A Questionnaire-Wide Association Study of Personality and Mortality: The Vietnam Experience Study

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Abstract

Objective—We examined the association between the Minnesota Multiphasic Personality Inventory (MMPI) and all-cause mortality in 4462 middle-aged Vietnam-era veterans.

Methods—We split the study population into half samples. In each half, we used proportional hazards (Cox) regression to test the 550 MMPI items' associations with mortality over 15 years. In all participants, we subjected significant ($p < .01$) items in both halves to principal-components analysis (PCA). We used Cox regression to test whether these components predicted mortality when controlling for other predictors (demographics, cognitive ability, health behaviors, mental/physical health).

Results—Eighty-nine items were associated with mortality in both half-samples. PCA revealed Neuroticism/Negative Affectivity, Somatic Complaints, Psychotic/Paranoia, and Antisocial components, and a higher-order component, Personal Disturbance. Individually, Neuroticism/Negative Affectivity ($HR = 1.55$, 95% $CI = 1.39,1.72$), Somatic Complaints ($HR = 1.66$; 95% $CI = 1.52,1.80$), Psychotic/Paranoid ($HR = 1.44$; 95% $CI = 1.32,1.57$), Antisocial ($HR = 1.79$; 95% $CI = 1.59,2.01$), and Personal Disturbance ($HR = 1.74$; 95% $CI = 1.58,1.91$) were associated with risk. Including covariates attenuated these associations (28.4 to 54.5%), though they were still significant. After entering Personal Disturbance into models with each component, Neuroticism/Negative Affectivity and Somatic Complaints were significant, although Neuroticism/Negative Affectivity's were now protective ($HR = 0.73$, 95% $CI = 0.58,0.92$). When the four components were entered together with or without covariates, Somatic Complaints and Antisocial were significant risk factors.

Conclusions—Somatic Complaints and Personal Disturbance are associated with increased mortality risk. Other components' effects varied as a function of variables in the model.

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Keywords

Minnesota Multiphasic Personality Inventory; Mortality; Negative Affect Personality; Vietnam Experience Study; Somatic Complaints

Introduction

Personality traits are moderately stable, genetically- and environmentally-based individual differences in behavior, affect, and thinking [1, 2] that are associated with health [3, 4]. The Five-Factor Model describes traits as falling along five broad dimensions: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness [5-7]. Neuroticism denotes individual differences in anxiety, emotional vulnerability, and depression. Extraversion denotes individual differences in sociability, positive affect, and excitement-seeking. Openness to Experience captures individual differences in sensitivities to aesthetics and feelings as well as a tendency to hold liberal political views. Agreeableness describes individual differences in cooperativeness, straightforwardness, and modesty. Conscientiousness describes individual differences in self-discipline, goal-directedness, and deliberation.

Higher Conscientiousness has been repeatedly associated with reduced mortality risk [3, 4, 8]. However, the picture for the other dimensions is complex. Whereas meta-analyses indicated that lower Neuroticism, higher Extraversion, higher Openness, and higher Agreeableness are related to longer life [9, 10], individual studies either found no such association or an association in the opposite direction [11, 12]. One explanation for this inconsistency is that different aspects, such as facets, of these personality dimensions are differentially-related to mortality risk [3]. Thus, the degree to which a personality instrument taps aspects of these dimensions related to higher or lower risk would determine the size and direction of the association.

Previous studies of personality-mortality associations followed a standard psychometric approach, i.e. personality dimensions were defined as given sets of items prior to examining their impact on health. These item sets will almost all have been derived via principal-components analysis or factor analysis to indicate how they load onto one or more personality dimensions. This approach ignores the aforementioned heterogeneity in how the facets or even items defining personality dimensions are associated with mortality risk. Empirically, items within dimensions can have different characteristics: for example, they have different heritabilities [13]. Therefore, rather than accept personality dimensions as given sets of items, we used empirical criterion keying to first identify individual personality items that are reliably associated with mortality, and then find how they agglomerate in dimensions.

To these ends we conducted a 'questionnaire-wide association study' (QWAS) to examine the personality-mortality association in the Vietnam Experience Study (VES) cohort. This approach was based on genome-wide association studies (GWAS), which use numerous single nucleotide polymorphisms as predictors. A similar approach was recently used to identify novel predictors of Type II diabetes from a large pool of environmental risk factors [14]. While not without their shortcomings, such "X"-WAS studies may complement other means of examining personality risk factors for mortality [15, 16].

