

**The Nexus of Cardiovascular Disease and Depression Revisited: The Complete Mental Health Perspective and the Moderating Role of Age and Gender**

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**Abstract**

This study employs a measure of mental health as a complete state that combines information about an individual's mental illness (i.e., major depressive episode in the past 12 months) and subjective well-being (i.e., mental health) status to investigate its linkage with CVD's. Data are from a representative sample of U.S. adults between the ages of 25 and 74 collected in 1995 (n=3,032). About 12% of adults reported any CVD.

Independent of mental health status, risk for any CVD increased with age and as education decreased, and the risk of any CVD was higher among males, married adults, and unemployed adults. The prevalence of any CVD was lowest in adults who were mentally healthy and higher among adults with major depressive episode, with minor depression, with languishing, and with moderate mental health. The relationship of CVD and mental health was moderated by age and sex; mental health status was associated with significant risk for any CVD primarily among females between the ages of 45 and 74. Findings contribute to a growing literature on the protective effects of high, and risk effects of low, levels of subjective well-being, and the role of age and sex in specifying specific physical and mental health comorbidities.

## **The Nexus of Cardiovascular Disease and Depression Revisited: The Complete Mental Health Perspective and the Moderating Role of Age and Gender**

Research that informs the prevention and management of cardiovascular disease (CVD) in primary care and community settings may benefit from a comprehensive conception and operationalization of mental health. Because science traditionally regarded mental health as the absence of mental illnesses like depression, there has been no standard by which to measure, diagnose, and study the presence of mental health. Recently Keyes' (2002, 2003) has conceptualized and diagnosed mental health as a “complete state” consisting of the presence of states of positive emotion and positive functioning in life rather than merely the absence of psychopathology.

The complete mental health diagnosis classifies individuals into one of five states of mental health. Specifically, *flourishing* is a state of mental health in which people are free of depression and filled with high levels of emotional, psychological, and social well-being. Human *languishing*, however, is a state of emptiness in which individuals are devoid of emotional, psychological, and social well-being, but they are not depressed. Languishing individuals are neither mentally ill nor mentally healthy. Moderately mentally healthy adults are not depressed and they are not languishing but they have not reached the level of flourishing in life. Lastly, individuals may fit the criteria for major depressive disorder and also report very low levels of subjective well-being—which is considered a comorbidity in terms of having depression and also languishing in life—or individuals may report a major depressive disorder but also fit the criteria for moderate mental health or flourishing life, which is considered a form of “pure depression” since it is not comorbid with languishing in life. This study employs the complete mental health

diagnosis to investigate its association with coronary artery and cardiovascular diseases in community-dwelling adults.

### Cardiovascular Disease and Mental Health

Cardiovascular disease (CVD) is a prevalent and costly chronic disease. Nearly 62 million Americans—52% of which are females 40% are estimated to be above the age of 65—have at least one or more types of CVD (American Heart Association, 2001). The combined direct (e.g., treatment) and indirect costs (e.g., lost days of work) of CVD was about \$180 billion in 1999 (Keyes and Lopez, 2002). Approximately 1 in 2.5 deaths directly result from CVD, and about 47% of men and 54% of women died from some form of CVD in 1999 (American Heart Association, 2001). However, more adults are living longer with CVD than ever before (Siegler, Kaplan, Von Dras and Mark, 1999). With the accumulation of information about the determinants of CVD (e.g., smoking), medical management (i.e., surgical and pharmacological) has improved, and risk factor modification of CVD (e.g., diet and exercise) has become an effective tool for preventing mortality (Lakatta, 1999; Riegel and Bennett, 2000; Smith and Leon, 1992). Deaths due to CVD have decreased by about 30% over the past 20 years (American Heart Association, 2001).

