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Conscientiousness and Longevity: An Examination of Possible Mediators

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Abstract

Objective—Conscientious individuals tend to experience a number of health benefits, not the least of which being greater longevity. However, it remains an open question as to why this link with longevity occurs. The current study tested two possible mediators (physical health and cognitive functioning) of the link between conscientiousness and longevity.

Method—We tested these mediators using a 10-year longitudinal sample (N = 512), a subset of the long-running Health and Retirement Study of aging adults. Measures included an adjective-rating measure of conscientiousness, self-reported health conditions, and three measures of cognitive functioning (word recall, delayed recall, and vocabulary) included in the 1996 wave of the HRS study.

Results—Our results found that conscientiousness significantly predicted greater longevity, even in a model including the two proposed mediator variables, gender, age, and years of education. Moreover, cognitive functioning appears to partially mediate this relationship.

Conclusions—This study replicates previous research showing that conscientious individuals tend to lead longer lives, and provides further insight into why this effect occurs. In addition, it underscores the importance of measurement considerations.

Keywords

conscientiousness; longevity; cognitive functioning; personality and health

Over the past two decades, personality traits have emerged as crucial in identifying those individuals predisposed to healthier lifestyles (Friedman, 2008; Smith, 2006). One trait frequently discussed in this literature is conscientiousness. Conscientious individuals perform healthier behaviors (Bogg & Roberts, 2004), and have decreased risks for a number

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of physical disorders (Goodwin & Friedman, 2006). In turn, conscientiousness predicts greater longevity (e.g., Friedman et al., 1993; Fry & Debats, 2009; Kern & Friedman, 2008; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007), whether measured in childhood (Taylor, Whiteman, Fowkes, Lees, Allerhand, & Deary, 2009) or old age (Weiss & Costa, 2005).

As this first wave of studies has demonstrated consistent evidence for a positive relationship between conscientiousness and longevity, research has turned toward explaining why this relation occurs. The current study sought to examine possible underlying mechanisms, by evaluating the mediational roles of physical health and cognitive functioning. First, we sought to replicate previous work by demonstrating that conscientious individuals live longer. Second, we examined whether this relationship remained significant with the addition of physical health and cognitive functioning added into the regression model. In so doing, we tested whether conscientiousness was an independent predictor of longevity, or whether these two variables might serve to explain the benefits afforded by conscientiousness. For these goals, we employed a 10-year longitudinal sample that comes as a subset of data from the Health and Retirement Study (HRS), a long-running nationwide study of aging American adults.

Physical Health and Cognitive Functioning as Possible Mediators

In most models of health, individual difference factors and environments are thought to directly or indirectly impinge on health and in turn longevity (Hampson & Friedman, 2008). This basic model is predicated on the empirical finding that physical health is one of the best predictors of longevity (Friedman, Kern, & Reynolds, 2010). Moreover, this finding even extends to self-reported health, which also turns out to be an excellent predictor of longevity (Idler & Benyamini, 1997). In turn, much health research has focused on predictors of physical health, such as personality traits (e.g., Roberts, Walton, & Bogg, 2005), and environmental factors (e.g., Taylor, Lerner, Sage, Lehman, & Seeman, 2004).

For example, previous research has shown that conscientious individuals tend to experience fewer major health problems, across a variety of ailments (Goodwin & Friedman, 2006). Indeed, conscientious individuals report lower high blood pressure, lower incidence of diabetes, stroke, and joint problems, and fewer psychiatric conditions. Of the Big Five, conscientiousness also was the best personality trait predictor of illness burden (i.e., physician quantified morbidity) even when controlling for education, substance abuse, hypertension, and cholesterol (Chapman, Lyness, & Duberstein, 2007). Similarly, childhood ratings of conscientiousness predict midlife health ratings independent of social environmental effects such as education and health-related behaviors (Hampson, Goldberg, Vogt, & Dubanoski, 2007). Conscientiousness has even been shown to predict slower disease progression in HIV patients (O'Cleirigh, Ironson, Weiss, & Costa, 2007).

