Published in final edited form as:
Am J Geriatr Psychiatry. 2013 August ; 21(8): . doi:10.1016/j.jagp.2012.11.013.

Personality and Physician-Assessed Illness Burden in Older Primary Care Patients Over Four Years

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Abstract

Background—Personality traits have been associated with physician-rated illness burden cross-sectionally, but longitudinal associations between personality and objective medical morbidity remain unclear.

Purpose—To examine associations between personality and physician-rated illness burden 4 years prospectively in older primary care patients.

Method—At baseline, patients (average age = 75, SD = 6.6, 62% female) completed the NEO-Five Factor Inventory. At baseline and 4 yearly follow-ups, a physician completed the Cumulative Illness Rating Scale based on medical records.

Results—Linear mixed effects models revealed that higher neuroticism and lower conscientiousness predicted worse *average* illness burden longitudinally. Relatively disagreeable persons (25th percentile) accumulated morbidity at a 33% faster rate than agreeable (75th percentile) peers. At the final follow-up, a person at the 75th percentile of neuroticism and the 25th percentile of conscientiousness and agreeableness showed morbidity comparable to a peer of average personality but 10 years older. An individual at the 25th percentile of neuroticism and 75th percentile of conscientiousness and agreeableness showed end-point illness burden comparable to a peer of average personality but 10 years younger. 21% of the morbidity associated with neuroticism was explained by total cholesterol. History of hypertension, smoking, alcohol/drug abuse, and affective symptoms of depression each explained 10% or less of the other observed personality effects.

Conclusion—Personality plays a non-trivial role in healthy aging among older persons. Brief personality assessment may identify at-risk older persons for closer monitoring, enhance the accuracy of medical prognosis, and provide clues for clinical interventions to promote better health.

Keywords

Personality Traits; Medical Illness; Older persons; Primary Care; Cohort Study

Introduction

Personality traits have been linked with both self-rated health (1, 2) and mortality (3). Whereas mortality is perhaps the most objective indicator of overall health, patient self-

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reports more accurately capture subjective health (4, 5). Yet less is known about how personality phenotype is linked to objective health, while patients are still alive. Clarifying such associations can provide clues about the importance of personality for objective disease before final end-points like mortality, when health and quality of life can be potentially be impacted.

There are at least three theoretical mechanisms through which personality may operate to influence objective disease load (6,7). First, personality traits are strongly associated with health behaviors such as smoking, diet, and exercise (8). Second, personality is associated with individual differences in psychophysiological processes relevant to health such as immune function (9), HPA axis function, and autonomic reactivity (10). Finally, personality is associated with social and interpersonal factors (11) that influence health (12). Any or all of these mechanisms operating over the lifespan, as well as novel pathways not yet known, could explain why people with particular personality traits tend to have lower levels of aggregate morbidity in old age.

The only report of which we are aware documenting associations between personality and aggregate illness burden assessed by a physician based on chart review was cross-sectional (13). The study used the comprehensive Five Factor Model (FFM) of personality (14, 15), which organizes specific personality traits along five general axes of human dispositional variation: Extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. Older persons who were more conscientious, and in particular those who maintained more orderly lives, appeared to have lower levels of illness burden. However, the temporal relationship between personality and medical morbidity remains ambiguous. For instance, the extent to which health changes influence personality is unknown. In the present paper, we address limitations inherent in that cross-sectional work with prospective analyses. Specifically, we examine whether personality traits predict illness burden over 4-years of follow-up, in the cohort on whom our original cross-sectional report was based.

We hypothesized that conscientiousness measured at baseline would be associated with better physician-assessed health prospectively. However, neuroticism is prospectively associated with a range of health outcomes in addition to subjective health (16). In light of this, it may also be associated with illness burden prospectively. Although some evidence exists for effects of the other FFM traits -- extraversion, openness to experience, and agreeableness -- their precise relationship to general medical morbidity is unknown. We therefore examined their effects but did not provide a priori hypotheses.