Compared with lifestyle, a less recognizable risk factor for CVD is mental illness, cases of which (e.g., depression) are misdiagnosed or under-treated in primary care settings (see e.g., Wells, Schoenbaum, Unützer, Lagomasino, and Rubenstein, 1999; Young, Klap, Sherbourne, and Wells, 2001). Major depressive disorder has been shown to be a cause and consequence of CVD (Ford, Mead, Chang, Cooper-Patrick, Wang and Klag, 1998; Hemmingway and Marmot, 1999; Glassman and Shapiro, 1998; Musselman,

Evans, and Nemeroff, 1998). Nearly two-thirds of heart attack survivors report some symptoms of depression (Carney, Freedland, Sheline, and Weiss, 1997), and the annual prevalence of major depression among heart attack survivors is markedly higher than in the general adult population (Carney et al., 1997; Lesperance, Frasura-Smith, and Talajic, 1996; U.S. Public Health Service, 1999). Even among older adults with no history of CVD, risk for cardiovascular mortality increases as depressive symptoms increase (Penninx, Beekman, Honig, Deeg, Schoevers, van Eijk, and van Tilburg, 2001; see also Lesperance et al., 1996).

Studies of the nexus of mental illness and CVD suffer from an impoverished conception and diagnosis of mental health. Literally all research has compared mentally ill individuals against individuals who do not meet Diagnostic and Statistical Manual (DSM—American Psychiatric Association, 1994) criteria for a mental illness. This approach treats individuals free of a mental illness as having been mentally healthy over a designated time period. However, recent research shows that barely one-quarter of individuals who had not suffered an episode of major depression during the past year fit the criteria for good mental health. The vast majority of non-depressed adults were moderately mentally healthy, while nearly one-quarter of non-depressed adults were diagnosed as *languishing* in life with very low levels of subjective well-being (Keyes, 2002; 2003).

Non-depressed adults who were languishing were indistinguishable from adults with a pure episode of major depression in their profiles of high limitations of daily activities, reduced workplace productivity, and number of days missed from work (Keyes, 2002; 2003). In turn, adults who were mentally healthy (i.e., *flourishing*) had the

fewest limitations of activities, the highest level of workplace productivity, and the fewest missed days of work. Consequently, estimates of CVD risk among depressed individuals are likely to be inaccurate and possibly underestimated because when compared against the group of non-depressed individuals that is heterogeneous with regard to mental health status.

### Atherosclerosis: Toward Understanding the Nexus of Mental Health and CVD

Atherosclerosis—i.e., arterial hardening and plaque buildup—is a leading explanation for the genesis of CVD (Smith & Leon, 1992) and for the nexus of mental illness and CVD (Musselman et al., 1998). Depression is purported to be a catalyst of coronary atherosclerosis because of the associated decrements in neurohormones (e.g., serotonin) that, in turn, have been shown to affect the shape and aggregation reactivity of platelets (Berk & Plein, 2000; Musselman et al., 1996). Put simply, depression (i.e., like poor diet) appears to be conducive to the buildup of coronary plaques.

Atherosclerosis is also a leading explanation for the linkages of aging and gender with CVD. With age, and independent of all known lifestyle risk factors, risk of CVD increases due to age-related accumulation of coronary atherosclerosis (Castelli, 1984; Grundy, 1999; Jackson et al., 1997). Although men are at greater risk for CVD than women at all ages, this disparity decreases markedly after the menopausal transition (Grundy, 1999). Perimenopausal women and post-menopausal<sup>1</sup> women are 2-to-3 times more likely than pre-menopausal women to have CVD (American Heart Association, 2002), which is attributed to decreased production of estrogen (and progesterone) during and after the menopausal transition (Mendelsohn, 2000). With age, then, men and

women experience age-related accumulation of coronary atherosclerosis; only women, however, accrue an additional atherosclerotic agent from the age-specific menopausal transition.

In sum, the purpose of this study is to employ a measure of mental health as a complete state (Keyes, 2002) that combines information about an individual's mental illness and subjective well-being (i.e., mental health) status to investigate its linkage with CVD. Are adults who are mentally healthy (i.e., "flourishing") least likely to report any CVD, compared with adults at all other levels of mental health? A second research question is whether the complete mental health diagnostic categories are independent risk factors for CVD. A third research question is whether the risk of CVD by mental health status depends on age and gender or is constant across ages and for men and women. There are three possible scenarios for the third research question. First, the relationship of mental health with CVD is the same for adults of all ages (i.e., risk of CVD by mental health is constant). However, this first scenario requires mental health to be a potent and fast-acting atherosclerotic agent to promote risk of CVD in young as well as old adults. Second, mental health may be a stronger risk factor for CVD in older than in younger adults (i.e., risk of CVD depends on age but not on gender).

