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20-Year Trajectories of Health in Midlife and Old Age: Contrasting the Impact of Personality
and Attitudes Toward Own Aging

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Conflict of Interest

None.

Abstract

Personality traits affect health throughout adulthood. Recent research has demonstrated that attitudes toward own aging (ATOA) also play an important role in various health outcomes. To date, the role of personality vs. ATOA for health has rarely been considered in parallel and contrasted for different periods of the second half of life, such as midlife vs. early-old age. We posit that with advancing age, associations of personality and ATOA with trajectories of health might change. To address this assumption, we examined trajectories of physician-rated health and its between-person and time-varying, within-person associations with personality (neuroticism and conscientiousness) and ATOA over 20 years in middle-aged (baseline age 43-46 years; $n = 502$) and older (61-65 years; $n = 500$) adults. Based on longitudinal multilevel regression models (controlling for gender and education), we found at the between-person level that lower neuroticism scores and more positive ATOA scores were independently associated with better physician-rated health at baseline. This association of ATOA with health was stronger in the old age sample than in the midlife sample. At the within-person level, time-varying associations revealed that both middle-aged and older individuals had better physician-rated health on measurement occasions when they reported more favorable ATOA. In addition, in the old age subsample alone, individuals' physician-rated health was better on occasions when they had higher conscientiousness scores. Our findings suggest that certain personality traits (conscientiousness, but not neuroticism) as well as attitudes toward own aging may gain in importance in later life as predictors of objective health changes.

Key Words: Old age, middle adulthood, neuroticism, conscientiousness, views on aging

7,437 Words

20-Year Trajectories of Health in Midlife and Old Age: Contrasting the Impact of
Personality and Attitudes Toward Own Aging

There is vast and unambiguous empirical evidence for the role of personality traits as risk or protective factors for health throughout adulthood (Bogg & Roberts, 2013; Jackson, Weston, & Schultz, 2017; Mroczek & Spiro, 2007; Reiss, Eccles, & Nielsen, 2014; Shanahan, Hill, Roberts, Eccles, & Friedman, 2014; Sutin, Zonderman, Ferrucci, & Terracciano, 2013; Terracciano, Löckenhoff, Zonderman, Ferrucci, & Costa, 2008). Other psychological factors with relevance for health and longevity have more recently been empirically identified. One such factor is subjective aging in general (Chang et al., 2020; Westerhof et al., 2014; Westerhof & Wurm, 2015; Wurm, Diehl, Kornadt, Westerhof & Wahl, 2017), and attitudes toward own aging (ATOA) in particular (Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorf, & Smith, 2009; Levy, Slade, & Kasl, 2002; Levy & Myers, 2005; Levy, Slade, Kunkel, & Kasl, 2002; Sargent-Cox, Anstey, & Luszcz, 2012).

Considering the impact on health of both personality and ATOA in combination is important from a lifespan perspective. Personality affects health from childhood and young adulthood on and exerts its impact on health throughout adulthood until old age (Friedman et al., 1995; Hampson, Edmonds, Goldberg, Dubanoski & Hillier, 2013; Hampson, Edmonds, Goldberg, Dubanoski & Hillier, 2015; Martin, Friedman, & Schwartz, 2007; Mueller, Wagner & Gerstorf, 2017; Mueller, Wagner, Voelkle, Smith, & Gerstorf, 2018). In contrast, subjective aging measures, including ATOA, seem to gain importance for developmental outcomes such as health from midlife on and thereafter, when first signs of aging set in (Beyer, Wolff, Warner, Schüz, & Wurm, 2015; Bergland, Nicolaisen, & Thorsen, 2014; Hubley & Russell, 2009; Levy et al., 2002). Following stereotype embodiment theory (Levy, 2009), age stereotypes do not become embodied and self-relevant before cues of aging accumulate at the

interpersonal level (e.g., patronizing forms of speech by the young) as well as at societal and institutional level (e.g., encountering ageism at the workplace as an older employee; Chang et al., 2020). Once these cues set in, attitudes toward one's own aging start to influence health via physiological, behavioral, and psychological pathways (Levy, 2009; Wurm et al., 2017).

To our knowledge, however, the health effects of both factors have rarely been considered and investigated together in one study. One exception is a study by Moor, Zimprich, Schmitt, and Kliegel (2006) who reported a mediating role of ATOA in the association between neuroticism and self-rated health among older adults. However, their analyses were based on cross-sectional data, so that alternative causal interpretations cannot be ruled out. Maier and Smith (1999) investigated various psychological predictors of mortality in a sample of older adults and found that when controlling for personality traits (neuroticism, extraversion, and openness) and multiple other predictors, ATOA remained a significant mortality predictor.

The aim of this study is to examine the unique and independent contribution of personality vs. ATOA as predictors of long-term health changes in midlife and old age. Among the established "Big Five" personality traits (Costa & McCrae, 1992a; Goldberg, 1990), we focus on neuroticism and conscientiousness in this study. Of the "Big Five", these two traits are those with particularly close and consistent associations with health in adulthood (Bogg & Roberts, 2013; Costa & McCrae, 1987; Reiss et al., 2014; Shanahan et al., 2014; Sutin et al., 2013). We will focus on an objective health outcome, namely physician-rated health, because most of the evidence on associations of personality and ATOA with health that is available to date relied on subjective health outcomes, which are to some extent confounded with measures such as personality and ATOA (e.g., Costa & McCrae, 1987). We investigate the associations of personality and ATOA with health trajectories over a long-term period of up to two decades, comparing the two crucial adult life periods, namely middle adulthood and old age.

Associations of Personality and Attitudes Toward Own Aging with Health

Personality. Personality is a meaningful predictor of health levels and changes in the second half of life (Costa & McCrae, 1987; Löckenhoff, Terracciano, Ferrucci, & Costa, 2012; Wettstein, Tauber, Wahl, & Frankenberg, 2017). Regarding underlying mechanisms, behavioral, physiological, and social pathways operate (Friedman & Kern, 2014; Jackson et al., 2017; Mueller et al., 2017; Smith & MacKenzie, 2006). These pathways including health behaviors (Bogg & Roberts, 2013; Graham et al., 2017; Reiss et al., 2014; Shanahan et al., 2014; Steptoe et al., 1994), stress reactivity (Bolger & Schilling, 1991; Suls & Martin, 2005), as well as the use of coping strategies when facing stressors (Gunthert, Cohen, & Armeli, 1999; Watson & Hubbard, 1996).

According to empirical evidence, decline in health outcomes has indeed been found to be less steep in individuals with lower neuroticism scores (Human et al., 2013; Löckenhoff et al., 2012; Magee, Heaven, & Miller, 2013; Turiano et al., 2012). Moreover, higher conscientiousness scores act as a protective factor in health changes (Human et al., 2013; Magee, Heaven, & Miller, 2013; Turiano et al., 2012; Wettstein et al., 2017). However, most of these previous findings were based on a) self-rated rather than objective health outcomes, such as physician ratings, and b) rather short observational periods. Thus, little is known so far as to whether and how neuroticism and conscientiousness are associated with *long-term* changes in *objective* health outcomes.

Attitudes Toward Own Aging. Converging evidence also indicates that how people experience their own aging process influences their health and longevity (e.g., Chang et al., 2020; Maier & Smith, 1999; Westerhof et al., 2014; Westerhof & Wurm, 2015; Wurm et al., 2017). The pathways discussed that operate between aging attitudes and health outcomes include motivational mechanisms (Levy, Slade, & Kasl, 2002; Levy et al., 2002), physiological effects (Levy, Hausdorff, Hencke, & Wei, 2000; Levy, Moffat, Resnick, Slade,

& Ferrucci, 2016; Levy et al., 2008; Stephan, Sutin, & Terracciano, 2015), as well as psychological-behavioral pathways (Beyer et al., 2015; Levy & Myers, 2004; Schmidt, Gabrian, Jansen, Wahl, & Sieverding, 2018; Sun et al., 2017; Wurm, Tomasik, & Tesch-Römer, 2010; Zhang, Kamin, Liu, Fung, & Lang, 2018).

These subjective evaluations of aging are thus another important determinant of health levels and respective changes in the second half of life, with a stronger unique impact of such evaluations on longevity than that of diverse other psychological predictors (Maier & Smith, 1999). As has been argued, societal beliefs about age and aging are internalized and reinforced throughout the lifespan, become increasingly self-relevant with advancing age and shape key developmental outcomes such as health (Diehl & Wahl, 2010; Kornadt, Kessler, et al., 2019; Levy, 2009). Controlling for a range of confounders, more negative attitudes are longitudinally associated with poorer functional health (Levy et al., 2002; Sargent-Cox, Anstey, & Luszcz, 2012; Tovel, Carmel, & Raveis, 2019) and higher risk of hospitalization (Sun, Kim, & Smith, 2017), cognitive decline and cognitive impairment (Siebert, Wahl, Degen, & Schröder, 2018; Siebert, Wahl, & Schröder, 2016), as well as of respiratory and all-cause mortality (Kotter-Grühn et al., 2009; Levy & Myers, 2005; Levy et al., 2002; Maier & Smith, 1999; Westerhof et al., 2014).

The Health-Relevance of Personality and Attitudes Toward Own Aging:

Contrasting Midlife vs. Old Age

We posit, as outlined in more detail below, that the associations of both personality and ATOA with health might change from midlife to old age, when health trajectories change from overall good and quite stable health (Lachman, 2004; Lachman, Teshale, & Agrigoroaei, 2014) to a trend of late-life health decline (Baltes & Smith, 2003; Berlau, Corrada, & Kawas, 2009; Jacobs et al., 2012; Kunzmann et al., 2019; Wahl, Schmitt, Danner, & Coppin, 2010). Specifically, the transition from midlife to old age is accompanied by a shift in individuals' overall focus from maintenance of function and balancing gains and losses to primarily

managing decline (Baltes, Lindenberger, & Staudiner, 2006; Heckhausen, Dixon, & Baltes, 1989), with middle adulthood representing the “point in life when vulnerabilities begin to emerge” (Infurna, Gerstorf, & Lachman, in press). From an applied view, personality (Jackson, Hill, Payne, Roberts, & Stine-Morrow, 2012; Magidson, Roberts, Collado-Rodriguez, & Lejuez, 2014; Mühlig-Versen, Bowen, & Staudinger, 2012; Roberts et al., 2017) and indicators of subjective aging (Beyer, Wolff, Freiberger, & Wurm, 2019; Brothers & Diehl, 2017; Dutt & Wahl, 2017; Stephan, Chalabaev, Kotter-Grühn, & Jaconelli, 2012; Wolff, Warner, Ziegelmann, & Wurm, 2014) seem to be plastic and changeable to some extent, so that change in both domains, e.g. based on interventions, may come with a substantial protective and preventive health effect, particularly in later life. As Westerhof and Wurm (2018) claim, “even a small positive change in subjective aging might come with a considerable societal impact in terms of health gains” and this seems to be also true for personality traits such as conscientiousness (Shanahan et al., 2014).

Personality. Considering the role of specific life phases over the second half of life, associations of neuroticism and conscientiousness with health changes might, for different reasons, change from midlife to old age. Personality changes across the entire life span (Lucas & Donnellan, 2011; Roberts, Walton, & Viechtbauer, 2006; Specht, 2017). The question therefore is that “If levels of personality characteristics change over the lifespan, do personality effects on intrapersonal or interpersonal outcomes change as well?” (Wrzus, 2019, p. 217). Generally speaking, psychosocial predictors including personality (but also views on aging) may be of varying importance at different life stages (Mueller et al., 2017): “Health-protective” factors — such as personality as a “system of adaptive functioning” (Baltes et al., 2006; p.637) — might be particularly crucial for the health of *older* adults. Health restrictions occur more frequently in old age than in midlife, as middle adulthood is characterized by a “balance and peak of functioning” (Lachman, 2015; p. 331) and thus by overall good health (Lachman, 2004; Lachman et al., 2014). Effects of personality traits such as neuroticism or

conscientiousness on health might also get stronger with advancing age as their consequences for health via pathways such as health behaviors may need time to develop and thus accumulate with age. This assumption is in line with the accumulation model which postulates that “factors that elevate disease risk or enhance good health may accumulate gradually over the life course” (Heikkinen, 2011; p. 9).

On the other hand, health changes at older ages might be primarily biologically driven (Baltes & Smith, 2003). Consequently, the importance and the potential of personality for maintaining good health could be reduced with increasing age (Baltes, 1997; Baltes & Smith, 2003; Gerstorf & Ram, 2009; Steinhagen-Thiessen & Borchelt, 1993).

