

# Personality Traits, Education, and Health-Related Quality of Life Among Older Adult Primary Care Patients

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**Both lower education and the personality trait of neuroticism have been associated with lower health-related quality of life (HRQOL) among older adults, but little is known about the role of other personality traits in HRQOL. We examined the associations of all Five-Factor Model personality traits and education, above and beyond physician-rated medical burden, with different aspects of HRQOL in a sample of 442 primary care patients 65 years of age or older who completed the NEO Five-Factor Inventory. We used the Medical Outcomes Survey Short Form-36 (SF-36), instrumental activities of daily living (IADLs), and the physical self-maintenance scale to assess different aspects of HRQOL. Even after statistically adjusting for age, gender, the presence of major depressive disorder, and physician-rated medical morbidity, we found that a higher neuroticism level was associated with lower functioning on the IADLs and the physical self-maintenance scale and worse HRQOL on the Social Functioning and Role Emotional subscales of the SF-36. Higher conscientiousness level was associated with better HRQOL on the SF-36 Role Physical scale and better IADL function. Higher education level was associated with better HRQOL on all measures except emotional role impairment. In exploratory moderation analyses, a higher openness level diminished the effect of medical burden on IADL impairment. Preliminary population-attributable risk comparisons suggest that—on a strictly population basis—the impairment conferred by a neuroticism level that is 1 *SD* above the mean may be equivalent to or greater than that of major depressive disorder. Future research aimed at understanding how personality traits are linked with HRQOL and functioning in later life may enhance the identification of at-risk older adults and inform the development of interventions.**

**H**EALTH-RELATED quality of life (HRQOL) is defined as “the extent to which physical dysfunction, pain, and distress result in limitations of people’s everyday behaviors, social activities, and psychological well-being” (Lawton, 2001, p. 595). HRQOL reflects, among other things, the ability to maintain social functioning, such as socializing with friends and family, physical functioning such as walking a block or climbing a flight of stairs, maintaining levels of work or productivity in the face of mental or physical health problems, and being able to perform essential everyday activities such as grocery shopping, cooking, and bathing (Lawton). An essential part of everyday well-being for older adults, HRQOL is in part a function of accumulated illness burden, but it is also due to other, less understood factors. Why might two older individuals of identical age, gender, and medical burden vary markedly in HRQOL?

One perspective holds that socioeconomic position, which reflects access to material, intellectual, financial, and social resources that facilitate a better standard of living (Berkman & Kawachi, 2001), is an important determinant of older adults’ quality of life (Breeze et al., 2004). Unlike income, education is fixed relatively early in life and is not adversely affected by declining health. It is thus particularly notable that education is strongly associated with older adults’ HRQOL (Kempen, Brillman, Ranchor, & Ormel, 1999).

Nevertheless, appealing to socioeconomic factors alone risks a “sociological fallacy” of neglecting the contribution of individual psychological factors (Ryff & Singer, 2002) to HRQOL. One powerful class of variables potentially linked to individual differences in HRQOL is personality traits. The

Five-Factor Model (FFM; McCrae & Costa, 2003) of personality is a taxonomy of traits at once parsimonious and comprehensive, consisting of five broad domains: Neuroticism, or the tendency to experience affective distress; Extraversion, or dispositions toward energy, activity, positive affect, and sociability; Openness to Experience, or interest in novel people, places, and things, and in intellectual and aesthetic pursuits; Agreeableness, or tendencies toward amiability, warmth, trust, and compliance; and Conscientiousness, reflecting goal-striving, diligence and dependability, and orderliness (Costa & McCrae, 1992). There are many reasons to think that FFM traits may be implicated in HRQOL beyond biomedical factors.

Five-factor theory (McCrae & Costa, 1999, 2003) is the conceptual framework underlying the FFM. According to this theoretical account, FFM traits are “basic tendencies” that give rise to “characteristic adaptations.” Such a distinction is consistent with other recent theoretical accounts of the general personality system (Hooker & McAdams, 2003; McAdams & Pals, 2006), which differentiate between fundamental dispositions and the dynamic and fluid processes arising from these dispositions. Maintaining everyday quality of life in the face of mental or emotional health is a major adaptive challenge, and characteristic adaptations associated with all FFM traits might enhance or detract from HRQOL among older adults. We now briefly consider the potential implications of each FFM domain for HRQOL.

## *Neuroticism*

Most research on personality and HRQOL in older adults has focused on Neuroticism, linking it to lower social and role

functioning and impairment in instrumental activities of daily living (IADLs; Kempen, Jelicic, & Ormel, 1997; Kressin, Spiro, & Skinner, 2000; Russo et al., 1997). Characteristic adaptations of Neuroticism include ineffective coping strategies such as self-blame and hostility (McCrae & Costa, 1986), and immature psychological defenses such as regression and displacement (Costa, Zonderman, & McCrae, 1991). Such characteristic “maladaptations” may lead to the alienation of social partners and negative and self-defeating emotions such as discouragement, shame, or anger, which undercut the successful maintenance of everyday routines and activities.