In addition to predicting health, conscientiousness has established relations with the various health behaviors known to contribute to poor health outcomes. Meta-analytic research has shown that conscientiousness-related traits significantly predict several health behaviors relevant to mortality risk including activity/exercise, excessive alcohol use, drug use, unhealthy eating, risky driving, risky sex, suicide, tobacco use, and violence (Bogg & Roberts, 2004). Specifically, conscientiousness was negatively correlated to all risky health behaviors, and positively correlated to all preventative health behaviors. Furthermore, research building on these findings shows that health behaviors partially mediate the relation between conscientiousness and self-reported physical health (Hampson et al., 2007; Lodi-Smith et al., 2010). Given the pervasive relation between conscientiousness, health, and the health behaviors that lead to poorer health, it is reasonable to assume that health conditions would serve as a mediator of the relation between conscientiousness and longevity.

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However, not all domains of conscientiousness influence health similarly. For example, in their study of Medicare patients, Weiss and Costa (2005) found that the self-discipline facet of conscientiousness was the best predictor of mortality, as opposed to other facets, such as competence and achievement striving. In the HRS study, the measure of conscientiousness primarily taps the facet of orderliness, defined as a propensity toward being organized and neat. While one study found orderliness to be the most robust predictor of mortality of those examined (Kern & Friedman, 2008), this facet is consistently the least related to health behaviors (Bogg & Roberts, 2004), which may diminish the possibility that it will predict health and that health will act as a mediator. Moreover, in a recent study, the significant relationship evidenced between conscientiousness and mortality was unaffected by physical health (Friedman, Kern, & Reynolds, 2010), again casting doubt on health conditions as a possible mediator. It is worth noting that this finding was based on the Terman sample, a uniformly intellectually gifted group of individuals. Such a sample thus prevented tests of another possible mediator, namely cognitive functioning.

Cognitive functioning is largely independent of conscientiousness (Ackerman & Heggestad, 1997) with one striking, health-related exception. Conscientiousness has now been linked to the onset of Alzheimer's disease across several studies. In an ongoing longitudinal study of Catholic nuns, priests, and brothers, conscientiousness was found to be a protective factor for the onset of Alzheimer's disease (Wilson, Schneider, Arnold, Bienias, & Bennett, 2007). People who were more conscientious were less likely to suffer from cognitive impairment at baseline and also less likely to be diagnosed with Alzheimer's disease at follow up 12 years later. A second study found that individuals with mild cognitive impairment associated with the onset of Alzheimer's disease were more likely to rate themselves as less conscientious and to be seen by others as less conscientious (Duchek, Balota, Storandt, & Larsen, 2007). Moreover, conscientiousness has been linked to the attentional deficits commonly linked to Alzheimer's related dementia (Tse, Balota, Yap, Duchek, & McCabe, 2010).

Accordingly, cognitive functioning might be considered a second possible mediator for the link between conscientiousness and longevity, particularly because cognitive functioning has been shown to predict greater longevity (for a review, see Batty, Deary, & Gottfredson, 2007). Conscientious individuals appear less susceptible to severe cognitive declines and impairments, which in turn tend to be associated with mortality. For example, it would seem to facilitate cognitive functioning if one was better at self-control and instituting order and structure, actions typical of conscientious individuals. Indeed, while Ackerman and Haggestad (1997) found that overall conscientiousness was largely unrelated to cognitive ability, their meta-analysis demonstrated relations between intelligence and measures of control. To this end, it is again worth noting that the measure used in the current work focused on the orderliness and organization component of conscientiousness.

In summary, we tested two general questions using HRS data. First, does conscientiousness predict longevity at a 10-year follow-up? Second, if so, can either physical health or cognitive functioning explain this effect, insofar that conscientious individuals may experience fewer health problems and demonstrate better cognitive functioning with age?

Method

Participants

We used data from the 1996 HRS survey to create our personality measures (for further details on the study, see Burkhauser & Gertler, 1995). In 1996, participants were randomly assigned to different modules that were additional to the baseline survey, one of which being a short personality inventory. Five hundred twelve participants completed the personality module (57% female, M_{age} = 58.7 years).