Third, risk of CVD by mental health status depends on both age and gender, with mental health playing its strongest role in risk for CVD among older women who are either in the midst of peri-menopause (i.e., women who are 45 years old or older) or who are post-menopausal. By comparison, mental health may play a lesser role in its risk for CVD among the same-aged group of older males, and still an even lesser role in risk for

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<sup>1</sup> Menopause is a period of at least six months or more of complete cessation of menstruation and, hence, ovulation, which occurs on average at the ages of 50-to-51 and is preceded by a ten-year period called

CVD among younger males and younger females. This third scenario assumes that mental health is a “synergistic” atherosclerotic agent because it becomes a risk factor for CVD when combined with multiple and distinctive risk factors such as advanced age and gender (i.e., menopause).

## **Methods**

### ***Sample***

Data are from the MacArthur Foundation’s Midlife in the United States survey. This survey was a random-digit-dialing sample of noninstitutionalized English-speaking adults age 25 to 74 living in the 48 contiguous states, whose household included at least one telephone. In the first stage of the multistage sampling design, investigators selected households with equal probability via telephone numbers. At the second stage, they used disproportionate stratified sampling to select respondents. The sample was stratified by age and sex, and males between ages 65 and 74 were over-sampled.

Field procedures were initiated in January of 1995 and lasted 13 months. Respondents were contacted and interviewed by trained personnel, and those who agreed to participate in the entire study took part in a computer-assisted telephone interview lasting 30 minutes, on average. Respondents then were mailed two questionnaire booklets requiring 1.5 hours, on average, to complete. Respondents were offered \$20, a commemorative pen, periodic reports of study findings, and a copy of a monograph on the study.

The sample consists of 3,032 adults. With a 70 percent response rate for the telephone phase and an 87 percent response rate for the self-administered questionnaire phase, the combined response is 61 percent ( $.70 \times .87 = .61$ ). Descriptive analyses are

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perimenopause, during which the frequency and intensity of menstruation and levels of estrogen decrease.

based on the weighted sample to correct for unequal probabilities of household and within household respondent selection. The sample weight post-stratifies the sample to match the proportions of adults according to age, gender, education, marital status, race, residence (i.e., metropolitan and non-metropolitan), and region (Northeast, Midwest, South, and West) based on the October 1995 Current Population Survey.

### ***Measures***

*Cardiovascular Disease.* During the telephone interview, respondents were asked whether they suspected, or had a medical doctor confirm, that they had heart trouble. Respondents who replied “yes” to that question were then asked to identify the diagnoses of their heart trouble. Interviewers read the following list in this order and asked respondents to indicate whether or not the diagnosis had been rendered by the doctor: (1) heart attack, (2) angina, (3) high blood pressure, (4) valve disease (mitrovalve prolapse, aortic insufficiency, bicuspic aortic valve), (5) hole in the heart (atrial septal defect, ventricular septal defect), (6) blocked or closed artery (coronary artery disease, coronary heart disease, ischemia), (7) irregular or fast heart beat (arrhythmia), (8) heart murmur, (9) heart failure (congestive heart failure, enlarged heart), and (10) any other cardiovascular disease. Respondents who did not nominate any of the 10 cardiovascular diseases were coded as having “none of the diseases” diagnosed.

*Mental illness.* The Midlife in the United States survey employed the Composite International Diagnostic Interview Short Form (CIDI-SF) scales (Kessler, Andrews, Mroczek, Ustun, and Wittchen, 1998), which demonstrated excellent diagnostic sensitivity and specificity when compared with diagnoses based on the complete CIDI in the National Comorbidity Study (Kessler, DuPont, Berglund, and Wittchen, 1999).