Participants were male Vietnam-era veterans who underwent a detailed medical and psychological examination [17-20]. As part of the psychological examination, participants completed the Minnesota Multiphasic Personality Inventory, a large battery of personality

traits [MMPI; 21, 22]. The MMPI's authors anticipated its use in this fashion: "(I)t seemed desirable to create a rather large reservoir of items from which various scales might be constructed in the hope of evolving a greater variety of valid personality descriptions than are available at the present time." [21]. Indeed, rather than being defined by a single set of accepted scales, as is, for example, the NEO-PI-R [6], the MMPI has been used to generate multiple sets of scales for different purposes [22-26].

Here we circumvent the need to choose a set of MMPI scales, each of which may be better or more poorly suited to the task of predicting mortality. Instead, we will first test which of the hundreds of MMPI personality trait items are associated with mortality. As with GWAS, our sample size was large and thus, to deal with Type I errors, we conducted the initial analysis on two half samples. In addition, we will form dimensions based on the items that were identified as predictors of mortality risk and examine their association with mortality after adjusting for numerous other risk factors. By considering all the MMPI items in this manner, we hope to identify novel, large personality-mortality associations and elucidate pathways from personality traits to mortality.

Methods

Participants

The sample was derived from the VES cohort. The VES was initiated by the U.S. Congress to determine whether health problems were associated with Agent Orange exposure [17-20]. Ethical approval was granted by the U.S. Office for Technology Assessment, the Department of Health and Human Services Advisory Committee, the Agent Orange Working Group Science Panel, and a review panel from the U.S. Centers for Disease Control.

The participants were derived from nearly five million male Vietnam-era U.S. Army veterans who entered military service between January 1, 1965 and December 31, 1971 and whose records were stored at the National Personnel Records Center. The VES cohort comprised 15,288 men from a random sample who were not excluded for any one of five possible reasons and who participated in a 1985 telephone interview. A random sample of men who participated in the telephone interview was invited to take part in a medical examination. The present sample comprises 4462 of those men who were invited to and participated in the 1986 medical examination. At the time of the medical examination, during which their personality was assessed, participants ranged from 30.8 to 48.0 years in age ($M = 37.9$; $SD = 2.5$). Further details about recruitment criteria for a telephone interview and medical examinations are described elsewhere [27].

Measures

Covariates—Archival records data included ethnicity and score at induction on the Army General Technical Test, a measure of cognitive ability [28]. Data collected during telephone interviews in 1985 included educational achievement, household income, marital status, smoking and drinking behavior, and whether participants were told by a doctor that they had hypertension, cancer, diabetes, or coronary heart disease. Data collected during examinations in 1986 included serum glucose level, systolic (SBP) and diastolic (DBP) blood pressure, physical activity (resting pulse rate), forced expiratory volume in 1 second (FEV_1), body mass index, and 12-month prevalence of major depression or generalized anxiety disorder, both defined in terms of the third edition of the American Psychiatric Association's Diagnostic and Statistical Manual [29] and assessed via the Diagnostic Interview Schedule [30].

MMPI—During the examination, participants were administered the 566 item MMPI [22]. Items can be answered "True", "False", or "?" and are keyed as belonging to one or more scales, none of which we shall use. Sixteen MMPI items are duplicates used to assess response consistency [22]; our analyses did not include the second occurrence of duplicated items.

Mortality—Vital status was first assessed starting from discharge date to December 31, 1983 [17]. The databases used to identify deaths in that study included those of the U.S. Army, Veterans Administration (Beneficiary Identification and Record Locator Subsystem), Social Security Administration, Internal Revenue Service, and National Center for Health Statistics (National Death Index). In a later study, follow-up time for assessing vital status was extended to December 31, 2000 [31]. In that study, vital status was assessed using the Department of Veterans Affairs (previously the Veterans Administration) Beneficiary Identification Record Locator Subsystem death file, the Social Security Administration Death Master File, and the National Death Index Plus (NDI Plus). All matches in the latter study were manually reviewed.

