Published in final edited form as:

Psychosom Med. 2008 July ; 70(6): 621–627.

Personality predictors of longevity: Activity, Emotional Stability, and Conscientiousness

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Abstract

Objective—To examine the association between personality traits and longevity.

Methods—Using the Guilford-Zimmerman Temperament Survey, personality traits were assessed in 2359 participants (38% women; age: 17 to 98 years, $M = 50$) from the Baltimore Longitudinal Study of Aging (BLSA), starting in 1958. Over the duration of the study, 943 (40%) participants died, on average 18 years after their personality assessment. The association of each trait with longevity was examined by Cox regression controlling for demographic variables.

Results—In preliminary analyses among the deceased, those who scored one SD above the mean on General Activity (a facet of Extraversion), Emotional Stability (low Neuroticism), or Conscientiousness lived on average two to three years longer than those scoring one SD below the mean. Survival analyses on the full sample confirmed the association of General Activity, Emotional Stability, and Conscientiousness with lower risk of death, such that every one SD increase was related to about 13%, 15%, and 27% risk reduction, respectively. The association of personality traits with longevity was largely independent from the influence of smoking and obesity. Personality predictors of longevity did not differ by sex, except for Ascendancy (a facet of Extraversion). Emotional Stability was a significant predictor when the analyses were limited to deaths due to cardiovascular disease, with comparable effect sizes for General Activity and Conscientiousness.

Conclusions—In a large sample of generally healthy individuals followed for almost five decades, longevity was associated with being conscientious, emotionally stable, and active.

Keywords

Neuroticism; Activity; health; mortality; longevity; personality; smoking; obesity

Introduction

Personality traits are dimensions of individual differences in cognitive, emotional, and behavioral patterns hypothesized to influence health and longevity (1–4). In part, this association is thought to be based on the impact of personality on health risk behaviors, such as those contributing to obesity, sexually transmitted disease, or cigarette smoking (1,5–8), which are leading causes of disability and death (9,10). In addition, personality traits are related to psychopathology (11–13), coping mechanisms (14), adherence to medical treatment (15, 16), well-being (17), as well as interpersonal relations and social integration (18), which in turn are all related to health outcomes (19,20).

Consistent with these associations, several studies provide empirical evidence for a connection between specific Five-Factor Model (FFM, 21) traits and longevity. The FFM is a comprehensive and widely replicated (22) model of personality structure that describes personality along five broad dimensions – Neuroticism, Extraversion, Openness to Experience, Agreeableness, Conscientiousness – which are each comprised of several individual facets (23). Within the FFM framework, the literature can be summarized by noting that most studies have found an association between high scores on Neuroticism and increased rates of mortality (24–29), but others have found no such effect (30,31), or even the opposite pattern (32). Most studies have found that Extraversion does not predict longevity (25,28,29,31,32), but there are some exceptions (26,27). On a more specific level, traits related to the positive emotion component of Extraversion (e.g., optimism and cheerfulness) have shown mixed associations with longevity (33–35). Generally, there appears to be no association between Openness to Experience and longevity (25,26,32), but on a more specific level, higher scores on the facets Openness to Feelings and Openness to Actions were found to predict survival in patients with coronary artery disease (36). The evidence is also mixed for Agreeableness (25,26,30,32,37), but fairly consistent in suggesting that high Conscientiousness is linked to lower mortality risk (25,26,31–33). The mixed findings in the literature are in part explained by differences in personality measures, differences in analytic choices, differences in socioeconomic and health status across samples, and by inadequate statistical power due to small samples, short follow-up periods, and limited proportion of deaths.

The present study examines the association between longevity and personality as measured by ten scales of the Guilford-Zimmerman Temperament Survey (GZTS, 38). To relate the GZTS scales to the broader literature, each scale can be interpreted in terms of higher- and lower-order traits of the FFM. Table 1 reproduces the correlations reported by Terracciano et al. (39) between the ten GZTS scales and a measure of the FFM, the NEO-PI-R (23). As seen in the table, GZTS scales mainly cover the Neuroticism and Extraversion domains, and offer the opportunity to examine whether certain facets of these two domains are associated differently with longevity. Within the Extraversion domain, of particular interest is whether being active, assertive (Ascendancy), or sociable are differently associated with longevity. Given the consistent results in the literature that support a role of Conscientiousness, we also estimated the Conscientiousness factor from the average of General Activity and Restraint, the two GZTS scales most strongly related to Conscientiousness. This composite correlates substantially with the NEO-PI-R Conscientiousness factor ($r = .60$) and its facets, and has discriminant correlations close to zero with the other four factors, including Extraversion (see Table 1).