During the telephone interview, the CIDI-SF was used to assess whether respondents exhibited symptoms indicative of major depression episode (MDE) during the past 12 months. Respondents were classified as having had a major depressive episode based on the criteria established by the DSM-III-R (American Psychiatric Association 1987).

Mental health is measured with 3 established multi-item scales of subjective well-being and based on Keyes (2002).

*Emotional well-being.* By self-administered questionnaire, respondents indicated how much of the time during the past 30 days—"all," "most," "some," "a little," or "none of the time"—they felt six symptoms of positive affect. The positive affect symptoms are (1) cheerful, (2) in good spirits, (3) extremely happy, (4) calm and peaceful, (5) satisfied, and (6) full of life. The internal reliability of the positive affect scale is .91. Respondents also evaluated their life satisfaction as follows: "rate their life overall these days" on a scale from 0 to 10, where 0 meant the "worst possible life overall" and 10 meant "the best possible life overall."

*Psychological well-being.* Ryff's (1989) measures of psychological well-being operationalize how much individuals see themselves thriving in their personal life. The scales represent distinctive dimensions (Ryff and Keyes 1995) of subjective well-being. The scales with a representative item in parenthesis are as follows: 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”).

Each scale consisted of three items with a relative balance of positive and negative items self-administered via the questionnaire. On a scale from 1 to 7 (with 4 as a middle category of neither agree nor disagree), respondents indicated whether they agreed or disagreed strongly, moderately, or slightly that an item described how they functioned (i.e., thought or felt). Negative items were reverse-coded. The three-items scales have shown modest internal consistency (i.e., around .50; see Ryff and Keyes 1995), and the internal consistency of the combined 18 items is .81.

*Social well-being.* Keyes’ (1998) measures of social well-being operationalize how much individuals see themselves thriving in their social life. The scales with a representative item in parentheses are as follows: social-acceptance (“People do not care about other peoples’ problems”), social actualization (“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”).

Each scale consisted of three items with a relative balance of positive and negative items and was self-administered. On a scale from 1 to 7 (with 4 as a middle category of neither agree nor disagree), respondents indicated whether they agreed or disagreed strongly, moderately, or slightly that an item described how they functioned (i.e., thought or felt). Negative items were reverse-coded. The three-item scales have shown modest-to-excellent internal consistency (Keyes 1998), and the internal consistency of the social well-being scale with all items combined is .81.

To diagnose mental health, all scales of well-being were divided by the number of constituent items, standardized, and tertiles were computed for each scale. Individuals with scores in the upper tertiles of one of the two emotional well-being scales and six of the 11 scales of psychological and social well-being were classified as flourishing. Individuals with scores in the lower tertiles of one of the two emotional well-being scales and six of the 11 scales of psychological and social well-being were classified as languishing. Adults who were neither flourishing nor languishing were classified as moderately mentally healthy.

Complete mental health status was constructed by crosstabulating the depression diagnosis with the mental health diagnosis. This resulted in the following categories of complete mental health: flourishing (i.e., completely mentally healthy), moderately mentally healthy, languishing (i.e., without MDE), major depressive episode (MDE), and languishing and MDE. In addition, 69 respondents had 1-3 symptoms of depression (i.e., did not meet criteria for major depression) and were coded into a sixth category and labeled “minor depression” (see Keyes, 2002 for further details of the diagnosis).

*Sociodemographic and control variables.* Chronological age was coded into four dummy variables—ages 25 to 34, 35 to 44, 45 to 54, and ages 55 to 64—and aged 65 to 74 was the reference category. Sex, race (white versus minority), marital status (currently married versus all other), and employment status (part- or full-time versus unemployed) were coded dichotomously. Education, measured as the highest grade or year of schooling completed at the time of the interview, was coded into three dummy variables: 12 or fewer years, 13 to 15 years, and respondents with 16 or more years of education (respondents with 12 years or fewer were in the reference category).