Analyses

Analyses were carried out using R version 2.15.2 [32]. Because of the large number of statistical tests involved in examining associations between MMPI items and mortality, we took steps to reduce the number of false positives. Specifically, we randomly divided the study population into two half samples. For each half, we used the -coxph- function to conduct proportional hazards (Cox) regression [33, 34] to determine whether, controlling for age and ethnicity, answering "True" was associated with all-cause mortality risk. In a previous study in which we examined cognitive ability and an MMPI-derived Neuroticism scale, we did not find any violation of the proportionality assumption [35]. Only items associated with mortality in the same direction and with a *p*-value < .01 *in both half samples* were retained for further analyses.

We then subjected the retained MMPI items to two principal-components analyses (PCA) using the -principal- function [36]. For the first PCA we treated MMPI responses as continuous and used the total sample. In addition, we treated the 424 missing responses as .5, a procedure similar to one that yields comparable correlation matrices to other methods for handling missing data [25]. For the second PCA, we treated MMPI responses as categorical by first obtaining tetrachoric correlations among items. This PCA required dropping 261 cases that had missing MMPI responses from the total sample. In both cases, we decided on the number of components to extract by examining the scree plot and conducting parallel analyses using the -paran- function [37]. We rotated the components from both PCAs using the promax procedure to clarify their content. Following a previous study of the MMPI [25], we defined item-component loadings as salient if they were $\geq |.3|$.

We next carried out Cox regressions in which we predicted mortality risk using the components as predictors. We planned models based on the assumption that a PCA of items discovered via the item-level mortality association analysis will yield multiple components. In a set of single-dimension models, each component will be tested separately in two separate models. The first model includes age and ethnicity (white, black, other) as covariates. The second model includes age, ethnicity, marital status (Married, Divorced/separated/widowed, Never married), cognitive ability, family income ($\leq$ \$20,000, \$20,001-\$40,000, > \$40,000), years of education ($\leq$ 8, 9-12, 13-16, 17-18), body mass index ($\leq$ 25, 25-30, > 30), pulse rate, presence of somatic conditions, smoking (non-smoker, former smoker, current smoker) and drinking behavior (never drinker, non-drinker, drinker, never binges, 1 binge/month, 2-7 binges/month, $\geq$ 8 binges/month), SBP, DBP, blood glucose,

FEV$_1$, history of major depression (absent, present), and history of generalized anxiety disorder (absent, present). Next, in multi-dimension models, the components were tested together to determine whether independent effects of each dimension predicted mortality. This set of models also includes two sets of models, one that only controls for age and ethnicity and one that controls for all of the covariates. In all models, categorical variables were dummy-coded so that the first level was the reference category and continuous variables were converted to z-scores.

Results

Sample Characteristics

Characteristics of the participants on all variables are presented in Table 1. Of the 4462 participants, 248 died by the end of December 31, 2000. Participant characteristics are shown for the total sample and broken down by half sample and mortality status.

Item-Level Mortality Associations

Of the 550 items, 159 and 163 were significantly ($p < .01$) related to mortality in the first and second half sample, respectively; 89 were significantly related to mortality in both half samples (see Figure 1 and Supplementary Digital Content 1).

Principal-Components Analyses

When the MMPI responses were treated as continuous, parallel analysis indicated that the eigenvalues of 8 components exceeded the 95th percentile of those derived from random permutations of the data set. The scree plot suggested that four or five components described the 89 items. The eight component solution had three relatively small components, with two having five salient loadings and one having four salient loadings. In addition, the four component solution was more interpretable than the five component solution.

When the MMPI responses were treated as categorical, parallel analysis indicated that the eigenvalues of 10 components exceeded the 95th percentile of those derived by chance. The scree plot suggested there were four components. The 10 component solution included 1 singlet and 4 small components comprising 3, 4, 5, and 6 salient loadings. Extracting only five components yielded one difficult to interpret component made up of only four salient loadings.

Based on these results, we retained the four components. These components accounted for 28% of the variance when responses were treated as continuous and 47% of the variance when responses were treated as categorical. We compared these two sets of loadings using targeted orthogonal Procrustes rotation [38] by rotating the solution when responses were treated as continuous to that derived when responses were treated as categorical. The congruence of the overall structure (.96) and those of the first three components (.99, .97, and 1.00) indicated clearly replicable [39, 40]. On the other hand, the congruence of the fourth component (.84) fell just short of indicating fair replicability [39, 40].