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Measures of Interest

Years of education—We also controlled for years of education in our regression analyses. The median was 12 years of education (41% of the sample), akin to completing a typical high school education. About one-sixth of the sample (16%) reported at least 16 years, typically indicative of completing a bachelor's degree.

Mortality data—For mortality data, we used the HRS tracker data, which provides year of death information on the sample using the National Death Index (NDI). Mortality data was available through the end of 2006, thus allowing us to predict survival for the decade following the 1996 initial assessment. For censored observations (survivors), we used an end date of 2007. Among the 58 decedents, survival time ranged from 0 to 10 years (M = 5.2 years).

Health conditions—Participants were asked to report whether a doctor ever told them that they had high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychiatric problems, and arthritis. Participants' scores ranged from 0 conditions to 7 conditions, with a median of 1 health condition reported.

Cognitive functioning—Three measures of cognitive functioning were created from the HRS data: word recall, delayed recall, and vocabulary skills. In the 1996 survey, participants were presented a list of 10 words and then asked to recall the words either immediately or after a delay. On average, participants recalled 6.11 words during the immediate recall task, and 5.19 words after the delay. Recent work has demonstrated that a simple delayed word recall task predicted longevity in a sample of older adults (Villarejo et al., 2010). In addition to these two measures, participants were asked to define five different words, a short measure akin to the WAIS vocabulary test. Participants' responses were scored on a 3-point scale, with 1 indicating an incorrect or no answer, 2 indicating a partially correct answer, and 3 a perfectly correct response. Thus participants could score anywhere from 5 to 15 on this measure, and the mean score was 10.49 points. These three cognitive measures had an average correlation of .38, and a principal components analysis suggested a clear one-factor solution, which accounted for 61.3% of the variance in the cognitive measures. For an overall cognitive functioning composite, we calculated participants' scores from this single factor. Previous work has suggested that cognitive composites tend to outperform single ability measures when predicting mortality, particularly when controlling for health (Anstey, Luszcz, Giles, & Andrews, 2001). Accordingly, for our purposes, we focused on the overall cognitive composite rather than attempting to consider any specific cognitive ability.

Personality inventory—During this wave, participants were asked to rate 12 different traits as self-descriptors on a scale from 0 (*very inaccurate*) to 10 (*very accurate*). Six of these items were indicative of conscientiousness (careless, neat, negligent, organized, sloppy, and systematic), while the other six were extraversion indicators. As one might expect with an older sample asked to complete a lengthy questionnaire, item analyses indicated evidence of aberrant responding (e.g., Mroczek, Ozer, Spiro, & Kaiser, 1998), which was particularly apparent with the negatively valenced items. Specifically, for the full sample, the negative conscientiousness items were largely unrelated to the positive items (average r = .00; range: −.06 to .17), which led to less-than-desirable reliability (α = .57). Moreover, they exhibited much higher levels of skewness and kurtosis.

Given these issues, we sought to identify aberrant responders by forming TRIN and VRIN indices (see Tellegen, 1988). The TRIN index examines how participants respond to synonymous items; for example, if participants rated themselves as a 0 on "neat" but a 10 on "organized," this would suggest aberrant responding. The VRIN index examines how

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participants respond to seemingly antagonistic items; for example, if participants rated themselves as a 10 on both "organized" and "sloppy," this would suggest aberrant responding. We calculated these indices using three item-pairs from both the conscientiousness and extraversion scales. Participants were eliminated if their average responses to these item-pairs differed by 8 or more points (in both examples provided, participants would have received a score of 10), which would seemingly only occur if the participant responded aberrantly. Put differently, participants were eliminated if their average scores on synonymous items differed by at least 8 points on a 10-point scale, or if their average scores on antagonist items differed by at least 8 points after the negatively valenced items were reverse scored. This process removed 66 participants (12.9% of the full sample), and all analyses were then performed on the remaining 446 participants.

