To Flourish or Not: Positive Mental Health and All-Cause Mortality

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Objectives. We investigated whether positive mental health predicts all-cause mortality.

Methods. Data were from the Midlife in the United States (MIDUS) study (n = 3032), which at baseline in 1995 measured positive mental health (flourishing and not) and past-year mental illness (major depressive episode, panic attacks, and generalized anxiety disorders), and linked respondents with National Death Index records in a 10-year follow-up ending in 2005. Covariates were age, gender, race, education, any past-year mental illness, smoking, physical inactivity, physical diseases, and physical disease risk factors.

Results. A total of 6.3% of participants died during the study period. The final and fully adjusted odds ratio of mortality was 1.62 (95% confidence interval [CI] = 1.00, 2.62; $P = .05$) for adults who were not flourishing, relative to participants with flourishing mental health. Age, gender, race, education, smoking, physical inactivity, cardiovascular disease, and HIV/AIDS were significant predictors of death during the study period.

Conclusions. The absence of positive mental health increased the probability of all-cause mortality for men and women at all ages after adjustment for known causes of death. (*Am J Public Health.* 2012;102:2164–2172. doi:10.2105/AJPH.2012.300918)

Historically, mental health has been viewed as the absence of mental disorder, despite conceptions that health in general is something positive and consists of well-being and not merely the absence of illness.[1] Mental well-being—i.e., positive mental health—is now a focus of national policy and science. The World Health Organization's report on mental health defined it as

> a state of well–being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community.[2(p10)]

Mental health has been operationalized under the rubric of subjective well-being, or individuals' evaluations of the quality of their lives. The nature of subjective well-being has been divided into 2 streams of research. The first approach equates well-being with feeling good and the second with functioning well in life. These 2 streams of subjective well-being research grew from 2 distinct philosophical viewpoints on happiness—one reflecting the hedonic tradition, which champions pleasure (i.e., positive feelings), and the other following the eudaimonic tradition, which emphasizes striving toward excellence or a good life as an individual and a citizen.

The hedonic tradition is reflected in research on emotional well-being, where scholars use measures of satisfaction with life and positive affect (e.g., cheerfulness, happiness, and contentment).[3] The tradition of eudaimonia is reflected in research on psychological[4] and social[5] well-being. Here, scholars use multidimensional scales that ask individuals to evaluate how well they see themselves functioning as they strive to achieve sufficient levels of purpose, contribution, integration, autonomy, intimacy, acceptance, and mastery in life. Studies support the tripartite model of emotional, psychological, and social well-being in US adults and youths.[6–8]

Although evidence links subjective well-being to mortality, most research has focused on emotional well-being. Reviews conclude that lower levels of positive emotions such as joy and happiness and lower levels of satisfaction with life are prospectively associated with increased risk of all-cause mortality in healthy populations[9–12] and in populations with preexisting physical illnesses.[9,11] In their review of 49 longitudinal studies, Howell et al. found an overall effect size of 0.14 for mortality between individuals with high and low emotional well-being (i.e., positive affect or life satisfaction).[11]

A few studies have investigated constructs reflecting psychological or social well-being.[13–18] These reports suggest that the dimensions of psychological well-being (e.g., purpose in life) and social well-being (e.g., social coherence—the belief that life makes sense and is predictable—and a sense of contribution to society) are also predictive of mortality. Adults with higher levels of purpose in life[13–15]; who find life more meaningful, manageable, and predictable[16,17]; and who feel more useful to other people[18] have a lower adjusted risk of all-cause mortality.

Published analyses of the Midlife in the United States (MIDUS) data identified an effect of positive mental health—on a continuum from languishing to moderate to flourishing mental health—on future mental illness.[19] We used data from the MIDUS cohort study[20] to extend the existing literature by investigating the risk of all-cause mortality by each of the components and the algorithm-derived categories of the mental health continuum,[21] incorporating measurement of psychological and social well-being in addition to emotional well-being.

We examined whether the integration of the 3 types of well-being into the categorization of positive mental health (i.e., flourishing or not flourishing) predicted 10-year all-cause mortality. We also investigated the extent to which 12-month diagnosis of internalizing psychopathology (major depressive episode, panic attacks, and generalized anxiety), education, gender, race, age, risk behaviors (physical inactivity and smoking), and preexisting physical illness confounded or explained the association between positive mental health and mortality.[22–27]

METHODS

We analyzed data from the national random-digit-dialing portion of the MIDUS study in 2011. This MIDUS sample comprised English-speaking, noninstitutionalized adults who resided in the 48 contiguous states and whose household included at least 1 telephone. For each household contacted, a random respondent aged between 25 and 74 years was selected. Respondents were invited to participate in a telephone interview, after which they were mailed questionnaires. Of those contacted, 70% agreed to participate in the telephone interview (n = 3485), and 87% of participants who completed the telephone interview also completed self-administered questionnaires, resulting in a sample size of 3032. Field procedures lasted approximately 13 months in 1994 to 1995 (most of the field procedures took place in 1995).