Given these findings, we chose to interpret the four large and clearly interpretable components derived when treating MMPI responses as continuous (see Table 2 and Supplementary Digital Content S2). Sixty-six items had salient loadings on only 1 component and 6 had salient loadings on 2 components. The first rotated component comprised items describing anxiety, low mood, self-defeating cognitions, and emotional fragility/vulnerability. It resembled Neuroticism and Negative Affectivity [25, 41] and was named thus. The second component comprised items describing self-reported good health and absence of somatic complaints or disturbed sleep. After reflecting this component, that

is multiplying its loadings by −1, it resembled the Somatic Complaints dimension previously derived from the whole MMPI [25]. We therefore assigned it the same name. The third component comprised items reflecting paranoid ideation, auditory hallucinations, avoidance, and aggressive thoughts and thus was similar to the Psychoticism/Infrequency dimension derived in the earlier study of the MMPI [25]. We therefore named it Psychotic/Paranoid. The fourth component was not previously described, though as it comprised items describing antisocial behaviors and cognitions, we named it Antisocial. We used the -alpha-function [36] to compute the internal consistencies (Cronbach's alphas) of each component based on items that had salient loadings. The internal consistencies for the components were .89, .85, .84, and .71, respectively.

The correlations between components ranged from |.41| to |.56|. We therefore computed standardized component scores for each individual and subjected these scores to a second-order PCA. Correlations between components could be described by a higher-order component onto which components loaded .84, .77, .81, and .77, respectively. We named this higher-order component "Personal Disturbance" and computed its standardized score for each participant. The internal consistency of this component was .81.

Cox Regressions

We tested the four components and the higher-order Personal Disturbance component individually to find if they were related to mortality risk (Table 3, upper left panel). Age and ethnicity were covariates. The increased risks associated with each standard deviation were 44% (Psychotic/Paranoid), 55% (Neuroticism/Negative Affectivity), 66% (Somatic Complaints), 79% (Antisocial), and 74% (Personal Disturbance).

Including the remaining covariates attenuated these associations by 54.5% for Neuroticism/ Negative Affectivity, 33.3% for Somatic Complaints, 38.6% for Psychotic/Paranoid, 44.3% for Antisocial, and 28.4% for Personal Disturbance, though they were still significant (see Table 3, upper middle panel). Thus, these effects were partly mediated or confounded by their relationship to physical health, psychological health, or health behaviors.

Including Personal Disturbance in the models that included age, ethnicity, and the remaining covariates affected the relationship between lower-order components and mortality (see Table 3, upper right panel). In each model, Personal Disturbance was significant (see Tables S10-S13). The effect of Somatic Complaints was attenuated by 47.7% when Personal Disturbance was included, but it was still significant, with each standard deviation now associated with a 23% increase in risk. Neuroticism/Negative Affectivity was also significant when Personal Disturbance was included, though each standard deviation was now associated with a 27% *reduction* in risk; i.e. opposite in direction to its effect when entered without Personal Disturbance. Neither Psychotic/Paranoid, which was now in the opposite direction, nor Antisocial, which was further attenuated by 70.5%, were significant in the presence of Personal Disturbance. Thus, the health-harming effects of the components were mostly or entirely attributable to variance they shared with other components. In addition, net of their shared variance with Personal Disturbance, the effects of Neuroticism/ Negative Affectivity, and possibly Psychotic/Paranoid, were protective.

When the four components were tested together in the same model alongside age and ethnicity, Somatic Complaints and Antisocial were significantly associated with mortality risk (see Table 3, lower left panel) with each standard deviation of either being equal to just over a 50% increase in risk. When including the remaining covariates, the effects of each were slightly attenuated such that each standard deviation of either was now associated with just under a 40% increase in risk (see Table 3, lower middle panel). Thus, whereas associations of mortality with Somatic Complaints and Antisocial were still significant after

taking the other components and even health risk factors into account, the effects of Neuroticism/Negative Affectivity and Psychotic/Paranoid were no longer significant.

Finally, because they were positively skewed, we used square root transformations to normalize the four components and Personal Disturbance and then re-ran the models. There were no substantial changes in the above-reported findings.

Discussion

We identified 89 MMPI items that were significantly ($p < .01$) related to all-cause mortality in both half-samples. These items could be accounted for by four components that described individual differences in neuroticism or negative affect, somatic complaints, psychotic or paranoid symptoms, and antisocial attitudes and behaviors. Further analyses revealed that these components shared substantial variance that could be described by a higher-order component named Personal Disturbance. Taken separately, all four components and Personal Disturbance were associated with greater mortality risk, and were attenuated only somewhat by demographic, health, and health behavior risk factors. However, when looking at the relationship between the components' independent contributions to mortality risk, only Somatic Complaints and Antisocial were significantly associated with greater risk. Moreover, when looking at the unique component variance, i.e., by including Personal Disturbance in the model, Somatic Complaints was still significantly associated with greater mortality risk; the effects of the Psychotic/Paranoid and Antisocial components became non-significant; and the effects of Neuroticism/Negative Affectivity reversed in that they were now significantly associated with *lower* mortality risk.