Method

Participants and Design

Our sample consisted of the baseline cohort described in our initial report (13), followed for up to 4 years. The study itself was a naturalistic cohort study, intended to examine the interrelationships between mental and physical health in primary care patients over 65 years of age. All patients 65 years and older who appeared on designated sampling days at internal and family-medicine offices were approached about enrollment. Eligibility requirements included being a patient at the designated primary care practice, 65 or older, and ability to provide informed consent. 50.1% of approached individuals met eligibility and consented to participate. Enrolled subjects did not significantly differ from non-enrolled patients in age, gender, or 15-item Geriatric Depression Scale (GDS) score. Subsequent to consent, patients underwent interviews with trained research assistants in their homes or at the University of Rochester Medical Center. All individuals had Medicare insurance.

The study funding was for 5 years, and intakes were staggered over the first 4 years of that period. Thus, in addition to a baseline assessment, each patient was eligible for 1–4 yearly follow-ups (up to 5 total assessments). Data were collected from April 2001 to April 2006. The number of assessments for each participant was dependent on entry into the study, and ranged from baseline only (i.e., no follow-up) to four years of follow-up after baseline (i.e., a total observation period of four years; details provided below). The final cohort thus involved diminishing numbers at each successive follow-up due not only to drop-out or death, but because some persons entered the study at a later date and were not eligible for later follow-ups. The study was designed to employ longitudinal analytic methods taking this pattern into account (see below). The study was approved by the local institutional IRB.

Instruments

NEO-Five Factor Inventory (NEO-FFI)—The NEO-FFI (19) is a 60-item personality inventory designed to assess the Big 5 personality dimensions of Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness. Each domain consists of subcomponents representing more specific traits: depression, anxiety, and self-reproach (Neuroticism); positive affect, sociability, and activity (Extraversion); aesthetic interests, intellectual interests, and unconventionality (Openness); prosocial orientation and nonantagonistic orientation (Agreeableness); and orderliness, goal-striving, and dependability (Conscientiousness) (20, 21). Following the baseline interview, participants were asked to return the completed NEO-FFI by mail. The factor structure in the sample corresponded to that intended for the instrument (19). In order to remove random measurement error from the Big 5 scales and hence improves reliability, factor scores were extracted from the NEO-FFI item correlation matrix via principal axis factoring with orthogonal rotation. In order to scale these scores so that a 1-unit change reflected a meaningful difference in the trait, we scaled score by the interquartile range (22). Thus, a one-unit change in the variable corresponds to the difference in the outcome (i.e., illness burden) for a person at the 75^{th}, vs. 25^{th} level of the of the Big 5 trait. Note that this is not achieved through categorization, but rather through a linear transformation of the continuous variable. Thus, no information is lost and a 1-unit change in the variables corresponds to the familiar public health/clinical medicine comparison of the top vs. bottom quartile of the distribution (22).

Cumulative Illness Rating Scale (CIRS)—The CIRS is one of the longest standing comorbidity indices in use (23). It has been validated for use with primary care patients (24), converges with coroner's pathology reports (25), and is a strong predictor of health-related quality of life (26) and survival (27–29). The CIRS quantifies the level of overall medical burden through ratings of disease severity (0 = no burden, 1 = mild burden, 2 = moderate burden, 3 = major burden, 4 = severe burden) across the following major organ systems: Cardiovascular/Respiratory (combining cardiac, vascular, upper respiratory, and Eyes Ears Nose and Throat items), Genitourinary, Musculoskeletal, Neurological, Gastrointestinal (combining upper and lower gastrointestinal and hepatic items), and Endocrine/Metabolic. CIRS ratings were made by a physician who was blind to the data on personality. These ratings were based on information taken from the participants' primary care charts including history, physical examinations, laboratory tests, and other health-relevant information. The physician rating the CIRS was familiar with the patient through consensus conference discussions with interviewers, but had not met the patient. CIRS ratings were all made in a medical center conference room based only on abstracted chart data. The physician had no knowledge of the patient's personality scores.

Hamilton Depression Rating Scale (HDRS)—The 24-item version of the HDRS (30) is a reliable and validated interviewer-administered measure of depressive symptom severity

within the previous week that has been used with older adults in primary care. As in prior work (13) we examined whether the affective portion of the scale measured at each wave explained any effect observed for Neuroticism, in order to separate dispositional from situational negative affect.