During the 10-year period following the 1995 MIDUS survey, all-cause mortality information was collected from the National Death Index.[28] Data were weighted to poststratify the sample by race, age, gender, and education.

Measures

We collected values for all variables used in the analyses for the baseline point of 1995.

Mental illness. The MIDUS used the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision*[29] criteria through the Composite International Diagnostic Interview Short Form scale[30] to measure 12-month major depressive episodes, generalized anxiety disorders, and panic attacks. We classified all participants who responded yes to having any of these in the past 12 months as having mental illness. We classified all others as having no mental illness.

Mental health. The MIDUS measured emotional well-being with a 6-item scale of positive affect (cheerful, in good spirits, happy, calm or peaceful, satisfied, and full of life during the past 30 days) and a single item of life satisfaction (0 = worst possible life overall these days to 10 = best possible life overall these days). The internal (α) consistency of the emotional well-being scale was 0.91 in 1995.

Positive functioning was measured with Ryff's 6 scales of psychological well-being[4] and Keyes's 5 scales of social well-being.[5] The psychological well-being scales, with a representative item in parentheses, were self-acceptance ("I like most parts of my personality"), positive relations with others ("Maintaining close relationships has been difficult and frustrating for me"), personal growth ("For me, life has been a continual process of learning, changing, and growth"), purpose in life ("I sometimes feel as if I've done all there is to do in life"), environmental mastery ("I am good at managing the responsibilities of daily life"), and autonomy ("I tend to be influenced by people with strong opinions"). The social well-being scales, with a representative item in parentheses, were social acceptance ("People do not care about other peoples' problems"), social growth ("Society isn't improving for people like me"), social contribution ("My daily activities do not create anything worthwhile for my community"), social coherence ("I cannot make sense of what's going on in the world"), and social integration ("I feel close to other people in my community"). The internal (α) consistency of the combined (11-item) scale of positive functioning was 0.81 in 1995.

According to Keyes's criteria, to be flourishing, individuals must exhibit high levels (upper tertile) on 1 of the 2 scales (positive affect or satisfaction) of emotional well-being and high levels on 6 of the 11 items of positive functioning.[31,32] We compared flourishing to not-flourishing adults.

Other variables. Sociodemographic characteristics collected from respondents were race (Whites, Blacks, and other race), gender, and chronological age (coded in 5 age groups for some analyses: 25–34, 35–44, 45–54, 55–64, and 65–74 years). We coded education as

1. professional degree,
2. 2- or 4-year college graduate,
3. some college,
4. high school or general equivalency degree, and
5. less than a high school education.

The MIDUS study measured level of physical inactivity with 5 questions, beginning with "How often do you engage in vigorous physical activity (for example, running or lifting heavy objects) long enough to work up a sweat?" Respondents were then asked how frequently they engaged in vigorous activity during the summer months, vigorous activity during the winter months, moderate activity during the summer months, and moderate activity during the winter months; possible responses were

1. "Several times a week,"
2. "About once a week,"
3. "Several times a month,"
4. "About once a month,"
5. "Less than once a month," and
6. "Never."

We summed the latter 4 items and divided by 4 to create a single continuous variable coded to reflect level of physical inactivity ranging from 1 (activity several times a week) to 6 (never). Finally, respondents were asked whether they were currently smoking cigarettes regularly (yes or no). If asked for clarification, interviewers read the prompt, "By regularly I mean at least a few cigarettes every day."

We included covariates measuring physical illness conditions or physical risk conditions known to predict mortality. We categorized participants as having any cardiovascular disease (CVD) if they reported a medical doctor–diagnosed (1) heart attack, (2) blocked or closed artery (coronary artery disease, coronary heart disease, ischemia), or (3) heart failure (congestive heart failure, enlarged heart). Respondents also indicated whether they had been diagnosed with HIV/AIDS, had had a stroke, or had been diagnosed with, or were under treatment for, any cancer. A separate question asked about whether respondents had breast, cervical, colon, lung, ovarian, prostate, skin, or uterine cancer; lymphoma; leukemia; melanoma; or any other cancer. We included body mass index (BMI; defined as weight in kilograms divided by the square of height in meters) obtained from the self-report of a respondent's current weight, waist size, hip size, and height. The MIDUS study obtained the BMI measurement by including a tape measure with each self-report questionnaire. All respondents were instructed, via a picture and words, to take the measurements standing, avoid taking measurements over clothing, record their answers to the nearest quarter inch, and use the provided diagram to specify the location of hips and waist.