### *Conscientiousness*

Conscientious individuals are organized, diligent, and reliable, and they employ more mature defenses (Costa et al., 1991) such as adaptive action patterns in response to stressors. Conscientiousness may therefore promote the maintenance of one’s everyday roles, routines, hobbies, and functioning in the face of physical or mental health problems. Conscientiousness is also linked to health-protective behaviors, including exercise, abstention from tobacco and lower levels of alcohol misuse and risky driving (Bogg & Roberts, 2004), and consumption of a lower fat diet (Goldberg & Strycker, 2002). One might therefore expect Conscientiousness to be associated with better quality of life in areas involving the regular performance of IADLs, and in the maintenance of physical function.

### *Extraversion*

Extraversion may affect aspects of HRQOL related to both social-emotional and physical quality of life. Extraversion encapsulates sociability, energy, and the frequent experiences of positive emotion (Costa & McCrae, 1992), and research on its characteristic adaptations suggests that it is associated with positive thinking, denial of problems, and facing problems with low levels of self-doubt (Costa et al., 1991; McCrae & Costa, 1986). Extraverted individuals also maintain broader social networks in older adulthood (Lang, Staudinger, & Carstensen, 1998), and they might enjoy better quality of life in aspects related to social functioning.

### *Openness to Experience*

Our prior work in an earlier primary cohort of older adults also found that a higher degree of Openness was associated with better physical functioning, even when objective levels of medical burden were controlled (Duberstein et al., 2003). We speculated that individuals who are more open may retain better physical functioning because they remain interested in learning new physical activities and tasks even into late life, are more receptive to and benefit more from health prevention and maintenance information available to the general public, or both. From a five-factor theory perspective, Open individuals might have better physical functioning in everyday life because they have a need for variety and are more adventurous (Costa & McCrae, 1988) and tend to think more creatively and flexibly (McCrae, 1987), possibly resulting in better problem-solving skills and greater willingness to develop alternative compensatory strategies for physical limitations.

### *Agreeableness*

Agreeableness is a trait marked by amiability, friendliness, and compassion. Investigations of correspondence between the FFM and the “love” and “dominance” axes of the interpersonal circumplex (Leary, 1957) show that Agreeableness is characterized by both high standing on “love” and low standing on “dominance,” making it a trait with important ramifications for social relationships (McCrae & Costa, 1989). However, its potential connections to HRQOL dimensions are somewhat less clear. We therefore wished to assess its importance in HRQOL among older adults on an exploratory basis.

### *Summary and Hypotheses*

The characteristic adaptations associated with FFM traits suggest that each may be linked to individual variation in different dimensions of HRQOL, above and beyond the effects of medical burden. In addition, little is known about whether personality and education are independently associated with HRQOL or confounded. A similar issue on which little consensus exists is the extent to which previously reported Neuroticism associations with HRQOL are confounded by depressive disorders (Kressin et al., 2000). To address the influence of Neuroticism and previously neglected FFM traits in conjunction with education and depression, we examined the relationships between personality traits, education, major depression, and HRQOL in a sample of older adults drawn from primary care practices.

Often serving as a point of first contact in the health care system, primary care clinics provide services to a broad array of older patients, ranging from community dwelling, healthy, higher functioning older individuals to those who are severely ill and functionally impaired. Such clinics can thus serve as excellent venues for identifying risk markers for decreased HRQOL and functioning in older adults. We focused on the following dimensions of HRQOL: social and physical functioning; the ability to maintain everyday role activities; and the ability to maintain IADLs, such as cooking meals or doing laundry, and physical self-maintenance scale (PSMS) items, such as bathing or grooming. On the basis of the pattern of characteristic adaptations discussed herein for each FFM trait, we made the following hypotheses.

1. Higher Neuroticism would be associated with worse social function, role impairment caused by emotional problems, and IADL impairment, which is consistent with prior work (Kempen et al., 1997; 1999; Kressin et al., 2000). We hypothesized that these effects would occur in a manner that was independent of major depressive disorder.
2. Higher Extraversion would be associated with better social functioning and role functioning in the face of emotional problems, owing to a pattern of characteristic adaptations characterized by positive thinking and sociability (Costa et al., 1991; McCrae & Costa, 1986).
3. Higher Openness would be associated with better physical function, consistent with previous work (Duberstein et al., 2003), stemming from the person’s adventurousness and creative thinking (Costa & McCrae, 1988; McCrae, 1987), which are important for problems solving and exploring new compensatory responses.

4. Higher Conscientiousness would be associated with better IADL function and physical functioning as a result of health-protective behavioral patterns associated with this trait (Bogg & Roberts et al., 2004).

In the absence of research or theory upon which to base further hypotheses, our analyses permitted for other, hypothesis-generating results to emerge.

## METHODS

### *Participants and Procedure*

Participants were members of a longitudinal study of mental and physical health among older adults in primary care (Lyness, Niculescu, Tu, Reynolds, & Caine, 2006) conducted between 2001 and 2006. Research assistants attempted to recruit all patients aged 65 years or older who were capable of giving informed consent and presented for primary care on selected recruitment days in several private internal medicine practices and university-affiliated internal medicine or family medicine clinics. All participants provided written informed consent in accordance with procedures approved by the University of Rochester Research Subjects Review Board. Enrolled subjects underwent semistructured interviews with trained interviewers and consented to primary care chart reviews.