Other Covariates—Demographic covariates included age at baseline, gender, and years of education. We also examined the effect of controlling for the set of health factors used in the prior report: history of hypertension at baseline (based on medical chart review); fasting cholesterol at each measurement point (medical chart records); current and previous smoking (self-report, corroborated by chart review); and lifetime history of alcohol or substance abuse or dependence (assessed by the Structured Clinical Interview for the DSM-IV(31) and corroborated by chart review).

Analysis

We implemented linear mixed effects models (32) to examine the effects of baseline personality on repeated CIRS measurements over the study period. We included non-linear terms for time to build a more flexible model that did not assume that change over time was linear, but instead could accommodate any reasonable trajectory of illness burden over the study period. Because linearity is an unnecessary statistical assumption that may not be met in the accumulation of age-related medical burden, we considered this more flexible approach more clinical meaningful. The examination of whether Big 5 traits affected patterns of change over time involved testing interaction terms between each Big 5 factor and time terms, and retaining those that were significant in the final model. This approach reflected an examination of not just whether a trait was, on average, associated with higher medical burden over the follow-up period (i.e., trait main effects), but also an examination of whether certain traits were associated with more precipitous rates of decline (i.e., the interaction terms with time). Both kinds of longitudinal effects would appear to have clinical and public health implications in aging cohorts.

We began with a model including all FFM factors and age, gender, and education to test the effect of each trait upon average levels of CIRS over the five-year period. Next, we examined whether any of the FFM traits were associated with steeper rates of health decline by interacting the trait with the time terms (including higher order polynomials). To assess whether other covariates explained personality effects on either average levels of morbidity or rate of health decline over follow-up, we covaried them one by one and examined the amount of change observed in parameter estimates for personality (34) for each covariate separately, then together as a block. When an FFM dimension was significant, we substituted its components one at a time to determine which specific aspect was driving the effect (17–18).

We also conducted multinomial logit analyses predicting dropout, death, and missed interview at each time period among those eligible for follow-up to determine whether data were Missing Completely at Random (MCAR; i.e., not predictable from prior observed covariates) or Missing at Random (MAR; i.e., predictable from prior observed covariates). Mixed-effect models yield unbiased parameter estimates under MAR (33), whereas more restrictive analytic methods generally require data to be MCAR.

Results

Sample Characterization

Data were unavailable on illness burden in 2 of 749 individuals at baseline (wave 1). Numbers at each follow-up assessment in this 5-year study were a function of 1) deaths, 2)

attrition, and 3) eligibility at each year. Eligibility for further follow-up varied with year of study entry. For instance, a patient entering the study at year 3 of the funding period would be eligible for only 2 follow-up interviews (in years 4 and 5). Because the funding did not extend beyond 5 years, however, this patient would not be eligible for 3 or 4-year follow-up assessments.

Deaths (n=28) and withdrawals (n=85) precluded follow-up on some of the cohort. Several others were inelligible for follow-up, given their date of study entry. 12-month post-baseline (wave 2) follow-up interviews were completed on 484 of 699 (69%) eligible; 24-month (wave 3) follow-up interviews were completed on 398 of 578 (69%) eligible; 36-month (wave 4) follow-up interviews were completed on 313 of 418 (75%) eligible; and 48-month (wave 5) follow-up interviews completed on 67 of 83 (81%) eligible. Multinomial logit models predicting death, withdrawal, or missing status at each time point against a reference category of completed interview from baseline characteristics revealed that older age decreased the probability of withdrawal at 1 year follow-up, greater baseline illness burden increased risk of death at 2 and 3 year follow-up and risk of missed interview at 2 years, and that higher education was associated with lower risk of termination by 2 years. The association of dropout with observed factors indicated that the data met MAR assumptions, necessitating the use of mixed models rather than other approaches relying on the more restrictive MCAR assumption.

Of interviewed persons at baseline, the return rate for personality questionnaires was 69%. Thus, the final analysis sample included 497 individuals at baseline, 364 at 12-month follow-up, 301 at 24-month follow-up, 250 at 36-month follow-up, and 54 at 48-month follow-up. Multivariate logit models indicated that this final analysis sample did not differ in terms of age or illness burden from those lacking data on at least one variable. However, these persons were more likely to be women, and had roughly one additional year of education compared to those missing data on at least one variable.

