Prediction of All-Cause Mortality by the Minnesota Multiphasic Personality Inventory Optimism-Pessimism Scale Scores: Study of a College Sample During a 40-Year Follow-up Period

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OBJECTIVE: **To examine a measure of explanatory style, the Optimism-Pessimism (PSM) scale derived from college-entry Minnesota Multiphasic Personality Inventory scores, as a predictor of all-cause mortality.**

SUBJECTS AND METHODS: **A total of 7007 students entering the University of North Carolina at Chapel Hill completed the Minnesota Multiphasic Personality Inventory during the mid-1960s. Of those students, 6958 had scores on the PSM scale and data for all-cause mortality through 2006. Scores on the PSM scale were evaluated as predictors of mortality using the Cox proportional hazards regression model, adjusted for sex. During the 40-year follow-up period, 476 deaths occurred.**

RESULTS: **Pessimistic individuals who scored in the upper tertile of the distribution had decreased rates of longevity (hazard ratio, 1.42; 95% confidence interval, 1.13-1.77) compared with optimistic individuals who scored in the bottom tertile of the distribution.**

CONCLUSION: **In a model that adjusted only for sex, a measure of optimistic vs pessimistic explanatory style was a significant predictor of survival during a 40-year follow-up period such that optimists had increased longevity.**

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CI = confidence interval; HR = hazard ratio; MMPI = Minnesota Multiphasic Personality Inventory; PSM = Optimism-Pessimism; UNCAHS = University of North Carolina Alumni Heart Study

A growing body of evidence has demonstrated an association between measures of emotion and health outcomes.[1] Closely related research has examined a measure of explanatory style, referred to as the Optimism-Pessimism (PSM) scale,[2,3] as a predictor of health and well-being. The PSM was derived from the Minnesota Multiphasic Personality Inventory (MMPI) items that tap into the 3 dimensions underlying the attributional model of depression described by Seligman et al.[4] Specifically, the theory of Seligman et al suggests that individuals can be classified into 3 areas (internal/external, stable/unstable, and global/specific) with respect to the attributions they give concerning negative and positive events in their life. For example, according to this model, individuals who view negative events as internal are likely to apply causality to themselves; likewise, individuals who view negative events as stable tend to think the event may last forever; and finally, individuals who attribute negative events as global are likely to believe the event will affect every aspect of their lives. Thus, these attributional styles manifest as pessimistic characteristics, such as blaming oneself, assuming that bad events will go on forever, and assuming that the results of negative events will likely affect all aspects of life. The opposite applies to someone who characteristically views negative events as external, unstable, and specific—that is, in optimistic terms. When applying this method to positive events, it is internal, stable, and global attributions that lead to an optimistic attributional style.

People who tend to view bad events as internal, stable, and global (ie, are pessimistic) have been shown to be more likely to develop depression,[4] to have poor physical health,[5] and to require use of various health care services.[6] Studies that have examined PSM scale ratings have shown that this measure of attributional explanatory style predicts, for example, assessments of self-reported health[7] and survival during a 30-year period in self-referred medical patients.[8] The current study was conducted to extend examination of the association between PSM scale scores and longevity to a college-aged sample (nonmedical college) that has been followed up for mortality for 40 years.

SUBJECTS AND METHODS

The University of North Carolina Alumni Heart Study (UNCAHS) is a series of studies that started with a target population of 7007 students from the University of North Carolina at Chapel Hill who were entering classes of 1964, 1965, and 1966 and who took the MMPI at college registration. The study is archival and prospective. In 1986, individuals with MMPIs on file were matched to alumni records, contacted by mail, and invited to join the UNCAHS. This approach resulted in 4989 participants joining the

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TABLE 1. **Number of Students at Risk for Death and Number of Deaths at Each 5-Year Interval of the Study**

Year	No. of students at risk	No. of deaths	Cumulative frequency	Date of deaths
0	6958	0	…	…
5	6923	35	35	12/11/65-12/02/70
10	6888	35	70	2/03/71-11/23/75
15	6863	25	95	3/06/76-11/22/80
20	6825	38	133	3/18/81-12/22/85
25	6772	53	186	2/26/86-11/30/90
30	6682	90	276	1/12/91-11/22/95
35	6576	106	382	2/01/96-12/29/00
40	6482	94	476	2/18/01-1/11/06

UNCAHS by 1992, when enrollment was closed. Details of the recruitment of the college cohort are in the article by Siegler et al.[9] The composition of the cohort reflects the demographic mixture at the University of North Carolina at that time (ie, 99% white, 83% men).