So far, empirical evidence on such “age-dependent personality effects” (Wrzus, 2019) with regard to health is scarce. Some empirical evidence is in support of stronger personality-health associations with advancing age, particularly for neuroticism and aspects of perceived health (Canada, Stephan, Jaconelli, & Duberstein, 2014; Duberstein et al., 2003). However, there is also some evidence for stronger personality-health associations at younger ages (Löckenhoff, Sutin, Ferrucci, & Costa Jr., 2008; Magee et al., 2013; Mueller et al., 2018; Scheier & Bridges, 1995). Finally, other studies (Morack, Infurna, Ram, & Gerstorf, 2013; Wettstein et al., 2017) found no or only negligible differences between age groups in personality-health associations.

Attitudes Toward Own Aging. How individuals perceive and evaluate their aging increasingly becomes a major part of the aging self (Diehl et al., 2014). As stereotype embodiment theory posits (Levy, 2009), views on aging “develop already in childhood but increase in salience with older chronological age” (Kornadt, Kessler, et al., 2019), thus becoming personally more important in later life, when people start to assign themselves to “old age”. Therefore, we assume that ATOA has a stronger impact on health in old age than in midlife.

Empirical evidence indeed indicates that negative aging attitudes bear significant long-term consequences for health particularly in old age, as indicated, for instance, by a heightened risk of late-life cardiovascular events and mortality (Kotter-Gröhn et al., 2009; Levy & Myers, 2005; Levy, Slade, Kunkel, et al., 2002; Levy, Zonderman, Slade, & Ferrucci, 2009; Maier & Smith, 1999; Westerhof et al., 2014). Also, in analogy to personality, the mechanisms via which attitudes on aging affect health might cumulate and thus need time to fully unfold, again in line with the accumulation model (Heikkinen, 2011). Moreover, old age represents the point in the lifespan when steeper health decline sets in (Baltes & Smith, 2003; Berlau et al., 2009; Jacobs et al., 2012; Kunzmann et al., 2019; Wahl et al., 2010). These decline dynamics might be buffered by more favorable ATOA, which are translated into more accumulated psychosocial resources and better health behaviors. In contrast, individuals usually spend their life period of middle adulthood in overall good and stable health (Lachman, 2004; Lachman et al., 2014) so that they may have less need of resources such as more positive ATOA to counteract health decline than older adults.

With regard to existing empirical evidence on the age-dependent role of ATOA on health outcomes, previous research supports increasing associations of subjective aging measures in general with health as people age (Bergland et al., 2014; Hubley & Russell, 2009; Stephan, Demulier, & Terracciano, 2012), though evidence specifically for ATOA is still missing. In contrast, a meta-analysis investigating the moderating role of age for associations of subjective aging with combined health outcomes found stronger linkages in samples with younger mean ages (Westerhof et al., 2014); however, the studies included in this meta-analysis comprised limited mean age ranges from 57 to 85 years, thus not including the entire midlife period. Moreover, several of the studies included were not focused on ATOA, but on other subjective aging measures.

Concluding, further empirical evidence on potentially age-dependent associations of both personality and ATOA with health is needed with a more differentiated consideration of

age groups also including midlife samples and with a *long-term* observational period on trajectories of health, as most studies so far are limited with regard to the length of the change period that was observed. Also, most studies so far contrasted age groups or life phases (such as young-old vs. old-old comparisons; Mueller et al., 2018) that did not cover midlife. As Lachman (2015) points out, “middle-aged adults are often omitted from research on adult development and aging” p. 327; see also Infurna et al., in press), obviously including research on health development. This is also particularly true with regard to ATOA, as most instruments assessing views on aging were specifically developed for and investigated in older adults (Faudzi et al., 2019).

Given that previous findings on potentially age-dependent personality-health-associations are mixed and mostly focused on other health outcomes as well as on other life phases than this study, we will investigate in an exploratory way and without stating an a-priori-assumption whether and how associations of personality with health change from midlife to old age. With regard to ATOA, our prediction is, following the assumptions of the stereotype embodiment theory (Levy, 2009) and the accumulation model (Heikkinen, 2011) as well as the albeit somewhat limited empirical evidence available, that associations of ATOA with long-term health trajectories are stronger in old age than in midlife.

Research Aims and Hypotheses

Although a body of empirical findings on the role of personality and ATOA in health changes in later life has accumulated, little is known about whether these associations differ in strength depending on the life phase (midlife vs. old age) when long-term health trajectories are considered. Addressing this research question requires the simultaneous consideration of both personality and ATOA as well as a long observational period. To our knowledge, personality and ATOA have not yet been integrated in one empirical analysis, apart from the two already described exceptions that were either based on cross-sectional data (Moor et al., 2006) or focused on longevity rather than health (Maier & Smith, 1999). Therefore, our major

research aim is to examine and compare the unique and independent contribution of each factor as predictor of long-term health changes in midlife vs. old age.

In the light of our reasoning above, our hypotheses are as follows: (1) We expect that, when considered in parallel in one model, both personality (neuroticism and conscientiousness) and ATOA, are meaningful, unique predictors of long-term health trajectories in midlife and old age, with high neuroticism, low conscientiousness as well as more negative attitudes toward own aging predicting poorer health and steeper health decline. (2) Following stereotype embodiment theory as well as the available empirical evidence, we assume that ATOA is more strongly associated with health in old age than in midlife, whereas we will test in an exploratory manner whether personality-health associations are also different in midlife vs. old age. (3) We also test at the explorative level whether the interplay of personality and ATOA (i.e. personality-ATOA interactions) also predicts health in midlife and old age, above and beyond the main effects of each of both factors.

Methods

Study Population and Sample Description

The data used in this study were collected as part of the Interdisciplinary Longitudinal Study of Adult Development (ILSE study; Sattler et al., 2015; Schmitt, Wahl, & Kruse, 2008), which is an ongoing population-based study, with samples stratified by age group (middle-aged and older adults), gender, and region. Study participants were randomly recruited via city registries in two areas in East and West Germany. So far, four measurement occasions have been completed (T1: 1993–1996, $n = 1,002$; T2: 1997–2000, $n = 894$; T3: 2005–2008, $n = 638$; T4: 20014-16, $n = 449$). Study participants were thus followed up for an interval of up to 20 years. Sample characteristics and recruitment, study design details, as well as findings of comprehensive attrition analyses have been reported elsewhere (Allemand, Zimprich, & Hertzog, 2007; Miche, Elsässer, Schilling, & Wahl, 2014; Sattler et al., 2015; Schmitt et al., 2008).

Two samples from different age groups were recruited for the ILSE study: an old-age sample (born between 1930 and 1932) and a midlife sample (born between 1950 and 1952). A sample description of both age groups is provided in Table 1, intercorrelations between study variables at T1 are shown in Table 2, and within-person correlations (i.e., correlations between measurement-occasion specific deviations in ATOA and personality with physician-rated health in a multilevel data structure) are summarized in Table 3. The midlife and the old-age sample were not significantly different from each other regarding gender composition and baseline conscientiousness. However, the old-age group revealed significantly fewer years of education, worse initial physician-rated health, higher baseline neuroticism scores as well as less positive ATOA at T1 compared to the midlife group.

(Insert Tables 1-3 about here)

To determine the extent of sample selectivity, we followed the approach suggested by Singer, Verhaeghen, Ghisletta, Lindenberger, and Baltes (2003) and compared all individuals who still participated in the study on the fourth measurement occasion ($n = 449$) with the “parent sample” of all participants who took part at baseline ($n = 1,002$) regarding the study variables at baseline. Effect sizes (d) did not exceed 0.21, thus all group differences corresponded to small effects (Cohen, 1992). Not surprisingly, the proportion of old-age individuals in the sample of the continuous participants (33.6%) was smaller than in the parent sample (50.6%). When computing the selectivity analyses separately for the midlife group and the old-age group, some differences were larger in the old-age sample but were still in a small effect size range, with the largest effects emerging for physician-rated health ($d = .34$), ATOA ($d = .26$), and education ($d = .24$).

Measures

Physician-rated Health. On each measurement occasion, individuals’ health was rated by one trained study physician based on an in-depth clinical examination (for a detailed description, see Miche et al., 2014) comprising a medical check-up, a laboratory blood test,

and a geriatric assessment. Each single clinical examination consisted of several subtests (e.g., hearing and vision assessment, blood pressure measurement). We recoded the physician ratings so that higher scores indicated better health (range from 1 = “*participant exhibits a serious medical condition, which is immediately life-threatening; professional healthcare is urgently needed*” to 6 = “*participant exhibits very good health*” (i.e., no chronic disease, no chronic pain, all clinical assessments suggest non-pathological findings)). The intraclass correlation (ICC) coefficient from a random-intercept-only model computed separately for both age groups was .43 for the midlife group and .33 for the old-age group. There is thus considerable within-person variability in this measure, as only 43% and 33% in the variation of physician-rated health was due to interindividual variation in middle-aged and older adults respectively.

Personality Traits: Neuroticism and Conscientiousness. Neuroticism and conscientiousness were assessed on each of the four measurement occasions by the NEO-Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992b). The respective subscales consist of 12 items with a 5-point response format (Cronbach’s α T1-T4 neuroticism midlife sample: .80, .84, .86, .83; Cronbach’s α T1-T4 neuroticism old-age sample: .77; .80; .80; .79; Cronbach’s α T1-T4 conscientiousness midlife sample: .77, .79, .71, .81; Cronbach’s α T1-T4 conscientiousness old-age sample: .73; .76; .81; .78; ICC coefficient neuroticism in the midlife sample/old-age sample: .60/.69; ICC coefficient conscientiousness .67 in both samples). A mean score of these 12 items was computed for each scale, ranging from 0 to 4, with higher values indicating higher neuroticism and higher conscientiousness, respectively.

Attitudes toward Own Aging. The Attitude toward Own Aging subscale of the Philadelphia Geriatric Center Morale Scale (Lawton, 1975) was also assessed across all measurement occasions. The scale consists of five items regarding the subjective evaluation of one’s own aging process (e.g., “I have as much pep as last year”; response format: 0 = *disagree*, 1 = *agree*; Cronbach’s α T1-T4 midlife sample: .61, .68, .71, .69; Cronbach’s α T1-

T4 old-age sample: .68; .66; .68; .67; ICC coefficient in the midlife sample/old-age sample: .38/.34). Items were transformed to a mean score (range 0-1), with higher scores indicating a more favorable attitude toward own aging.

Age Group. Two age groups were distinguished, namely the old-age sample (born between 1930 and 1932; aged 61-65 years at baseline; $n = 500$) and the midlife sample (born between 1950 and 1952; aged 43-46 years at baseline; $n = 502$).

Covariates. As additional predictors, we included gender and education (i.e., self-reported formal education in years) in our analyses.

Statistical Analyses

Trajectories of physician-rated health as well as the extent of interindividual differences in these intraindividual trajectories were investigated based on longitudinal multilevel regression models (Hox & Kreft, 1994; Ram & Grimm, 2015). We specified linear and curvilinear (quadratic) change models as health changes do not necessarily follow a linear trend. Goodness of fit of both models was compared using the Bayesian Information Criterion (BIC; if $2[\Delta\text{BIC}] \geq 6$, the curvilinear change model was chosen; Kass & Raftery, 1995). Additionally, we used the Likelihood Ratio Test for nested models to compare the nonlinear (quadratic) change model with the linear change model.

Neuroticism, conscientiousness, and ATOA were included as time-varying predictors of physician-rated health, as both were assessed on each measurement occasion. Such time-varying predictors comprise a within-person component as well as a between-person component. We followed the recommendations by Hoffman and Stawski (2009) as well as by Schwartz and Stone (1998) and specified the between-person component by computing each individual's person-specific mean for neuroticism, conscientiousness, and ATOA across all his/her available measurement occasions. The within-person component corresponds to the measurement-occasion-specific, intraindividual deviation score from an individual's person-specific overall mean score.

To reduce model complexity, interaction terms of the predictors with age group that did not reach statistical significance were not included in the final models. All analyses were computed using Stata 15.0 (StataCorp., 2017).

Results

Trajectories of Physician-Rated Health in Midlife and Old Age

The quadratic model of change in physician-rated health did not result in a substantially better model fit in terms of the BIC difference than the respective linear change model. Also, the Likelihood Ratio Test for nested model comparisons was not significant, confirming that the quadratic change model does not provide a better fit than the more parsimonious linear change model. Therefore, for the sake of model parsimony, we decided on the model with a linear slope component only.