A major strength of the present study lies in the large sample of participants from the Baltimore Longitudinal Study of Aging (BLSA, 40) who were followed for almost five decades. With notable exceptions (e.g., 29, 31), previous studies were largely based on samples in poor health, followed for short intervals, with personality data obtained a few years before death (e.g., 25, 32, 36). By contrast, the BLSA participants are generally healthy and personality data were collected during adulthood, decades before death, so disease related processes or terminal declines were unlikely to affect the personality assessment. Further, although the sample is generally healthy, we examined whether the effects of the two major leading causes of preventable deaths (9), smoking and obesity, modify the associations of personality traits with risk of death. Finally, we examined whether personality predictors of longevity differ by sex, and whether the predictors for the sample as a whole differ from the predictors for the single most frequent cause of death, cardiovascular disease (41).

Method

Participants

Participants were 2,359 community-dwelling volunteers drawn from the BLSA, an ongoing multidisciplinary study of aging, who had completed the GZTS survey. Age at first personality assessment ranged from 17 to 98 years ($M = 50.1$, $SD = 16.9$). BLSA participants are generally healthy and highly educated ($M = 16.2$ years of education, $SD = 2.8$); the present sample is 85% European-American, 11% African-American, and 4% other self-identified ethnic groups. There were 1,472 men and 887 women. Personality (GZTS), smoking, and anthropometrical measures were collected during the same regularly scheduled visit, for men starting in October 1958, and for women in January 1978, and continuing until May 2002 (39).

Measure: Personality

The GZTS (38) is a factor-based personality questionnaire consisting of 300 items, 30 for each of the 10 GZTS scales. For each item, participants choose between 'yes,' 'no,' and '?.' Any scale with more than three '?' responses was considered missing, a procedure suggested by Guilford and Zimmerman (42). Therefore, small variations in the number of participants will be seen in the analyses for different scales. Raw scores range from 0 to 30.

The GZTS scales are valid and reliable (38). Internal consistency coefficients range from .75 to .87 ($Mdn = .80$)(38). In the BLSA, the structural stability of the GZTS has been shown across age, cohort, and time-of-measurement (43). Retest stability coefficients for men ranged from .64 to .78 ($Mdn = .68$) over an average interval of 16 years, and retest coefficients for women ranged from .68 to .78 over an average of interval of 11 years ($Mdn = .71$)(44).

Measure: Smoking and obesity

Cigarette smoking was determined by asking participants whether they had ever smoked more than 5 packs of cigarettes (100 cigarettes) during their entire life so far and the average number of cigarettes smoked a day. Individuals who never smoked or smoked less than the threshold were coded as never smokers (0; $n = 1133$, 48%), those who smoked once in awhile, not every day, or less than 10 cigarettes a day were classified as occasional/light smokers (1, $n = 427$, 18%), and those who smoked more than 10 cigarettes a day were classified as medium/heavy smokers (2, $n = 764$, 32%). We classified as missing 35 individuals who responded "don't know, don't remember" the average number of cigarettes smoked a day during their time as smokers.

Height (m) and weight (kg) were measured with a clinical calibrated scale. Body Mass Index ($BMI = kg/m^2$) was computed from those measures, and individuals were categorized as either normal (0, $BMI < 25$; $n = 1292$, 55%), overweight (1, $BMI = 25-30$; $n = 838$, 36%), or obese (2, $BMI > 30$; $n = 222$, 9%). The median date of visit was 1979, which in part explains the relatively low prevalence of obesity in this American sample.