Individuals who had never smoked were coded 0 and respondents who said they had smoked or were currently smoking several cigarettes a day were coded 1. Individuals who were taking prescribed medications for diabetes were coded 1, and those who were not were coded 0 and assumed to be free of diabetes. Last, in four separate questions, respondents were asked about how much they exercised (1) vigorously (enough to break a sweat) or (2) moderately during the (3) summer months and during the (4) winter months. The exercise variable reflects a count of the number of times a respondent said she or he exercised “several times a week or more.” As such, the exercise variable ranges from a high of 4, meaning the respondents engaged in both moderate and vigorous physical activities at least several times or more a week during the summer and the winter months, while a 0 means the respondents did not engage in any regular moderate or vigorous physical activity.

## **Results**

Table 1 presents the weighted sample prevalence estimates of CVDs, mental health status, and their crosstabulation. Nearly 12% had at least one CVD. Generally, the prevalence of any specific CVD’s was between 1% and 2%, with the exception of heart failure (i.e., 0.5%), septal defect (i.e., 0.2%), and “any other” (i.e., 4.4%) CVDs. Over half of the sample fit the criteria for moderate mental health; just over 17% fit the criteria for complete mental health (i.e., “flourishing”). Almost 12% fit the criteria for the absence of mental health (i.e., “languishing”), while just over 2% had minor depression, defined here as 1-to-3 symptoms of major depression. In turn, nearly 5% of the sample fit the criteria for complete mental illness with a major depressive episode as well as

languishing; exactly 9.5% had a major depressive episode during the past 12 months without languishing (i.e., had moderate or higher levels of subjective well-being).

[Table 1 about here]

Table 1 also contains the unadjusted association of CVD with mental health. Of course, there is a corpus of research linking physical health (objective and subjective reports) with mental health, showing that mental health decreases as physical health decreases (see e.g., Cohen and Rodriguez, 1995; Patrick and Erickson, 1993; Salovey, Rothman, Detweiler, and Steward, 2000). Consistent with this prior research, this study shows that the complete mental health diagnosis covaries with any CVD. The prevalence of any CVD is highest (i.e., 18.9%) among adults who are completely mentally ill—i.e., having major depression and languishing in life. Conversely, the prevalence of any CVD is lowest (i.e., 8.2%) among adults who are flourishing and completely mentally healthy—i.e., having high levels of subjective well-being and no major depressive episode during the past year. Consistent with the premise of the complete mental health perspective, the prevalence of any CVD among adults who are languishing or moderately mentally healthy was literally the same as the prevalence of any CVD among adults who had major depressive disorder. The same “gradient” of CVD by complete mental health status was found for the specific diseases of valve disease (e.g., aortic insufficiency), congestive heart failure, septal defects (i.e., hole in the heart), and “any other” CVDs.

When controlling for other known sociodemographic risk factors of CVD such as age, sex, social inequality (i.e., educational attainment), is complete mental health status still associated with the likelihood of any CVD? Table 2 presents the results of the

multivariate logistic regression of the dichotomous outcomes of any CVD (1=yes; 0=no) onto all control variables and mental health status. Regardless of mental health status, males, older adults above the ages of 45, less educated, married, and unemployed individuals were at greater risk for any CVD. Moreover, current or past smokers, diabetics, and individuals who did not exercise regularly were at elevated risk for CVD.

Using dummy coded variables for each mental health status, the reported odds ratio is the adjusted risk of any CVD when compared against mentally healthy adults (i.e., flourishing adults). Adults with minor depression had the same odds of any CVD as mentally healthy adults. However, moderately mentally healthy adults were 1.5 times more likely than flourishing adults to have any CVD. The languishing variable was a marginally statistically significant predictor at a p-level of .07, and languishing adults were 1.5 times more likely than the mentally healthy adults to have any CVD. Thus, the absence of mental health—moderate mental health or languishing—may be a risk factor for CVD when compared against genuinely mentally healthy adults.

