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Personality Traits Predict the Onset of Disease

Sara J. Weston[1], Patrick L. Hill[2], and Joshua J. Jackson[1]

Abstract

While personality traits have been linked concurrently to health status and prospectively to outcomes such as mortality, it is currently unknown whether traits predict the diagnosis of a number of specific diseases (e.g., lung disease, heart disease, and stroke) that may account for their mortality effects more generally. A sample ($N = 6{,}904$) of participants from the Health and Retirement Study, a longitudinal study of older adults, completed personality measures and reported on current health conditions. Four years later, participants were followed up to see if they developed a new disease. Initial cross-sectional analyses replicated past findings that personality traits differ across disease groups. Longitudinal logistic regression analyses predicting new disease diagnosis suggest that traits are associated with the risk of developing disease—most notably the traits of conscientiousness, neuroticism, and openness. Findings are discussed as a means to identify pathways between personality and health.

Keywords

personality, health, disease, conscientiousness, openness, neuroticism

Personality traits are important psychological predictors of health (Hampson, 2012). Associations between personality and health hold across decades, as childhood personality traits predict self-rated health in middle age (Hampson, Goldberg, Vogt, & Dubanoski, 2007). Furthermore, these findings extend beyond self-reports of general health to objective markers of health such as physician-rated health (Chapman, Lyness, & Duberstein, 2007), biomarkers of health (Hampson, Edmonds, Goldberg, Dubanoski, & Hillier, 2013), and longevity (Jokela et al., 2013; Kern & Friedman, 2008; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). Yet few studies examine the relationship of personality traits with the onset of specific diseases. This oversight is unfortunate, given that uncovering whether personality influences disease onset informs the processes by which traits influence health and longevity (Chapman, Roberts & Duberstein, 2011). This study examines this pathway by testing whether personality traits serve as a risk factor for the onset of various diseases using a large longitudinal sample of older adults.

While a few studies have examined the association between Big Five traits and disease, it is unclear to what extent personality traits serve as risk factors for the onset of many diseases. This oversight is problematic, given that understanding how personality traits influence specific diseases, rather than health broadly, can inform the search for the mechanisms by which personality influences health outcomes. For example, if a trait predicts a respiratory disease (e.g., emphysema) but not a cardiovascular disease (e.g., heart attack), that trait is more likely to influence health through smoking than eating behaviors. However, if the trait affects both, it likely works through a pathway shared by these diseases, for example, exercise. Thus, identifying the distinct outcomes predicted by personality traits narrows the potential pathways through which traits operate.

Previous studies that examine the relationship between personality and disease are limited by at least three factors. First, the relationship between traits and disease onset has been investigated in only a small number of diseases, often with conflicting results. For example, neuroticism has been identified as a potential risk factor for cancer (Eysenck, 1985), though other studies have failed to replicate the association (e.g., Shipley, Weiss, Der, Taylor, & Deary, 2007). While a small number of recent studies are beginning to link personality traits with diseases including metabolic syndrome (Sutin, Ferrucci, Zonderman, & Terracciano, 2011), Alzheimer's disease (Wilson, Schneider, Arnold, Bienias, & Bennett, 2007), and heart disease (Booth-Kewley & Friedman, 1987), there is a dearth of studies that examine the most common and costly diseases, including stroke and diabetes.

A second impediment is that previous studies fail to include a broad range of personality traits. Traditionally, personality-

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health research has relied on single typologies, for example, Type A, to link personality with disease onset (e.g., Matthews, 1988). In contrast, recent research finds utility in using the Big Five traits of conscientiousness and neuroticism, given that they evidence the strongest links with health measures across studies (Hampson, 2012). The strong associations, however, have led researchers to concentrate on these traits at the expense of the other Big Five personality traits, given the cost and benefit ratios associated with large-scale studies (e.g., Nakaya et al., 2010). This is a potentially unfortunate omission as all of the Big Five traits are associated with health (Chapman, Roberts & Duberstein, 2011; Miller, Smith, Turner, Guijarro, & Hallet, 1996; Turiano, Spiro, & Mroczek, 2012).

A third and perhaps the most troubling aspect of previous studies of personality and disease is that most studies use cross-sectional designs and thus cannot distinguish between personality traits as risk factors or as by-products of the disease. For example, one cross-sectional study found that coronary heart disease, pulmonary disease, and high cholesterol were related to higher level traits associated with neuroticism (Yousfi, Matthews, & Schmidt-Rathjens, 2004). Similarly, the best example of a study, to our knowledge, that examines both all the Big Five personality traits and a large number of diseases used a cross-sectional design (Goodwin & Friedman, 2006). This study examined data collected through the Midlife Development in the United States survey, a large, nationally representative survey of persons aged 25–74 years and found that adults who have a major disease differ in personality from those without (e.g., experiencing stroke is associated with lower levels of conscientiousness). At least three interpretations are possible from these findings. Personality traits may influence the onset of disease and constitute a true prospective relationship, where traits serve as risk factors for disease. Or, personality differences may emerge after the onset of a disease and represent a by-product of the disease (e.g., Duchek, Balota, Storandt, & Larsen, 2007) rather than a risk factor. Finally, a third variable may explain both disease onset and trait levels. To better understand how personality traits predict important outcomes such as health, longitudinal analyses are needed.