This analysis approach revealed the personality structure or MMPI profiles of individuals who are at risk of earlier death. These findings are consistent with studies showing associations between personality traits and longevity [3,4, 8-10]. They also go some way to explaining the fickle association between neuroticism and mortality. Specifically, the significance and direction of the effects of the Neuroticism/Negative Affectivity component depended on what other components were included in the model: on its own this component was a risk factor, alongside Personal Disturbance it was protective, and alongside Somatic Complaints, Psychotic/Paranoid, and Antisocial, it was not significant. Further studies could help determine which aspects of neuroticism and negative affectivity are risk factors or protective factors for mortality.

We also found a robust relationship between somatic complaints and mortality risk. This component was largely composed of items that are used in the MMPI to distinguish cases of hypochondriasis or conversion hysteria from normal controls [42]. The higher-order PCA results are consistent with previous studies showing that somatic complaints are associated with neuroticism [43-45]. However, we found that, even after taking this into account, endorsing items belonging to this scale in the direction of more somatic complaints is linked to shorter life. Thus, responses to these items contain valid information about subsequent poor health, leading to mortality. One possible explanation lies in the fact that individuals high in neuroticism or similar traits are not just more sensitive to emotional stressors [46], but also more sensitive to, aware of, bothered by, and less likely to ignore symptoms [44].

Like Neuroticism/Negative Affectivity, the effects of the Psychotic/Paranoid and Antisocial components were influenced by the other variables in the model. With respect to Psychotic/Paranoid, its effects were not significant in models that included Personal Disturbance and all of the covariates or in models that included the Neuroticism/Negative Affectivity, Somatic Complaints, and Antisocial. Thus, the tendency to endorse items referring to psychotic, paranoid thoughts, and possibly the increased mortality risk conferred by serious

mental health conditions such as schizophrenia [47], may reflect their relationship to other personality risk factors. With respect to the latter, its effects were not significant in models that included Personal Disturbance and all of the covariates. Likewise, antisocial tendencies appear to be associated with greater risk because they are markers of general personal disturbance and are associated with physical health, psychological health, and health behaviors.

Limitations of this dataset have been noted elsewhere [35]. The primary limitation is that the sample is not highly generalizable as it included no women, and all members had to pass a physical fitness exam upon induction into the U.S. military. This limitation may be particularly problematic in the present study, namely because of the fine-grained level analysis of the QWAS. In short, the items, and consequent dimensions, associated with mortality may differ depending on the composition of the group, cause or death, or other factors. However, this potential limitation also highlights a potential strength of QWAS. If true, it would mean that QWAS is sensitive enough to determine whether the impact of personality on mortality differs across groups or causes of death. Thus, future studies should be conducted not only to determine the degree to which the present results replicate across samples, but also to highlight the circumstances in which QWAS will be most beneficial for understanding the association between personality and health.

Another limitation, and one specific to this study, is that items associated with Conscientiousness are not well-represented in the MMPI [25, 26, 48]. Thus, we could not determine to what extent traits related to Conscientiousness may impact the final structure of mortality-related personality dimensions and the association between those dimensions and mortality. However, Conscientiousness is already well studied, and the major novel contribution here was to find other personality dimensions that are associated with mortality and to demonstrate the feasibility of using this approach to identify such associations in a large set of traits that were not theoretically developed. Another limitation is that, while we used two half samples, they were drawn from the same population. It would thus be useful to conduct a similar QWAS analysis or confirmatory analyses in other samples that include MMPI and mortality information. On the other hand, the dataset has numerous strengths, primarily its size, length of follow-up, and the ability to control for demographic factors, physical health, mental health, health behaviors, and cognitive ability.

We demonstrated the power of this approach for discovering new associations between personality traits and all-cause mortality in the VES cohort. This approach should not be thought of as a substitute for the psychometric approach. Instead, it should be thought as complementary and useful in certain cases, such as when the goal is to generate hypotheses, to resolve inconsistencies in the results of previous studies, or to test whether the same clusters of traits predict health or mortality across different populations or at different times in the lifespan.