Vital status

Participants' vital status was determined by telephone follow-up, correspondence, and searches of the National Death Index up to 13 July 2007, the censoring date. By the censoring date, 943 (40%) participants were deceased. Compared to those still alive ($n = 1416$), the deceased were older at time of first assessment ($M = 41.5$ years vs. $M = 63.0$, $p < .001$), less likely to be women (49.9% vs. 19.1%, $p < .001$), and more likely to be European American (77.0% vs. 96.9%, $p < .001$), but there were no differences in education. The time interval between personality assessment and death ranged from 0 to 46 years ($M = 18$; $SD = 11$) and the interval between personality assessment and censoring date ranged from 5 to 48 years ($M = 22$; $SD = 12$). Less

than 1% ($n = 9$) of participants died within one year from personality assessment. Less than 4% ($n = 90$) died within five years from personality assessment.

Cause of death was determined by a consensus of three physicians who reviewed death certificates, medical records, correspondences, and other available material. About 35% died from cardiovascular disease, 20% from cancer, and 3% by accident. The remainder died of other, not yet coded, or unknown causes.

Data analysis

The analyses were conducted using SPSS 13.0. Basic descriptive statistics were performed using correlation or ANOVA. The main analyses consisted of a series of Cox's Proportional Hazard Models (45) to examine the relation between personality traits and the risk of death. Time to event was defined as the time (in years) from the personality assessment to death or censoring date. Age at time of personality assessment, sex, education, and ethnicity (white, other, black) were tested as covariates and retained in the models if they emerged as significant predictors. Each personality scale was modeled separately, but in an additional model we included all significant personality predictors to examine whether the associations of personality traits with longevity were independent. Smoking and BMI were also tested in additional models to examine whether these risk factors mediate the association of personality traits with longevity.

The proportional hazards assumption for the GZTS scales was evaluated by testing the interaction of time by trait. The interactions were not significant for most scales, supporting the proportionality assumption, except for General Activity and the estimated Conscientiousness. These analyses suggested that the risk of death was not proportional across different levels of General Activity and Conscientiousness, a problem usually addressed by stratifying the non-proportional predictor (32,46). So, in addition to models that used the continuous scores, we tested models in which General Activity and Conscientiousness were trichotomized, using cut-offs at 1 *SD* below and above the mean. Because women were enrolled in the study about 20 years later, additional analyses compared the pattern of associations for women and men. To statistically test for sex differences in mortality risk, we added a sex by trait interaction term in a second step of the Cox's regression model. Additional analyses examined personality predictors of mortality when limiting the sample to deaths due to cardiovascular disease, and when individuals assessed within five years from the outcome were excluded.

We performed a large number of statistical tests, which raises the problem of evaluating statistical significance when performing multiple comparisons. None of the effects we report below would be likely to survive the overly stringent Bonferroni correction. However, questions about the number of tests to correct for, whether the GZTS scales are truly independent, and whether the Bonferroni correction is appropriate, do not have clear-cut answers (47). Consistent with most previous studies (e.g., 29, 31), we therefore opt to focus on the effect sizes, comparing the results we obtained with those reported in the literature.

Results

In preliminary analyses among the deceased, we examined whether personality traits were associated with longevity (age at time of death) after controlling for age at time of assessment, sex, education, and ethnicity. Partial correlations indicate that individuals with higher scores on General Activity ($r = .07$; $p < .05$), Emotional Stability ($r = .08$; $p < .05$), Personal Relations ($r = .08$; $p < .05$), and Conscientiousness ($r = .08$; $p < .05$) lived longer. To further evaluate the effect of personality traits on longevity, we used ANCOVA analyses to estimate marginal means after controlling for demographic variables. As shown in Figure 1, individuals scoring

one *SD* above the mean on General Activity, Emotional Stability, or Conscientiousness lived on average two to three years longer than individuals scoring one *SD* below the mean. For Personal Relations the effects were weaker. With the exception of Emotional stability, there were little differences in longevity between the groups scoring average and low on these scales.

Using Cox's Proportional Hazard Model on the full sample we tested the association of each personality scale with mortality risk while controlling for demographic characteristics. Being older and male was associated with increased risk of death, but ethnicity and education were not significant predictors of mortality and were excluded from the final models. The hazard ratios associated with each personality scale are reported in Table 2. High levels of General Activity, Emotional Stability (low Neuroticism), and Conscientiousness were associated with lower mortality risk, such that every one *SD* increase was related to about 13%, 15%, and 27% risk reduction, respectively. A Cox regression model, using the forward stepwise (Wald) enter criteria, tested simultaneously the above three significant predictors. The results indicate that Conscientiousness (HR = 0.976, 95% CI = 0.957–0.996) and Emotional Stability (HR = 0.987, 95% CI = 0.975–0.998) are independent predictors of mortality. General Activity did not contribute significantly to this model, which is not surprising given that Conscientiousness was derived from the mean of General Activity and Restraint.