Personality Effects Upon Illness Burden

Multivariate models are shown in Table 2. Persons higher in conscientiousness and lower in neuroticism showed lower average levels of illness burden over the course of the follow-up. Persons higher in agreeableness accumulated morbidity less rapidly over the follow-up. The interaction term indicated that a person at the 75th percentile of agreeableness would show an increase of roughly (1.28 coefficient for linear time −.18 coefficient for interaction term =) 1.10 CIRS points per year, while at the 25th percentile of agreeableness would gain roughly 1.46 (1.28 + .18 =) CIRS points per year. In other words, disagreeable persons aged medically 33% faster (1.46/1.10 = 1.163) than agreeable persons. More concretely, over the study period, a disagreeable person accumulated over 2 additional CIRS point than an agreeable one-- the equivalent of moving from minor to severe burden in an organ system. This represents a within-person gauge of morbidity acceleration over time.

We also gauged the importance of personality from a between-person perspective using model coefficients to compare two persons of differing personality, both 75 years old at baseline, in terms of their illness burden at the final wave, when both were 79. An individual at the 75th percentile of Conscientiousness and Agreeableness, and 25th percentile of Neuroticism finished with a CIRS score of 10.5. A person average on all traits, started the study at age 65 would achieve a roughly similar score four years later at 69. By comparison, a person starting the study at age 75 but at the 25th percentile of Conscientiousness and Agreeableness and 75th percentile Neuroticism would by age 79 have a CIRS score 13.8. A person average on all traits but starting the study at age 85 would achieve this state of medical deterioration by age 89. Thus, persons with beneficial personality configurations reached an end-state similar to average persons 10 years younger than them, while those

with maladaptive configurations reached an end-state similar to those 10 years older than them.

Health Covariate Analysis

Analyses examining whether these personality effects could be accounted for by covariates are shown in Table 3. Change in estimates due to each covariate suggested that HDRS affective symptoms explained roughly 6.2% of the Neuroticism association, while hypertension explained about 4.5% of the Conscientiousness association with average illness burden over follow-up. History of alcohol or substance misuse explained approximately 10% of the association of Agreeableness with rate of morbidity accumulation. Cholesterol levels also explained 21% of the association between Neuroticism and worse illness burden over the follow-up. Entering all covariates simultaneously did not lead to appreciably larger explained variation.

FFM Subcomponent Analysis

Examination of FFM subcomponents showed that each facet of Neuroticism contributed to the domain's overall effect (B(SE) each for interquartile ranges of trait anxiety and depression = .60 (.16), z = 3.89 and z = 3.64, respectively; p <.001; self reproach = .43 (.19), z = 2.29, p = .022). The Conscientiousness effect was driven primarily by orderliness (B(SE) = −.40(.17), z = −2.35, p = .019) and the linear combinations of orderliness and dependability (B(SE) = −.39(.17), z = −2.26, p = .024) and orderliness and goal-striving (B(SE) = −.42(.18), z = −2.42, p = .016). Finally, the effect of Agreeableness on health decline was attributable to non-antagonistic orientation (B(SE) = −.21(.06), z = −3.51, p = .001), rather than prosocial orientation. Antagonistic older persons (25^{th} percentile) accumulated medical burden at a 36% faster rate than their less-antagonistic (75^{th} percentile) peers (roughly 1 additional CIRS point each year).

Conclusion

We hypothesized that previously observed cross-sectional associations between higher Conscientiousness and lower physician-rated illness burden (13) would be replicated longitudinally in a sample of older primary care patients. Our findings extend prior cross-sectional results for the role of conscientiousness in health. Persons higher in Conscientiousness entered the study in better health, and maintained this advantage over the follow-up period. As in prior cross-sectional work, it was primarily the orderliness aspect of Conscientiousness that proved important. However, the advantage of orderliness was potentiated when it was combined with either high levels of dependability, or high levels of goal-striving. Recent meta-analytic findings also suggest an important role for this facet of Conscientiousness in longevity (35).