This study addresses these limitations by using a longitudinal sample of older adults to test whether the Big Five traits predict the onset of a number of common diseases. We start by attempting to replicate past work on the concurrent associations between personality and disease (e.g., Goodwin & Friedman, 2006) and then examine the prospective relationship between personality traits and disease onset to demonstrate the differences between designs. Concurrent analyses likely inflate the magnitude of the relationship between personality traits and disease, as they include both effects on health and effects on personality; therefore, we hypothesize that while personality traits will predict the onset of certain diseases, the association will be smaller than suggested by previous cross-sectional studies (e.g., Goodwin & Friedman, 2006). The seven common diseases available in the Health and Retirement Study (HRS) were assessed, namely high blood pressure or hypertension, diabetes, cancer, lung disease, heart disease, stroke, and arthritis. These diseases are especially important, as they are each responsible for a great deal of monetary expense and emotional distress. Furthermore, these diseases differ in their causal processes and thus inform the common or unique pathways by which personality traits influence disease.

Given that conscientiousness and neuroticism are among the most frequently connected to health outcomes more broadly, we expect these traits will prove the strongest concurrent and longitudinal predictors of disease outcomes (Hampson, 2012; Sutin, Zonderman, Ferrucci, & Terracciano, 2013; Weston & Jackson, in press). Furthermore, openness is likely associated with the onset of disease, given the recent association between openness and longevity (Turiano et al., 2012).

Provided that personality traits are associated with the onset of disease, we expect trait-specific relationships with certain outcomes, based on whether the causes of the disease are closely associated with the behaviors and cognitions associated with that trait. For example, diseases most affected by health behaviors (e.g., diabetes and stroke) should be predicted by conscientiousness, given the trait's strong relationship with health behaviors (Bogg & Roberts, 2004). On the other hand, diseases associated with autoimmune functioning (e.g., arthritis; Goronzy & Weyand, 2007) and cardiovascular issues will be better predicted by neuroticism, as negative affect weakens the body's defenses (Smith, 2006).

Method

Participants

Data were taken from the 2006 (the first year personality traits were administered) and 2010 (the most recent follow-up) waves of the HRS, a nationwide study of aging American adults (Juster & Suzman, 1995; Roberts, Jackson, Duckworth, & Von Culin, 2011). To guard against the possibility that participants have an undiagnosed disease and may be inappropriately categorized as healthy, participants were included only if they completed a psychosocial questionnaire during the 2006 survey and if they had responded 1 or more to, ''How many times have you seen or talked to a medical doctor about your health, including emergency room or clinic visits in the last 2 years?'' Out of the 25,760 total participants, 6,904 met these criteria (59% female; $M_{age} = 68.4$, $SD = 11.0$). Personality scales were included in self-administered questionnaires, which participants returned by e-mail. The response rate for the self-administered questionnaires was 74%. Ethnicity was 83% White, 13% African American, 2% Hispanic, and 2% other. For the analyses, ethnicity was coded as *Caucasian* = 1, *other* = 0. Participants reported their marital status as married or not married.

Measures

Personality was assessed in 2006 with the Midlife Development Inventory personality scales (Lachman & Weaver, 1997), where adjectives are used as markers of the Big Five personality traits. Participants rated themselves on 5 items for

Table 1. Associations Between Controls and Personality Traits.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Age	—															
2. Gender	**−0.03**	—														
3. Race	**−0.05**	**0.04**	—													
4. Marital status	**−0.23**	**−0.24**	**−0.15**	—												
5. Extraversion	**−0.05**	**0.10**	**0.06**	−0.02	—											
6. Agreeableness	**−0.03**	**0.27**	0.02	**−0.04**	**0.58**	—										
7. Conscientiousness	**−0.10**	**0.09**	**−0.05**	**0.05**	**0.41**	**0.44**	—									
8. Neuroticism	**−0.13**	**0.07**	**−0.06**	0.00	**−0.21**	**−0.11**	**−0.23**	—								
9. Openness	**−0.13**	0.00	0.01	**−0.03**	**0.54**	**0.42**	**0.47**	**−0.18**	—							
10. High blood pressure	**0.18**	0.00	**0.11**	**−0.06**	**−0.04**	0.01	**−0.10**	**0.04**	**−0.08**	—						
11. Diabetes	**0.05**	**−0.04**	**0.09**	−0.01	**−0.06**	**−0.04**	**−0.10**	**0.04**	**−0.05**	**0.21**	—					
12. Cancer	**0.18**	**−0.05**	**−0.04**	**−0.03**	−0.01	−0.02	**−0.04**	−0.02	−0.02	0.03	0.02	—				
13. Lung disease	**0.05**	0.01	**−0.03**	**−0.07**	**−0.06**	−0.01	**−0.06**	**0.07**	**−0.04**	**0.03**	0.02	**0.06**	—			
14. Heart condition	**0.24**	**−0.10**	**−0.03**	**−0.04**	**−0.06**	−0.02	**−0.09**	**0.03**	**−0.03**	**0.16**	**0.14**	**0.08**	**0.11**	—		
15. Stroke	**0.11**	**−0.05**	**0.04**	**−0.03**	**−0.05**	**−0.05**	**−0.10**	0.02	−0.04	**0.11**	**0.10**	**0.03**	**0.03**	**0.16**	—	
16. Arthritis	**0.25**	**0.12**	0.00	**−0.09**	**−0.04**	**0.03**	**−0.09**	**0.07**	**−0.07**	**0.16**	**0.08**	**0.08**	**0.10**	**0.14**	**0.06**	—
M	68.42	1.59	1.14	0.63	3.20	3.52	3.35	2.07	2.94	0.58	0.20	0.15	0.10	0.24	0.06	0.61
SD	11.02	0.49	0.35	0.48	0.55	0.47	0.48	0.61	0.55	0.49	0.40	0.36	0.30	0.43	0.23	0.49

Note. *M* = mean; *SD* = standard deviation. Gender: men = 1; women = 2; Race: Caucasian = 1; other = 2; marital status: 1 = married; 0 = not married. Disease is assessed in 2006. Items in boldface are significant at $p < .05$.

extraversion, agreeableness, and conscientiousness each; 4 items for neuroticism; and 7 items for openness on a 4-point rating scale, indicating how well each adjective described them (1 = *not at all*, 4 = *a lot*). Responses were averaged to create a score on each trait. The scales have good construct validity (Hill, Turiano, Mroczek, & Roberts, 2012) and adequate levels of α reliability for a short measure (α = .75, .78, .66, .71, and .79, respectively). Correlations between the personality traits, disease status, and the control variables are displayed in Table 1.