Seven hundred and sixteen individuals completed the first wave of data collection. Ranging in age from 65 to 97 years,  $M(SD) = 75(6.9)$ , they were predominantly Caucasian (92%) and female (64%). After the initial interview, participants were instructed to complete and mail back a packet of questionnaires, including the NEO Five-Factor Inventory (NEO-FFI) and the Medical Outcomes Study Short Form-36 (SF-36). Postage and envelopes were provided. Of the 451 individuals who returned the SF-36 and the NEO-FFI (return rate 63%), 442 had complete data on all the variables included in the analyses reported here. A multivariate logistic regression predicting return of the questionnaires from age, gender, education, and overall illness burden revealed that individuals who returned the questionnaire were more educated than those who did not:  $z = 2.32$ ,  $p = .002$ , odds ratio(95% confidence interval) = 1.08(1.01–1.14);  $M(SD) = 14.27$  (2.32) years of education for those returning questionnaires versus 13.57(3.15) for those not returning them. However, they did not otherwise differ from the general sample.

### *Measures*

*NEO Five-Factor Inventory.*—The NEO-FFI (Costa & McCrae, 1992) is a 60-item personality inventory designed to assess five broad personality domains: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness. Cronbach's alpha internal consistency estimates in the present sample ranged from  $\alpha = 0.73$  (Openness) to  $\alpha = 0.88$  (Neuroticism).

*Cumulative Illness Rating Scale.*—The Cumulative Illness Rating Scale (CIRS; Linn, Linn, & Gurel, 1968) quantifies the level of overall medical burden through ratings of disease severity across the following major organ systems: cardiovas-

cular–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 made on the basis of chart review highly correlate with ratings made by a pathologist at autopsy (Conwell, Forbes, Cox, & Caine, 1993), and in the present study we had ratings made by a physician who was blind to the personality data. These ratings were based on information taken from the participants' primary care charts, including history, physical examinations, laboratory tests, and other sources of health-relevant information.

*Medical Outcomes Survey Short Form-36.*—The SF-36 (McHorney, Ware, Lu, & Sherbourne, 1994; Ware & Sherbourne, 1992) is a commonly used multidimensional measure of HRQOL. The Social Functioning scale assesses the extent to which physical or emotional health problems impede social activities, such as the amount of time spent with friends; the Role Emotional scale measures the degree to which emotional problems decrease the amount of time devoted to work or other activities; the Physical Functioning scale measures how much health-related problems interfered with basic physical activities such as walking and climbing stairs; and the Role Physical scale assesses the extent to which physical health problems affected functioning in work or other activities. Higher scores indicate better functioning on all scales. Published reliability coefficients for the scales are .70 and up (Ware, Snow, Kosinski, & Gandek, 1993). Cronbach's alpha estimates of internal consistency in the present study were  $\alpha = 0.85$  (Physical Function),  $\alpha = 0.84$  (Role Physical),  $\alpha = 0.64$  (Social Function), and  $\alpha = 0.54$  (Role Emotional).

*Instrumental Activities of Daily Living and Physical Self-Maintenance Scales.*—The IADL scale and the PSMS (Lawton, 1988) are complementary indexes that measure the extent of impairment in eight essential activities of daily living such as cooking, shopping, and housekeeping, and in six basic physical self-maintenance activities such as feeding, dressing, and grooming. Each item refers to a separate activity in which there may be no, mild, moderate, or severe impairment. Total scores indicate the degree of impairment, with higher scores indicating greater impairment. Previously reported Cronbach's estimates of internal consistency were  $\alpha = 0.91$  (IADL) and  $\alpha = 0.83$  (Lawton), and in the present sample were  $\alpha = 0.85$  (IADL) and  $\alpha = 0.63$  (PSMS).

*Structure clinical interview for DSM-IV disorders.*—The structural clinical interview for DSM-IV disorders, known as SCID-IV (Spitzer, Gibbon, & Williams, 1994), is a semi-structured interview used to assess the presence of mental disorders, according to criteria set forth in the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2000). We had it used in the context of a diagnostic consensus conference involving all available sources of data, including medical chart reviews, to derive a diagnosis of major depression. Research diagnoses based on SCID interview and all-source consensus-based diagnostic meetings achieve a high level of rigor in diagnostic accuracy (Maziade et al., 1992).

Table 1. Sample Demographics ( $N = 442$ )

	<i>M</i> (or <i>N</i> )	<i>SD</i> (or %)
Age	75.00	6.55
Education	14.27	2.33
Cumulative Illness Rating Scale	7.36	2.89
Gender		
Male	166	37.6%
Female	276	62.4%
Ethnicity		
Caucasian	425	96.81%
Minority	14	3.19%
Major depressive disorder		
Active disorder	20	4.52%
No Active disorder	422	95.48%
Neuroticism	15.03	7.82
Extraversion	28.41	6.33
Openness	26.93	5.66
Agreeableness	35.34	4.96
Conscientiousness	34.16	5.91
Social Functioning	82.24	23.79
Role Emotional	77.41	35.47
Physical Functioning	64.04	26.94
Role Physical	58.05	41.64
IADL	1.46	3.05
No. with no IADL impairment	270	61.08%
PSMS	1.37	1.90
No. with no PSMS impairment	212	47.96%

Notes: IADL = instrumental activities of daily living; PSMS = physical self-maintenance scale.

Three individuals did not indicate their ethnicity; SF-36 transformed scores were used for the Social Functioning, Role Emotional, Physical Functioning, and Role Physical subscales.