Statistical Analyses

We performed all analyses on weighted data with PASW (formerly SPSS) version 20.0 (SPSS Inc, Chicago, IL). We implemented bivariate analyses of both death and positive mental health with known predictors of death to evaluate their potential confounding effect on the relationship between death and mental health. We generated bivariate frequencies and χ^2 statistics to assess the association of death with positive mental health, mental illness, gender, race, age, educational attainment, tobacco use, and frequency of exercise. We generated bivariate frequencies and χ^2 statistics to assess the association between level of positive mental health with mental illness, gender, race, age, educational attainment, tobacco use, and frequency of exercise.

We used the logistic procedure to run a crude regression model that generated odds ratios (ORs) of death coded as dichotomous (dead or alive at the end of the follow-up period) by level of mental health, coded as flourishing or not flourishing.[33] From a full regression model with the main independent variable of positive mental health and potential confounders, we used a stepwise approach to investigate whether sociodemographic characteristics (age, gender, race, and educational attainment), mental illness, physical inactivity, current smoking, and physical illness and BMI confounded the relationship between death and mental health. We entered the independent variables of age and BMI as continuous variables. The independent variables education and physical inactivity entered models as ordinal variables. We treated all other independent variables as categorical during modeling.

Because 29 observations had missing values for the physical inactivity variable, which affected the precision of regression-based estimates, we used simulation techniques to determine which prediction model was better to impute these values.[34] We randomly selected 29 observations for lack of exercise with known values as our reference point. We then assigned their values as missing and used linear regression to estimate and impute those values. We generated 5 models to regress physical activity with 1 variable at a time: model 1 had age (as categorical), model 2 had age (as continuous), model 3 had gender, model 4 had positive mental health, and model 5 had smoking. We chose these independent variables because of their potential confounding and predictive effect on physical inactivity and death. We generated a sixth model with these 4 independent variables together as predictors: age (continuous), gender, smoking, and positive mental health.

We calculated bias in estimation for each of the 29 observations and total bias. With increasingly accurate imputed values, total bias approached zero, indicating better prediction. We repeated simulations 1000 times to obtain summation of absolute values of total bias. We found the model with gender only and the model with age, gender, mental health, and smoking as predictors to have the lowest, and comparable, absolute values of bias. The analytic set included 29 observations with values for physical inactivity imputed from the latter model. After imputation for physical inactivity, a total of 2 respondents had missing values on education and were dropped from analyses.

We used the −2 log likelihood χ^2 statistic to evaluate the interaction of positive mental health with age and with gender in the logistic regression, once all other variables were adjusted for in the model; however, none of the interactions terms were statistically significant. We evaluated regression model adequacy and fitness by the Hosmer–Lemeshow goodness-of-fit statistic.[35]

RESULTS

Table 1 presents the bivariate association of death with key variables. Death was not associated with baseline (1995) mental illness, but it was associated with positive mental health. Fewer than 1.0% of adults with flourishing mental health in 1995 died over the subsequent 10-year period; 5.5% of nonflourishing adults died.

More men than women and more Blacks than Whites (or respondents of other race) died during the 10-year follow-up period; however, neither correlation reached statistical significance. Both age and level of education were associated with rates of mortality in the expected directions, with mortality increasing as age increased and as level of education decreased. Smoking and level of physical inactivity were associated with mortality, with smokers being more likely to die than nonsmokers, and mortality increasing among individuals who were more inactive. We found no difference in BMI between those who survived and those who died over the study period. However, rates of death were higher among respondents with than without HIV/AIDS, any cancer, stroke, and any CVD.

Adults free of any mental illness were more likely than those with a mental illness to be flourishing (Table 2). More men than women were flourishing. Although more Blacks than Whites were flourishing, the race difference did not reach statistical significance. In general, older adults had higher rates of flourishing than did the 2 youngest age cohorts, and rates of flourishing increased as educational attainment increased. Adults who smoked, who were more physical inactive, and who had higher BMI were less likely to be flourishing. However, we observed no difference in disease status—HIV/AIDS, cancer, stroke, and CVD—between flourishing and nonflourishing adults.

Regression Models

Table 3 shows results of forward-entry stepwise regression, whose aim was to obtain a final and trimmed model that investigated whether preexisting physical illness conditions and risks explained the excess mortality attributable to the absence of positive mental health. The stepwise procedure allowed for entry ($P \leq .05$ for entry) of the following variables: any mental illness, the interaction term of positive mental health by any mental illness, race, age, education, gender, smoking status, physical inactivity, any cancer, HIV/AIDS status, stroke, any CVD, and BMI. In model 1 we discarded the 29 missing observations on physical inactivity and compared this model against model 2, in which we imputed the missing observations.