Health measures were collected in both 2006 and 2010 through telephone interviews. All specific disease measures collected by the HRS were included in the analyses, with the exception of specific cardiovascular diseases, which were included in the "heart condition" category. Participants were asked, "Has a doctor ever told you that you have [specific illness]?" Illnesses were high blood pressure or hypertension; diabetes or high blood sugar; cancer or a malignant tumor, excluding minor skin cancer; a chronic lung disease, such as chronic bronchitis or emphysema; a heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems; a stroke; and arthritis or rheumatism. Answers were compared to responses in previous waves to assess the onset of a new disease. Responses were coded as either *yes* (1) or *no* (0).

The samples for each set of analyses differed slightly: for the cross-sectional analyses, all participants were used, and those who reported having the illness in 2006 were coded as "Disease Present," while those who reported not having the illness were coded as "Disease Absent." For the sample sizes of each group, see Table 2. For the longitudinal analyses, only participants who were previously coded as "Disease Absent" in 2006 and reported in 2010 that they saw a doctor between 2006 and 2010 were examined, so as to determine whether personality traits predict the onset of the disease in 2010. For the longitudinal analyses, samples ranged in size from 2,224 to 5,770 participants. Illnesses more likely to occur (e.g., high blood pressure) have smaller initial samples, while illnesses less likely to occur (e.g., cancer) have larger initial samples. Likelihood of disease diagnosis also differed across disease category. For sample sizes and new cases for each illness in the longitudinal analyses, see Table 3. Of the 6,904 participants who provided disease data in 2006, 1,046 did not in 2010. Of those, 703 participants died before 2010. However, participants who did not provide a second wave of data did not differ in any personality traits or demographic variables, with the exception of age (for specific analyses regarding attrition, please view Supplemental Table 3 on this journal's website).

Analyses

First cross-sectional analyses were conducted to allow for comparisons to previous research. For these analyses, *t*-tests were used to test the difference in each trait between those with and those without each chronic illness in 2006. Cohen's *d* values and 95% confidence intervals are reported for each difference in personality between those and those without each disease. Additionally, binary logistic regressions determined how each trait was associated with the likelihood of having been diagnosed with a specific disease; odds ratios (ORs) estimated from these regressions are presented in Table 2.

For the longitudinal analyses, we considered only the set of participants who reported not having the specific disease diagnosed during the interviews in 2006. Binary logistic regression analyses determined how each trait predicts the likelihood of being diagnosed with each chronic illness over 4 years. All analyses control for age, gender, race, and marital status. While disease diagnosis was collected through self-report, there was

Table 2. Personality Traits Among Older Adults with and Without Chronic Illness.

		High Blood Pressure	Diabetes	Cancer	Lung Disease	Heart Condition	Stroke	Arthritis
	#Absent	2,829	5,463	5,847	6,182	5,153	6,477	2,619
	#Present	3,979	1,396	1,036	667	1,683	383	4,191
Extraversion	Absent	3.22 (.54)	3.22 (.54)	3.20 (.55)	3.21 (.55)	3.22 (.54)	3.21 (.55)	3.22 (.54)
	Present	3.18 (.56)	3.13 (.57)	3.19 (.56)	3.09 (.55)	3.14 (.56)	3.08 (.57)	3.18 (.55)
	Cohen's *d*	**−0.08 [−0.12, −0.04]**	**−0.16 [−0.21, −0.11]**	−0.02 [−0.08, 0.03]	**−0.22 [−0.29, −0.15]**	**−0.14 [−0.18, −0.09]**	**−0.24 [−0.32, −0.15]**	**−0.08 [−0.12, −0.03]**
	OR	**0.89**	**0.77**	1.05	**0.70**	**0.86**	**0.73**	**0.86**
Agreeableness	Absent	3.52 (.47)	3.53 (.46)	3.52 (.47)	3.52 (.47)	3.53 (.47)	3.53 (.47)	3.51 (.47)
	Present	3.52 (.48)	3.48 (.50)	3.50 (.48)	3.50 (.48)	3.50 (.49)	3.42 (.55)	3.53 (.47)
	Cohen's *d*	0.01 [−0.03, 0.05]	**−.10 [−.15, −.05]**	−0.04 [−0.10, 0.01]	−0.04 [−0.11, 0.02]	−0.05 [−0.09, 0.00]	**−0.11 [−0.32, −0.15]**	**0.05 [0.01, 0.10]**
	OR	1.03	**0.85**	1.00	0.90	1.07	**0.73**	**0.99**
Conscientiousness	Absent	3.41 (.46)	3.37 (.47)	3.36 (.48)	3.36 (.48)	3.37 (.47)	3.36 (.47)	3.41 (.46)
	Present	3.31 (.49)	3.25 (.51)	3.30 (.51)	3.27 (.49)	3.27 (.51)	3.15 (.55)	3.31 (.49)
	Cohen's *d*	**−.20 [−0.24, −0.15]**	**−0.26 [−0.31, 0.20]**	**−0.11 [−0.17, −0.06]**	**−.20 [−0.26, −0.13]**	**−0.22 [−0.26, −0.17]**	**−0.45 [−0.54, −0.36]**	**−0.19 [−0.23, −0.15]**
	OR	**0.70**	**0.63**	**0.89**	**0.70**	**0.74**	**0.51**	**0.67**
Neuroticism	Absent	2.04 (0.59)	2.06 (.60)	2.07 (.61)	2.05 (.60)	2.06 (.60)	2.07 (.60)	2.02 (.60)
	Present	2.09 (0.61)	2.11 (.62)	2.04 (.60)	2.20 (.65)	2.11 (.62)	2.13 (.62)	2.11 (.61)
	Cohen's *d*	**0.09 [0.05, 0.13]**	**0.09 [0.05, 0.14]**	−0.05 [−0.10, 0.00]	**0.24 [0.17, 0.31]**	**0.08 [0.03, 0.13]**	**0.11 [0.02, 0.19]**	**0.15 [0.11, 0.19]**
	OR	**1.27**	**1.22**	1.02	**1.52**	**1.35**	**1.37**	**1.45**
Openness	Absent	2.99 (.54)	2.95 (.54)	2.94 (.55)	2.94 (.55)	2.95 (.55)	2.94 (.55)	2.99 (.54)
	Present	2.91 (.56)	2.88 (.58)	2.92	2.88 (.53)	2.90 (.56)	2.84 (.62)	2.91 (.56)
	Cohen's *d*	**−0.15 [−0.19, −0.12]**	**−0.13 [−0.17, −0.08]**	−0.05 [−0.10, 0.01]	**−0.12 [−0.19, −0.05]**	**−0.08 [−0.13, −0.03]**	**−0.18 [−0.27, −0.09]**	**−0.14 [−0.18, −0.10]**
	OR	**0.82**	**0.82**	1.04	**0.83**	**0.99**	**0.81**	**0.86**