### Statistical Analysis

We fit separate ordinary least squares regression models for each of the SF-36 variables. These models included age, gender (coded 1 for female vs 0 for male), years of education, CIRS scores, and active major depression in addition to all five personality traits, including Agreeableness, to allow for the possibility that this trait might be associated with HRQOL dimensions. We used robust standard errors (White, 1967) to correct for heteroscedasticity (Cohen, Cohen, West, & Aiken, 2003). The IADL and PSMS were severely positively skewed with a preponderance of zeros (61% of the IADL scores and 48% of the PSMS scores were 0), so we used zero-inflated Poisson (ZIP) regression models (Cheung, 2002).

ZIP models treat zero-inflated count distributions as a mixture of two distinct underlying distributions: One of these is a distribution of excess zeros, representing individuals free from the outcome of interest (i.e., no IADL or PSMS impairment); the other is a standard Poisson distribution, representing individuals with some count on the outcome (i.e., some degree of impairment in IADL–PSMS activities). ZIP models produces two parameter estimates for each independent variable. The first refers to the odds of being free of IADL–PSMS impairment (i.e., a 0). The second corresponds to the coefficient from a Poisson regression, adjusted for the excess zeros in the distribution. It indicates the degree of IADL or PSMS impairment. The relative fit of ZIP versus regular Poisson models can be evaluated with the Vuong test for

nonnested models (Vuong, 1989). To quantify the size of all effects, we computed the standard deviation change in each outcome associated with a 1-*SD* difference in each independent variable (or presence vs absence of dummy-coded variables). Finally, we explored multiplicative interactions between the five personality traits and education, age, and medical burden to allot for the possibility of multiplicative as well as additive effects. We set alpha was set at  $\alpha = 0.003$ , applying a strict Bonferroni adjustment (i.e., 5 traits  $\times$  3 other variables = 15 interactions per outcome;  $0.05/15 = 0.003$ ). We performed the analyses in Intercooled Stata 9.

### RESULTS

Table 1 reports the demographic characteristics of the sample. Table 2 reports the correlation matrix of all variables in the study. Table 3 reports the findings from the regression analyses. As hypothesized, higher Neuroticism was associated with lower SF-36 Social Functioning and Role Emotional scores. Adjusting for age, gender, education, active major depression, and physician-rated illness burden, we found that effect sizes (in standard deviations, per 1-*SD* difference in Neuroticism) ranged from 0.215 (Social Functioning) to 0.605 (IADL), all in the expected direction. Vuong tests indicated that ZIP models fit the data better than standard Poisson regressions for both the IADL ( $z = 5.82, p < .001$ ) and PSMS ( $z = 3.65, p < .001$ ). Contrary to hypotheses, Extraversion was not associated with Social Functioning scores and Openness was not associated with physical functioning. Unexpectedly, Openness was associated with worse Social Functioning scores. Higher Conscientiousness was associated with higher SF-36 Role Physical scores, and with freedom from any IADL impairment, as hypothesized, but it was not associated with SF-36 Physical Functioning scores.

Exploratory analyses revealed no robust evidence of multiplicative interactions between personality traits and education, or between personality and age. However, Openness moderated the effect of medical burden on IADL impairment severity ( $z = -3.50, p < .001$ ), such that the effect of medical burden on severity of IADL impairment was attenuated at higher levels of Openness. Education was independently associated with nearly every HRQOL outcome, save for Role Emotional scores and the presence of IADL impairment, and major depression was associated with nearly every outcome except freedom from IADL or PSMS impairment or PSMS impairment severity. Finally, analyses excluding individuals with major depression resulted in no substantial differences in findings.

### DISCUSSION

We designed this study to examine the effects of personality traits and education on HRQOL in older primary care patients, above and beyond medical burden. Although our findings were generally consistent with our hypotheses, there were two notable exceptions (Openness and physical function; Extraversion and social function), an unexpected finding (Openness and social function), and an interesting exploratory finding (Openness moderating illness burden effects on IADL impairment). Several aspects warrant comment.

Table 2. Study Variable Correlation Matrix

	Age	Education	Gender	MDD	CIRS	Neuroticism	Extraversion	Openness	Agreeableness	Conscientiousness	Social Function	Physical Function	Role Emotional	Role Physical	IADL	PSMS
Age																
Education	-.15**															
Gender	.12*	-.21***														
MDD	-.09	-.04	.03													
CIRS	.27***	.10***	.04	.11*												
Neuroticism	.01	-.25***	.23***	.36***	.21***											
Extraversion	-.02	.11*	-.07	-.28***	-.19***	-.53***										
Openness	-.12**	.43***	.02	.01	-.12*	-.16***	.19***									
Agreeableness	.07	.15***	.19***	-.19***	-.09*	-.37***	.28***	.07								
Conscientiousness	-.03	.03	-.05	-.19***	-.20***	-.45***	.47***	.03	.31***							
Social Function	-.07	.22***	-.13***	-.32***	-.35***	-.41***	.29***	.00	.18***	.26***						
Physical Function	-.26***	.25***	-.23***	-.22***	-.46***	-.31***	.23***	.11*	.07	.18***	.50***					
Role Emotional	-.14**	.21***	-.12**	-.26***	-.33***	-.47***	.26***	.17**	.22***	.18***	.44***	.36***				
Role Physical	-.20***	.20***	-.22***	-.19***	-.43***	-.33***	-.25***	.07	.13**	.28***	.60***	.62***	-.51***			
IADL impairment	.21***	.18***	.06	.27***	.36***	.29***	-.21***	-.09	-.15**	-.18***	-.37***	-.46***	-.30***	-.38***		
PSMS impairment	.25***	.21***	.21***	.16***	.42***	.28***	-.19***	-.09	-.01	-.14**	-.37***	-.59***	-.30***	-.45***	.62***	

Notes: IADL = instrumental activities of daily living; PSMS = physical self-maintenance scale; MDD = Major depressive disorder (current); CIRS = Cumulative Illness Rating Scale. MDD and gender are dummy coded (1 = female, major depressed) and biserical correlations with other variables.