Mortality surveillance does not depend on participation in the UNCAHS. Mortality surveillance is not dependent on participation in the UNCAHS. All alumni files are regularly checked against the National Death Index by the General Alumni Association staff, and UNCAHS staff regularly check the Social Security Death Index for nonparticipants. In addition, family members report the deaths of participants to the UNCAHS or the General Alumni Association as participants die. Of the 7007 members of the original sample, 6958 (99.3%) had scores on the PSM scale and follow-up data for all-cause mortality. The current sample consisted of 5750 male students (82.6%) and 1208 female students (17.4%). The mean age of the participants at the beginning of the study was 18.5 years (SD, 2.6 years), and 95% were undergraduates. The mean follow-up time for mortality was 40.0 years (SD, 4.8 years).

Table 1 reports the number of students at risk for death and the number of deaths at each 5-year interval of the study. Table 2 provides information regarding the cause of death for the 95.2% of the students who died during the study. The percentage of death by suicide (13.7%) is not surprising given that the mean age of the survivors is approximately 60 years.

TABLE 2. **Cause of Death***

Cause	No. (%) of deaths (n=476)
Accident	66 (13.9)
AIDS	47 (9.9)
Cancer	116 (24.4)
CAD	36 (7.6)
Heart disease (non-CAD)	43 (9.0)
Other, medical related	61 (12.8)
Suicide	65 (13.7)
Violent	19 (4.0)
Unknown	23 (4.8)

*Cause of death reported on death certificates and coded by a nosologist according to *International Classification of Diseases*. AIDS = acquired immunodeficiency syndrome; CAD = coronary artery disease.

Assessment of PSM Scale Scores

The PSM scale[2,3] was created on the basis of the theory of explanatory style described by Seligman et al[4] so that clinicians and researchers might use MMPI data as a means of identifying individuals as pessimistic or optimistic. Initially, the MMPI items were grouped according to their response to a good, bad, or unclassifiable event. Items that referred to unclassifiable events were not further used. Next, 3 expert judges reviewed the resulting 298 items that could be classified as good or bad and further rated them using the Content Analysis of Verbatim Explanations[10] system. This technique was designed to classify the causal explanation of an event on the dimensions of internal/external, stable/unstable, and global/specific. Using the Content Analysis of Verbatim Explanations system, the MMPI items were rated on a 7-point Likert scale by the 3 trained judges. The sum of the average ratings across the judges was then used to calculate a composite weight (ranging from 3 to 21) for each item according to the 3 dimensions of internality, stability, and globality.

Composite positive and negative scores were then calculated by summing the composite weights of the items (positive or negative) that were answered "true." Finally, the composite positive and negative scores were used to calculate a bipolar PSM scale score per Malinchoc et al,[3] which ranges from optimistic (a low value) to pessimistic (a high value). Normalized T-score values were generated, with a mean of 50 and an SD of 10.

The 2476 members (35.6%) of the entering class of 1966 responded to a shorter MMPI form that excluded 109 items not used in calculation of the MMPI clinical scales. Of the 109 items, 12 were part of the 85 good events items and 16 were part of the 178 bad events items as described in Tables 1 and 2.[3] The 4482 persons with complete data (classes 1964 and 1965) were used to derive a PSM scale prorated score based on polynomial regression procedures that successfully reproduced the original scores. Scores for the 4482 individuals were calculated with both the full set and the reduced set of items. The predicted score calculated with the reduced set of items was correlated (r=0.993) with the score calculated with the full set. The mean PSM scale score was 52.05 for the original version and 52.07 for the predicted version. Thus, we used the predicted version for the entire sample.

Statistical Analyses

The Cox proportional hazards model was used to assess the association between survival time and PSM scale scores.