Note. Means and standard deviations are presented for each group. Cohen's *d* is the standardized difference between two groups; the 95% confidence interval around Cohen's *d* is included. OR = odds ratios calculated from logistic regressions controlling for age, gender, and marital status.
Items in boldface are significant at $p < .05$.

Table 3. Personality Traits and the Prediction of Disease Onset, Controlling for Age, Gender, Race, and Marital Status.

		High Blood Pressure	Diabetes	Cancer	Lung Disease	Heart Condition	Stroke	Arthritis
	Total sample	2,437	4,671	5,026	5,297	4,521	5,522	2,235
	New cases	506	347	276	196	448	190	497
Extraversion	*B*	−0.30	−0.13	0.13	0.02	−0.10	−0.18	−0.14
	SE	0.09	0.10	0.12	0.14	0.09	0.13	0.09
	OR	**0.74**	0.88	1.13	1.02	0.90	0.84	0.87
Agreeableness	*B*	−0.19	0.19	−0.04	0.17	−0.07	−0.06	−0.24
	SE	0.11	0.13	0.14	0.17	0.11	0.17	0.11
	OR	0.82	1.21	0.96	1.18	0.93	0.95	**0.79**
Conscientiousness	*B*	−0.31	−0.23	0.12	−0.06	−0.13	−0.46	−0.26
	SE	0.11	0.12	0.14	0.16	0.11	0.15	0.11
	Odds	**0.73**	**0.80**	1.13	0.92	0.88	**0.63**	**0.77**
Neuroticism	*B*	0.32	−0.04	−0.21	0.25	0.22	0.09	0.22
	SE	0.09	0.10	0.11	0.12	0.09	0.13	0.09
	OR	**1.37**	0.96	0.81	**1.29**	**1.24**	1.10	**1.25**
Openness	*B*	−0.34	0.01	0.14	0.03	−0.19	−0.37	−0.23
	SE	0.09	0.10	0.12	0.13	0.09	0.13	0.10
	OR	**0.71**	0.99	1.15	1.03	**0.83**	**0.69**	**0.79**

Note. *SE* = standard error; OR = odds ratio. Items in boldface are significant at $p < .05$. Sample sizes include only individuals who provided information for all demographic and personality variables.

high stability in the report of disease. Specifically, of the respondents who reported having a disease in 2006, 92.20%—97.69% continued to report having that disease in 2010; thus, reducing any concern that people are incorrectly reporting their diagnosis.

Results

The relationships between personality traits and control variables are presented in Table 1. Women were more extraverted, agreeable, conscientious, and neurotic than men. Older adults were less extraverted, conscientious, neurotic, and open than younger adults. Married individuals were more conscientious, open and emotionally stable than nonmarried individuals.

Table 2 displays the concurrent associations between each personality trait and each chronic disease. Nearly, every test of personality differences between individuals with a disease and those without proved statistically significant. Overall, high conscientiousness, extraversion, openness, agreeableness, and low neuroticism were associated with better health or absence of disease. Together, these analyses suggest a strong relationship between personality and disease.

Longitudinal models were next examined to determine the predictive ability of each trait on disease diagnosis. Separate logistic regression models were fit for each trait to estimate the odds of being diagnosed with the illness between 2006 and 2010. To ease interpretation, logistic regression estimates were transformed into ORs, which can be interpreted as the change in odds of being diagnosed with the disease if their trait standing increased by one unit. Preliminary analyses indicate that sex and age were significant predictors of the onset of nearly every disease. Women were shown to have a greater risk of an arthritis diagnosis (OR = 1.74) and a decreased risk of heart condition, diabetes, stroke, and cancer diagnoses (ORs ranging from .61 to .81) compared to men. Age was significantly positively associated with the diagnosis of all diseases except diabetes and lung disease (ORs for the statistically significant models ranged from 1.01 to 1.05). Overall, disease diagnosis was normally distributed over age (see Figure 1). Interactions between age and personality were also examined. ORs ranged from .98 to 1.02, with only one significant effect, suggesting that there is no moderating effect of age on the relationships described subsequently.