\*p < .05; \*\*p < .01; \*\*\*p < .0001.

*Independent Effects of Neuroticism and Major Depression*

We replicated findings linking Neuroticism to role impairment arising from emotional problems and for decreased social function (Kempen et al., 1997; Kressin et al., 2000). We also demonstrated that these effects are independent of active major depressive disorder. Although Neuroticism is a risk factor for major depressive disorder (Kendler, Gatz, Gardner, & Petersen, 2006), points of distinction are important to keep in mind because each has unique associations with HRQOL.

First, the primary affective components of Axis I major depressive disorder involve either depressed mood or anhedonia, with possible guilt or worthlessness (American Psychiatric Association, 2000). By contrast, Neuroticism involves many different negative affects that tend to covary, including dysphoria or depression, anxiety, anger, shame, guilt, feelings of vulnerability, and self-consciousness (e.g., McCrae & Costa, 2003). Major depression's anhedonia component also signals the lack of positive affect rather than the presence of negative affect and may therefore correspond more closely to low Extraversion. In contrast to major depressive disorder, which is an episodic clinical syndrome with waxing and waning course, Neuroticism also represents a relatively stable disposition toward generalized negative affects. Major depression also typically involves vegetative and somatic symptoms, which are not considered a part of Neuroticism. Finally, Neuroticism is a personality dimension on which individuals may fall high, low, or anywhere in between, whereas major depressive disorder is a syndromic category that is either present or absent, depending on sufficient manifestation of signs and symptoms.

Rose's (1992) theorem may help clarify the independent effects of major depressive disorder and Neuroticism on HRQOL in the population. Rose's theorem states that risk factors with higher population prevalence but small effects exert a greater impact on public health than do risk factors with lower prevalence but large effects. In epidemiology, the statistical estimate of population-attributable risk (Gordis, 2004) expresses this idea by quantifying the degree to which an undesirable outcome could be reduced in the population if a risk factor for it were removed. A simple illustration may demonstrate this.

Our results indicated that a 1-SD increase in Neuroticism is associated with a 0.34-SD decrease in Role Emotional scores, whereas active major depression decreased Role Emotional Scores by about 0.55 SD. Whereas the prevalence of major depression in older adults is approximately 5% (Blazer, 2002), by definition nearly 16% of the population scores 1 SD above the mean on Neuroticism. Keeping in mind that the impact of a risk factor on an outcome in the population is a function of both the risk factor's population prevalence and the magnitude of its association with the outcome, one can use this information to construct a preliminary comparison of the population effects of high Neuroticism on the one hand and major depressive disorder on the other. An estimate of the amount of role impairment in the population that is attributable to elevated Neuroticism (i.e., 1 SD or more) is 0.0544 (e.g., 0.34-SD deficit in Role Emotional × 0.16 population prevalence = 0.0544), whereas an estimate for role impairment that is attributable to major depressive disorder is 0.0275 (e.g., 0.55-SD deficit in Role Emotional × 0.05 population prevalence = 0.0275). This

Table 3. Predictors of HRQOL Outcomes ( $N = 442$ )