Last, adults who had a pure episode of major depression were 2.1 times more likely than flourishing adults to have any CVD. Strikingly, adults who were completely mental ill with languishing and a major depressive episode were nearly 3.0 times more likely than flourishing adults to have any CVD. Thus, next to the age range of 65 to 74, complete mental illness (i.e., depressed and languishing) was the second highest risk factor for CVD, and a greater risk factor for CVD than diabetes. Based on a separate logistic regression (results not shown but available upon request), where mental health status was coded as depressed or non-depressed, the risk for any CVD was only 1.7 times higher among adults with major depression compared against non-depressed adults. Thus,

the complete mental health perspective, as predicted, provides a more accurate assessment of the risk of poor mental health, because it compares the risk against the more homogenous group of genuinely mentally healthy adults.

[Table 3 about here]

Does the relationship of mental health status with any CVD constant across age and gender categories or does it depend on an individual's age, sex, or both? Table 3 presents the adjusted odds ratio of any CVD associated with mental health status separately for younger (ages 25 to 44) and older (ages 45 to 74) males and females. The cut-off point of age 45 was chosen because it represents the average age at which women are at the midpoint of perimenopause and therefore should be experiencing noteworthy reductions of estrogen. Among younger males, only minor depression was associated with elevated risk for any CVD. Young males with 1-to-3 symptoms of major depression were 5.6 times more likely than young flourishing males to have any CVD. Among older males, the comorbid condition of depressed and languished was a marginally statistically significant risk factor for CVD. That is, older males who were languishing and depressed were 3.0 times more likely than older flourishing males to have any CVD. In general, and when controlling for sociodemographic variables and some known lifestyle causes of CVD, mental health status among males is a poor predictor of risk for any CVD.

Among younger females, mental health status did not predict risk of any CVD. However, mental health status was strongly associated with elevated risk of any CVD among older females. Specifically, and compared with mentally healthy (“flourishing”) older females, older females who were languishing were 2.4 times more likely, and older

females with moderate mental health were 3.2 times, more likely to report any CVD. Moreover, older females with a pure episode of major depression were nearly 4 times more likely, while older females who were languishing and had an episode of major depression were 5.7 times, more likely than mentally healthy older females to have any CVD.

In short, the relationship of cardiovascular disease and mental health status depends on both age and sex, with risk of any CVD associated with mental health status being primarily specific to older women. Only minor depression in younger males, and the comorbid condition of languishing and depressed in older makes, were independent risk factors for CVD.

## **Discussion**

Cardiovascular disease and mental disorders are among the most socially and economically burdensome diseases in the U.S. (see e.g., Keyes and Lopez, 2002). Major depression and CVD are highly comorbid, with studies supporting the view that mental illness is a cause as well as a consequence of CVD (e.g., post myocardial infarction) that hastens death and spawns additional disease. Prior research may underestimate the risk for CVD associated with depression, for example, because that risk is compared against a heterogeneous group of non-depressives, members of which are assumed to be mentally healthy. However, the presumption of mental health among all non-depressed individuals has been challenged by research that employs the diagnosis of mental health as a complete state (see Keyes, 2002; in press). This study employed this expanded

conception and measurement of complete mental health to better estimate its linkage with CVD, and to investigate whether this relationship was moderated by age or sex.

Truly mentally healthy adults—i.e., flourishing adults—had the lowest prevalence of any CVD. By comparison, adults who have the worst profile of mental health—i.e., individuals who are not only absent of mental health but also have depression—also had the highest prevalence of any CVD. Adults who had the absence of mental health (i.e., languishing) had the same prevalence of any CVD as adults who had a major depressive episode. Moreover, multivariate logistic regression revealed that, compared with the mentally health adults (i.e., flourishing individuals), all other adults other than those with minor depression were at elevated risk for any CVD. The risk of any CVD was 1.7 times higher among depressed when compared against all non-depressed. However, the complete mental health perspective revealed that the “true” risk of any CVD for depression was higher when compared against mentally healthy adults. In particular, the risk of any CVD was threefold among depressed adults when they were also languishing in life, compared against mentally healthy (flourishing) adults.