More conscientious older patients may enjoy better health by virtue of more cautious evaluation of health risks (36, 37)(36–38). In our analysis, smoking, alcohol/substance misuse, and hypertension and hypercholesterolemia (biological consequences of poor diet and exercise) accounted for trivial portions of the observed effect, consistent with prior findings that health behaviors account for only a modest portion of the association between conscientiousness and health outcomes (39, 40). One suggestion is that conscientiousness people may enjoy better immune functioning (41), perhaps because their approach to life reduces stress (42, 42). Conscientiousness also predicts less cognitive decline in old age (43), which may mean that this trait has an indirect effect on health through better cognitive functioning.

Second, higher neuroticism was associated with higher average illness burden over the course of the study. This is consistent with findings that higher Neuroticism is a mortality risk (44–46), although findings to the contrary also exist (47). Roughly 6% of this risk was explained by depressive symptoms, consistent with reports that Neuroticism is a risk for depression in older persons (48, 49). However, 21% of the Neuroticism risk was explained by high cholesterol levels, potentially implicate poorer diet and exercise habits in those prone to emotional distress. Neuroticism may also affect illness burden both through other health behaviors not captured here, and/or physiological mechanisms related to stress sensitivity such as allostatic load (50).

Third, we found that the rate of health decline was roughly 33% faster over the study period in those relatively low (25^{th} percentile) compared to relatively high (75^{th} percentile) in agreeableness. A small portion of the effect was explained by lifetime diagnosis of alcohol or substance abuse or dependence, consistent with findings that persons misusing substances, including alcohol, tend to be lower in agreeableness (51–53). A small portion of the influence of agreeableness upon rate of health decline was due to cholesterol levels, also consistent with prior reports (52). In particular, antagonism, or the tendency to engage in overt interpersonal conflict (17, 20), drove the overall agreeableness effect, consistent with the pathogenic effects of hostility upon elements of the cardiovascular system (6, 54). Hostile older persons probably also abdicate the health benefits of social support (55).

The current findings have clinical, public health, and research implications. Identifying patients requiring closer long-term monitoring in clinical practice may be assisted by assessing basic dispositions. Such persons might require additional preventive precautions. In the case of hostile or disagreeable persons, lipid management and drinking patterns may be avenues for intervention. Hostility itself can be successfully reduced in patients (56), leading some to call for brief screening (58) of pathogenic traits in primary care settings (57). Personality variation may also have a substantial impact at the public health level, particularly as lifespan increases in the US. More work is needed on targeted prevention in older persons of high neuroticism, low conscientiousness, and low agreeableness, who may respond differentially to public health messages (59). Finally, emerging findings on naturalistic personality change even in the latter years (60, 61) suggests that the direct mitigation of maladaptive dispositions may deserve consideration.

Our findings must be contextualized in study strengths and limitations. While we established a robust prospective predictive role for personality with respect to medically documented illness burden, we examined only a small range of possible explanatory factors for these effects. Future work may shed additional light on this. Although prior work has documented the reliability and validity of the CIRS, only one physician made ratings in this study, precluding inter-rater reliability estimates. Other valid frameworks for personality measurement also exist (62, 63, 64). We were able to establish the two components of causality possible in cohort work—association, and temporal precedence of putative cause over the effect. Despite this, we urge restraint in interpretation. The potential confounding of unmeasured factors can never be fully known in any observational study. At the same time, a great benefit of our naturalistic research is that it provides a window onto the real world. Also, our sample, though large, was limited to one geographic location. Finally, we did not address the extent to which health itself influences personality change. In the end, our findings suggest that personality phenotype may capture a wide and general range of psychological and behavioral tendencies with important prognostic value over and above traditionally considered biomedical risk factors.