In the model without additional predictors besides time and age group (see Table 4), there was a significant effect of age group on the intercept of physician-rated health: Not surprisingly, in the old-age sample compared to the midlife sample, baseline physician-rated health was poorer ($\beta_{\text{Age Group}} = 0.21, p < .001$). Moreover, age group also affected the rate of change in physician-rated health ($\beta_{\text{Age Group} * \text{Time}} = 0.02, p < .001$): In the old-age sample, physician-rated health revealed a slight mean-level decline across the 20-year observational period (0.01 units per year), whereas a negligible annual improvement of 0.009 units was observed in the midlife individuals.

(Insert Table 4 about here)

Associations of Personality and ATOA with Health

When including neuroticism, conscientiousness, and ATOA as between-person and within-person, time-varying predictors (controlling for gender and education; see Table 5), the overall model fit improved, with a substantial change in BIC from 6078 to 5736.

Between-Person Effects. Regarding the between-person predictor effects of personality and ATOA (see Figures 1 and 2), a higher overall between-person neuroticism

score corresponding to individuals' person-specific mean neuroticism computed across all measurement occasions was significantly associated with worse baseline physician-rated health ($\beta = -0.13, p < .05$; see Figure 1), with no difference in effect size between the midlife and the old-age sample. There was no significant association of the between-person neuroticism component with change in health, either in midlife or in old age. With regard to the between-person effects of ATOA, overall higher ATOA scores, again corresponding to the individuals' person-specific mean scores across all measurement occasions, were significantly associated with better baseline physician-rated health ($\beta = 1.00, p < .001$), and this association was stronger in the old-age group ($\beta_{\text{ATOA*Age Group}} = -0.38, p < .05$; see Figure 2).

(Insert Table 5 about here)

(Insert Figures 1 and 2 about here)

Within-Person Effects. Finally, several within-person predictor effects of personality and ATOA reached statistical significance: Physician-rated health was better on occasions when individuals scored higher on conscientiousness ($\beta = 0.21, p < .05$), but this effect was limited to the old age sample ($\beta_{\text{Conscientiousness*Age Group}} = -0.31, p < .01$; see Figure 3).

Measurement-occasion-specific deviations in ATOA were also significantly associated with health: On measurement occasions when individuals reported more favorable ATOA, they had a better physician-rated health score ($\beta = 0.25, p < .001$). There was no difference in the size of this association between the midlife and the old-age group.

(Insert Figure 3 about here)

To test whether the inclusion of within-person predictor effects results in an improved model fit, we compared the fit (BIC) of a model without within-person predictor effects with the fit of the full model from Table 5 containing both between- and within-person predictor effects. This comparison was clearly in favor of the full model (BIC = 5736 vs. BIC = 5854).

Additional Predictors of Physician-Rated Health

Regarding the effects of the socio-demographic predictors included, the association of higher education with better baseline physician-rated health was stronger in the midlife sample than in the old-age sample ($\beta_{\text{Education*Age Group}} = 0.04, p < .01$), whereas – when controlling for all other predictors – there were no significant gender differences in levels and changes of physician-rated health.

The Interplay Between Personality and ATOA

We also explored possible moderation effects of personality on ATOA and vice versa by specifying an additional model with interaction terms between both domains on level and slope of health, both on the between-person and within-person level (and also including higher-order interactions with age group, i.e. ATOA*personality*age group). Only one of the 18 interaction terms reached statistical significance: The within-person effect of ATOA on physician-rated health was moderated by the within-person component of conscientiousness. That is, on occasions when their ATOA were more positive, individuals had a better physician-rated health score, but less so when they additionally scored high on conscientiousness.¹

Discussion

We investigated 20-year trajectories of physician-rated health and their predictors in a sample of middle-aged (baseline age: 43-46 years) and older adults (baseline age: 61-65 years). Two health-relevant, psychosocial factors, namely personality (neuroticism and conscientiousness) and attitudes toward own aging, were examined in parallel as predictors of long-term health changes to estimate their unique predictive contributions. Moreover, we

¹ To check the robustness of ATOA-health associations, we specified one more model containing all Big Five personality traits as between-person and within-person predictors of physician-rated health. The between- and within-person effects of ATOA on health as well as the interaction of the between-person ATOA component with age group remained significant. In contrast, the between-person effect of neuroticism and the within-person component of conscientiousness were now no longer significant ($p = .074$ and $p = .064$, respectively), whereas the interaction of the within-person conscientiousness component with age group remained significant. The only new significant effect that emerged was that overall higher openness to experience (between-person component) was associated with a less steep health decline over time, with no differences between age groups regarding this effect.

analyzed whether these associations vary according to which life phase is considered, namely midlife and old age.

20-Year Trajectories in Physician-Rated Health

In the old-age sample, physician-rated health deteriorated over time. This change pattern was expected and is in line with a multitude of other findings (Berlau et al., 2009; Jacobs et al., 2012; Kunzmann et al., 2019; Wahl et al., 2010). The mean-level trajectory of physician-rated health in the midlife sample was characterized by overall stability or even very subtle improvement. High stability of health in midlife – or even slight improvement (Kunzmann et al., 2019) – has been reported before (Lachman, 2004). Although “midlife marks the shift from the predominance of growth and gains to an increasing risk of age-related losses” (Westerhof & Wurm, 2015; p. 153), and although “in midlife, individuals begin to see the first signs of their own physical decline“ (Merrill & Verbrugge, 1999; p. 77), this transition does not seem to become manifest in objective health. However, we also found, not surprisingly, considerable interindividual variability in intraindividual health trajectories, both in midlife and even more pronounced in old age, so that this mean-level stability should not be interpreted as a sign of health stability in every single individual.

It is also important to point out when interpreting the 20-year trajectories of physician-rated health that in the model including age group only and without any additional predictors, the estimated annual mean-level rate of change for physician-rated health was .03 for the old age sample, thus not even accumulating to 1 point over the entire 20-year period on the scale ranging from 1 to 6. When the mean-level-trajectory is considered, physician-rated health thus seems to remain quite stable not only in midlife, but also in old age, even when observed over this extended 2-decade period.

Not surprisingly, the old-age and the midlife sample had different levels of baseline physician-rated health which was in favor of the midlife sample. Middle-aged individuals thus seem to be in better objective health than older individuals. Given that this is a comparison of

age groups at one point in time, this difference might also reflect a cohort effect, with later-born cohorts revealing better health than earlier-born cohorts (see also Christensen et al., 2013; Crimmins, 2015; Heikkinen et al., 2011; König et al., 2018; Taylor & Lynch, 2011; Yang & Lee, 2009), or a mixture of a cohort effect and an age effect. However, the effect size of this age group difference in baseline physician-rated health was small ($d = .24$), which implies the difference between the midlife and the old-age sample in physician-rated health was not large.

Associations of Personality and ATOA with Physician-Rated Health in Midlife and Old Age

Our original expectation was that ATOA is more closely associated with health in old age than in midlife, whereas, given the inconsistency in previous findings, we tested “age-dependent personality effects” (Wrzus, 2019) by an exploratory approach. Though late-life health changes are remarkably heterogeneous (Leigh, Byles, & Mishra, 2017; Wettstein et al., 2016; Willis, Jay, Diehl, & Marsiske, 1992), health usually deteriorates with advancing age (Baltes & Smith, 2003; Jacobs et al., 2012; Santoni et al., 2015), so that psychosocial factors such as attitudes on aging may become more crucial for achieving stable health in old age than in midlife (Mueller et al., 2017). Additionally, ATOA, and also personality, might have a long-term, cumulating effect on health via their various pathways such as health behaviors whose effects evolve gradually and result in better or worse health at a later point in time, corresponding to theoretical conceptions such as the accumulation model (Heikkinen, 2011). Developmental time frames may differ for personality and ATOA because personality exerts its health impact much longer across the lifespan (Friedman et al., 1995; Hampson et al., 2013; Hampson et al., 2015). In contrast, stereotype embodiment theory (Levy, 2009) predicts that self-perceptions of aging become manifest and salient only later in life, when the cognition of “being old now” finds increasing cues, such as retirement transition or the onset of health-related problems.

Beginning with personality, one age moderation effect was observed. Specifically, the within-person component of conscientiousness interacted with age group, thus indicating an “age-dependent personality effect” (Wrzus, 2019): On occasions when individuals scored higher on conscientiousness, they had better health, which corresponds to previous findings (e.g., Chapman, Roberts, Lyness, & Duberstein, 2013). Notably, this effect was restricted to older (and not middle-aged) individuals. These individuals had an approximately 0.2 points higher health score (on a scale from 1 to 6) when their measurement-occasion specific conscientiousness score exceeded their person-specific mean by one point (on a scale from 0 to 4), which reflects an appreciable effect. In the case of between-person effects, overall higher neuroticism, considered across all measurement occasions, was related with poorer physician-rated health, but this effect did not vary in strength by age group. Each additional point on the neuroticism mean was associated with a decrease in baseline health by 0.13 points, so that an individual with the lowest possible neuroticism score and one with the highest possible score would reveal a health difference of about $\frac{1}{2}$ a point.

The assumption that personality-health associations increase from midlife to late life may thus need further refinement. Only specific traits, such as conscientiousness – perhaps the most prominent “personality trait marker of health and longevity” (Bogg & Roberts, 2013; see also Martin et al., 2007) – might gain in importance, and only from a within-person perspective, whereas other traits, such as neuroticism, do not. Conscientiousness may get more health-relevant with advancing age because its effects accumulate over time and because specific mediating pathways to health, including higher doctor and medication adherence, grow stronger with age (Hill & Roberts, 2011). Also, based on the intraclass correlation coefficients, we found the proportion of overall variability in physician-rated health that is due to within-person variability was higher in the old-age sample than in the midlife sample. This might have additionally contributed to our finding of stronger within-

person associations of conscientiousness with physician-rated health in old age than in middle adulthood.

Similar to personality, several associations of attitudes toward own aging with health were significant. From a between-person perspective, overall more favorable ATOA, considered over all measurement occasions, were associated with better baseline physician-rated health. In addition, from a within-person perspective, on measurement occasions when individuals' ATOA were more positively toned, they also scored higher on health. That is, a measurement-occasion specific score revealing most favorable ATOA from a person-specific mean revealing most negative ATOA would be associated with an increase in health by .25 points. Attitudes toward own aging thus seem to be particularly "health-relevant", as they are systematically related both from a between-person and a within-person perspective with physician-rated health, whereas the personality traits included were either only associated with health on a between-person level (neuroticism) or from a within-person level (conscientiousness).

Generally, our findings show that both the between-person and the within-person effects need to be taken into account when investigating associations of personality and ATOA with health as both types of effects were significant, and omitting the within-person perspective by dropping all within-person effects from the model was associated with a decrease in model fit. It is thus not only the between-person effects of personality and ATOA that account for variance in health, but rather the combination of between- and within-person associations, with significant effects on both analysis levels.

The effects of ATOA on health also seem to be remarkably robust, more so than the personality effects identified: the inclusion of all Big Five personality traits as predictors did not change the significant associations of ATOA with health, whereas the formerly significant effects of neuroticism and conscientiousness were reduced to marginal significance. This finding is in line with the study by Maier and Smith (1999) who found that dissatisfaction

with aging remained a significant predictor of mortality even when various psychological factors, including the Big Five personality traits, were controlled for. ATOA thus seems to reveal an association with health that is independent of personality, and the between-person and within-person predictor effects of ATOA account for variation in health above and beyond the variation accounted for by personality traits.

Moreover, as theoretically predicted by stereotype embodiment theory (Levy, 2009), the data supported our assumption that views on aging gain in importance for health with advancing age. Specifically, the association between overall ATOA and baseline health was stronger in old age than in midlife. Among older adults, those with the overall most favorable ATOA scored 1 point higher on health than those with the overall least favorable scores, whereas this health difference was reduced to .62 points among middle-aged adults. This might to some extent be due to higher baseline interindividual health variability in later life; however, comparing the variation in baseline physician-rated health in the midlife and the late-life group, we found only a slightly higher variance (by factor 1.2) in the older group. Our finding is in line with several previous findings that reported an increase in the association between subjective aging indicators and health with advancing age (Bergland et al., 2014; Hubley & Russell, 2009; Stephan et al., 2012).