Further analyses revealed that the nexus of CVD and mental health was contingent on both age and by sex. When controlling for sociodemographic and lifestyle risk factors, results revealed that there the risk of any CVD associated with mental health was located almost exclusively among females who were 45 years old or older. Older females who were moderately mentally healthy, who were languishing, who had pure depression, or had the condition of depression on top of languishing were at elevated risk for any CVD when compared against mentally healthy older females. Whether this association of CVD and mental health in older women is due to the hypothesized

synergies of the physiological catalysts of atherosclerosis associated with age, menopause, and poor mental health remains an interesting path for future research.

The importance of accurately assessing the risk and burden of diseases and disorders such as CVD and mental health and illness is paramount in the 21<sup>st</sup> century. According to the World Health Report (World Health Organization, 2000) that ranked the healthcare systems of 191 nations, the U.S. ranked 1<sup>st</sup> in per capita health expenditures. With the largest cohort of adults approaching older adulthood (i.e., “baby boom”), it is disquieting that healthcare in the U. S. is currently among the most costly budget items for families and government. Healthcare consumes almost 1/7<sup>th</sup> of the country's Gross Domestic Product (GDP). Healthcare spending consumes 13% of the GDO, compared with 6% for public education spending and 4% for national defense spending. By about 2020, as the baby boom generation begins to reach the age of about 70, healthcare expenditures are projected to rise to 25% of the GDP (see e.g., Lamm, 2000). Despite spending the most on health, the U.S. ranked 24<sup>th</sup> in life expectancy, 71<sup>st</sup> in level of health, and 37<sup>th</sup> in terms of overall health system performance (World Health Organization, 2000).

While the reduction of rates of CVD over the past decades has done much to alleviate the direct and indirect costs associated with this most burdensome disease (see American Heart Association, 2001), the story regarding mental illness is not nearly as promising. Rates of major depression remain high and appear to be on the rise in many countries, and the age of first onset of depression has declined (Cross-National Collaborative Group, 1992; Murray and Lopez, 1996; Wickramaratne, Weissman, Leaf, and Holford, 1989). Moreover, a consistent research finding is the u-shaped association

of age with number of depressive symptoms and depression caseness (e.g., Mirowsky and Ross, 1992). That is, depression is most prevalent among younger adults (18-39), least prevalent among middle-aged adults (40-65), and its prevalence is high among older adults, though not reaching the same level as in younger adults. As such, a larger portion of more recent cohorts will spend more of the life-course with a very high risk for recurrent depression and its sequelae, while the current baby boom generation may be approaching the stage in life when it is at elevated risk for mental illness and its complications. In sum, understanding the nexus of complete mental health with cardiovascular diseases, among others, should be a paramount objective.

Measures of subjective well-being, which are the basis for the diagnosis of complete mental health (Keyes, 2003), have been associated with mortality and morbidity. Whereas high levels of subjective well-being protect against, low levels of subjective well-being elevate risk for, premature death and physical disease and limitations. Research has shown that low emotional well-being (e.g., happiness, positive affect, life satisfaction) has been linked as a risk factor for premature death (Danner, Snowdon, and Friesen, 2001), a rise in physical limitations of daily living (Ostir, Markides, Black, and Goodwin, 2000; Penninx, Guralnik, Bandeen-Roche, Kasper, Simonsick, Ferrucci, and Fried, 2000), and incidence of stroke (Ostir, Markides, Peek, and Goodwin, 2001) among older adults. Similarly, and independent of controls for dietary and lifestyle factors, low levels of life satisfaction increased the risk of suicide over the 20-year period of the Finnish cohort study (Koivumaa-Honkanen, Honkanen, Viinamäki, Heikkilä, Kaprio, and Koskenvuo, 2001). Here, life satisfaction was operationalized as a composite of an individual's perceived interest in life, happiness

with life, perceived ease of living, and feeling of loneliness. Even among older populations with severe chronic physical disabilities, studies have shown that as much as one-third has a high level of subjective well-being, levels of which are associated with modifiable factors such as maintenance of cognitive and visual abilities, frequent face-to-face contact, and emotional support (Penninx, Guralnik, Simonsick, Kasper, Ferrucci, and Fried, 1998; see also Keyes, Shmotkin, and Ryff, 2002).