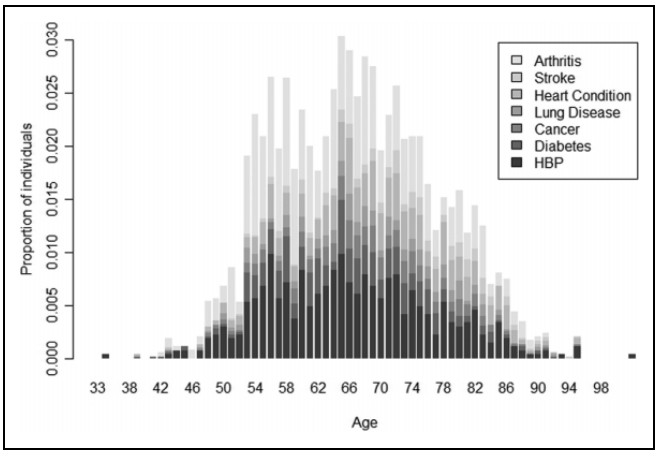

Figure 1. Proportion of new cases of disease plotted against age at 2006. Diseases are stacked atop one another, with the proportion of individuals who developed high blood pressure as the bottom and darkest bar and the proportion of individuals who developed arthritis as the topmost and lightest bar. Thus, the full bar represents the total proportion of individuals of a given age who developed any disease.

Table 3 displays the relationship between personality traits and disease diagnosis, as well as the ORs associated with those effects, after controlling for all of our covariates. Consistent

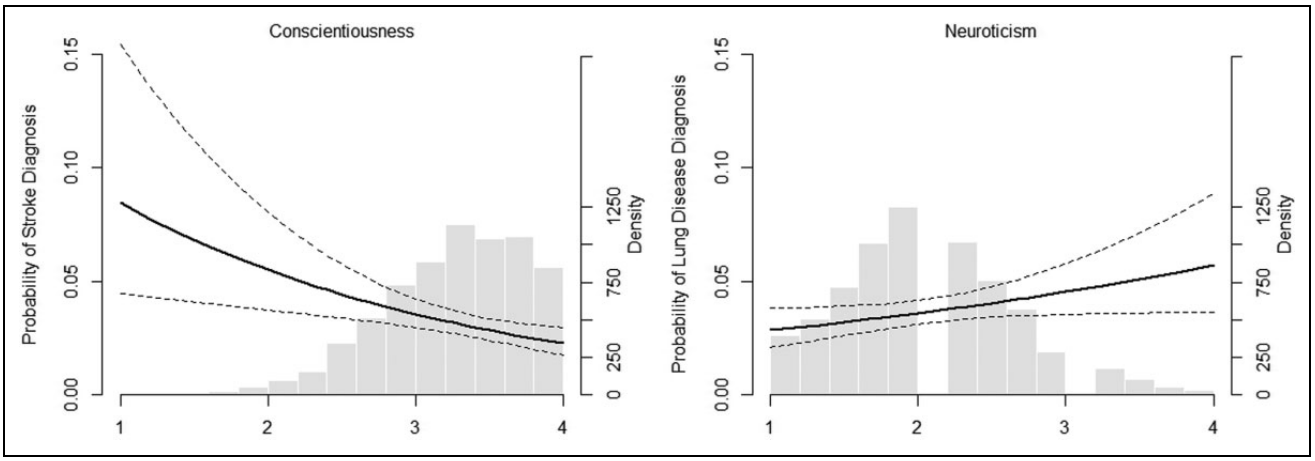

Figure 2. The probability of developing stroke and lung disease predicted by levels of conscientiousness and neuroticism. Each solid line depicts the probability of developing a disease between 2006 and 2010, given levels of the personality trait at 2006. The dotted lines represent the 95% confidence bands around these probabilities. Histograms, which represent the distribution of scores on the personality traits at 2006, accompany the regression lines. The right-side axis provides the number of individuals who obtained each score.

with our expectations, conscientiousness lowered the risk for several common illnesses. A one unit ($SD = 2.08$) increase in conscientiousness decreases the odds of a stroke diagnosis by 37%. The left panel of Figure 2 indicates the effect of conscientiousness on the probability of a stroke diagnosis at different levels of conscientiousness. Similarly, a one unit increase in conscientiousness decreases the odds of a high blood pressure diagnosis by 27%, diabetes by 20%, and arthritis by 23%.

Neuroticism, on the other hand, is associated with increases in the risk of being diagnosed with an illness. The right panel of Figure 2 shows the probability of a lung disease diagnosis at different levels of neuroticism. A one unit ($SD = 1.64$) increase in neuroticism increased the odds of a heart condition diagnosis by 24%. Similar increases in neuroticism increased the odds of a lung disease diagnosis by 29%, high blood pressure by 37%, and arthritis by 25%. The remaining Big Five traits were also associated with the illness diagnoses, most notably the trait of openness. Similar to the cross-sectional analyses, the longitudinal analyses demonstrate that conscientiousness, neuroticism, and openness have associations with a variety of health outcomes, while agreeableness appears to have a more limited role. A one unit increase in openness decreased the odds of a stroke diagnosis by 31%, heart conditions by 17%, high blood pressure by 29%, and arthritis by 21%. Extraversion and agreeableness, on the other hand, showed fewer relationships with health outcomes. Whereas concurrent analyses show numerous associations for the trait of extraversion, longitudinal analyses find nearly no effect of extraversion on illness diagnoses. A one unit increase in extraversion decreased only the odds of a high blood pressure diagnosis by 26%. A one unit increase in agreeableness decreased the odds of an arthritis diagnosis by 21%.[2] Numerous analyses increase opportunity for Type I error. However, using a Monte Carlo simulation generating random data for personality scores and disease status (based on the average intercorrelation of these variables), we determined the expected number of significant results out of 35 analyses as 1.76 (99% CI [0, 7]), and the probability of finding 14 significant results is essentially 0, increasing our confidence that personality is associated with future disease diagnosis.