Our model 2 results were similar to those of model 1. The missing observations on physical inactivity were not missing at random—respondents with missing data were more likely to die over the study period and were less likely to be flourishing than respondents without missing data on physical inactivity. Therefore, failure to include respondents with these missing data could have introduced bias into the estimate of the effect of positive mental health on mortality.

TABLE 1—Study Population Characteristics and Follow-Up Mortality: Midlife in the United States Study, 1995–2005

Baseline Variable[a]	Baseline,[a] No. (%) or Mean ±SD	Survived Follow-up,[b] No. (%) or Mean ±SD	Died During Follow-Up,[b] No. (%) or Mean ±SD	*P*
Mental illness in past y[c]				.24
None	2483 (81.6)	2303 (76.3)	180 (5.4)	
≥1	549 (18.4)	517 (17.4)	32 (1.0)	
Mental health status				.04
Flourishing	584 (18.0)	546 (17.2)	38 (0.8)	
Not flourishing	2448 (82.0)	2273 (76.4)	175 (5.5)	
Gender				.17
Male	1469 (51.5)	1351 (92.9)	118 (7.1)	
Female	1563 (48.5)	1469 (94.2)	94 (5.8)	
Race				.13
White	2586 (85.2)	2405 (93.9)	181 (6.1)	
Black	201 (6.6)	184 (91.2)	17 (8.8)	
Other[d]	245 (8.2)	231 (97.2)	14 (5.3)	
Age, y				<.001
25–34	628 (20.8)	626 (99.6)	2 (0.4)	
35–44	734 (24.2)	721 (98.0)	13 (2.0)	
45–54	730 (24.0)	687 (94.0)	43 (6.0)	
55–64	599 (19.9)	526 (87.9)	73 (12.1)	
65–74	341 (11.1)	260 (77.3)	81 (22.7)	
Educational attainment				<.001
< high school diploma	301 (13.2)	258 (85.5)	43 (14.5)	
High school or general equivalency diploma	888 (38.3)	822 (93.6)	66 (6.4)	
Some college	724 (19.8)	674 (94.8)	50 (5.2)	
College degree	737 (19.2)	703 (96.7)	34 (3.3)	
Professional degree	382 (9.4)	363 (96.5)	19 (3.5)	
Cigarette smoker				.002
Yes	697 (24.3)	628 (91.2)	69 (8.8)	
No	2335 (75.7)	2192 (94.4)	143 (5.6)	
Physical activity				<.001
Several times/wk	1146 (36.9)	1103 (97.3)	43 (2.7)	
~1 time/wk	736 (23.9)	698 (95.9)	38 (4.1)	
Several times/mo	671 (21.7)	614 (91.4)	57 (8.6)	
~1 time/mo	313 (11.4)	274 (88.4)	39 (11.6)	
< 1 time/mo	72 (3.8)	58 (80.2)	14 (19.8)	
Never	93 (2.3)	72 (80.4)	21 (19.6)	
BMI, kg/m^2	30.2 ±16.4	30.2 ±16.4	30.8 ±15.7	
HIV/AIDS status				.004
Infected	10 (0.4)	6 (72.7)	4 (27.3)	
Not infected	3022 (99.6)	2814 (93.7)	208 (6.3)	
Cancer diagnosis ever				<.001
Yes	208 (6.2)	174 (85.1)	34 (14.9)	
No	2824 (93.8)	2646 (94.2)	178 (5.8)	
Stroke diagnosis ever				<.001
Yes	31 (1.0)	22 (73.3)	9 (26.7)	
No	3001 (99.0)	2798 (93.9)	203 (6.1)	
CVD diagnosis ever[e]				<.001
Yes	98 (3.0)	67 (64.1)	31 (35.9)	
No	2934 (97.0)	2753 (94.6)	181 (5.4)	
Total	3032 (100.0)	2820 (93.7)	212 (6.3)	

Note. BMI = body mass index; CVD = cardiovascular diseases. Values are unweighted cell counts and weighted prevalence estimates. Not all columns may sum to column totals because of missing data.

[a]Baseline was 1995.

[b]Follow-up ended 2005.

[c]Mental disorders were major depressive episodes, panic attacks, and generalized anxiety disorders.

[d]Native American/Aleutian Islanders/Eskimo, Asian/Pacific Islanders, or any other race.

[e]Heart attack, blocked or closed artery (coronary artery disease, coronary heart disease, or ischemia), or heart failure (congestive heart failure, or enlarged heart).

