 2016), and fewer health-risk behaviors, such as smoking and alcohol use (Hakulinen et al., 2015b; Luchetti et al., 2018), which have significant impacts on health. Conscientiousness is also related to lower risk of chronic disease (Weston et al., 2015), obesity (Jokela et al., 2013), and depressive symptoms (Hakulinen et al., 2015a) over time that may be reflected in better self-rated health. Higher conscientiousness is also associated with better lung function, stronger grip strength, and faster walking speed (Sutin et al., 2018) that may foster positive ratings of health. Biological factors may likewise explain part of this link. Indeed, conscientiousness is related to healthier metabolic, cardiovascular, and inflammatory markers (Luchetti et al., 2014; Sutin et al., 2018) and higher cardiorespiratory fitness (Terracciano et al., 2013). This better biomedical profile may lead to more favorable evaluations of one's health.

Consistent with the hypothesis and existing cross-sectional studies (Löckenhoff et al., 2012; Turiano et al., 2012), extraversion was related to better concurrent self-rated health (see Tables 2 and 3). Extraverted individuals have a tendency to be optimistic and have a positive outlook that may result in positive perception of their health (Sutin and Terracciano, 2016). Extraversion is also associated with a physically active lifestyle (Kroenke et al., 2019; Sutin et al., 2016), better sleep quality (Stephan et al., 2018a,b), and fewer depressive symptoms (Hakulinen et al., 2015a), which may benefit self-rated health. Furthermore, extraverted individuals tend to have higher physical functioning (Stephan et al., 2018a,b) and aerobic capacity (Terracciano et al., 2013), which may lead to positive self-ratings of health.

Unexpectedly, openness and agreeableness were both related to concurrent self-rated health, but the effect sizes were slightly smaller compared to the other traits (see Tables 2 and 3). This pattern of associations was found across almost all of the samples, which suggests that the mixed findings in previous studies could be due to lack of power. Recent research indicates that openness is related to physical activity (Sutin et al., 2016), better physical function (Stephan et al., 2018a,b), and lower inflammation (Luchetti et al., 2014), which may be reflected into more positive evaluations of health. A recent large meta-synthesis revealed that agreeableness is related to better overall health (Strickhouser et al., 2017), a pattern confirmed in this study with self-rated health. Moreover, agreeable individuals may evaluate positively their health in part because they are more likely to engage in health-promoting behavior, such as more objectively assessed physical activity (Artese et al., 2017), alcohol abstinence (Luchetti et al., 2018), and better medication adherence (Axelsson et al., 2011).

Longitudinal analysis revealed a contrasting pattern of relationships. First, consistent with the cross-sectional findings, higher extraversion, openness, and conscientiousness, and lower neuroticism were related to a lower probability of reporting fair/poor self-rated health over time among those who reported good to excellent health at baseline (see Table 4). However, the longitudinal analyses using MLM revealed unexpected patterns of association between personality and change in self-rated health. The associations with the intercept were consistent with the cross-sectional analyses: Lower neuroticism and higher extraversion, openness, agreeableness, and conscientiousness were associated with better self-rated health (see Table 4). These traits, however, were associated with declines in self-rated health rather than maintenance of better self-rated health (see Fig. 1). This finding is in contrast with the hypotheses and previous studies (Lockenhoff et al., 2012; Mund and Neyer, 2016). Although unexpected, this pattern was apparent across most of the samples, indicating that it is replicable. The overall pattern may be indicative of regression to the mean or adjustment and self-regulation processes. Indeed, the associations between lower neuroticism and higher extraversion, openness, agreeableness, and conscientiousness and declines in self-rated health could be explained by a recalibration response shift (Spuling et al., 2017). Recalibration response shift refers to a change in internal standards of health evaluation. Individuals tend to retrospectively overestimate their health and thus lower their standards for good health, even if they do not experience a health event (Spuling et al., 2017). It may be that the decline in self-rated health of emotionally stable, extraverted, open, agreeable, and conscientious individuals reflects a recalibration process and overall readjustment of health standards. Another explanation is based on the sensitivity of self-rated health to temporal comparison process (Lockenhoff et al., 2012). Although emotionally stable, extraverted, open, agreeable and conscientious individuals hold more positive self-rated health compared to their counterparts who score lower on these traits, they may have less favorable evaluations of their health over time because of temporal comparisons between their current function, energy and fitness levels to their past levels. Future research could help disentangle regression to the mean from regulatory processes to help explain the unexpected pattern of association between personality and change in self-rated health over time in the multilevel models.

The present study provides robust evidence that a single item asking individuals to rate their health reflects in part their characteristic ways of thinking, feeling, and behaving. Furthermore, it is likely that self-rated health may be an early marker in the pathway between personality and a range of health and cognitive outcomes. For example, higher neuroticism and lower conscientiousness are related to higher risk of incident Alzheimer's disease (Terracciano et al., 2014) and mortality (Graham et al., 2017) and poor self-rated health is predictive of both higher incident dementia and mortality (DeSalvo et al., 2006; Montlahuc et al., 2011). Therefore, it is likely that lower self-rated health may represent an early sign for risk of morbidity and mortality in individuals with higher neuroticism and lower conscientiousness.

This study has several strengths including concurrent and longitudinal associations between personality and self-rated health, a follow up extending to almost 20 years, eight large samples of adults, the inclusion of samples from different countries, and the assessment of all five major personality factors in each sample.

4.1. Limitations

The meta-analysis revealed that there was heterogeneity across studies in the associations observed between personality and self-rated health. This heterogeneity could be attributable to the differences in measures of personality, the differences in demographic characteristics, and cultural differences among samples. Other factors that were not measured may also help explain the heterogeneity across studies, including biological and objective health factors. The association between personality and changes in self-rated health was rather small. Furthermore, the observational design does not establish causality. Indeed, reciprocal associations are likely to exist between personality and self-rated health. Furthermore, attrition analysis revealed that there was positive selection effect of participants, which may limit the generalizability of the findings. The study did not include all available cohorts. That is, we only included cohorts with which we were familiar and that are widely used in past research on personality and health. It remains to be tested whether these patterns generalize to other cohorts, particularly cohorts from other cultural contexts and in countries with lower economic resources. Finally, more research is needed to identify the specific facets of personality that are related to self-rated health.

5. Conclusions

In conclusion, the present study revealed replicable cross-sectional and longitudinal associations between personality and self-rated health. Specifically, higher neuroticism was related to lower self-rated health concurrently, whereas higher extraversion, openness, agreeableness, and conscientiousness were related to more favorable current ratings of one's health. Furthermore, although unexpected, there was consistent evidence that higher emotional stability, extraversion, openness, agreeableness, and conscientiousness were related to steeper

declines in health ratings that may indicate recalibration of health standards and self-regulation. Therefore, this study contributes to the identification of individuals at risk of worsening health over time that may be targeted by interventions and preventive actions.

Author contributions

Yannick Stephan: Conceptualization, Methodology, Formal analysis, Writing - original draft, Writing - review & editing, Visualization, Supervision, Project administration, Angelina R Sutin: Conceptualization, Writing - review & editing, Visualization, Martina Luchetti: Methodology, Writing - review & editing, Visualization, Brice Canada: Writing - review & editing, Visualization, Louis Hognon: Writing - review & editing, Visualization, Antonio Terracciano. Conceptualization, Formal analysis, Writing - original draft, Writing - review & editing, Visualization, Supervision.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2020.113245.

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