Given that preliminary analyses suggested that the risk of death was not distributed proportionally across low, average, and high scores of General Activity and Conscientiousness, we tested models in which the two scales were trichotomized (32,46). For General Activity, there were no significant differences in risk between participants with average as compared to low scores (HR = 0.916, 95% CI = 0.779–1.077), but the most active participants had about 23% lower risk of dying during the course of the study as compared to the least active participants (HR = 0.771, 95% CI = 0.614–0.967). Similarly, a model in which Conscientiousness was trichotomized indicated that there were no differences between average and low scorers (HR = 0.899, 95% CI = 0.757–1.067), but the most conscientious participants had about a 26% lower risk of dying during the course of the study as compared to the least active participants (HR = 0.738, 95% CI = 0.590–0.923).

Smoking and obesity

A model that included the two leading causes of preventable deaths, along with demographic covariates, indicated that medium/heavy cigarette smoking (HR = 1.545, 95% CI = 1.331–1.794) and obesity (BMI > 30: HR = 1.558, 95% CI = 1.204–2.014) were associated with higher risk of death. Occasional/light smokers were not at greater risk than never smokers (HR = 1.050, 95% CI = 0.878–1.255). Overweight (BMI = 25 to 30) individuals were not at greater risk of death compared to individuals with normal weight (HR = 1.106, 95% CI = 0.964–1.268). Additional analyses examined whether the associations of personality traits were mediated by smoking and obesity. Including these two risk factors, along with demographic covariates, had little effect on the risk associated with General Activity (HR = 0.987, 95% CI = 0.976–0.998) and Emotional Stability (HR = 0.985, 95% CI = 0.973–0.996), and slightly reduced the effect of Conscientiousness (HR = 0.978, 95% CI = 0.959–0.998).

Sex differences?

To examine sex differences in the association of personality traits with longevity, the sex by trait interactions were tested. For most scales we found no evidence of interaction effects. However, the analyses revealed a significant interaction effect of sex with Ascendancy (HR = 0.964, 95% CI = 0.933–0.996), such that higher scores on Ascendancy were associated with lower risk of death among women but not among men. When the analyses were conducted on men and women separately, Emotional Stability (HR = 0.986, 95% CI = 0.974–0.998) and Conscientiousness (HR = 0.975, 95% CI = 0.954–0.996) were significant only in the male

sample, but the effect sizes were essentially the same for the smaller female sample (HR = 0.982, 95% CI = 0.955–1.009 and HR = 0.966, 95% CI = 0.921–1.012, respectively). Similarly, on General Activity, men (HR = 0.989, 95% CI = 0.978–1.001) and women (HR = 0.976, 95% CI = 0.952–1.001) showed consistent effects.

Cause specific mortality (cardiovascular disease)

Additional analyses examined the association of personality traits with cause-specific mortality. Death due to cardiovascular diseases (stroke, vascular, coronary and non-coronary heart disease) was confirmed in 321 cases. Individuals that died of other, unknown, or not yet classified causes of death were excluded from the analyses. We found trends for General Activity (HR = 0.985, 95% CI = 0.967–1.003) and Conscientiousness (HR = 0.977, 95% CI = 0.944–1.011) and a significant association for Emotional Stability (HR = 0.979, 95% CI = 0.960–0.999) with risk of death due to cardiovascular diseases. These associations became slightly weaker when cigarette smoking and obesity were entered in the analyses, but the effect of Emotional Stability remained significant. Given the substantial overlap, it is not surprising to find similar personality predictors of mortality due to all-cause mortality and cardiovascular disease. However, Emotional Stability is the most salient personality predictor of mortality due to cardiovascular disease.

Terminal decline?