TABLE 2—Baseline Study Population Characteristics and Associations with Positive Mental Health: Midlife in the United States Study, 1995

Baseline Variable	Baseline, No. (%) or Mean ±SD	Not Flourishing, No. (%) or Mean ±SD	Flourishing, No. (%) or Mean ±SD	*P*
Mental illness in past y[a]				<.001
None	549 (18.4)	516 (94.6)	33 (5.4)	
≥ 1	2483 (81.6)	1932 (79.1)	551 (20.9)	
Gender				.004
Male	1469 (43.5)	1165 (79.6)	304 (20.4)	
Female	1563 (56.5)	1282 (83.7)	280 (16.3)	
Race				.22
White	2586 (82.0)	2089 (82.2)	497 (17.8)	
Black	201 (11.2)	154 (78.8)	47 (21.3)	
Other[b]	245 (6.9)	205 (84.0)	40 (16.0)	
Age, y				.001
25–34	628 (26.0)	528 (84.5)	100 (15.5)	
35–44	734 (27.7)	617 (84.1)	117 (15.9)	
45–54	730 (19.2)	566 (77.4)	164 (22.6)	
55–64	599 (15.2)	462 (78.7)	137 (21.3)	
65–74	341 (11.9)	275 (82.6)	66 (17.4)	
Educational attainment				<.001
< high school diploma	301 (13.2)	265 (88.2)	36 (11.8)	
High school or general equivalency diploma	888 (38.3)	752 (84.6)	136 (15.4)	
Some college	724 (19.8)	604 (84.4)	120 (15.6)	
College degree	737 (19.2)	559 (76.2)	178 (23.8)	
Professional degree	382 (9.4)	268 (69.2)	114 (30.8)	
Cigarette smoker				<.001
Yes	697 (24.2)	591 (86.8)	106 (13.2)	
No	2335 (75.7)	1875 (80.4)	478 (19.6)	
Physical inactivity[c]	2.41 ±1.26	2.48 ±1.27	2.10 ±1.17	
BMI, kg/m^2	30.2 ±16.4	30.7 ±17.3	28.0 ±11.1	
HIV/AIDS status				.53
Infected	10 (0.4)	8 (75.0)	2 (25.0)	
Not infected	3022 (99.6)	2440 (82.0)	582 (18.0)	
Cancer diagnosis ever				.706
Yes	208 (6.2)	168 (83.0)	40 (17.0)	
No	2824 (93.8)	2280 (81.9)	544 (18.1)	
Stroke diagnosis ever				.5
Yes	31 (1.0)	27 (86.7)	4 (13.3)	
No	3001 (99.0)	2421 (81.9)	580 (18.1)	
CVD diagnosis ever[d]				.474
Yes	98 (3.0)	81 (84.8)	17 (15.2)	
No	2934 (97.0)	2367 (81.9)	567 (18.1)	
Total	3032 (100.0)	2448 (82.0)	584 (18.0)	

Note. BMI = body mass index; CVD = cardiovascular disease. Values are unweighted cell counts and weighted prevalence estimates.
[a]Mental disorders were major depressive episodes, panic attacks, and generalized anxiety disorders.
[b]Native American/Aleutian Islanders/Eskimo, Asian/Pacific Islanders, or any other race.
[c]Coded from 1 = several times/week to 6 = never; *P* value derived from the *F* test.
[d]Heart attack, blocked or closed artery (coronary artery disease, coronary heart disease, or ischemia), or heart failure (congestive heart failure, or enlarged heart).

TABLE 3—Forward-Entry Stepwise Logistic Regression of 10-Year All-Cause Mortality: Midlife in the United States Study, 1995–2005