Acknowledgments

Support: R01MH61429 (Jeffrey Lyness, PI), T32MH073452 (Jeffrey Lyness and Paul Duberstein, PIs), R21AG023956 (Jan Moynihan and Paul Duberstein, PIs), and K08AG031328 (Ben Chapman, PI)

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Table 1

Sample Characteristics

	Mean/N	SD/%
Baseline Characteristics		
Age (years)	75	6.6
Male	188	38%
Female	309	62%
Education (years)	14.3	2.4
Neuroticism	44.8	10
Extraversion	51.3	10
Openness	49.9	9.8
Agreeableness	54.6	9.6
Conscientiousness	49.5	9.9
No History of Alcohol/Substance Abuse/Dependence		
No History of Alcohol/Substance Abuse/Dependence		
Never Smoker	294	39%
Current Smoker	65	9%
Former Smoker	390	52%
Normal Tensive History	138	28%
History of Hypertension	359	72%
Time-Varying Characteristics		
HDRS Affective Symptoms		
Wave 1 (Baseline)	2.8	3.8
Wave 2 (12 Month Follow-up)	2.6	3.3
Wave 3 (24 Month Follow-up)	2.2	2.9
Wave 4 (36 Month Follow-up)	2.4	3.1
Wave 5 (48 Month Follow-up)	2.5	2.8
Fasting Cholesterol		
Wave 1 (Baseline)	195.0	36.4
Wave 2 (12 Month Follow-up)	190.3	36.4
Wave 3 (24 Month Follow-up)	186.4	38.9
Wave 4 (36 Month Follow-up)	180.7	39.2
Wave 5 (48 Month Follow-up)	183.7	39.8
Cumulative Illness Rating Scale		
Wave 1 (Baseline)	7.4	2.9
Wave 2 (12 Month Follow-up)	8.6	3.1
Wave 3 (24 Month Follow-up)	9.3	3
Wave 4 (36 Month Follow-up)	9.9	3.2
Wave 5 (48 Month Follow-up)	11	2.6

Note: HDRS = Hamilton Depression Rating Scale

Table 2

	Hypothesis Tested	
Predictor	**Personality Predicts *Average Levels* Of Illness Burden Over Follow-up**	**Personality Predicts *Rate of Illness Burden Accumulation* Over Follow-up**
Fixed Effects		
Neuroticism	0.62*** (0.16)	0.63*** (0.16)
Extraversion	−0.16 (0.16)	−0.16 (0.17)
Openness	−0.06 (0.18)	−0.06 (0.18)
Agreeableness	−0.13 (0.18)	0.03 (0.19)
Conscientiousness	−0.43** (0.16)	−0.44** (0.16)
Time: Years	1.28*** (0.06)	1.37*** (0.07)
Time: Years ^{2}	−0.11* (0.05)	−0.11* (0.05)
Time: Years ^{3}	0.06 (0.03)	0.06* (0.03)
Baseline Age (Years)	0.13*** (0.02)	0.13*** (0.02)
Education (Years)	−0.07 (0.06)	−0.07 (0.06)
Female Gender	−0.48 (0.28)	−0.49 (0.28)
Agreeableness * Time		−0.18** (0.05)
Intercept (Average CIRS at Wave 3)	9.72*** (0.22)	9.73*** (0.22)
Random Effects		
Linear Time Variance	0.53*** (0.07)	0.51*** (0.07)
Quadratic Time Variance	.08*** (0.03)	.08*** (0.03)
Cubic Time Variance	.05*** (0.02)	.05*** (0.02)
Intercept Variance	7.09*** (0.49)	7.11*** (0.49)
Residual Variance	.59*** (0.06)	.59*** (0.05)
N	1453	1453
AIC	5714	5709
BIC	5804	5804

Notes. Entries are parameter estimates (change in CIRS scores per unit increase in predictor), beneath which standard errors are in parentheses. Personality traits scaled by interquartile range, so that 1 unit corresponds to difference between a person at 75th v. 25th percentile.

* $p \leq .05$

** $p \leq .01$

*** $p \leq .001$.

Random effect standard errors smaller than .001 are reported as zero. P-values are from z-statistics.