Functional Outcome	Significant IV	$\beta$	$SE$	$p$	Effect Size
Social Functioning	Age	.002	.013	.882	
	Gender	-.056	.165	.735	
	<b>Education</b>	<b>.156</b>	<b>.042</b>	<b>&lt;.001</b>	<b>.191</b>
	<b>MDD</b>	<b>-1.57</b>	<b>.448</b>	<b>.001</b>	<b>-.826</b>
	<b>Illness burden</b>	<b>-.175</b>	<b>.029</b>	<b>&lt;.001</b>	<b>-.267</b>
	<b>Neuroticism</b>	<b>-.052</b>	<b>.015</b>	<b>&lt;.001</b>	<b>-.215</b>
	Extraversion	.019	.015	.202	
	<b>Openness</b>	<b>-.053</b>	<b>.016</b>	<b>.001</b>	<b>-.157</b>
	Agreeableness	.001	.0173	.941	
	Conscientiousness	.014	.015	.363	
Role Emotional	Age	-.012	.007	.082	
	Gender	-.044	.095	.645	
	Education	.022	.022	.323	
	<b>MDD</b>	<b>-.583</b>	<b>.258</b>	<b>.024</b>	<b>-.550</b>
	<b>Illness burden</b>	<b>-.073</b>	<b>.015</b>	<b>.000</b>	<b>-.198</b>
	<b>Neuroticism</b>	<b>-.046</b>	<b>.008</b>	<b>&lt;.001</b>	<b>-.336</b>
	Extraversion	-.01	.008	.243	
	Openness	.014	.008	.08	
	Agreeableness	.01	.01	.284	
	Conscientiousness	.014	.01	.126	
Role Physical	Age	-.021	.012	.065	
	<b>Gender</b>	<b>-.496</b>	<b>.153</b>	<b>.001</b>	<b>-.297</b>
	<b>Education</b>	<b>.077</b>	<b>.038</b>	<b>.042</b>	<b>.108</b>
	<b>MDD</b>	<b>-.64</b>	<b>.3</b>	<b>.033</b>	<b>-.385</b>
	<b>Illness burden</b>	<b>-.191</b>	<b>.024</b>	<b>&lt;.001</b>	<b>-.331</b>
	Neuroticism	-.019	.012	.1	
	Extraversion	.012	.014	.391	
	Openness	-.016	.013	.251	
	Agreeableness	.009	.016	.571	
	<b>Conscientiousness</b>	<b>.034</b>	<b>.015</b>	<b>.021</b>	<b>.120</b>
Physical Function	Age	-.109	.036	.003	-.132
	<b>Gender</b>	<b>-1.417</b>	<b>.466</b>	<b>.003</b>	<b>-.263</b>
	<b>Education</b>	<b>.348</b>	<b>.115</b>	<b>.003</b>	<b>.150</b>
	<b>MDD</b>	<b>-3.44</b>	<b>1.26</b>	<b>.007</b>	<b>-.638</b>
	<b>Illness burden</b>	<b>-.682</b>	<b>.075</b>	<b>&lt;.001</b>	<b>-.366</b>
	Neuroticism	-.068	.038	.075	
	Extraversion	.053	.042	.207	
	Openness	-.031	.044	.475	
	Agreeableness	-.046	.048	.335	
	Conscientiousness	.009	.043	.844	
Freedom from IADL impairment	<b>Age</b>	<b>-.085</b>	<b>.020</b>	<b>.000</b>	<b>.573</b>
	Gender	.093	.270	.729	
	<b>Education</b>	<b>.171</b>	<b>.059</b>	<b>.004</b>	<b>1.49</b>
	<b>MDD</b>	<b>-1.03</b>	<b>.591</b>	<b>.082</b>	
	<b>Illness burden</b>	<b>-.114</b>	<b>.043</b>	<b>.008</b>	<b>.719</b>
	Neuroticism	.029	.02	.159	
	Extraversion	.034	.024	.157	
	Openness	-.041	.024	.089	
	Agreeableness	.039	.028	.159	
	<b>Conscientiousness</b>	<b>.071</b>	<b>.025</b>	<b>.005</b>	<b>1.52</b>
IADL impairment severity	Age	-.104	.105	.138	
	Gender	-.104	.105	.323	
	<b>Education</b>	<b>-.046</b>	<b>.021</b>	<b>-.088</b>	<b>-.294</b>
	<b>MDD</b>	<b>.521</b>	<b>.135</b>	<b>&lt;.001</b>	<b>.551</b>
	<b>Illness burden</b>	<b>.102</b>	<b>.014</b>	<b>&lt;.001</b>	<b>.440</b>
	<b>Neuroticism</b>	<b>.022</b>	<b>.006</b>	<b>.001</b>	<b>.389</b>
	Extraversion	-.001	.009	.882	
	Openness	-.006	.009	.509	
	Agreeableness	-.002	.009	.852	
	Conscientiousness	.016	.009	.079	
Freedom from PSMS impairment	<b>Age</b>	<b>-.094</b>	<b>.025</b>	<b>&lt;.001</b>	<b>.540</b>
	<b>Gender</b>	<b>-.834</b>	<b>.336</b>	<b>.013</b>	<b>.434</b>
	Education	.059	.068	.384	
	<b>MDD</b>	<b>-1.51</b>	<b>1.06</b>	<b>-1.43</b>	
	<b>Illness burden</b>	<b>-.208</b>	<b>.058</b>	<b>&lt;.001</b>	<b>.548</b>

(Table 3 continues)

Table 3. Predictors of HRQOL Outcomes ( $N = 442$ ) (Continued)

Functional Outcome	Significant IV	$\beta$	SE	$p$	Effect Size
PSMS impairment severity	Neuroticism	-.016	.026	.534	
	Extraversion	.032	.028	.252	
	Openness	-.014	.028	.613	
	Agreeableness	-.028	.035	.423	
	Conscientiousness	.022	.03	.465	
	Age	.006	.007	.347	
	Gender	.127	.125	.309	
	<b>Education</b>	<b>-.058</b>	<b>.022</b>	<b>.009</b>	<b>-.459</b>
	MDD	.115	.175	.509	
	<b>Illness burden</b>	<b>.083</b>	<b>.015</b>	<b>&lt;.001</b>	<b>.668</b>
	<b>Neuroticism</b>	<b>.018</b>	<b>.007</b>	<b>.015</b>	<b>.605</b>
	Extraversion	-.004	.01	.662	
	Openness	.006	.01	.518	
	Agreeableness	.018	.012	.115	
Conscientiousness	.007	.009	.439		

Notes: HRQOL = health-related quality of life; IADL = instrumental activities of daily living; PSMS = physical self-maintenance scale; MDD = Major depressive disorder (current); SE = standard error; IV = independent variable.