Baseline Predictors[a]	Model 1 (n = 3001) OR (95% CI)	Model 1 (n = 3001) *P*	Model 2[b] (n = 3030) OR (95% CI)	Model 2[b] (n = 3030) *P*
Crude model				
Not flourishing	1.50 (0.97, 2.30)	.07	1.55 (1.0, 2.39)	.048
Flourishing (Ref)	1.00		1.00	
Step 1				
Not flourishing (Ref = flourishing)	1.69 (1.10, 2.65)	.024	1.75 (1.12, 2.75)	.015
Chronological age	1.10 (1.08, 1.14)	<.001	1.10 (1.08, 1.11)	<.001
Step 2				
Not flourishing (Ref = flourishing)	1.78 (1.10, 2.82)	.013	1.84 (1.17, 2.90)	.009
Chronological age	1.11 (1.09, 1.12)	<.001	1.10 (1.09, 1.11)	<.001
Men (Ref = women)	1.50 (1.10, 2.06)	.012	1.42 (1.04, 1.94)	.027
Step 3				
Not flourishing (Ref = flourishing)	1.64 (1.04, 2.62)	.035	1.68 (1.06, 2.66)	.028
Chronological age	1.10 (1.09, 1.12)	<.001	1.09 (1.08, 1.11)	<.001
Men (Ref = women)	1.56 (1.10, 2.15)	.006	1.48 (1.08, 2.03)	.015
Educational attainment[c]	1.23 (1.05, 1.40)	.008	1.24 (1.07, 1.43)	.004
Step 4				
Not flourishing (Ref = flourishing)	1.70 (1.03, 2.61)	.025	1.75 (1.10, 2.78)	.018
Chronological age	1.10 (1.09, 1.12)	<.001	1.10 (1.08, 1.11)	<.001
Men (Ref = women)	1.57 (1.10, 2.17)	.006	1.49 (1.09, 2.05)	.013
Educational attainment[c]	1.19 (1.03, 1.38)	.016	1.21 (1.05, 1.39)	.009
Blacks (Ref = Whites)	1.79 (1.12, 2.85)	.015	1.94 (1.23, 3.06)	.004
Other race (Ref = Whites)	1.45 (0.58, 2.30)	.286	1.35 (0.69, 2.64)	.383
Step 5				
Not flourishing (Ref = flourishing)	1.71 (1.07, 2.73)	.026	1.76 (1.10, 2.81)	.019
Chronological age	1.11 (1.09, 1.13)	<.001	1.11 (1.09, 1.12)	<.001
Men (Ref = women)	1.51 (1.10, 2.09)	.012	1.44 (1.05, 1.98)	.025
Educational attainment[c]	1.12 (0.97, 1.30)	.131	1.14 (0.98, 1.31)	.085
Blacks (Ref = Whites)	1.84 (1.15, 2.96)	.012	2.01 (1.27, 3.18)	.003
Other race (Ref = Whites)	1.50 (0.75, 2.97)	.25	1.38 (0.70, 2.69)	.345
Cigarette smoker (Ref = nonsmoker)	2.83 (1.97, 4.06)	<.001	2.73 (1.90, 3.90)	<.001
Step 6				
Not flourishing (Ref = flourishing)	1.67 (1.04, 2.69)	.035	1.72 (1.07, 2.77)	.025
Chronological age	1.10 (1.09, 1.12)	<.001	1.10 (1.10, 1.12)	<.001
Men (Ref = women)	1.45 (1.03, 1.99)	.031	1.37 (1.37, 1.89)	.059
Educational attainment[c]	1.12 (1.12, 1.28)	.137	1.12 (1.12, 1.30)	.137
Blacks (Ref = Whites)	1.92 (1.19, 3.09)	.008	2.09 (1.31, 3.32)	.002
Other race (Ref = Whites)	1.33 (0.66, 2.68)	.429	1.25 (0.63, 2.48)	.529
Cigarette smoker (Ref = nonsmoker)	3.03 (2.10, 4.39)	<.001	2.91 (2.02, 4.20)	<.001
CVD (Ref = no CVD)	4.27 (2.57, 7.08)	<.001	4.21 (2.54, 6.98)	<.001
Step 7				
Not flourishing (Ref = flourishing)	1.66 (1.03, 2.68)	.038	1.70 (1.06, 2.74)	.028
Chronological age	1.11 (1.09, 1.12)	<.001	1.11 (1.09, 1.12)	<.001
Men (Ref = women)	1.41 (1.01, 1.97)	.04	1.34 (0.97, 1.85)	.081
Educational attainment[c]	1.09 (0.94, 1.27)	.252	1.11 (0.96, 1.29)	.165
Blacks (Ref = Whites)	1.86 (1.15, 3.01)	.011	2.03 (1.27, 3.24)	.003

Continued

In Table 3, the crude OR of death was 1.55 (95% CI = 1.0, 2.38; *P* = .048) for adults not flourishing relative to those who were flourishing. The effect of positive mental health on death did not depend on mental illness; this interaction term did not meet entry criteria (results therefore not shown). We entered all sociodemographic predictors from step 1 through step 4. With age entered in step 1, the OR of death among those not flourishing rose from 1.55 in the crude model to 1.75 in step 1, indicating that age confounded the relationship of positive mental health with mortality. With gender entered, the OR of death for those not flourishing rose from 1.75 in step 1 to 1.84 in step 2, indicating that gender partially confounded the relationship of positive mental health with mortality.

In step 3, decreasing levels of education increased the likelihood of death (OR = 1.24; 95% CI = 1.07, 1.43; *P* = .004). Moreover, the OR of death decreased from 1.84 in step 2 to 1.68 in step 3 for nonflourishing adults; thus, the lower level of educational attainment among nonflourishing adults explained a 9% reduction of the odds of death associated with the absence of positive mental health. With race entered, the OR of death for those not flourishing rose from 1.68 in step 3 to 1.75 in step 4; race partially confounded the relationship of positive mental health with mortality because more Blacks, who were more likely to die, were flourishing than were Whites.