Discussion

This study found that Big Five personality traits prospectively predicted the diagnosis of multiple diseases in later life, such as having a stroke, being diagnosed with lung disease, and having a heart condition. These findings support the emerging consensus that personality traits play an important role in the health process (Chapman, Roberts, & Duberstein, 2011; Hampson, 2012) and constitute risk factors for major diseases. As predicted, high levels of conscientiousness were protective against the diagnosis of disease, while neuroticism was a risk factor. Additionally, openness to experience lowered the odds of being diagnosed with multiple diseases, suggesting it may have a greater effect on health than previously thought. By mitigating the limitations of cross-sectional designs, restricted outcomes, and focusing on specific Big Five traits, these results demonstrate the importance of traits in the development of disease during later adulthood.

These findings are consistent with recent studies that identify Big Five traits as risk factors for specific diseases (e.g., Wilson et al., 2007). Interestingly, personality traits did not predict the diagnosis of cancer, one of the most pervasive diseases and a leading cause of death. This association replicates previous longitudinal analyses that find that neuroticism and extraversion do not predict the onset of cancer (Shipley et al., 2007) and extends this lack of relationship to the rest of the Big Five.

In addition to conscientiousness and neuroticism, the trait of openness predicted the onset of stroke, heart disease, arthritis, and high blood pressure. The association between openness and disease diagnosis is consistent with recent studies, which identify openness as protective in the health processes (Ferguson &

Bibby, 2012). While future work needs to establish the mechanisms that link openness with health outcomes, it appears that this effect is not entirely due to the overlap between openness and intelligence (Turiano et al., 2012). Two intriguing mechanisms that warrant further investigation: Openness may promote activity engagement (Jackson et al., in press) or more creative coping strategies to relieve stress (Connor-Smith & Flachsbart, 2007); and individuals high in openness may improve their health through better communication with their physicians (Eaton & Tinsley, 1999).

While personality traits clearly are risk or protective factors for longevity and general health status, the mechanisms involved are only beginning to be examined (Hampson, 2012; Hill, Turiano, Hurd, Mroczek, & Roberts, 2011; Hill & Roberts, 2011; Lodi-Smith et al., 2011; Weston & Jackson, in press). A novel way to examine these mechanisms is testing the extent to which outcomes are predicted by multiple traits. Some diseases (i.e., lung disease and diabetes) were only predicted by one trait, indicating that personality traits do not impact all health outcomes similarly. These unique, single-trait associations can prove theoretically informative for locating the specific role of personality on disease onset; for instance, the association between conscientiousness and the diagnosis of diabetes points this trait's likely influence on health through promoting positive health behaviors, such as healthy eating and exercise (Bogg & Roberts, 2004).

In contrast, most diseases did not evidence single trait associations, indicating that multiple health processes work in conjunction to influence the development of these diseases. For instance, one can consider the example of stroke diagnosis, which was predicted by both conscientiousness and openness. Risk factors for having a stroke include smoking, heavy alcohol consumption, lack of exercise, obesity, stress, and poor cognitive functioning (Boden-Albala & Sacco, 2000; Ferrucci et al., 1996). Conscientiousness is associated with each of these behaviors (Bogg & Roberts, 2004), suggesting that this trait's effects may be largely through behavioral mechanisms (Jackson et al., 2010). Openness, in contrast, has a strong association with cognitive functioning and cognition-related activities that challenge the mind, unlike conscientiousness (Sharp, Reynolds, Pedersen, & Gatz, 2010; Soubelet & Salthouse, 2011). Thus, openness is likely protective through cognitive pathways rather than behavioral. Together, these multiple trait associations with disease suggest multiple pathways to a particular disease, a point that warrants future research.

Comparisons of cross-sectional and longitudinal analyses also provide novel insights the relationship between personality traits and health. Levels of extraversion, conscientiousness, neuroticism, and openness differed between those with the disease compared to those without for most of the diseases examined, replicating previous large-scale study of personality traits and disease in a middle-aged sample (Goodwin & Friedman, 2006). Yet, the longitudinal findings suggest a far more limited role for personality factors and the onset of disease. Disparities across designs likely indicate the consequences the disease has on individuals' daily functioning. Unsurprisingly, major diseases such as the ones included in the study are quite debilitating as they influence one's ability to do daily tasks and constrain their social circles (e.g., Mayo et al., 1999; Zautra, Fasman, Parish, & Davis, 2007) and ultimately influence self-perceptions of personality. Thus, future research is needed to examine the consequences of health on personality development (e.g., Takahashi, Edmonds, Jackson, & Roberts, 2013).