Caution is needed with regard to the causality of the associations we observed. In the case of within-person relations, for instance, it might be health change from one occasion to the next that causes change in conscientiousness and in ATOA rather than vice versa. However, previous research suggests that the pathways from both personality and subjective aging to health might indeed be stronger than the reversed effects (Jackson et al., 2017; Spuling, Miche, Wurm, & Wahl, 2013; Sutin et al., 2013; Wurm, Tesch-Römer & Tomasik, 2007).

Implications and Future Directions

A key finding of this study is that personality and ATOA both have unique and independent contributions as predictors of health across the second half of life. Notably, these associations are not necessarily of equal strength in midlife and old age; in fact, we observed a stronger between-person effect of ATOA and a stronger within-person effect of conscientiousness in old age than in midlife. The importance of these factors for health thus seems to increase across the second half of life. This finding underlines the importance of considering ATOA and personality as dynamic, changeable constructs and as determinants of developmental outcomes from a lifespan perspective (Kornadt, Kessler, et al., 2019; Mueller et al., 2017), whose role as drivers of key outcomes of functioning such as health does not remain stable across the lifespan.

Thus, assuming that personality and subjective aging experiences act as driving forces in health change, interventions to modify personality (Jackson et al., 2012; Magidson et al., 2014; Mühlig-Versen et al., 2012; Roberts et al., 2017) and to improve individuals' perspectives on their aging (Beyer et al., 2019; Brothers & Diehl, 2017; Dutt & Wahl, 2017; Stephan et al., 2012; Wolff et al., 2014) might in the long run contribute to achieving and maintaining higher levels of objective health across middle adulthood and late life. Such interventions might be particularly promising for older adults, as our findings suggest that they are not only at a higher risk of steeper deteriorations in physician-rated health but also reveal closer associations of conscientiousness and ATOA with health than middle-aged individuals. However, there is still a lack of profound insights into the specific, potentially age-differential mechanisms via which these psychosocial factors affect health as well as regarding the interplay within such factors, which requires further research.

When investigating this interplay by testing interactions within the psychosocial domain (i.e. personality-ATOA interactions), our findings based on additional exploratory analyses did not demonstrate strong and systematic moderation effects of ATOA on personality-health associations or of personality on ATOA-health associations. ATOA and

personality thus seem to reveal independent associations with health, but they do not buffer or augment each other's relation with health. However, and important for future research, there may be moderating factors from other resource domains – such as optimism (Wurm & Benyamini, 2014) – that might, for instance buffer the detrimental impact of negative age views on health. Moreover, future research needs to identify which specific objective health outcomes – beyond the global one used in this study – are (most) affected by which personality traits and by ATOA. There is, for instance, evidence for predictive effects of age stereotypes and personality on late-life sensory functioning (Levy, Slade, & Gill, 2006; Mueller et al., 2018), and there may be other functional domains that are affected by these factors. Also, given the multidimensionality of subjective aging (Kornadt, Kessler, et al., 2019), with different subjective aging measures revealing different associations with outcomes such as everyday behaviors or well-being (Brothers et al., 2015; Montepare, 2019; Spuling, Klusmann, Bowen, Kornadt, & Kessler, 2019), other subjective aging indicators may relate differently, maybe even more strongly, to objective health measures than ATOA.

Limitations

This study has several strengths and limitations. Among the strengths of this study are the parallel consideration of personality and attitudes toward aging, the extended observation period of up to 20 years, and the availability of a physician-rated health measure representing objective health as well as of measures of personality and attitudes toward own aging throughout the entire study period. Moreover, the ILSE study design allowed us to compare two broad samples representing two crucial adult life phases, namely midlife and old age.

However, there certainly are limitations too. Specifically, several of the described effects and associations were of small effect size. Moreover, as already pointed out, firm causal conclusions cannot be drawn based on our findings because time-varying, within-person associations between psychosocial factors and health might also result from a reversed pathway leading from health to personality and ATOA, though previous empirical evidence

favors the opposite direction (Jackson et al., 2017; Spuling et al., 2013; Sutin et al., 2013; Tovel, Carmel, & Raveis, 2019; Wurm et al., 2007).

Also, we found evidence of meaningful associations between psychosocial factors and health in midlife and old age, but we can only speculate about mediating mechanisms – which might additionally vary by age (e.g., Hill & Roberts, 2011; Klusmann et al., 2019) – and about potential moderating factors that may additionally augment or reduce these associations. Regarding the interplay of factors within the psychosocial domain, ATOA might mediate associations between personality and health, or personality might be a mediator of ATOA-health associations. Though one study, albeit based on cross-sectional data, did report a mediating role of ATOA on associations between neuroticism and health (Moor et al., 2006), longitudinal empirical evidence suggests rather limited prospective predictor effects of ATOA on personality change and vice versa (Kornadt, Siebert, & Wahl, 2019). Personality and ATOA thus seem to be linked with health via other mediational pathways. Further research is required on the identification of such additional mediators, including, for instance, stress reactivity and coping which were unfortunately not assessed in this study, as well on the identification of additional moderators beyond age.

Finally, our observation period ended when the individuals in the late-life sample were in their mid-eighties and thus in the transition to very old age. This transition from third to fourth age is a particular life episode when health deteriorations might become more pronounced for many individuals, challenging their adaptational and self-regulatory capacities (Baltes & Smith, 2003; Gerstorf & Ram, 2009; Santoni et al., 2015). Additionally, very old age is a life phase of specific personality change dynamics (Möttus, Johnson, & Deary, 2012; Wagner, Ram, Smith, & Gerstorf, 2015). Associations of psychosocial factors, particularly personality, with health changes in very old age might therefore differ in strength and maybe even in their direction when compared with other life phases, such as midlife or old age

(Mueller et al., 2017). Therefore, future research is also needed to illuminate the interplay of psychosocial factors and health in advanced old age.

Conclusion

20-year changes in physician-rated health among middle-aged and older-adults are independently associated with both personality and ATOA. More favorable attitudes toward own aging are associated with better physician-rated health, both on a between-person and on a within-person level. With regard to personality, between-person associations indicated that higher overall neuroticism is related to poorer baseline health, and within-person, time-varying associations revealed that higher conscientiousness relates to better physician-rated health, but in old age only. Hence there is evidence of an increasingly closer connection of selected personality factors (i.e., conscientiousness) and ATOA with health from midlife to old age. Therefore, particularly older adults' objective health may benefit from higher conscientiousness and more favorable views on aging. Strengthening these psychosocial factors - which are generally subject to plasticity across the life span – in midlife and especially in later life could hence be a promising approach to help individuals to achieve and maintain high levels of health.

Conflict of Interest

None.

References

- Allemand, M., Zimprich, D., & Hertzog, C. (2007). Cross-Sectional Age Differences and Longitudinal Age Changes of Personality in Middle Adulthood and Old Age. *Journal of Personality, 75*(2), 323-358. doi: 10.1111/j.1467-6494.2006.00441.x
- Baltes, P. B. (1997). On the incomplete architecture of human ontogeny: Selection, optimization, and compensation as foundation of developmental theory. *American Psychologist, 52*(4), 366-380. doi: 10.1037/0003-066X.52.4.366
- Baltes, P. B., Lindenberger, U., & Staudinger, U. M. (2006). Lifespan theory in developmental psychology. In W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology: Vol. 1. Theoretical models of human development*. New York: Wiley.
- Baltes, P. B., & Smith, J. (2003). New Frontiers in the Future of Aging: From Successful Aging of the Young Old to the Dilemmas of the Fourth Age. *Gerontology, 49*(2), 123-135.
- Bergland, A., Nicolaisen, M., & Thorsen, K. (2014). Predictors of subjective age in people aged 40–79 years: a five-year follow-up study. The impact of mastery, mental and physical health. *Aging & Mental Health, 18*(5), 653-661. doi: 10.1080/13607863.2013.869545
- Berlau, D. J., Corrada, M., & Kawas, C. (2009). The prevalence of disability in the oldest-old is high and continues to increase with age: findings from the 90+ study. *Int J Geriatr Psychiatry, 24*. doi: 10.1002/gps.2248
- Beyer, A.-K., Wolff, J. K., Freiburger, E., & Wurm, S. (2019). Are self-perceptions of ageing modifiable? Examination of an exercise programme with vs. without a self-perceptions of ageing-intervention for older adults. *Psychology & Health, 34*(6), 661-676. doi: 10.1080/08870446.2018.1556273
- Beyer, A.-K., Wolff, J. K., Warner, L. M., Schüz, B., & Wurm, S. (2015). The role of physical activity in the relationship between self-perceptions of ageing and self-rated

- health in older adults. *Psychology & Health*, 30(6), 671-685. doi:
10.1080/08870446.2015.1014370
- Bogg, T., & Roberts, B. (2013). The Case for Conscientiousness: Evidence and Implications for a Personality Trait Marker of Health and Longevity. *Annals of Behavioral Medicine*, 45(3), 278-288. doi: 10.1007/s12160-012-9454-6
- Bolger, N., & Schilling, E. A. (1991). Personality and the Problems of Everyday Life: The Role of Neuroticism in Exposure and Reactivity to Daily Stressors. *Journal of Personality*, 59(3), 355-386. doi: 10.1111/j.1467-6494.1991.tb00253.x
- Brothers, A., Miche, M., Wahl, H.-W., & Diehl, M. (2015). Examination of associations among three distinct subjective aging constructs and their relevance for predicting developmental correlates. *The Journals of Gerontology: Series B*, 72(4), 547-560. doi: 10.1093/geronb/gbv085
- Brothers, A., & Diehl, M. (2017). Feasibility and Efficacy of the AgingPlus Program: Changing Views on Aging to Increase Physical Activity. *Journal of Aging and Physical Activity*, 25(3), 402-411. doi: 10.1123/japa.2016-0039
- Canada, B., Stephan, Y., Jaconelli, A., & Duberstein, P. R. (2014). The Moderating Effect of Chronological Age on the Relation Between Neuroticism and Physical Functioning: Cross-Sectional Evidence From Two French Samples. *The Journals of Gerontology: Series B*, 71(1), 35-40. doi: 10.1093/geronb/gbu083
- Chang, E. S., Kanno, S., Levy, S., Wang, S.-Y., Lee, J. E., & Levy, B. R. (2020). Global reach of ageism on older persons' health: A systematic review. *PloS one*, 15(1), e0220857. doi: 10.1371/journal.pone.0220857
- Chapman, B. P., Roberts, B., Lyness, J., & Duberstein, P. (2013). Personality and Physician-Assessed Illness Burden in Older Primary Care Patients Over 4 Years. *The American Journal of Geriatric Psychiatry*, 21(8), 737-746. doi:
<https://doi.org/10.1016/j.jagp.2012.11.013>

- Christensen, K., Thinggaard, M., Oksuzyan, A., Steenstrup, T., Andersen-Ranberg, K., Jeune, B., . . . Vaupel, J. W. (2013). Physical and cognitive functioning of people older than 90 years: a comparison of two Danish cohorts born 10 years apart. *The Lancet*, 382(9903), 1507-1513. doi: [https://doi.org/10.1016/S0140-6736\(13\)60777-1](https://doi.org/10.1016/S0140-6736(13)60777-1)
- Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112(1), 155-159. doi: 10.1037/0033-2909.112.1.155
- Costa, P. T., & McCrae, R. R. (1987). Neuroticism, Somatic Complaints, and Disease: Is the Bark Worse than the Bite? *Journal of Personality*, 55(2), 299-316. doi: 10.1111/j.1467-6494.1987.tb00438.x
- Costa, P. T., & McCrae, R. R. (1992a). Four ways five factors are basic. *Personality and Individual Differences*, 13(6), 653-665. doi: 10.1016/0191-8869(92)90236-I
- Costa, P. T., & McCrae, R. R. (1992b). *Revised NEO personality inventory and NEO five factor inventory (Professional Manual)*. Odessa, TX: Psychological Assessment Resources.
- Crimmins, E. M. (2015). Lifespan and Healthspan: Past, Present, and Promise. *The Gerontologist*, 55(6), 901-911. doi: 10.1093/geront/gnv130
- Dening, T. R., Chi, L.-Y., Brayne, C., Huppert, F. A., Paykel, E. S., & O'Connor, D. W. (1998). Changes in self-rated health, disability and contact with services in a very elderly cohort: a 6-year follow-up study. *Age and Ageing*, 27(1), 23-33. doi: 10.1093/ageing/27.1.23
- Diehl, M., & Wahl, H.-W. (2010). Awareness of age-related change: examination of a (mostly) unexplored concept. *The journals of gerontology. Series B, Psychological sciences and social sciences*, 65B(3), 340-350. doi: 10.1093/geronb/gbp110
- Diehl, M., Wahl, H.-W., Barrett, A. E., Brothers, A. F., Miche, M., Montepare, J. M., . . . Wurm, S. (2014). Awareness of Aging: Theoretical Considerations on an Emerging Concept. *Developmental review : DR*, 34(2), 93-113. doi: 10.1016/j.dr.2014.01.001