Table 3

Effects of Covariate Adjustment on Personality Estimates

	Covariates Tested to Explain Personality Effects				
Predictor	**HDRS Affective**	**Alcohol/Substance**	**Smoking**	**Hyper-Tension**	**Fasting Cholesterol**
Fixed Effects					
Neuroticism	0.59*** (0.17)	0.62*** (0.16)	0.62*** (0.16)	0.61*** (0.16)	0.50*** (0.17)
Extraversion	−0.15 (0.16)	−0.17 (0.17)	−0.16 (0.16)	−0.21 (0.16)	−0.21 (0.17)
Openness	−0.07 (0.18)	−0.07 (0.18)	−0.06 (0.18)	−0.09 (0.18)	0.01 (0.19)
Agreeableness	−0.23 (0.18)	−0.19 (0.18)	−0.43 (0.18)	−0.19 (0.18)	−0.31 (0.18)
Conscientiousness	−0.43** (0.16)	−0.43** (0.16)	−0.43** (0.16)	−0.42** (0.16)	−0.49** (0.16)
Time: Years	1.28*** (0.06)	1.25*** (0.07)	1.33*** (0.09)	1.34*** (0.10)	1.35*** (0.08)
Time: Years ^{2}	−0.11* (0.05)	−0.11* (0.05)	−0.11* (0.05)	−0.11* (0.05)	−0.11* (0.05)
Time: Years ^{3}	0.06 (0.03)	0.06* (0.03)	0.06* (0.03)	0.06* (0.03)	0.06 (0.03)
Baseline Age (Years)	0.13*** (0.02)	0.13*** (0.02)	0.13*** (0.02)	0.12*** (0.02)	0.12*** (0.02)
Education (Years)	−0.07 (0.06)	−0.07 (0.06)	−0.07 (0.06)	−0.05 (0.06)	−0.09 (0.06)
Female Gender	−0.49 (0.28)	−0.42 (0.29)	−0.49 (0.28)	−0.48 (0.28)	−0.47 (0.28)
Agreeableness * Time	−0.18** (0.07)	−0.16* (0.07)	−0.19** (0.05)	−0.19** (0.05)	−0.17* (0.07)
HDRS Affective (Time varying)	0.09 (0.07)				
HDRS Affective * Time	0.03 (0.06)				
History of Alcohol/Substance Abuse/Dependence		0.42 (0.33)			
History of Alcohol/Substance Abuse/Dependence * Time		0.15 (0.11)			
Current Smoker			−.13 (0.51)		
Current Smoker * Time			−0.16 (0.19)		
Former Smoker			−0.01 (0.27)		
Former Smoker * Time			−0.08 (0.10)		
History of Hypertension				1.02*** (0.28)	
History of Hypertension * Time				−0.08 (0.11)	
Fasting Cholesterol (Time Varying)					−0.00 (0.00)
Fasting Cholesterol * Time					−0.00 (0.00)

	Covariates Tested to Explain Personality Effects				
Predictor	**HDRS Affective**	**Alcohol/Substance**	**Smoking**	**Hyper-Tension**	**Fasting Cholesterol**
Intercept (Average CIRS at Year 3)	9.59*** (0.25)	9.59*** (0.25)	9.73*** (0.28)	9.00*** (0.30)	9.70*** (0.23)
Random Effects					
Linear Time Variance	0.50*** (0.06)	0.50*** (0.06)	−0.51*** (0.07)	−0.50*** (0.07)	0.50*** (0.08)
Quadratic Time Variance	.08*** (0.02)	.08*** (0.02)	.08*** (0.03)	.08*** (0.03)	.08*** (0.03)
Cubic Time Variance	.05*** (0.02)	−.05*** (0.02)	.05*** (0.02)	.05*** (0.02)	.05*** (0.02)
Intercept Variance	7.11*** (0.49)	7.11*** (0.49)	7.10*** (0.49)	6.89*** (0.48)	6.95*** (0.48)
Residual Variance	.59*** (0.06)	.59*** (0.06)	.59*** (0.49)	0.59*** (0.06)	.60*** (0.06)
N	1453	1453	1453	1453	1414
AIC	5710	5709	5715	5697	4856
BIC	5816	5815	5831	5803	4958

Notes. Entries are parameter estimates (change in CIRS scores per unit increase in predictor), beneath which standard errors are in parentheses. HDRS = Hamilton Depression Rating Scale. Personality traits and HDRS affective scores scaled by interquartile range, so that 1 unit corresponds to difference between a person at 75th v. 25th percentile.

* p ≤ .05

** p ≤ .01

*** p ≤ .001.

P-values are from z-statistics.