Despite the use of a large, longitudinal sample that assessed a number of diseases, this study is limited in ways that should motivate future research. First, collecting measures of personality earlier in the life span or across longer periods of time may further clarify the relationship between personality and health. Second, the age range of the sample limits generalizability to older adults. The influence of personality traits on health may accumulate with time; consequently, personality likely has a greater influence on disease onset in old age. Given that HRS participants are sampled to be representative of the population in the United States, we believe these results are likely to replicate in other representative samples of adults approaching retirement age in the United States, although it is not possible to know if the results would replicate in other age-groups or countries, or with other measures of personality. It should be noted that Goodwin and Friedman's (2006) previous study found similar cross-sectional results to our own with a sample including younger adults. Another concern is that a disease may be present and impact personality before the official diagnosis. While possible, the reverse-causality hypothesis still suggests that personality traits are predictive risk factors or warning signs for disease onset, just as chest discomfort often precedes a heart attack. For some diseases in our study (e.g., stroke), there are no existing warning signs that emerge in this time frame; thus, identifying a link between personality and stroke (and, broadly and disease) is important regardless of causal direction. Finally, disease diagnosis was assessed through self-report of whether a doctor had told the participant whether they had a particular disease. This may be problematic as neurotic individuals tend to be more vigilant of their health status (Goubert, Crombez, & Van Damme, 2004), and conscientious individuals may be more likely to visit doctors more often (Jerram & Coleman, 1999). However, previous associations between personality and objective markers of health such as mortality (e.g., Kern & Friedman, 2008; Roberts et al., 2007) clearly establish a link between personality traits and health, mitigating these worries. Future studies should explore the use of biomarkers of disease or medical records, for more accurate measure of health problems.

In sum, these findings are among the first to demonstrate that personality traits are not merely predictors of general health but also serve as risk factors for the development of a number of diseases. To this end, personality traits should be included in routine assessments by health professionals, insofar as they could identify individuals with greater risk for developing debilitating and costly illnesses. Additionally, these findings may help to uncover the potential pathways through which traits influence longevity, by pointing to mechanisms through which traits lead to those illnesses.

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Notes

1. All variables used in the analyses, as well as any transformations applied, are listed in Appendix A on the journal's website.
2. Both controlling for self-rated health and including all traits simultaneously reduces the effects of some, but not all effects. Analyses controlling for self-rated health are available in Supplemental Tables 1 and 2 on the journal's website.

Supplemental Material

The online data supplements are available at http://spp.sagepub.com/supplemental.

References

Boden-Albala, B., & Sacco, R. L. (2000). Lifestyle factors and stroke risk: Exercise, alcohol, diet, obesity, smoking, drug use, and stress. *Current Atherosclerosis Reports*, *2*, 160–166.

Bogg, T., & Roberts, B. W. (2004). Conscientiousness and health-related behaviors: A meta-analysis of the leading behavioral contributors to mortality. *Psychological Bulletin*, *130*, 887–919.

Booth-Kewley, S., & Friedman, H. S. (1987). Psychological predictors of heart disease: A quantitative review. *Psychological Bulletin*, *101*, 343–362.

Chapman, B. P., Roberts, B. W., & Duberstein, P. R. (2011). Personality and longevity: Knowns, unknowns, and implications for public health and personalized medicine. *Journal of Aging Research*, *2011*, 1–24.

Chapman, B. P., Lyness, J. M., & Duberstein, P. R. (2007). Personality and medical illness burden among older adults in primary care. *Psychosomatic Medicine*, *69*, 277–282.

Connor-Smith, J. K., & Flachsbart, C. (2007). Relations between personality and coping: A meta-analysis. *Journal of Personality and Social Psychology*, *93*, 1080.

Duchek, J. M., Balota, D. A., Storandt, M., & Larsen, R. (2007). The power of personality in discriminating between healthy aging and early-stage Alzheimer's disease. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *62*, 353–361.

Eaton, L. G., & Tinsley, B. J. (1999). Maternal personality and health communication in the pediatric context. *Health Communication*, *11*, 75–96.

Eysenck, H. J. (1985). Personality, cancer and cardiovascular disease: A causal analysis. *Personality and Individual Differences*, *6*, 535–556.

Ferguson, E., & Bibby, P. A. (2012). Openness to experience and all-cause mortality: A meta-analysis and equivalent from risk ratios and odds ratios. *British Journal of Health Psychology*, *17*, 85–102.

Ferrucci, L., Guralnik, J. M., Salive, M. E., Pahor, M., Corti, M. C., Baroni, A., & Havlik, R. J. (1996). Cognitive impairment and risk of stroke in the older population. *Journal of the American Geriatrics Society*, *44*, 237–241.

Goodwin, R. D., & Friedman, H. S. (2006). Health status and the five-factor personality traits in a nationally representative sample. *Journal of Health Psychology*, *11*, 643–654.

Goronzy, J. J., & Weyand, C. M. (2007). The innate and adaptive immune systems. *Cecil medicine* (23rd ed.). Philadelphia, PA: Saunders Elsevier.

Goubert, L., Crombez, G., & Van Damme, S. (2004). The role of neuroticism, pain catastrophizing and pain-related fear in vigilance to pain: A structural equations approach. *Pain*, *107*, 234–241.

Hampson, S. E. (2012). Personality processes: Mechanisms by which personality traits "get outside the skin." *Annual Review of Psychology*, *63*, 315–339.

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*, 925–928. doi:10.1037/a0031655

Hampson, S. E., Goldberg, L. R., Vogt, T. M., & Dubanoski, J. P. (2007). Mechanisms by which childhood personality traits influence adult health status: Educational attainment and health behaviors. *Health Psychology*, *26*, 121–125.

Hill, P. L., & Roberts, B. W. (2011). The role of adherence in the relationship between conscientiousness and perceived health. *Health Psychology*, *30*, 797–804.

Hill, P. L., Turiano, N. A., Hurd, M. D., Mroczek, D. K., & Roberts, B. W. (2011). Conscientiousness and longevity: An examination of possible mediators. *Health Psychology*, *30*, 536–541.

Hill, P. L., Turiano, N. A., Mroczek, D. K., & Roberts, B. W. (2012). Examining concurrent and longitudinal relations between personality traits and social well-being in adulthood. *Social Psychological and Personality Science*, *3*, 698–705.