- Duberstein, P. R., Sörensen, S., Lyness, J. M., King, D. A., Conwell, Y., Seidlitz, L., & Caine, E. D. (2003). Personality is associated with perceived health and functional status in older primary care patients. *Psychology and Aging, 18*(1), 25-37. doi: 10.1037/0882-7974.18.1.25
- Dutt, A. J., & Wahl, H.-W. (2017). Feeling sad makes us feel older: Effects of a sad-mood induction on subjective age. *Psychology and Aging, 32*(5), 412-418. doi: 10.1037/pag0000179
- Faudzi, F. N. M., Armitage, C. J., Bryant, C., & Brown, L. J. E. (2019). A systematic review of the psychometric properties of self-report measures of attitudes to aging. *Research on Aging, 41*(6), 549-574. doi: 10.1177/0164027518825117
- Friedman, H. S., Tucker, J. S., Schwartz, J. E., Martin, L. R., Tomlinson-Keasey, C., Wingard, D. L., & Criqui, M. H. (1995). Childhood conscientiousness and longevity: Health behaviors and cause of death. *Journal of Personality and Social Psychology, 68*(4), 696–703. doi: 10.1037/0022-3514.68.4.696
- Friedman, H. S., & Kern, M. L. (2014). Personality, Well-Being, and Health. *Annual Review of Psychology, 65*(1), 719-742. doi: doi:10.1146/annurev-psych-010213-115123
- Gerstorf, D., & Ram, N. (2009). Limitations on the Importance of Self-Regulation in Old Age. *Human development, 52*(1), 38-43. doi: 10.1159/000189214
- Goldberg, L. R. (1990). An alternative 'description of personality': The Big-Five factor structure. *Journal of Personality and Social Psychology, 59*(6), 1216-1229. doi: 10.1037/0022-3514.59.6.1216
- Graham, E. K., Rutsohn, J. P., Turiano, N. A., Bendayan, R., Batterham, P. J., Gerstorf, D., . . . Mroczek, D. K. (2017). Personality predicts mortality risk: An integrative data analysis of 15 international longitudinal studies. *Journal of Research in Personality, 70*, 174-186. doi: <https://doi.org/10.1016/j.jrp.2017.07.005>

- Gunthert, K. C., Cohen, L. H., & Armeli, S. (1999). The role of neuroticism in daily stress and coping. *Journal of Personality and Social Psychology*, *77*(5), 1087-1100. doi: 10.1037/0022-3514.77.5.1087
- Hampson, S. E., Edmonds, G. W., Goldberg, L. R., Dubanoski, J. P., & Hillier, T. A. (2013). Childhood conscientiousness relates to objectively measured adult physical health four decades later. *Health Psychology*, *32*(8), 925–928. doi: 10.1037/a0031655
- Hampson, S. E., Edmonds, G. W., Goldberg, L. R., Dubanoski, J. P., & Hillier, T. A. (2015). A life-span behavioral mechanism relating childhood conscientiousness to adult clinical health. *Health Psychology*, *34*(9), 887–895. doi: 10.1037/hea0000209
- Heckhausen, J., Dixon, R. A., & Baltes, P. B. (1989). Gains and losses in development throughout adulthood as perceived by different adult age groups. *Developmental Psychology*, *25*(1), 109–121. doi: <https://doi.org/10.1037/0012-1649.25.1.109>
- Heikkinen, E. (2011). A life course approach: research orientations and future challenges. *European Review of Aging and Physical Activity*, *8*(1), 7-12. doi: 10.1007/s11556-010-0069-2
- Heikkinen, E., Kauppinen, M., Rantanen, T., Leinonen, R., Lyyra, T.-M., Suutama, T., & Heikkinen, R.-L. (2011). Cohort differences in health, functioning and physical activity in the young-old Finnish population. *Aging Clinical and Experimental Research*, *23*(2), 126-134. doi: 10.3275/6932
- Hill, P. L., Nickel, L. B., & Roberts, B. W. (2014). Are You in a Healthy Relationship? Linking Conscientiousness to Health via Implementing and Immunizing Behaviors. *Journal of Personality*, *82*(6), 485-492. doi: 10.1111/jopy.12051
- Hill, P. L., & Roberts, B. W. (2011). The role of adherence in the relationship between conscientiousness and perceived health. *Health Psychology*, *30*(6), 797-804. doi: 10.1037/a0023860

- Hoffman, L., & Stawski, R. S. (2009). Persons as Contexts: Evaluating Between-Person and Within-Person Effects in Longitudinal Analysis. *Research in Human Development, 6*(2/3), 97-120. doi: 10.1080/15427600902911189
- Hox, J. J., & Kreft, I. G. G. (1994). Multilevel Analysis Methods. *Sociological Methods & Research, 22*(3), 283-299. doi: 10.1177/0049124194022003001
- Hubley, A. M., & Russell, L. B. (2009). Prediction of subjective age, desired age, and age satisfaction in older adults: Do some health dimensions contribute more than others? *International Journal of Behavioral Development, 33*(1), 12-21. doi: 10.1177/0165025408099486
- Human, L. J., Biesanz, J. C., Miller, G. E., Chen, E., Lachman, M. E., & Seeman, T. E. (2013). Is Change Bad? Personality Change Is Associated with Poorer Psychological Health and Greater Metabolic Syndrome in Midlife. *Journal of Personality, 81*(3), 249-260. doi: 10.1111/jopy.12002
- Infurna, F.J., Gerstorf, D., & Lachman, M.E. (in press). Midlife in the 2020s: Opportunities and Challenges. *American Psychologist*.
- Jackson, J. J., Hill, P. L., Payne, B. R., Roberts, B. W., & Stine-Morrow, E. A. L. (2012). Can an old dog learn (and want to experience) new tricks? Cognitive training increases openness to experience in older adults. *Psychology and Aging, 27*(2), 286-292. doi: 10.1037/a0025918
- Jackson, J. J., Weston, S. J., & Schultz, L. H. (2017). Personality development and health. In Specht, J. (Ed). *Personality Development Across the Lifespan* (pp. 371-384). Academic Press.
- Jacobs, J. M., Maaravi, Y., Cohen, A., Bursztyjn, M., Ein-Mor, E., & Stessman, J. (2012). Changing profile of health and function from age 70 to 85 years. *Gerontology, 58*(4), 313-321. doi: 10.1159/000335238

- Jopp, D., Park, M.-K. S., Lehrfeld, J., & Paggi, M. E. (2016). Physical, cognitive, social and mental health in near-centenarians and centenarians living in New York City: findings from the Fordham Centenarian Study. [journal article]. *BMC Geriatrics*, *16*(1), 1-10. doi: 10.1186/s12877-015-0167-0
- Kass, R. E., & Raftery, A. E. (1995). Bayes Factors. *Journal of the American Statistical Association*, *90*(430), 773-795. doi: 10.1080/01621459.1995.10476572
- Kern, M. L., & Friedman, H. S. (2008). Do conscientious individuals live longer? A quantitative review. *Health Psychology*, *27*(5), 505-512. doi: 10.1037/0278-6133.27.5.505
- Klusmann, V., Sproesser, G., Wolff, J. K., & Renner, B. (2019). Positive self-perceptions of aging promote healthy eating behavior across the life span via social-cognitive processes. *The Journals of Gerontology: Series B*, *74*(5), 735-744.
- König, M., Drewelies, J., Norman, K., Spira, D., Buchmann, N., Hülür, G., . . . Demuth, I. (2018). Historical trends in modifiable indicators of cardiovascular health and self-rated health among older adults: Cohort differences over 20 years between the Berlin Aging Study (BASE) and the Berlin Aging Study II (BASE-II). *PLOS ONE*, *13*(1), e0191699. doi: 10.1371/journal.pone.0191699
- Kornadt, A. E., Kessler, E.-M., Wurm, S., Bowen, C. E., Gabrian, M., & Klusmann, V. (2019). Views on ageing: a lifespan perspective. *European Journal of Ageing*. doi: 10.1007/s10433-019-00535-9
- Kornadt, A. E., Siebert, J. S., & Wahl, H.-W. (2019). The interplay of personality and attitudes toward own aging across two decades of later life. *PLOS ONE*, *14*(10), e0223622-e0223622. doi: 10.1371/journal.pone.0223622
- Kotter-Grühn, D., Kleinspehn-Ammerlahn, A., Gerstorf, D., & Smith, J. (2009). Self-perceptions of aging predict mortality and change with approaching death: 16-year

- longitudinal results from the Berlin Aging Study. *Psychology and Aging*, 24(3), 654-667. doi: 10.1037/a0016510
- Kunzmann, U., Schilling, O. K., Wrosch, C., Siebert, J. S., Katzorreck, M., Wahl, H.-W., & Gerstorf, D. (2019). Negative Emotions and Chronic Physical Illness: A Lifespan Developmental Perspective. *Health Psychology*, Advance online publication. doi: <http://dx.doi.org/10.1037/hea0000767>
- Lachman, M. E. (2004). Development in Midlife. *Annual Review of Psychology*, 55(1), 305-331. doi: doi:10.1146/annurev.psych.55.090902.141521
- Lachman, M. E. (2015). Mind the gap in the middle: A call to study midlife. *Research in Human Development*, 12(3-4), 327-334.
- Lachman, M. E., Teshale, S., & Agrigoroaei, S. (2014). Midlife as a pivotal period in the life course: Balancing growth and decline at the crossroads of youth and old age. *International Journal of Behavioral Development*. doi: 10.1177/0165025414533223
- Lawton, M. P. (1975). The Philadelphia Geriatric Center Morale Scale: A Revision1. *Journal of Gerontology*, 30(1), 85-89. doi: 10.1093/geronj/30.1.85
- Leigh, L., Byles, J. E., & Mishra, G. D. (2017). Change in physical function among women as they age: findings from the Australian Longitudinal Study on Women's Health. *Quality of Life Research*, 26(4), 981-991. doi: 10.1007/s11136-016-1422-3
- Levy, B. (2009). Stereotype embodiment: A psychosocial approach to aging. *Current directions in psychological science*, 18(6), 332-336. doi: 10.1111/j.1467-8721.2009.01662.x
- Levy, B. R., Zonderman, A. B., Slade, M. D., & Ferrucci, L. (2009). Age stereotypes held earlier in life predict cardiovascular events in later life. *Psychological science*, 20(3), 296–298. doi:10.1111/j.1467-9280.2009.02298.x

- Levy, B., Hausdorff, J. M., Hencke, R., & Wei, J. Y. (2000). Reducing Cardiovascular Stress With Positive Self-Stereotypes of Aging. *The Journals of Gerontology: Series B*, 55(4), P205-P213. doi: 10.1093/geronb/55.4.P205
- Levy, B., Moffat, S., Resnick, S. M., Slade, M. D., & Ferrucci, L. (2016). Buffer against cumulative stress: Positive age self-stereotypes predict lower cortisol across 30 years. *GeroPsych: The Journal of Gerontopsychology and Geriatric Psychiatry*, 29(3), 141-146. doi: 10.1024/1662-9647/a000149
- Levy, B., & Myers, L. M. (2004). Preventive health behaviors influenced by self-perceptions of aging. *Preventive Medicine*, 39(3), 625-629. doi: 10.1016/j.ypmed.2004.02.029
- Levy, B., & Myers, L. M. (2005). Relationship between respiratory mortality and self-perceptions of aging. *Psychology & Health*, 20(5), 553-564. doi: 10.1080/14768320500066381
- Levy, B., Ryall, A. L., Pilver, C. E., Sheridan, P. L., Wei, J. Y., & Hausdorff, J. M. (2008). Influence of African American elders' age stereotypes on their cardiovascular response to stress. *Anxiety, Stress, & Coping*, 21(1), 85-93. doi: 10.1080/10615800701727793
- Levy, B., Slade, M. D., & Gill, T. M. (2006). Hearing Decline Predicted by Elders' Stereotypes. *The Journals of Gerontology: Series B*, 61(2), P82-P87. doi: 10.1093/geronb/61.2.P82
- Levy, B., Slade, M. D., & Kasl, S. V. (2002). Longitudinal benefit of positive self-perceptions of aging on functional health. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 57(5), 409-417. doi: 10.1093/geronb/57.5.P409
- Levy, B., Slade, M. D., Kunkel, S. R., & Kasl, S. V. (2002). Longevity increased by positive self-perceptions of aging. *Journal of Personality and Social Psychology*, 83(2), 261-270. doi: 10.1037/0022-3514.83.2.261