Although rank-order stability of personality traits is high in adulthood (44), it is of interest to address the possibility that personality assessment was influenced by terminal decline or other conditions associated with incipient death. We repeated the main analyses on a subsample with at least five years interval between assessment and death or censoring date ($n = 2269$). Excluding the 90 individuals with less than five years between assessment and outcome, the results remained essentially the same, with significant effects for General Activity (HR = 0.989, 95% CI = 0.978–0.999), Emotional Stability (HR = 0.984, 95% CI = 0.972–0.996), and Conscientiousness (HR = 0.976, 95% CI = 0.957–0.996), and a trend for Objectivity (HR = 0.987; 95% CI = 0.974–1.002).

Discussion

In a large sample followed for almost five decades, we found that high levels of Activity (a facet of Extraversion), Emotional stability (or low Neuroticism), and Conscientiousness were associated with longer life. These effects are substantially independent from those of two major health risk factors, cigarette smoking and obesity. Among the deceased, a weaker association with longevity was also found for Personal Relations, a trait related to low Neuroticism and Trust (a facet of Agreeableness; see also 48). Among women, higher scores on Ascendancy were associated with lower risk of death. These results contribute to the literature because of the large sample size, as well as the large number of deaths, the long duration of the study, and the high data quality. However, the conclusions from this study are limited by the use of a personality questionnaire that does not assess all five major personality factors and by the use of a non-representative sample. The BLSA participants are particularly educated and healthy, with life expectancies longer than the general population (see Figure 1), a feature that is common to other long-running longitudinal studies (e.g., Terman study, 33). Despite these possible limitations, our results are consistent with expectations and with some previous studies.

The Conscientiousness finding is consistent with the literature on personality predictors of mortality (25,26,32,33), and also with a large body of evidence suggesting that conscientious people avoid health risk behaviors and engage in a wide range of health-promoting activities (1,7,31,49–51). Conscientious people tend to be more informed and are more resourceful,

disciplined, and organized (23). They are less likely to smoke or abuse drugs (5) and more likely to exercise and control weight (8,52), which have large impact on mortality risk (10). In this study, smoking and obesity lead to a reduction in the effect of Conscientiousness, but these two risk factors were not crucial mediators. Conscientious people are also more attentive to health protective practices (6) and more able to care for themselves and adhere to medical regimens (15,53). More generally, conscientious people avoid hazardous situations and are more resilient in face of adversity (54).

Although the literature has been mixed on the links between Neuroticism and longevity, some of the largest studies have found high Neuroticism associated with greater risk of death (27–29). This association is also consistent with evidence that a general tendency to experience negative emotions, such as anxiety, anger, or depression, is associated with poor mental health (11,12), poor quality of life (17), and more health risk behavior (5). Furthermore, Neuroticism has been linked to higher risk of disease (19,55), and poor adherence to prescribed medical regimens and recovery from disease (15,55–57), although the links with physical health are in some cases ambiguous. Individuals high on Neuroticism tend to report more somatic complaints (58), which are not always substantiated by objective measure of medical status. As reported in Table 1, Emotional Stability is most strongly associated with the Depression facet of the Neuroticism domain. Clinical depression and depression symptoms have been repeatedly associated with cardiac and all cause mortality (41,59–61). Objectivity, the other GZTS scale associated with Neuroticism and in particular with the Self-Consciousness facet of the NEO-PI-R, showed a weaker effect that did not reach statistical significance: Future research should differentiate among the facets of N as predictors of mortality.

Extraversion is a complex factor composed of distinct facets such as sociability, assertiveness, activity, and positive emotions, which follow different maturational patterns (39,62) and show different patterns of sex differences (63). We found them to have distinct associations with longevity. Given that social engagement and social activity have been found to be associated with lower risk of death (64,65), it could be expected that the Sociability scale would be associated with longevity. However, the present BLSA study and the Terman study (33) found no such association. This null finding suggests that involvement in social networks might have health benefits independent from the individual's intrinsic disposition. Ascendancy, the assertive or dominant component of Extraversion, was found to be associated with lower risk of death among women. Most important, we found that active, energetic, fast-paced individuals live longer, which is consistent with evidence that physical activity reduces the risk of all-cause mortality (66–68). The effect sizes we observed – with active individuals living about two and half years longer – is in line with evidence from direct measures of physical activity or exercise (66). These findings highlight the importance of assessing both broad and specific facets of personality to obtain a more comprehensive evaluation. Examining specific aspects of personality, such as the FFM facets, might also reduce inconsistency across studies that emerge from the use of broader constructs.