In this remaining sample, the reliability for the six-item conscientiousness scale was $\alpha = .62$. Average item scores ranged from 6.69 (systematic) to 8.00 (sloppy), after reverse scoring the negative items, and item standard deviations ranged from 2.54 to 2.80. We performed a principal components factor analysis to examine its factor structure, which suggested a one-factor solution, on which all items evidenced moderate to strong loadings (absolute values ranged from .39 to .74).

Because the adjectives in the HRS study were unique to that survey, and were not reassessed at a later assessment, they had not been validated using traditional approaches to construct validity. However, in several ongoing studies, we have collected ratings of hundreds of trait adjectives associated with conscientiousness, which happen to include the six adjectives rated by the HRS participants. We used one of these samples ($N = 281$; $M_{age} = 51.3$ years; 61.7% female) to provide independent information about the psychometric properties of the HRS scale. The six-item adjective measure demonstrated good reliability, $\alpha = .79$. Moreover, it correlated strongly with AB5C (Goldberg, 1999) conscientiousness scale, $t(257) = .61$, $p < .05$, as well as the eight other AB5C conscientiousness facet scales; $t(257)$'s range from .32 to .63. The highest correlation among these facets was with orderliness subscale from the AB5C ($r = .63$). A subset of this sample ($N = 152$; $M_{age} = 58.4$ years; 63% female) completed a longitudinal follow-up survey three to four years later. In this subsample, we evidenced a strong test-retest correlation for our six-item measure, $t(140) = .76$, $p < .05$. Therefore, we found strong support for using the six-item HRS scale as a measure of conscientiousness, and, more specifically, the facet of orderliness.

Results

Table 1 presents the descriptive statistics for the measures of interest, separately for those living and deceased after 10 years. To test the independent effects of each variable, we performed separate univariate Cox regressions predicting mortality, the results of which are presented in the right-hand columns of Table 1. For all Cox regressions, we employed one-tailed *t* tests given (a) we were testing clear directional hypotheses, and (b) the relatively low proportion of deaths in our sample, thus restricting our predictive power. In our remaining sample, 58 (13.0%) participants were reported as deceased by the end of 2006. For ease of interpretation, cognitive functioning and conscientiousness were entered as z-scores. Our univariate results replicated the previous literature by demonstrating that participants in our sample lived longer when they (a) were female, (b) had more years of education, (c) were younger, (d) reported fewer health conditions, (e) had better cognitive functioning, and (f) scored higher on conscientiousness.

Given these results, we next investigated the relations between conscientiousness and the two possible mediators. Zero-order correlations for all variables of interest are presented in Table 2. Conscientiousness did positively correlate with cognitive functioning, $t(445) = .13$,

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$p < .05$. However, it did not evidence a relation with health conditions, $r(445) = -.04$, $p > .05$. Therefore, while we proceeded to test the mediational effect of cognitive functioning using a multivariate Cox regression, it does not appear that health conditions served as a mediator of the conscientiousness to longevity relation.

We next performed a Cox regression predicting mortality from both conscientiousness and cognitive functioning. In this model, both conscientiousness, B = −.23, W(1) = 3.34, $p < .05$, and cognitive functioning, B = −.47, W(1) = 13.42, $p < .05$, remained significant predictors. Moreover, the effect of conscientiousness was attenuated (18% decrease in B) when cognitive functioning was entered into the model. We examined the significance of the indirect effect with a decomposition technique that employs SEM methods in MPlus (Muthén & Muthén, 1998–2010) to "trace" the path from the predictor to the outcome, and examine the product of the predictor-mediator and mediator-outcome paths (see Ploubidis & Grundy, 2009 for a similar approach). This product term was significant, $t = 2.23$, $p < .05$ (two-tailed), suggesting that cognitive functioning did partially explain the effect of conscientiousness on longevity. We also examined the alternative hypothesis, namely that the effect of cognitive functioning on mortality was mediated by conscientiousness. This hypothesis was not supported by the data, as the indirect effect through conscientiousness was not significant, $t = 1.61$, $p > .1$.