- Liang, J., Shaw, B. A., Krause, N., Bennett, J. M., Kobayashi, E., Fukaya, T., & Sugihara, Y. (2005). How Does Self-Assessed Health Change With Age? A Study of Older Adults in Japan. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *60*(4), S224-S232. doi: 10.1093/geronb/60.4.S224
- Löckenhoff, C. E., Sutin, A. R., Ferrucci, L., & Costa Jr, P. T. (2008). Personality traits and subjective health in the later years: The association between NEO-PI-R and SF-36 in advanced age is influenced by health status. *Journal of Research in Personality*, *42*(5), 1334-1346. doi: <http://dx.doi.org/10.1016/j.jrp.2008.05.006>
- Löckenhoff, C. E., Terracciano, A., Ferrucci, L., & Costa, P. T. (2012). Five-Factor Personality Traits and Age Trajectories of Self-Rated Health: The Role of Question Framing. *Journal of Personality*, *80*(2), 375-401. doi: 10.1111/j.1467-6494.2011.00724.x
- Lodi-Smith, J., Jackson, J., Bogg, T., Walton, K., Wood, D., Harms, P., & Roberts, B. W. (2010). Mechanisms of health: Education and health-related behaviours partially mediate the relationship between conscientiousness and self-reported physical health. *Psychology & health*, *25*(3), 305-319. doi: 10.1080/08870440902736964
- Lucas, R. E., & Donnellan, M. B. (2011). Personality development across the life span: Longitudinal analyses with a national sample from Germany. *Journal of Personality and Social Psychology*, *101*(4), 847.
- Magee, C. A., Heaven, P. C. L., & Miller, L. M. (2013). Personality Change Predicts Self-Reported Mental and Physical Health. *Journal of Personality*, *81*(3), 324-334. doi: 10.1111/j.1467-6494.2012.00802.x
- Magidson, J. F., Roberts, B. W., Collado-Rodriguez, A., & Lejuez, C. W. (2014). Theory-driven intervention for changing personality: expectancy value theory, behavioral activation, and conscientiousness. *Developmental psychology*, *50*(5), 1442-1450. doi: 10.1037/a0030583

- Maier, H., & Smith, J. (1999). Psychological predictors of mortality in old age. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, 54(1), P44–P54. <https://doi.org/10.1093/geronb/54B.1.P44>
- Martin, L. R., Friedman, H. S., & Schwartz, J. E. (2007). Personality and mortality risk across the life span: The importance of conscientiousness as a biopsychosocial attribute. *Health Psychology*, 26(4), 428-436.
- Merrill, S. S., & Verbrugge, L. M. (1999). Health and Disease in Midlife. In S. L. Willis & J. D. Reid (Eds.), *Life in the Middle* (pp. 77-103). San Diego: Academic Press.
- Miche, M., Elsässer, V. C., Schilling, O. K., & Wahl, H.-W. (2014). Attitude toward own aging in midlife and early old age over a 12-year period: Examination of measurement equivalence and developmental trajectories. *Psychology and Aging*, 29(3), 588-600. doi: 10.1037/a0037259
- Montepare, J.M. (2019). An exploration of subjective age, actual age, age awareness, and engagement in everyday behaviors. *European Journal of Ageing*. Advance Online Publication. doi:10.1007/s10433-019-00534-w
- Moor, C., Zimprich, D., Schmitt, M., & Kliegel, M. (2006). Personality, aging self-perceptions, and subjective health: A mediation model. *The International Journal of Aging and Human Development*, 63(3), 241-257. doi: 10.2190/AKRY-UM4K-PB1V-PBHF
- Morack, J., Infurna, F. J., Ram, N., & Gerstorf, D. (2013). Trajectories and personality correlates of change in perceptions of physical and mental health across adulthood and old age. *International Journal of Behavioral Development*, 37(6), 475-484. doi: 10.1177/0165025413492605
- Möttus, R., Johnson, W., & Deary, I. (2012). Personality traits in old age: measurement and rank-order stability and some mean-level change. *Psychology and Aging*, 27(1), 243.

- Mroczek, D. K., & Spiro, A., 3rd. (2007). Personality change influences mortality in older men. *Psychological science*, *18*(5), 371-376. doi: 10.1111/j.1467-9280.2007.01907.x
- Mueller, S., Wagner, J., & Gerstorf, D. (2017). On the role of personality in late life. In J. Specht (Ed.), *Personality development across the lifespan*. San Diego, CA: Elsevier.
- Mueller, S., Wagner, J., Voelkle, M. C., Smith, J., & Gerstorf, D. (2018). The interplay of personality and functional health in old and very old age: Dynamic within-person interrelations across up to 13 years. *Journal of Personality and Social Psychology*, *115*(6), 1127–1147. <https://doi.org/10.1037/pspp0000173>
- Mühlig-Versen, A., Bowen, C. E., & Staudinger, U. M. (2012). Personality plasticity in later adulthood: Contextual and personal resources are needed to increase openness to new experiences. *Psychology and Aging*, *27*(4), 855-866. doi: 10.1037/a0029357
- Nybo, H., Gaist, D., Jeune, B., McGue, M., Vaupel, J. W., & Christensen, K. (2001). Functional Status and Self-Rated Health in 2,262 Nonagenarians: The Danish 1905 Cohort Survey. *Journal of the American Geriatrics Society*, *49*(5), 601-609. doi: 10.1046/j.1532-5415.2001.49121.x
- Ram, N., & Grimm, K. J. (2015). Growth Curve Modeling and Longitudinal Factor Analysis. In R. M. Lerner (Ed.), *Handbook of Child Psychology and Developmental Science: Volume 1. Theory and method* (7 ed., pp. 758-788). Hoboken, N.J.: Wiley.
- Reiss, D., Eccles, J. S., & Nielsen, L. (2014). Conscientiousness and public health: Synthesizing current research to promote healthy aging. *Developmental Psychology*, *50*(5), 1303-1314. doi: 10.1037/a0036473
- Roberts, B. W., Luo, J., Briley, D. A., Chow, P. I., Su, R., & Hill, P. L. (2017). A systematic review of personality trait change through intervention. *Psychological Bulletin*, *143*(2), 117-141. doi: 10.1037/bul0000088

- Roberts, B. W., Walton, K. E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: a meta-analysis of longitudinal studies. *Psychological Bulletin*, *132*(1), 1.
- Santoni, G., Angleman, S., Welmer, A.-K., Mangialasche, F., Marengoni, A., & Fratiglioni, L. (2015). Age-Related Variation in Health Status after Age 60. *PLOS ONE*, *10*(3), e0120077. doi: 10.1371/journal.pone.0120077
- Sargent-Cox, K. A., Anstey, K. J., & Luszcz, M. A. (2012). The relationship between change in self-perceptions of aging and physical functioning in older adults. *Psychology and Aging*, *27*(3), 750-760. doi: 10.1037/a0027578
- Sattler, C., Wahl, H., Schröder, J., Kruse, A., Schönknecht, P., Kunzmann, U., (2015). Interdisciplinary Longitudinal Study on Adult Development and Aging (ILSE). In N. Pachana (Ed.), *Encyclopedia of Geropsychology*. New York: Springer.
- Scheier, M. F., & Bridges, M. W. (1995). Person Variables and Health: Personality Predispositions and Acute Psychological States as Shared Determinants for Disease. *Psychosomatic medicine*, *57*(3), 255-268.
- Schmidt, L. I., Gabrian, M., Jansen, C.-P., Wahl, H.-W., & Sieverding, M. (2018). Extending research on self-regulation of physical activity in older age: Role of views on aging within an intensive ambulatory assessment scheme. *Journal of Self-regulation and Regulation*, *4*, 43-59. doi: 0.11588/josar.2018.0.4936
- Schmitt, M., Wahl, H.-W., & Kruse, A. (2008). *Interdisziplinäre Längsschnittstudie des Erwachsenenalters (ILSE). Abschlussbericht anlässlich der Fertigstellung des dritten Messzeitpunkts*. Berlin: Bundesministerium für Familie, Senioren, Frauen und Jugend.
- Schwartz, J. E., & Stone, A. A. (1998). Strategies for analyzing ecological momentary assessment data. *Health Psychology*, *17*(1), 6-16. doi: 10.1037/0278-6133.17.1.6

- Shanahan, M. J., Hill, P. L., Roberts, B. W., Eccles, J., & Friedman, H. S. (2014).
Conscientiousness, health, and aging: The Life Course of Personality Model.
Developmental Psychology, 50(5), 1407-1425. doi: 10.1037/a0031130
- Siebert, J. S., Wahl, H.-W., Degen, C., & Schröder, J. (2018). Attitude toward own aging as a
risk factor for cognitive disorder in old age: 12-year evidence from the ILSE study.
Psychology and Aging, 33(3), 461-472. doi: 10.1037/pag0000252
- Siebert, J. S., Wahl, H.-W., & Schröder, J. (2016). The Role of Attitude Toward Own Aging
for Fluid and Crystallized Functioning: 12-Year Evidence From the ILSE Study. *The
Journals of Gerontology: Series B, 73*(5), 836-845. doi: 10.1093/geronb/gbw050
- Singer, T., Verhaeghen, P., Ghisletta, P., Lindenberger, U., & Baltes, P. B. (2003). The fate of
cognition in very old age: Six-year longitudinal findings in the Berlin Aging Study
(BASE). *Psychology and Aging, 18*(2), 318-331. doi: 10.1037/0882-7974.18.2.318
- Smith, T. W., & MacKenzie, J. (2006). Personality and Risk of Physical Illness. *Annual
Review of Clinical Psychology, 2*(1), 435-467. doi:
doi:10.1146/annurev.clinpsy.2.022305.095257
- Specht, J. (2017). *Personality development across the lifespan*. Elsevier Academic Press. doi:
<https://doi.org/10.1016/B978-0-12-804674-6.00005-3>
- Spuling, S. M., Klusmann, V., Bowen, C. E., Kornadt, A. E., & Kessler, E.-M. (2019). The
uniqueness of subjective ageing: convergent and discriminant validity. *European
Journal of Ageing*. doi: 10.1007/s10433-019-00529-7
- Spuling, S. M., Miche, M., Wurm, S., & Wahl, H.-W. (2013). Exploring the Causal Interplay
of Subjective Age and Health Dimensions in the Second Half of Life. *Zeitschrift für
Gesundheitspsychologie, 21*(1), 5-15. doi: 10.1026/0943-8149/a000084
- StataCorp. (2017). *Stata Statistical Software: Release 15*. College Station, TX: StataCorp
LLC.