As the MMPI is a widely used scale, QWAS could be used to mine existing datasets and further explore personality structures related to mortality or other health-related outcomes in other populations. Moreover, the present findings recommend re-evaluating somatoform disorders as somatic complaints, even without obvious symptoms or signs, because they predicted mortality and thus should be taken seriously to help ensure patient survival.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Abbreviations

DBP	diastolic blood pressure
FEV$_1$	forced expiratory volume in 1 second
GWAS	genome-wide association study or studies
MMPI	Minnesota Multiphasic Personality Inventory
PCA	principal-components analysis
QWAS	questionnaire-wide association study or studies
SBP	systolic blood pressure
VES	Vietnam Experience Study

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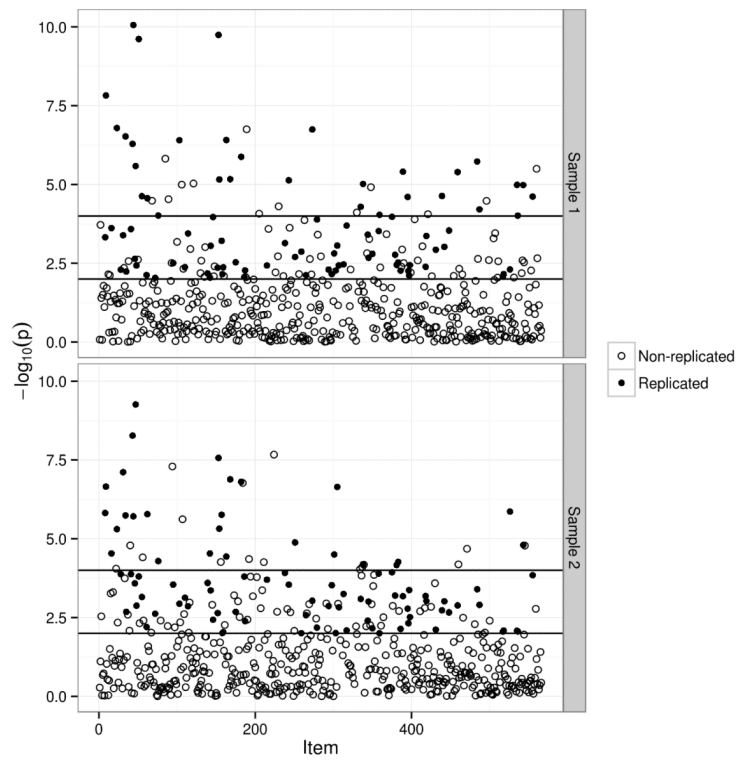
Figure 1.
Associations between the MMPI items and mortality in the two half samples. Significant and replicable associations are denoted by closed circles. Figure by the authors, licensed under a Creative Commons Attribution 3.0 Unported License and published under the terms of this license. See http://creativecommons.org/licenses/by/3.0/ for more information.

Table 1

Characteristics of the two half samples and total samples on all covariates broken down by mortality status