We entered all physical health variables from step 5 through step 8. Stroke and BMI did not predict mortality; neither variable met forward-entry criteria (results therefore not shown). In step 8, with all significant health variables entered, the OR of death was 1.62 (95% CI = 1.0, 2.62; *P* = .05) for nonflourishing relative to flourishing adults. The OR of death for those not flourishing decreased from 1.75 in step 5 (where no health variables were entered) to 1.62 in step 8, indicating that the physical disease variables collectively explained only about 7% of the odds of death attributable to the absence of positive mental health. This was not surprising because none of the bivariate associations of the disease variables in step 8 were associated with level of positive mental health (Table 2). Adults with HIV/AIDS were nearly 16 times as likely

TABLE 3—*Continued*

Other race (Ref = Whites)	1.34 (0.66, 2.72)	.411	1.27 (0.58, 2.52)	.503
Cigarette smoker (Ref = nonsmoker)	3.07 (2.12, 4.44)	<.001	2.96 (2.05, 4.27)	<.001
CVD (Ref = no CVD)	4.31 (2.59, 7.16)	<.001	4.27 (2.57, 7.08)	<.001
HIV/AIDS (Ref = no HIV/AIDS)	15.9 (3.40, 74.1)	<.001	17.0 (3.97, 72.9)	<.001
Step 8[d]				
Not flourishing (Ref = flourishing)	1.57 (0.97, 2.54)	.068	1.62 (1.00, 2.62)	.05
Chronological age	1.10 (1.08, 1.12)	<.001	1.10 (1.08, 1.12)	<.001
Men (Ref = women)	1.55 (1.11, 2.17)	.01	1.46 (1.05, 2.03)	.025
Educational attainment[c]	1.06 (0.91, 1.23)	.464	1.08 (0.93, 1.25)	.315
Blacks (Ref = Whites)	1.60 (0.98, 2.62)	.063	1.76 (1.09, 2.85)	.02
Other race (Ref = Whites)	1.20 (0.59, 2.44)	.616	1.15 (0.57, 2.29)	.698
Cigarette smoker (Ref = nonsmoker)	2.91 (2.01, 4.23)	<.001	2.82 (1.95, 4.07)	<.001
CVD (Ref = no CVD)	3.84 (2.30, 6.40)	<.001	3.81 (2.29, 6.35)	<.001
HIV/AIDS (Ref = no HIV/AIDS)	14.6 (3.19, 67.2)	<.001	15.7 (3.73, 66.3)	<.001
Level of physical inactivity[e]	1.26 (1.11, 1.42)	<.001	1.24 (1.10, 1.40)	<.001

Note. CI = confidence interval; CVD = cardiovascular disease; OR = odds ratio. *P* value for model entry ≤ .05.
[a]Baseline measures taken in 1995.
[b]The variable of physical inactivity had values imputed for 29 missing observations.
[c]Treated as continuous (ordinal) and coded from 1 = professional degree to 5 = did not graduate from high school.
[d]Predictive accuracy for model 1 was 93.6% (χ^2 = 10.2; *df* = 8; *P* = .254) and for model 2 was 93.5% (χ^2 = 13.9; *df* = 8; *P* = .083), according to the Hosmer–Lemeshow goodness-of-fit test.
[e]Treated as continuous (ordinal) and coded from 1 = several times/week to 6 = never.

as those without to die during the study period (OR in step 8 = 15.7; 95% CI = 3.73, 66.3; *P* < .001), but the confidence intervals (CIs) were large because few participants had HIV/AIDS at baseline. Adults who smoked were nearly 3 times as likely as nonsmokers to die (OR = 2.82; 95% CI = 1.95, 4.07; *P* < .001), adults with CVD were almost 4 times as likely as those without to die (OR = 3.81; 95% CI = 2.29, 6.35; *P* < .001), and the odds of death were greater among more physically inactive adults (OR = 1.24; 95% CI = 1.10, 1.40; *P* < .001).

Mental Health and Mortality

We investigated whether specific components of well-being that made up the categorical assessment of positive mental health were more or less predictive of mortality. We regressed separately, and in specific combinations, the continuous variables measuring overall emotional, overall psychological, and overall social well-being onto death, while adjusting for all sociodemographic variables from step 4 (Table 3). Alone, an increasing level of emotional well-being (OR = 0.91; 95% CI = 0.85, 0.98; *P* = .01) and psychological well-being (OR = 0.95; 95% CI = 0.92, 0.98; *P* = .002) predicted decreasing likelihood of death; social well-being was marginally statistically significant (OR = 0.97; 95% CI = 0.94, 1.0; *P* = .087). When regressed with social well-being, emotional well-being remained a predictor of mortality (OR = 0.91; 95% CI = 0.84, 0.98; *P* = .017), and social well-being remained insignificant. When combined with psychological well-being, emotional well-being no longer predicted mortality (OR = 0.95; 95% CI = 0.88, 1.0; *P* = .21). Increasing levels of psychological well-being predicted a decreasing chance of death (OR = 0.96; 95% CI = 0.92, 0.99; *P* = .03). Thus, all of the effect of emotional well-being on mortality was explained by its modest correlation with psychological well-being (*r* = 0.54; *P* < .001).