- Steinhausen-Thiessen, E., & Borchelt, M. (1993). Health Differences in Advanced Old Age. *Ageing and Society, 13*(4), 619-655. doi: 10.1017/s0144686x00001380
- Stephan, Y., Chalabaev, A., Kotter-Grühn, D., & Jaconelli, A. (2012). "Feeling Younger, Being Stronger": An Experimental Study of Subjective Age and Physical Functioning Among Older Adults. *The Journals of Gerontology: Series B, 68*(1), 1-7. doi: 10.1093/geronb/gbs037
- Stephan, Y., Demulier, V., & Terracciano, A. (2012). Personality, self-rated health, and subjective age in a life-span sample: The moderating role of chronological age. *Psychology and Aging, 27*(4), 875-880. doi: 10.1037/a0028301
- Stephan, Y., Sutin, A. R., & Terracciano, A. (2015). Younger subjective age is associated with lower C-reactive protein among older adults. *Brain, Behavior, and Immunity, 43*, 33-36. doi: <https://doi.org/10.1016/j.bbi.2014.07.019>
- Stephens, A., Wardle, J., Vinck, J., Tuomisto, M., Holte, A., & Wichstrøm, L. (1994). Personality and attitudinal correlates of healthy and unhealthy lifestyles in young adults. *Psychology & health, 9*(5), 331-343. doi: 10.1080/08870449408407492
- Suls, J., & Martin, R. (2005). The Daily Life of the Garden-Variety Neurotic: Reactivity, Stressor Exposure, Mood Spillover, and Maladaptive Coping. *Journal of Personality, 73*(6), 1485-1510. doi: 10.1111/j.1467-6494.2005.00356.x
- Sun, J. K., Kim, E. S., & Smith, J. (2017). Positive Self-Perceptions of Aging and Lower Rate of Overnight Hospitalization in the US Population Over Age 50. *Psychosomatic medicine, 79*(1), 81-90. doi: 10.1097/psy.0000000000000364
- Sutin, A. R., Zonderman, A. B., Ferrucci, L., & Terracciano, A. (2013). Personality Traits and Chronic Disease: Implications for Adult Personality Development. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 68*(6), 912-920. doi: 10.1093/geronb/gbt036

- Taylor, M. G., & Lynch, S. M. (2011). Cohort Differences and Chronic Disease Profiles of Differential Disability Trajectories. *The Journals of Gerontology: Series B*, *66B*(6), 729-738. doi: 10.1093/geronb/gbr104
- Terracciano, A., Löckenhoff, C. E., Zonderman, A. B., Ferrucci, L., & Costa, P. T., Jr. (2008). Personality predictors of longevity: activity, emotional stability, and conscientiousness. *Psychosomatic medicine*, *70*(6), 621-627. doi: 10.1097/PSY.0b013e31817b9371
- Tovel, H., Carmel, S., & Raveis, V. H. (2019). Relationships Among Self-perception of Aging, Physical Functioning, and Self-efficacy in Late Life. *The Journals of Gerontology: Series B*, *74*(2), 212-221. doi: 10.1093/geronb/gbx056
- Turiano, N. A., Pitzer, L., Armour, C., Karlamangla, A., Ryff, C. D., & Mroczek, D. K. (2012). Personality Trait Level and Change as Predictors of Health Outcomes: Findings From a National Study of Americans (MIDUS). *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *67B*(1), 4-12. doi: 10.1093/geronb/gbr072
- Vogelsang, E. M. (2017). Feeling Better at This Age? Investigating Three Explanations for Self-Rated Health Improvements Among the Oldest-Old. *The Gerontologist*, *58*(5), 825-834. doi: 10.1093/geront/gnx149
- Wagner, J., Ram, N., Smith, J., & Gerstorf, D. (2015). Personality Trait Development at the End of Life: Antecedents and Correlates of Mean-Level Trajectories. *Journal of Personality and Social Psychology*. doi: 10.1037/pspp0000071
- Wahl, H.-W., Schmitt, M., Danner, D., & Coppin, A. (2010). Is the Emergence of Functional Ability Decline in Early Old Age Related to Change in Speed of Cognitive Processing and Also to Change in Personality? *Journal of Aging and Health*, *22*(6), 691-712. doi: 10.1177/0898264310372410

- Watson, D., & Hubbard, B. (1996). Adaptational Style and Dispositional Structure: Coping in the Context of the Five-Factor Model. *Journal of Personality, 64*(4), 737-774. doi: 10.1111/j.1467-6494.1996.tb00943.x
- Watson, D., & Pennebaker, J. W. (1989). Health complaints, stress, and distress: Exploring the central role of negative affectivity. *Psychological Review, 96*(2), 234-254. doi: 10.1037/0033-295x.96.2.234
- Westerhof, G. J., Miche, M., Brothers, A. F., Barrett, A. E., Diehl, M., Montepare, J. M., . . . Wurm, S. (2014). The influence of subjective aging on health and longevity: A meta-analysis of longitudinal data. *Psychology and Aging, 29*(4), 793-802. doi: 10.1037/a0038016
- Westerhof, G. J., & Wurm, S. (2015). Longitudinal research on subjective aging, health, and longevity: Current evidence and new directions for research. In M. Diehl & H.-W. Wahl (Eds.), *Annual review of gerontology and geriatrics: Vol. 35. Annual review of gerontology and geriatrics, Vol. 35, 2015: Subjective aging: New developments and future directions* (p. 145–165). Springer Publishing Co.
- Wettstein, M., Schilling, O. K., & Wahl, H. W. (2016). “Still Feeling Healthy After all these Years”: The Paradox of Subjective Stability versus Objective Decline in Very Old Adults’ Health and Functioning Across Five Years. *Psychology and Aging, 31*(8), 815-830.
- Wettstein, M., Tauber, B., Wahl, H.-W., & Frankenberg, C. (2017). 12-Year Associations of Health with Personality in the Second Half of Life: Being versus Feeling Healthy. *GeroPsych: The Journal of Gerontopsychology and Geriatric Psychiatry*.
- Willis, S. L., Jay, G. M., Diehl, M., & Marsiske, M. (1992). Longitudinal Change and Prediction of Everyday Task Competence in the Elderly. *Research on aging, 14*(1), 68-91. doi: 10.1177/0164027592141004

- Wolff, J. K., Warner, L. M., Ziegelmann, J. P., & Wurm, S. (2014). What do targeting positive views on ageing add to a physical activity intervention in older adults? Results from a randomised controlled trial. *Psychology & health, 29*(8), 915-932. doi: 10.1080/08870446.2014.896464
- Wrzus, C. (2019). Does Age Matter for Personality Psychology? *European Journal of Personality, 33*(3), 217-220. doi: 10.1002/per.2205
- Wurm, S., Tesch-Römer, C., & Tomasik, M. J. (2007). Longitudinal Findings on Aging-Related Cognitions, Control Beliefs, and Health in Later Life. *The Journals of Gerontology: Series B, 62*(3), P156-P164. doi: 10.1093/geronb/62.3.P156
- Wurm, S., & Benyamini, Y. (2014). Optimism buffers the detrimental effect of negative self-perceptions of ageing on physical and mental health. *Psychology & Health, 29*(7), 832-848.
- Wurm, S., Diehl, M., Kornadt, A. E., Westerhof, G. J., & Wahl, H.-W. (2017). How do views on aging affect health outcomes in adulthood and late life? Explanations for an established connection. *Developmental Review, 46*, 27-43. doi: <https://doi.org/10.1016/j.dr.2017.08.002>
- Wurm, S., Tomasik, M. J., & Tesch-Römer, C. (2010). On the importance of a positive view on ageing for physical exercise among middle-aged and older adults: Cross-sectional and longitudinal findings. *Psychology and Health, 25*(1), 25-42.
- Yang, Y., & Lee, L. C. (2009). Sex and Race Disparities in Health: Cohort Variations in Life Course Patterns. *Social Forces, 87*(4), 2093-2124. doi: 10.1353/sof.0.0183
- Zhang, X., Kamin, S. T., Liu, S., Fung, H. H., & Lang, F. R. (2018). Negative Self-perception of Aging and Mortality in Very Old Chinese Adults: The Mediation Role of Healthy Lifestyle. *The Journals of Gerontology: Series B, gby136*. doi: 10.1093/geronb/gby136

Table 1

Sample Description (Baseline)

	Midlife Sample (<i>n</i> = 502; age T1: 43-46 years)	Late-Life Sample (<i>n</i> = 500; age T1: 61-65 years)	Test
Health			
Physician-Rated Health ¹ , <i>M</i> ± <i>SD</i>	4.73±0.78	4.53±0.87	<i>t</i> (966.1) = 3.71, <i>p</i> < .001
Psychosocial Factors:			
Neuroticism, <i>M</i> ± <i>SD</i>	1.48±0.59	1.56±0.58	<i>t</i> (980) = 2.11, <i>p</i> < .05
Conscientiousness, <i>M</i> ± <i>SD</i>	2.93±0.45	2.94±0.44	<i>t</i> (979.8) = 0.48, <i>p</i> = .62
Attitudes Toward Own Aging, <i>M</i> ± <i>SD</i>	0.75±0.27	0.71±0.30	<i>t</i> (964.35) = -2.27, <i>p</i> < .05
Socio-Demographic Factors:			
Female sex, <i>n</i> (%)	260 (51.8%)	260 (52%)	χ^2 (1) = .004, <i>p</i> = .95
Education, <i>M</i> ± <i>SD</i>	14.07±2.50	12.89±2.76	<i>t</i> (980) = -7.05, <i>p</i> < .001

Note. *M* = mean; *SD* = standard deviation.

¹ Higher values indicate better physician-rated health.

Table 2

Correlations between Study Variables (T1)

Variables	Physician- Rated Health ¹	Neuroticism	Conscien- tiousness	ATOA	Gender	Education
Neuroticism	-.16***					
Conscientiousness	.08*	-.32***				
ATOA	.22***	-.37***	.08*			
Gender	.01	.28***	-.07*	.04		
Education	.17***	-.20***	-.02	.08*	-.17***	
Age Group ²	.12***	.07*	-.02	.07*	.00	.22***

Note. ATOA = Attitudes Toward Own Aging.

* $p < .05$; ** $p < .01$; *** $p < .001$.

¹ Higher values indicate better physician-rated health.

² 0 = old-age sample, 1 = midlife sample

Table 3

Correlations between Physician-Rated Health and Occasion-Specific Deviations in Personality and ATOA (Multilevel Data Structure)

Variables	Physician-Rated Health ¹	Neuroticism Deviations	Conscientiousness Deviations
Neuroticism Deviations	-.01		
Conscientiousness Deviations	.02	-.31***	
ATOA Deviations	.07***	-.28***	.17***

Note. ATOA = Attitudes Toward Own Aging.

* $p < .05$; ** $p < .01$; *** $p < .001$.

¹ Higher values indicate better physician-rated health.

Table 4

20-Year Change in Physician-Rated Health in Midlife and Old Age Based on Longitudinal Multilevel Regression Models

	Physician-Rated Health ¹
Fixed Regression Coefficients:	
Intercept [SE]	4.51*** [0.03]
Linear slope [SE]	- 0.01** [0.00]
Age Group ² [SE]	0.21*** [0.05]
Age Group*Time [SE]	0.02*** [0.00]
Random Variances and Covariances:	
Variance Intercept [SE]	0.31** [0.03]
Variance Slope [SE]	0.00* [0.00]
Covariance Intercept-Slope [SE]	-0.01** [0.00]
Residual Variance [SE]	0.33*** [0.01]

Note. Time unit is years. ATOA = Attitudes Towards Own Aging.

* $p < .05$; ** $p < .01$; *** $p < .001$.

¹ Higher values indicate better physician-rated health.

² 0 = old-age sample, 1 = midlife sample

Table 5

Predictors of 20-Year Changes in Physician-Rated Health Based in Midlife and Old Age Based on Longitudinal Multilevel Regression Models

	Physician- Rated Health ¹
Fixed Regression Coefficients:	
Intercept [SE]	3.88*** [0.24]
Age Group ² [SE]	0.36** [0.12]
Gender ³ [SE]	0.05 [0.05]
Education [SE]	0.01 [0.01]
Education*Age Group [SE]	0.04** [0.01]
Linear slope (Time) [SE]	0.01 [0.02]
Age Group *Time [SE]	0.02*** [0.00]
Gender*Time [SE]	0.01 [0.00]
Education*Time [SE]	0.00 [0.00]
Between-Person Predictor Effects of Personality and ATOA:	
Neuroticism mean ⁴ [SE]	-0.13* [0.05]
Conscientiousness mean ⁴ [SE]	0.05 [0.06]
ATOA mean ⁴ [SE]	1.00*** [0.13]
ATOA mean ⁴ *Age Group [SE]	-0.38* [0.16]
Neuroticism mean ⁴ *Time [SE]	0.00 [0.01]
Conscientiousness mean ⁴ *Time [SE]	-0.01 [0.01]
ATOA mean ⁴ *Time [SE]	-0.00 [0.01]
Within-Person Predictor Effects of Personality and ATOA:	

Neuroticism dev ⁵ [SE]	0.01 [0.04]
Conscientiousness dev ⁵ [SE]	0.21* [0.09]
Conscientiousness dev ⁵ * Age Group [SE]	-0.31** [0.11]
ATOA dev ⁵ [SE]	0.25*** [0.07]

Random Variances and Covariances:

Variance Intercept [SE]	0.23*** [0.02]
Variance Slope [SE]	0.00 [0.00]
Covariance Intercept-Slope [SE]	-0.00** [0.00]
Residual Variance [SE]	0.33*** [0.01]

Note. Time unit is years. ATOA = Attitudes Toward Own Aging.

* $p < .05$; ** $p < .01$; *** $p < .001$.

¹ Higher values indicate better physician-rated health.