The mechanisms through which personality traits influence health and longevity are surely complex. We have often referred to behaviors that mediate the health benefits of being conscientious, emotionally stable, and active, but the analyses that included smoking and obesity suggest that health risk behaviors are unlikely to fully explain the personality-longevity association. Personality traits might also be linked to longevity through direct and indirect emotional and cognitive influences on physiological systems, such as immunity. It is also possible that personality traits are linked to socio-demographic, life-pathway, genetic or other biological factors that are the underlying cause of life expectancy differences. Whatever the causal mechanisms, the finding that personality traits are linked to longevity has clinical implications, from a better understanding of individual differences in longevity to the tailoring of prevention and treatment plans to the needs of individual patients.

Acknowledgements

This research was supported by the Intramural Research Program of the NIH, National Institute on Aging. We thank Robert R. McCrae for comments on an earlier version of this manuscript, in particular the idea of combining General Activity and Restraint to obtain a measure of Conscientiousness.

Glossary

SD

Standard Deviation

M

Mean

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Figure 1.

Differences in longevity between groups scoring one SD above and below the mean on four personality traits.

Note. The bars depict estimated marginal means controlling for demographic variables. Error bars are standard errors.

Table 1
Correlations between GZTS Scales and NEO-PI-R Factors and Most Strongly Related Facet.

GZTS scale	NEO-PI-R Factor					NEO-PI-R Facet	r
	N	E	O	A	C		
General Activity	-.11	.51	.08	-.28	.37	E4: Activity	.75
Restraint	.11	-.48	-.01	.15	.39	C6: Deliberation	.46
Ascendancy	-.39	.47	.26	-.33	.22	E3: Assertiveness	.69
Sociability	-.35	.69	.19	.01	.03	E2: Gregariousness	.70
Emotional Stability	-.74	.11	-.08	.00	.21	N3: Depression	-.75
Objectivity	-.63	.07	.05	.07	.00	N4: Self-Consciousness	-.53
Friendliness	-.21	-.15	-.01	.47	-.22	A4: Compliance	.51
Thoughtfulness	.16	-.08	.46	.05	.15	O5: Ideas	.47
Personal Relations	-.31	.07	.04	.14	-.03	A1: Trust	.46
Masculinity	-.41	-.11	-.07	-.33	-.06	N1: Anxiety	-.33
Conscientiousness*	.01	.01	.05	-.10	.60	C4: Achievement Striving	.54

Note. N = 757 to 854 from a BLSA sub-sample of 900 individuals who were administered both tests during the same visit. Last two columns report the specific NEO-PI-R facet with which each GZTS scale is most highly correlated. Correlations over ± .40 are given in bold. GZTS = Guilford-Zimmerman Temperament Survey; NEO-PI-R = Revised NEO Personality Inventory; N = Neuroticism; E = Extraversion; O = Openness to Experience; A = Agreeableness; C = Conscientiousness.

* Conscientiousness was estimated using the mean of General Activity and Restraint. Table adapted from Terracciano et al. (39)

Table 2

Personality predictors of all-cause mortality

<i>GZTS scales</i>	<i>N</i>	HR	HR 95% C.I.
General Activity	2279	0.987	(0.977 – 0.998)*
Restraint	2276	0.990	(0.974 – 1.006)
Ascendancy	2269	0.999	(0.987 – 1.011)
Sociability	2270	1.005	(0.994 – 1.016)
Emotional Stability	2306	0.985	(0.974 – 0.996)*
Objectivity	2253	0.991	(0.978 – 1.004)
Friendliness	2280	0.995	(0.982 – 1.007)
Thoughtfulness	2308	1.003	(0.990 – 1.017)
Personal Relations	2166	0.994	(0.980 – 1.007)
Masculinity	2294	0.992	(0.975 – 1.010)
Conscientiousness*	2236	0.973	(0.954 – 0.992)*

Note. For all personality scales tested, age and sex were significant covariates. HR = Hazard ratio.

* Conscientiousness was estimated using the mean of General Activity and Restraint.