	Sample 1			Sample 2			Total Sample		
	Alive (*n* = 2077)	Dead (*n* = 124)	Total (*n* = 2201)	Alive (*n* = 2086)	Dead (*n* = 124)	Total (*n* = 2210)	Alive (*n* = 4163)	Dead (*n* = 248)	Total (*n* = 4411)
Categorical Variables[1]									
Ethnicity									
White	1693 (81.5)	83 (66.9)	1776 (85.5)	1748 (83.8)	87 (70.2)	1835 (83.0)	3441 (82.7)	170 (68.5)	3611 (81.8)
Black	241 (11.6)	30 (24.2)	271 (13.0)	224 (10.7)	25 (20.2)	249 (11.3)	465 (11.2)	55 (22.2)	520 (11.8)
Other[2]	143 (6.9)	11 (8.9)	154 (7.4)	114 (5.5)	12 (9.7)	126 (5.7)	257 (6.2)	23 (9.3)	280 (6.3)
Somatic conditions									
Absent	1794 (86.7)	81 (65.9)	1875 (85.5)	1825 (88.0)	100 (81.3)	1925 (87.6)	3619 (87.3)	181 (73.6)	3800 (86.5)
Present	276 (13.3)	42 (34.1)	318 (14.5)	250 (12.0)	23 (18.7)	273 (12.4)	526 (12.7)	65 (26.4)	591 (13.5)
Major depression									
Absent	1950 (93.9)	108 (87.1)	2058 (93.5)	1959 (93.9)	106 (85.5)	2065 (93.4)	3909 (93.9)	214 (86.3)	4123 (93.5)
Present	127 (6.1)	16 (12.9)	143 (6.5)	127 (6.1)	18 (14.5)	145 (6.6)	254 (6.1)	34 (13.7)	288 (6.5)
Generalized anxiety disorder									
Absent	1898 (91.4)	99 (79.8)	1997 (90.7)	1893 (90.7)	96 (77.4)	1989 (90.0)	3791 (91.1)	195 (78.6)	3986 (90.4)
Present	179 (8.6)	25 (20.2)	204 (9.3)	193 (9.3)	28 (22.6)	221 (10.0)	372 (8.9)	53 (21.4)	425 (9.6)
Smoking									
Nonsmoker	523 (25.2)	22 (17.7)	545 (24.8)	550 (26.4)	20 (16.1)	570 (25.8)	1073 (25.8)	42 (16.9)	1115 (25.3)
Former smoker	630 (30.4)	28 (22.6)	658 (29.9)	584 (28.0)	20 (16.1)	604 (27.3)	1214 (29.2)	48 (19.4)	1262 (28.6)
Current smoker	921 (44.4)	74 (59.7)	995 (45.3)	951 (45.6)	84 (67.7)	1035 (46.9)	1872 (45.0)	158 (63.7)	2030 (46.1)
Drinking									
Never drinker	204 (9.9)	8 (6.5)	212 (9.7)	212 (10.2)	9 (7.3)	221 (10.0)	416 (10.1)	17 (6.9)	433 (9.9)
Nondrinker	328 (15.9)	24 (19.5)	352 (16.1)	281 (13.5)	24 (19.5)	305 (13.9)	609 (14.7)	48 (19.5)	657 (15.0)
Never binges	689 (33.5)	30 (24.4)	719 (33.0)	695 (33.5)	23 (18.7)	718 (32.6)	1384 (33.5)	53 (21.5)	1437 (32.8)
1 binge/month	493 (24.0)	30 (24.4)	523 (24.0)	518 (24.9)	32 (26.0)	550 (25.0)	1011 (24.5)	62 (25.2)	1073 (24.5)
2-7 binges/month	170 (8.3)	11 (8.9)	181 (8.3)	187 (9.0)	13 (10.6)	200 (9.1)	357 (8.6)	24 (9.8)	381 (8.7)
8 binges/month	173 (8.4)	20 (16.3)	193 (8.9)	184 (8.9)	22 (17.9)	206 (9.4)	357 (8.6)	42 (17.1)	399 (9.1)
Continuous Variables[3]									
Age	37.9 (2.6)	38.3 (2.6)	37.9 (2.5)	37.9 (2.4)	38.0 (2.8)	37.9 (2.4)	37.9 (2.5)	38.2 (2.7)	37.9 (2.5)
Army General Technical Test									
Verbal	107.2 (22.0)	101.8 (22.3)	106.9 (22.0)	107.8 (22.3)	100.0 (24.9)	107.4 (22.5)	107.5 (22.1)	100.9 (23.6)	107.2 (22.3)
Arithmetic	104.4 (21.9)	97.4 (20.8)	104.0 (21.9)	105.3 (21.9)	96.5 (24.4)	104.8 (22.1)	104.9 (21.9)	96.9 (22.6)	104.4 (22.0)
Pulse rate/minute	81.3 (12.2)	85.9 (14.0)	81.6 (12.3)	80.9 (11.9)	85.5 (13.7)	81.2 (12.1)	81.1 (12.1)	85.7 (13.8)	81.4 (12.2)
Blood pressure									
Systolic	123.0 (11.9)	125.9 (16.1)	123.2 (12.2)	122.7 (11.5)	124.9 (14.8)	122.8 (11.7)	122.9 (11.7)	125.4 (15.4)	123.0 (12.0)
Diastolic	84.0 (9.3)	86.7 (11.2)	84.2 (9.4)	84.0 (9.2)	85.7 (12.1)	84.1 (9.4)	84.0 (9.2)	86.2 (11.7)	84.1 (9.4)
Blood glucose (mg/dl)	93.6 (12.7)	107.2 (52.1)	94.4 (17.7)	94.0 (15.8)	98.5 (26.6)	94.2 (16.6)	93.8 (14.3)	102.8 (41.5)	94.3 (17.1)
FEV$_1$	4.0 (0.6)	3.8 (0.7)	4.0 (0.7)	4.1 (0.6)	3.7 (0.7)	4.1 (0.7)	4.1 (0.6)	3.8 (0.7)	4.0 (0.7)

Note.