Jackson, J. J., Hill, P. L., Payne, B. R., Chui, H., Parisi, J. M., & Stine-Morrow, E. L. (2014). Why is openness related to cognitive ability? The role of daily behavior. Manuscript under review.

Jackson, J. J., Wood, D., Bogg, T., Walton, K. E., Harms, P. D., & Roberts, B. W. (2010). What do conscientious people do? Development and validation of the Behavioral Indicators of Conscientiousness (BIC). *Journal of Research in Personality*, *44*, 501–511.

Jerram, K. L., & Coleman, P. G. (1999). The big five personality traits and reporting of health problems and health behaviour in old age. *British Journal of Health Psychology*, *4*, 181–192.

Jokela, M., Batty, G. D., Nyberg, S. T., Virtanen, M., Nabi, H., Singh-Manoux, A., & Kivimäki, M. (2013). Personality and all-cause mortality: Individual-participant meta-analysis of 3,947 deaths in 76,150 adults. *American Journal of Epidemiology*, *178*, 667–675.

Juster, F. T., & Suzman, R. (1995). An overview of the Health and Retirement Study. *Journal of Human Resources*, *30*, S7–S56.

Kern, M. L., & Friedman, H. S. (2008). Do conscientious individuals live longer? A quantitative review. *Health Psychology*, *27*, 505.

Lachman, M. E., & Weaver, L. S. (1997). *Midlife Development Inventory (MIDI) personality scales: Scale construction and scoring*. Technical report, Brandeis University, Waltham, MA.

Lodi-Smith, J., Jackson, J. J., Bogg, T., Walton, K. E., Wood, D., Harms, P. D., & Roberts, B. W. (2010). Mechanisms of health: Education and health-related behaviors partially mediate the relationship between conscientiousness and self-reported physical health. *Psychology & Health*, *25*, 305–19.

Matthews, K. A. (1988). Coronary heart disease and type A behaviors: Update on and alternative to the Booth-Kewley and Friedman (1987) quantitative review. *Psychological Bulletin*, *104*, 373.

Mayo, E., Wood-Dauphinee, S., Ahmed, S., Gordon, C., Higgins, J., Mcewen, S., & Salcach, N. (1999). Disablement following stroke. *Disability & Rehabilitation*, *21*, 258–268.

Miller, T. Q., Smith, T. W., Turner, C. W., Guijarro, M. L., & Hallet, A. J. (1996). Meta-analytic review of research on hostility and physical health. *Psychological Bulletin*, *119*, 322.

Nakaya, N., Bidstrup, P. E., Saito-Nakaya, K., Frederiksen, K., Koskenvuo, M., Pukkala, E., . . . Johansen, C. (2010). Personality traits and cancer risk and survival based on Finnish and Swedish registry data. *American Journal of Epidemiology*, *172*, 377–385.

Roberts, B. W., Jackson, J. J., Duckworth, A., & Von Culin, K. (2011). Personality measurement and assessment in large panel surveys. *Forum for Health Economics and Policy*, *14*, 1–23.

Roberts, B. W., Kuncel, N. R., Shiner, R. L., Caspi, A., & Goldberg, L. R. (2007). The power of personality: The comparative validity of personality traits, socioeconomic status, and cognitive ability for predicting important life outcomes. *Perspectives on Psychological Science*, *2*, 313–345.

Sharp, E. S., Reynolds, C. A., Pedersen, N. L., & Gatz, M. (2010). Cognitive engagement and cognitive aging: Is openness protective? *Psychology and Aging*, *25*, 60.

Shipley, B. A., Weiss, A., Der, G., Taylor, M. D., & Deary, I. J. (2007). Neuroticism, extraversion, and mortality in the UK Health and Lifestyle Survey: A 21-year prospective cohort study. *Psychosomatic Medicine*, *69*, 923–931.

Smith, T. W. (2006). Personality as risk and resilience in physical health. *Current Directions in Psychological Science*, *15*, 227–231.

Soubelet, A., & Salthouse, T. A. (2011). Personality—Cognition relations across adulthood. *Developmental Psychology*, *47*, 303.

Sutin, A. R., Ferrucci, L., Zonderman, A. B., & Terracciano, A. (2011). Personality and obesity across the adult life span. *Journal of Personality and Social Psychology*, *101*, 579.

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*, 912–920.

Takahashi, Y., Edmonds, G. W., Jackson, J. J., & Roberts, B. W. (2013). Longitudinal correlated changes in conscientiousness, preventative health behaviors, and self-perceived physical health. *Journal of Personality*, *81*, 417–427.

Turiano, N. A., Spiro, A., & Mroczek, D. K. (2012). Openness to experience and mortality in men: Analysis of trait and facets. *Journal of Aging and Health*, *24*, 654–672.

Weston, S., & Jackson, J. J. (in press). Identification of the healthy neurotic: Personality traits predict smoking after disease onset. *Journal of Research in Personality*. doi:10.1016/j.jrp.2014.04.008

Wilson, R. S., Schneider, J. A., Arnold, S. E., Bienias, J. L., & Bennett, D. A. (2007). Conscientiousness and the incidence of Alzheimer disease and mild cognitive impairment. *Archives of General Psychiatry*, *64*, 1204–1212.

Yousfi, S., Matthews, G., Amelang, M., & Schmidt-Rathjens, C. (2004). Personality and disease: Correlations of multiple trait scores with various illnesses. *Journal of Health Psychology*, *9*, 627–647.

Zautra, A. J., Fasman, R., Parish, B. P., & Davis, M. C. (2007). Daily fatigue in women with osteoarthritis, rheumatoid arthritis, and fibromyalgia. *Pain*, *128*, 128–135.

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