SF-36 (Medical Outcomes Survey Short Form-36) raw scores are used; significant variables are set in boldface for ease of reading. Effect size for significant outcomes = standard deviation change in outcome associated with 1-SD increase in IV (or with being female or having active MDD) for Social Functioning, Role Emotional, Physical Functioning, and Role Physical subscale scores, and IADL-PSMS severity; Effect size = Odds ratio of being impairment free associated with a 1-SD unit increase in predictor (or being female or having active MDD) for "IADL-PSMS impairment free."

comparison suggests that, on a population basis, high Neuroticism may lead to nearly twice the role impairment of active major depressive disorder ( $0.0544/0.0275 = 1.98$ ). This is probably a conservative estimate because it disregards the continued increase in magnitude of role impairment that would be expected as Neuroticism increases above 1 SD.

Neuroticism was also associated with the severity of both IADL and PSMS limitations, with 1-SD difference approaching the effects of active major depressive disorder. People higher in Neuroticism may have greater IADL and PSMS impairment because emotional lability and feelings of vulnerability lead them to neglect the regular performance of activities of daily living and self-maintenance. Self-consciousness, shame, and vulnerability may decrease tolerance for failure, and therefore may lead to the neglect of basic physical activities that were once taken for granted. Our exclusion of individuals with major depression did not substantially alter the parameter estimates for Neuroticism, underscoring the apparently independent implications of these two constructs for HRQOL and functioning in older adults.

### Conscientiousness

Higher Conscientiousness was associated with better role physical functioning. Conscientious individuals may be more devoted to maintaining their roles, hobbies, or daily routine, and they may make every effort to continue these pursuits throughout the life span. Conscientious individuals were also more likely to be free from limitations in IADLs. More orderly, organized, and fastidious older adults may have developed stronger habits and routines for performing everyday tasks such as cooking and cleaning.

Although major depressive disorder had an effect on physical function, possibly because of its anergic components, individual differences in Conscientiousness do not appear strongly related to physical functioning when objective disease burden is controlled. For some aspects of physical health, the effects of age-related illness accumulation may override the effects of

personality characteristics (Scheier & Bridges, 1995). The SF-36 measure of physical function tapped gross ambulatory activities such as walking a block or climbing stairs, which may be primarily determined by illness burden and other factors dictating physical capacity. Although no personality traits were robustly associated with these major physical tasks, personality effects on IADL and PSMS suggest traits may be involved in everyday household and self-care activities.

### Extraversion

Extraversion was not associated with social functioning. Our hypotheses were premised on the fact that extraverts are intrinsically sociable (McCrae & Costa, 1999) and employ characteristic adaptations such as positive thinking and seeking social support (McCrae & Costa, 1989), as well as on empirical associations between Extraversion and social network size in older adults (Lang et al., 1998). However, when one considers the specific instance of decreases in social functioning as a consequence of health problems, Extraversion was not uniquely associated with such health-related social changes. Extraversion, Neuroticism, and major depression showed some overlap, despite the theoretical orthogonality of Extraversion and Neuroticism. The low positive affect of Extraversion, high negative affect of Neuroticism, and depressed mood—lack of pleasure and potential social withdrawal of major depression may overwhelm or confound theoretically expected Extraversion associations with social function.

### Openness

Openness was not associated with SF-36 physical function, contrary to hypotheses and the finding in our previous study (Duberstein et al., 2003) of a sample that was 4 to 5 years younger on average and slightly less medically burdened than the sample used here. However, a robust moderating effect for Openness emerged in exploratory interaction analyses: Higher Openness attenuated the effects of illness burden upon the severity of IADL impairment. Individuals who are more open

might be able to problem solve the daily activity limitations imposed by medical burden to a greater degree because they tend to think creatively (McCrae, 1987). Openness is associated with generally better coping, including the use of humor (McCrae & Costa, 1986), which might maintain one's spirit in the face of mounting health burdens, resulting in motivation to continue performing IADLs. The moderating effect of Openness in this study was not dissimilar in general form and function to its moderation of the effects of age on physical function in our prior work (Duberstein et al.). In both cases, higher Openness appears to diminish functional limitations imposed by age-related factors (i.e., increasing medical burden, or age itself). Such findings raise the possibility that traits may govern the strength of association between previously established risks and outcomes in the health and aging literature. These possibilities warrant further exploration.

Individuals higher in Openness also reported worse social functioning arising from emotional or physical health problems. The Social Functioning scale reflected cutbacks on the amount of time spent with others as a result of health problems. One reason for this unexpected result might be that individuals higher in Openness tend to enjoy intellectual and aesthetic hobbies that often can be pursued in solitude. When health problems threaten to impinge on the amount of time they can spend socializing, it may be relatively easier for them to withdraw into solitary intellectual and artistic pursuits. Another possibility is that because less open individuals tend to cope more through faith (McCrae & Costa, 1986), they have social networks that are church based and perhaps more stable because they revolve around scheduled church activities. Such possibilities are intriguing and warrant further investigation.

### *Agreeableness*

We hypothesized and observed no relationships between Agreeableness and HRQOL. The amiability and tendencies toward interpersonal cohesiveness associated with Agreeableness do not appear to confer either an advantage or disadvantage after other traits, education, and covariates were taken into account. Agreeableness overlapped slightly with Neuroticism and Extraversion, raising the possibility that unique associations were overpowered by the influence of these affective-based (and in the case of Extraversion, also socially based) dispositions. Extraversion and Agreeableness have been considered in the context of the dominance and love axes of Leary's (1957) interpersonal circumplex (McCrae & Costa, 1989), and although both FFM traits are associated with love, Agreeableness involves lower dominance and Extraversion higher dominance. This distinction appeared largely irrelevant for these traits' associations with socially based aspects of HRQOL, perhaps because of the overpowering influence of Neuroticism or other determinants such as illness burden.