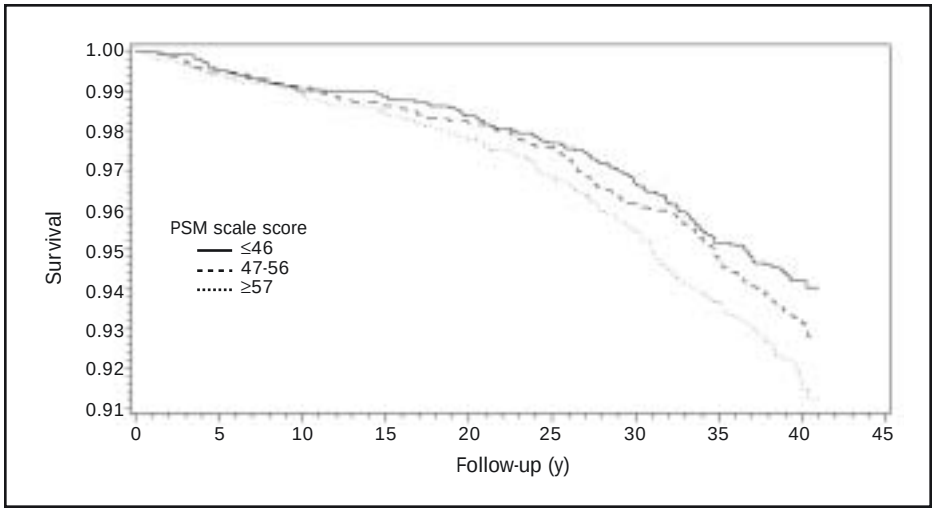

FIGURE 1. Optimism-Pessimism (PSM) scale scores as a predictor of survival during a 40-year period. Kaplan-Meier survival curves by tertiles of PSM scores.

The beginning time point was the date of the MMPI administration for each participant, and follow-up for mortality was assessed through April 1, 2006. Violation of the assumption of proportionality across time was appropriately examined. Specifically, proportionality was examined as described by Harrell,[11] both graphically and by observing the correlation between the residuals and the rank order of the failure time.

Before model entry, the PSM scale scores were standardized to reflect a change of 1 SD. Sex (0 = female, 1 = male) was included as a covariate in the model. SAS statistical software version 9 (SAS Institute Inc, Cary, NC) was used to compute all analyses. The level of statistical significance was set at $P<.05$.

RESULTS

According to a classification method used in prior work with the PSM scale,[8] 923 participants were classified as optimistic (scoring ≤39), 4405 were classified as mixed (scoring 40-60), and 1630 were classified as pessimistic (scoring >60). Following this classification method, in the current sample there was a tendency for the male students to be somewhat more optimistic ($P=.04$).

The current model met the assumption of proportionality over time ($P=.60$). Results showed that higher ratings on the standardized PSM scale (ie, ratings reflecting a more pessimistic explanatory style) were significantly associated with decreased survival (hazard ratio [HR], 1.16; 95% confidence interval [CI], 1.06-1.27; $P=.001$), controlled for sex.

Figure 1 displays the survival curves for 3 groups of participants—those who scored in the bottom, middle, and upper tertiles with respect to PSM scale scores (tertiles were empirically defined using data from the current sample). As depicted, those who scored as pessimistic (ie, in the upper tertile) had decreased rates of longevity (HR, 1.42; 95% CI, 1.13-1.77) compared with optimistic individuals who scored in the bottom tertile (HR, 1.18; 95% CI, 0.94-1.48).

DISCUSSION

Scores on the PSM scale, a measure reflecting an explanatory style that falls on a continuum from optimistic to pessimistic, were significantly associated with survival during a 40-year period in participants who registered for college in the mid-1960s. The current results replicate, in a nonmedical sample, those of Maruta et al[8] that suggest that optimism is associated with increased survival. Many mechanisms may link explanatory style to health outcomes. For example, extensive literature has indicated that depression is a risk factor for mortality[12,13]; thus, optimism may influence health through its strong inverse association with depression. In addition, optimists may be more likely to use the health care system to their benefit and to have a lifestyle that consists of healthy dietary practices and exercise habits.

The findings of this study have several limitations. The current data did not allow the ability to covary constructs that are generally related to mortality, such as body mass index and smoking. Multivariate models that included physical health parameters and poor health habits may have minimized the effects of the PSM scale scores, suggesting the possibility of mediation effects. In addition,

the current sample is homogeneous with respect to certain demographic constructs, such as race, age, and education level; thus, the findings may not be generalizable to more diverse samples. Finally, only 17.4% of the current sample is female, and women are known to have higher rates of depression.[14] Thus, given the noted relationship between depression and mortality, sex may also play a role in the relationship between constructs related to depression, such as optimism and pessimism, and mortality. However, as part of our preliminary testing, we examined optimism and pessimism by sex product interaction term. This term was not statistically significant (P=.51), and this leads us to conclude that the relationship between optimism or pessimism and death is not materially different between men and women in the current sample.

CONCLUSION

In a model that adjusted only for sex, a measure of optimistic vs pessimistic explanatory style was a significant predictor of survival during a 40-year follow-up period such that optimists had increased longevity. In addition, these results point to the usefulness of archival datasets that can be examined for survival during an extended period.

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