When regressed together, neither emotional, psychological, nor social well-being reached conventional levels (*P* < .05) of statistical significance. However, when all 3 forms of well-being were summed together, total well-being was a significant predictor of mortality (OR = 0.98; 95% CI = 0.96, 0.99; *P* = .008). When we included the physical health variables, total well-being remained a predictor of death up to step 8 (OR = 0.99; 95% CI = 0.97, 1.0; *P* = .119), at which point physical inactivity explained its relationship with mortality. Thus, the predictive power of the categorical assessment of positive mental health—which integrates all components of well-being—could not be attributed to any single component of well-being and especially not emotional well-being, which has been the focus of most previous studies.[9–12]

DISCUSSION

The absence of positive (flourishing) mental health increased the probability of all-cause mortality for men and women at all ages after adjustment for known causes of death. The full adjusted likelihood of death increased by as much as 62% over a 10-year follow-up for adults who were not flourishing, which represents 8 in 10 US adults, according to the MIDUS national probability sample. The effect of the absence of positive mental health on mortality was independent of the individual and joint effects of factors known to be causally related to death, such as age, gender, race, physical inactivity, smoking, and physical disease (CVD, cancer, stroke, etc.).

A key strength of our study was its longitudinal nature, which allowed evaluation of the temporal associations of mental health measured in 1995 with death during the ensuing 10 years. The MIDUS study included comprehensive and validated scales and diagnostic tools for mental health and mental illness.[4,5,7,8,31,32,36–40]

Limitations

Selection bias could have affected the enrollment of the cohort in 1995 or the death records follow-up in 1995 to 2005. However, individuals were selected through a form of randomized sampling in 1995, and participation rates between 1995 and 2005 were adequate, so selection bias was likely small. Confounding by variables known to be causally associated with death and related to positive mental health could have affected our findings. We incorporated variables known in the scientific literature to be strong predictors of death: age, gender, race, smoking, physical inactivity, cancer, CVD, HIV/AIDS, and BMI. We also included variables known to be associated with positive mental health, such as mental illness, education, and gender. The

negative bias affected by this set of potential confounders on the association between death and positive mental health was significant. For example, we observed an increase of 20% over the crude model in the odds of death among those who were not flourishing when we included age. Gender and race were also confounders that produced slight increases in the odds of death among those not flourishing.

Finally, the imputation of physical inactivity values for the 29 missing observations was necessary to increase the precision of estimates. Because respondents who had missing data were more likely than others to die, and physical inactivity among those with complete data also predicted death, failure to include those with missing values on the physical inactivity variable could have led to some bias in estimation. In addition, comparison across regression models with physical inactivity imputed or not imputed, with or without adjustment for confounders, showed the point estimate for the strength of the association (i.e., ORs) between death and positive mental health did not meaningfully change.

Conclusions

Tobacco use and physical inactivity, which are among the leading modifiable causes of death in the United States,[24,25] are likely mechanisms that may explain how positive mental health affects risk of mortality. Previous studies focusing on measures of emotional well-being found associations with health-protective behaviors, which helped to explain the risk of mortality. Across several cultures and studies, lower levels of emotional well-being have been associated with increased tobacco use and physical inactivity, each of which has partially explained the excess mortality associated with lower emotional well-being.[22,23] We found that smoking, physical inactivity, and any CVD—all of which were higher among adults who were not flourishing than among those with flourishing mental health—partially explained the OR of mortality associated with the absence of flourishing mental health. However, all variables were measured at the same time point, so we could not determine temporal ordering and true mediation without further research.

The mechanisms by which positive mental health may exert its influence on the odds of death should therefore be investigated by other longitudinal studies that have longer follow-up periods and a more comprehensive array of variables. Positive mental health should be considered for surveillance and ongoing panel studies for these purposes, together with other mental health and quality-of-life indicators, to better predict mortality. ■

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Contributors

C. L. M. Keyes conceptualized the study and supervised all aspects of its implementation. Both authors performed analyses and wrote the article.

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Human Participant Protection

The Midlife in the United States Study survey complied with institutional review board standards of the University of Wisconsin and of the Harvard Medical School, and interviewers read to the interviewees a standard informed consent protocol at the beginning of the telephone interview, which preceded the self-administered questionnaires.

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