### *Education*

Across all outcomes except the Role Emotional scale and the presence or absence of any IADL impairments, individuals with higher levels of education reported better HRQOL. As an index of socioeconomic position, higher levels of education provide entrée to higher status occupations with greater pay. The near-ubiquity of education effects point toward a previously

identified socioeconomic gradient (Breeze et al., 2004; Kempen et al., 1997), independent of personological variability, in the HRQOL of older adults. The joint effects of such societal inequalities and individual dispositional differences appeared additive rather multiplicative in this sample. In future work, researchers may wish to consider the effects of both socioeconomic and personality factors, as our results suggest that each are independently associated with HRQOL. Although Openness and education may correlate, for instance, each may bear unique associations to aspects of everyday life quality. Openness may also be associated with other socioeconomic indicators, including choice of occupation and income. Openness may affect choice of peer group, a factor that seems potentially important given increasing attention to "social capital"—or access to powerful and influential others—as a critical aspect of socioeconomic status (Berkman & Kawachi, 2001). Considering either personality or socioeconomic factors without sufficient attention to the other paints an incomplete picture, as personality traits and socioeconomic forces operate in conjunction during everyday life. Future work should better explicate points of confluence between personality and socioeconomic forces.

### *Conclusions*

Our descriptive study suggests that personality traits and education appear to be uniquely associated with HRQOL outcomes, beyond medical burden and demographics. Results must be qualified by the current cross-sectional design, however. Personality traits evidence increasing stability across the life course, but their stability is far from absolute (Roberts & DelVecchio, 2000), so there is the possibility that HRQOL affects traits cannot be ruled out in cross-sectional analyses. Furthermore, although we used interviewer-rated and self-reported measures of physical function, physical tests of functioning that tapped maximum performance were not conducted. The current sample was also different from the broader study sample (more educated), which in turn was different from local demographics (more Caucasians). Information on previous diseases, social network size, or history was not available. Interrater reliability data on the CIRS was unavailable; only one physician completed all CIRS scores. Any rating biases would have affected all individuals, rather than only specific subsets, however. Cronbach's alpha estimates of internal consistency for the Social Functioning, Role Emotional, and PSMS scales were smaller than what has been reported as typical (e.g., Ware et al., 1993), but reliability is a greater concern among predictors than criteria (Nunnally & Bernstein, 1994). Study outcomes were also intercorrelated (−.29 for Role Emotional and IADL scales to .62 for IADL and PSMS measures), indicating 9% to 36% shared variance in interrelated dimensions of HRQOL. Study strengths involved multimethod assessments of HRQOL across these interrelated domains and a rigorous measure of medical burden completed by an experienced physician to protect against confounds in personality-HRQOL–functioning relationships caused by objective illness.

As consistent evidence for certain trait risk factors accumulates, work on characteristic adaptations explaining personality risk factor–outcome associations is cautiously warranted. Such adaptations may involve coping, defensive, or motivational



processes, as well as social-cognitive processes such as risk evaluation, judgment and decision making, self-efficacy, and other social-cognitive functions defining “process” or “dynamic” elements of personality (see, e.g., Mischel & Shoda, 1999). Though we did not investigate the possibility, there may also be physiological components of personality traits that influence HRQOL. Research on the basic processes linking traits to HRQOL could help clarify points of intervention in older individuals whose enduring dispositions confer risk for worse outcomes. So-called mechanism-based research must be undertaken with caution, however. Without extensive evidence for the regularity of trait outcome associations—including under what circumstances, or in what populations they reliably occur—proposed mechanisms may represent pseudospecific causal channels that hold only under certain circumstances and represent only a small portion of the dynamic and diffuse causal processes by which traits are linked to outcomes. Thus, epidemiological work studying and clarifying trait risk factor–health outcome associations remains critically important.

Given the public health, societal, and economic significance of HRQOL and decreased functioning, further research is needed to determine whether personality assessment in medical practice can enhance clinical care in a cost-effective fashion. Some medical practices already screen for depression and other behavioral risk factors. Brief assessment of phenotypic personality traits would seem feasible with the right instruments and format. Such assessment could furnish health care providers with a descriptive personality profile useful in understanding and approaching a patient, as well as individually tailored information based on the accumulating empirical literature on personality and health. The collation and integration of personality information and output of individualized description and recommendations is already a routine part of many existing personality instruments. Sometimes automated software accomplishes this task, under the oversight of a trained professional. Personality assessment is already both a standard aspect of clinical care in mental health as well as a heavily used tool for selection and personnel decisions in industrial–organizational settings.

From a societal and population perspective, work on socioeconomic gradients in age-related health outcomes might also benefit from considering the role of individual personality traits and processes. Epidemiological studies on HRQOL and other potentially dispositionally influenced health outcomes in older individuals commonly involve some assessment of socioeconomic indicators, but they should also consider measuring personality. These initiatives would represent promising steps toward integrating the person into public health and medical research and practice, an endeavor sure to pay dividends in a world where individuals differ in myriad ways beyond biomedical and socioeconomic dimensions.

## CORRESPONDENCE

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