[1] The value outside the parentheses is the frequency; the value within the parentheses is the percentage.

[2] Comprised of Hispanics, Asians, Pacific Islanders, American Indians, and Native Alaskans.

[3] The value outside the parentheses is the mean; the value within the parentheses is the standard deviation.

Table 2

Examples of items and their loadings for each component

Loading	Item	Definition
PC1: Neuroticism/Negative Affectivity		
−.60	379	I very seldom have spells of the blues.
.56	555	I sometimes feel that I am about to go to pieces.
.65	418	At times I think I am no good at all.
PC2: Somatic Complaints (reversed)		
.63	153	During the past few years I have been well most of the time.
−.54	62	Parts of my body often have feelings like burning, tingling, crawling, or like "going to sleep."
−.46	47	Once a week or oftener I feel suddenly hot all over, without apparent cause.
PC3: Psychotic/Paranoid		
.61	35	If people had not had it in for me I would have been much more successful.
.48	345	I often feel as if things were not real.
.43	350	I hear strange things when I am alone.
PC4: Antisocial		
−.49	294	I have never been in trouble with the law.
.44	381	I am often said to be hot-headed.
.43	313	The man who provides temptation by leaving valuable property unprotected is about as much to blame for its theft as the one who steals it.

Table 3

Summary of Cox regressions examining personality components as predictors of all-cause mortality

Components tested separately	Age and ethnicity[a]				All covariates[b]				All covariates and Personal Disturbance[c]			
		95% CI				95% CI				95% CI		
	HR	lower	upper	p	HR	lower	upper	p	HR	lower	upper	p
PC1: Neuroticism/Negative Affectivity	1.55	1.39	1.72	<.001	1.25	1.09	1.43	.001	0.73	0.58	0.92	.007
PC2: Somatic Complaints	1.66	1.52	1.80	<.001	1.44	1.29	1.61	<.001	1.23	1.05	1.44	.010
PC3: Psychotic/Paranoid	1.44	1.32	1.57	<.001	1.27	1.14	1.42	<.001	0.85	0.70	1.03	.088
PC4: Antisocial	1.79	1.59	2.01	<.001	1.44	1.25	1.65	<.001	1.13	0.94	1.36	.199
Personal Disturbance	1.74	1.58	1.91	<.001	1.53	1.35	1.74	<.001	---	---	---	---

Components tested together	Age and ethnicity[d]				All covariates[e]			
		95% CI				95% CI		
	HR	lower	upper	p	HR	lower	upper	p
PC1: Neuroticism/Negative Affectivity	0.96	0.81	1.13	.603	0.91	0.77	1.09	.318
PC2: Somatic Complaints	1.51	1.34	1.71	<.001	1.39	1.22	1.58	<.001
PC3: Psychotic/Paranoid	0.97	0.85	1.10	.615	1.03	0.90	1.19	.669
PC4: Antisocial	1.54	1.33	1.79	<.001	1.36	1.16	1.59	<.001

Note. Effects for the components are per standard deviation. Ethnicity was defined using two variables which compared risk in blacks to that in whites and risk in "other" ethnic groups to risk in whites. The covariates included marital status, Army General Technical Test score (z-score), family income, educational achievement, pulse rate/minute (z-score), somatic conditions, systolic blood pressure (z-score), diastolic blood pressure (z-score), blood glucose (mg/dl) (z-score), forced expiratory volume in one second (FEV1; z-score), body mass index, major depression, generalized anxiety disorder, drinking, and smoking. $N = 4270$. Number of deaths = 237. 95% CI = 95% confidence interval. HR = hazard ratio.

[a]See Supplementary Digital Content 3 for the five full models.

[b]See Supplementary Digital Content 4-8 for the five full models.

[c]See Supplementary Digital Content 9-12 for the four full models.

[d]See Supplementary Digital Content 13 for the full model.

[e]See Supplementary Digital Content 14 for the full model.