² 0 = old-age sample, 1 = midlife sample

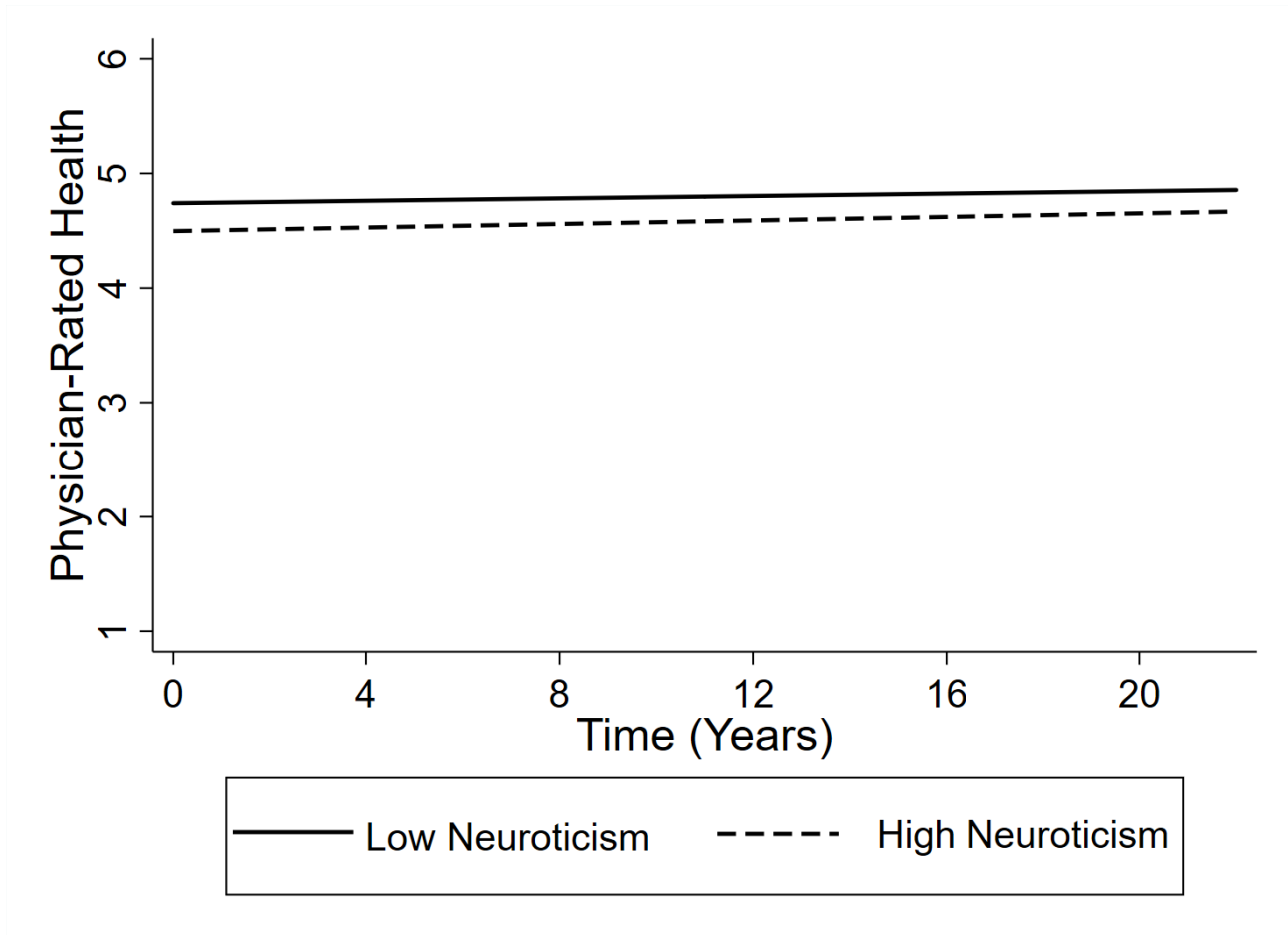
³ 0 = male, 1 = female

⁴ individuals' mean scores across all available measurement occasions

⁵ individuals' measurement-occasion-specific deviations from their mean scores

Figure 1

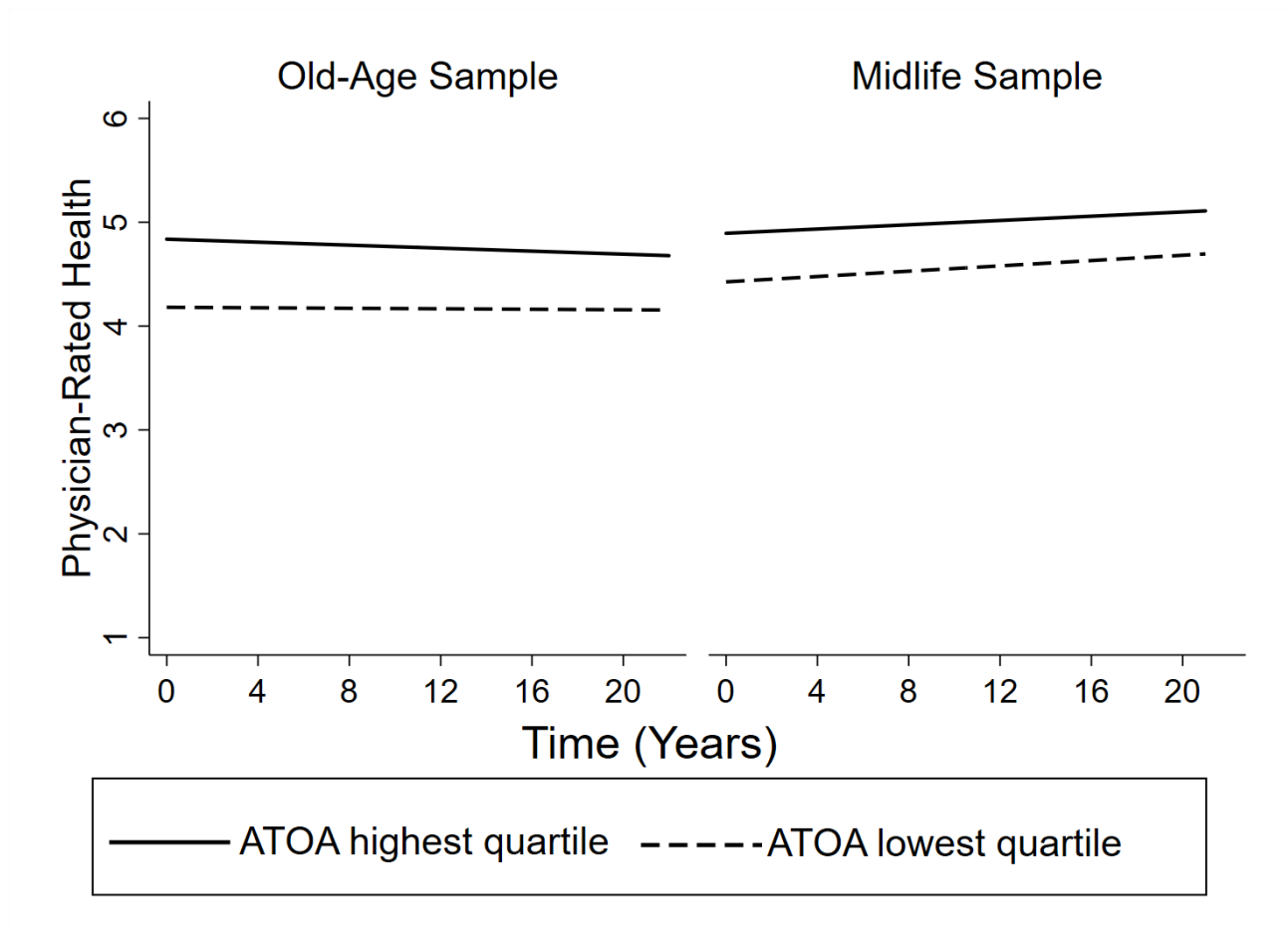
Association of Neuroticism (Between-Person Component) with Physician-Rated Health



Note. Higher values indicate better physician-rated health. Low vs. high neuroticism were categorized based on median split. Overall lower neuroticism was associated with better physician-rated health at baseline. Neuroticism was unrelated to rate of health change.

Figure 2

Association of ATOA (Between-Person Component) with Physician-Rated Health by Age Group

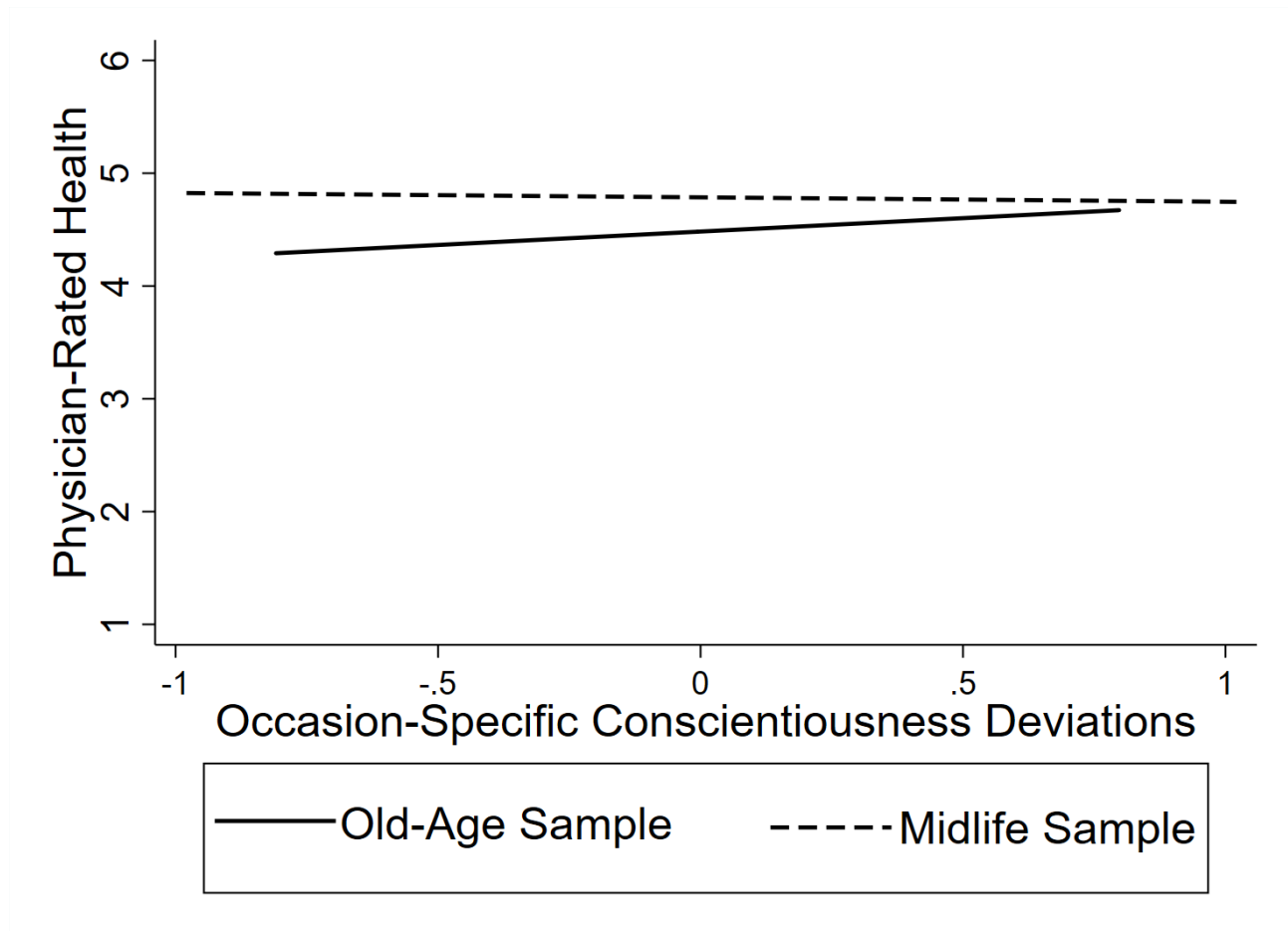


Note. Higher values indicate better physician-rated health. ATOA = Attitudes Toward Own Aging.

To illustrate the interaction of ATOA with age group, the lowest and highest quartile of ATOA scores were contrasted. Overall higher ATOA scores were associated with better baseline physician-rated health, and this association was stronger in old age than in midlife. In both samples, overall ATOA scores were not significantly associated with rate of change in physician-rated health.

Figure 3

Association of Conscientiousness (Within-Person Component) with Physician-Rated Health by Age Group



Note. Lower values indicate better physician-rated health. In the old-age sample, on occasions when individuals scored higher on conscientiousness, they had better physician-rated health scores. In the midlife sample, occasion-specific deviations in conscientiousness and physician-rated health were unrelated.