Finally, to avoid any possible confounds, we estimated one final model with all control variables entered, along with conscientiousness and cognitive functioning. Table 3 presents the results for this full Cox regression model. In this final model, conscientiousness remained a significant predictor of mortality, as did gender, health conditions, and cognitive functioning. Indeed, the regression weight for conscientiousness only dropped from −.29 (as a single predictor) to −.22, despite including five variables in the model that evidenced univariate effects on longevity. Thus, it appears that conscientiousness predicts longevity both because of its relation to cognitive functioning, and for reasons independent of cognitive functioning.

Discussion

The current study adds to the burgeoning literature in support of the general claim that conscientiousness confers important health benefits. Indeed, conscientiousness predicted decreased mortality risk, even when controlling for a number of relevant predictors, such as age, education, gender, cognitive functioning, and reported health conditions. Moreover, these effects were evidenced even in a sample with a relatively low mortality rate. Therefore, the primary message from this data is that it again speaks to the importance of studying conscientiousness as an identifier of healthier individuals.

In addition, our results add to the literature by providing some explanation for this relationship. On one hand, conscientiousness was unrelated to health conditions in our sample, likely because the HRS measure focused on orderliness, a facet relatively less relevant to the discussion of the healthy lifestyle. Our results mirror those found in several other studies that have not directly tested meditational hypotheses, but have nonetheless shown that conscientiousness predicts important health outcomes even when controlling for health problems (Duchek et al., 2007; Friedman et al., 2010). On the other hand, conscientiousness did correlate with better cognitive functioning, which in part explained the relationship with longevity. While this indirect effect was modest, it does present an interesting suggestion that personality traits may influence important outcomes by virtue of their promotion of cognitive skills. Recent economic work has similarly proposed that noncognitive skills (such as personality traits) may promote cognitive skill development, but the reverse is less likely (Cunha & Heckman, 2008), thus supporting the directional claims

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proposed here. Moreover, we found little evidence for conscientiousness as a mediator, although this finding is tempered by the fact that both variables were assessed simultaneously. Future research should continue to investigate the developmental interplay between traits and cognitive skills, and how these uniquely or interactively predict life outcomes.

To date, most research has focused simply on linking personality traits, such as conscientiousness to health and longevity. These studies often adopt an epidemiological framework where other variables are considered potential confounds and controlled for rather than formally tested as intervening mechanisms (e.g., Taylor et al., 2009). Moreover, other research has proceeded under the assumption that the link to longevity can be explained, in part, by the existing relations one typically finds between conscientiousness and other health factors, such as health behaviors and education (Roberts et al., 2005). Although a reasonable assumption given the typical findings that conscientiousness is correlated with most of these factors, it seems when formally tested that the path from conscientiousness to longevity remains. Although the lack of strong meditational effects could be attributed to measurement issues, such as focusing on the orderliness facet of conscientiousness, another possibility is that researchers should reexamine their assumptions about how conscientiousness affects health and mortality. In addition to the usual suspects, such as health behaviors or even physical health, researchers may want to explore alternative pathways. For example, conscientiousness may affect longevity through its negative relation to stress (Carver & Connor-Smith, 2010). Stress leads to distinct physiological changes that if diminished or avoided may be one reason for the protective effect of conscientiousness. Previous work has suggested that conscientious individuals not only experience less stress (e.g., Vollrath, 2000) but also employ better coping mechanisms for dealing with stress (e.g., Penley & Tomaka, 2002). Future research should begin to test and explore these alternative explanations for the predictive effect of conscientiousness on longevity.

A few additional limitations are worth noting as avenues for future research. First, as noted above, our power for predicting longevity was limited by the low number of deaths reported in the sample. Due to this fact, some predictors of longevity in our study would have failed to reach significance using a two-tailed alpha, when controlling for multiple other predictors. However, it should be noted that the effects evidenced are nontrivial in magnitude; for example, even with all other variables in the model, the results in Table 3 suggest that a one standard deviation increase in conscientiousness would lead to a 20% reduction in the odds of mortality. Moreover, Cox regression models fair well when predicting low frequency outcomes (Annesi, Moreau, & Lellouch, 1989). Second, conscientiousness and its possible mediators were assessed at the same time, thus limiting our ability to posit directional claims. This limitation was largely necessary, as taking later measures of the mediators would have eliminated a large proportion of the witnessed deaths in the current study. To address both limitations, it would be valuable to test these claims in a larger longitudinal sample, including assessments of conscientiousness and the possible mediators before any substantial proportion of the deaths had occurred. However, with respect to directionality, it is worth again noting that our predicted causal pathway from conscientiousness to cognitive functioning follows the literature reviewed above (e.g., Cunha & Heckman, 2008). Third, conscientiousness and health conditions were assessed using self-reported measures, which leaves open the possibility of biased reporting. It would be valuable to include observer ratings of personality, as well as physician reports of physical health. Indeed, it is possible that issues with the health conditions measure may have led to the lack of relationship between conscientiousness and physical health ailments in the current study.

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As a final point, we hope this study encourages others to employ the personality measures now available in a number of large-scale longitudinal health studies. Our results point to the predictive value available from such measures, even when they are relatively brief as in the current study. In so doing, researchers should consider the possibility of aberrant item responses, a problem particularly salient when asking older adults to complete lengthy questionnaires, as often done in these large-scale studies. Moreover, these findings suggest the promise of including personality questionnaires into surveys for patients, insofar that they could alert the doctor to those individuals who might be more likely to adhere to treatments and maintain a healthier lifestyle. To this end, we hope that the current study provides impetus for psychologists to consider how interventions focused on personality traits might serve to motivate individuals toward better health.

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Table 1

Descriptive Statistics for Participants Living and Deceased After 10 Years, and Results of Univariate Cox Regressions to Test Each Variable's Unique Effect on Mortality

Measure	Living *M* (*SD*)	Deceased *M* (*SD*)	B (s.e.)	Wald	Exp(B) (90% CI)
Gender	62% Female	35% Female	−1.06 (.28)	14.70*	0.35 (0.22 to 0.55)
Years of education	12.83 (2.27)	12.03 (2.69)	−0.13 (.06)	5.71*	0.88 (0.80 to 0.96)
Age (years)	58.13 (5.63)	60.78 (4.82)	0.08 (.02)	12.89*	1.08 (1.04 to 1.12)
Health conditions	1.22 (1.18)	1.93 (1.35)	0.36 (.09)	17.77*	1.43 (1.25 to 1.65)
Cognitive functioning (z-score)	0.07 (0.96)	−0.46 (1.14)	−0.49 (.13)	15.02*	0.61 (0.50 to 0.75)
Conscientiousness (z-score)	0.04 (0.99)	−0.28 (1.01)	−0.29 (.13)	5.03*	0.75 (0.61 to 0.93)

Note. N's for living and deceased are 388 and 58 respectively. For gender, males were coded as 1, females as 2; thus, a negative effect indicates that the risk of death was greater for males.

* $p < .05$, one-tailed.

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Table 2

Correlations Between Variables of Interest

	Ed.	Age	HC	CF	Cons.
Years of education	—	−.06	−.19*	.37*	.05
Age		—	.21*	−.18*	.04
Health conditions			—	−.11*	−.04
Cognitive functioning				—	.13*
Conscientiousness					—

Note. $N = 445$.

* $p < .05$.

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Table 3

Results of Overall Cox Regression Predicting Mortality With All Variables in the Model

Variable	B (s.e.)	Wald	Exp(B)	90% CI for Exp(B)
Gender	−0.75 (.29)	6.54*	0.47	0.29 to 0.77
Years of education	−0.02 (.06)	0.19	0.98	0.89 to 1.07
Age	0.03 (.02)	2.10	1.04	1.00 to 1.08
Health conditions	0.29 (.10)	9.07*	1.33	1.14 to 1.56
Cognitive functioning	−0.30 (.15)	3.98*	0.75	0.58 to 0.95
Conscientiousness	−0.22 (.13)	2.93*	0.80	0.65 to 0.99

* $p < .05$, one-tailed.