The present study provides a cross-sectional snapshot of the association of complete mental health with CVD. It remains an empirical question whether CVD causes mental health status, whether mental health status causes CVD, or whether the relationship is reciprocal. Given the mounting evidence of the protective effects of high levels of subjective well-being, it may be worth pursuing an agenda of longitudinal studies of complete mental health in aging cohorts. Does flourishing in life protect older adults with a history of CVD from risk for cardiac mortality and other complications; does languishing elevate such risk? Does mental health buffer individuals without any history of coronary artery and heart problems from the onset of CVD; does languishing elevate such risk? Answers to such question could provide valuable information for better managing the course and onset of CVD and other problems normally attributable to aging and modifiable lifestyle factors.

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Table 1.  
*Prevalence and Unadjusted Association of Cardiovascular Disease (CVD) and Mental Health Status (sample weighted; n = 2,952)*

CVD %	Complete Mental Health Status						$\chi^2$ df=5
	Languishing and Major Depression 143 4.8%	Major Depression 280 9.5%	Minor Depression 69 2.3%	Languishing 351 11.9%	Moderately Mentally Healthy 1,599 54.2%	Flourishing, Mentally Healthy 511 17.3%	
Any CVD 11.7%	18.9%	12.5%	14.7%	12.0%	11.8%	8.2%	14.0**
Myocardial Infarction 1.2%	0.7%	1.1%	0.0	1.1%	1.6%	0.8%	3.5
Ischemia <sup>1</sup> 1.3%	0.0	0.7%	0.0	0.9%	1.5%	1.8%	5.5
High Blood Pressure 1.1%	1.4%	0.4%	1.5%	2.3%	1.1%	0.6%	7.5
Arrhythmia <sup>2</sup> 1.5%	2.8%	2.5%	0.0	1.7%	1.3%	1.2%	5.8
Angina 0.8%	0.0	1.8%	0.0	1.1%	0.9%	0.2%	8.0

Valve Disease <sup>3</sup> 1.3%	5.6%	1.1%	4.4%	0.6%	1.4%	0.2%	31.6**
Heart Murmur 1.7%	2.8%	1.4%	2.9%	1.1%	1.8%	1.4%	2.9
Heart Failure <sup>4</sup> 0.5%	2.1%	0.7%	0.0	0.0	0.5%	0.2%	11.2*
Septal Defect <sup>5</sup> 0.2%	1.4%	0.0	0.0	0.0	0.1%	0.0	18.4**
Other 4.4%	7.7%	5.4%	10.3%	6.0%	3.8%	2.7%	16.8**

*Note:* \*  $p < .05$ ; \*\* $p < .01$  (two-tailed).

<sup>1</sup>Includes Coronary Artery Disease, Blocked or Closed Artery.

<sup>2</sup>Includes Irregular and Fast Heart Beat.

<sup>3</sup>Includes Mitrovalve Prolapse, Aortic Insufficiency and Bicuspid Aortic Valve.

<sup>4</sup>Includes Enlarged Heart and Congestive Heart Failure.

<sup>5</sup>Includes Hole in the Heart, and Atrial or Ventricular Septal Defect.

Table 2.

*Simple Logistic Regression of Any CVD onto Sociodemographic Predictors and Mental Health Status (n= 2,952; sample unweighted)*

Predictors	Odds Ratio (OR)	95% Confidence Interval for (OR)
Languishing and Depressed	2.9***	(1.6–5.1)
Pure Major Depression Episode	2.1**	(1.3–3.3)
Minor Depression	1.4	(.58–3.4)
Languishing	1.5†	(.96–2.5)
Moderately Mentally Healthy	1.5*	(1.0–2.1)
Flourishing	1.0	(—)
<b><i>Control Variables:</i></b>		
Females	1.0	(—)
Males	1.3*	(1.1–1.7)
Caucasians	1.1	(.79–1.7)
Minority Status	1.0	(—)
Age 25 to 34	1.0	(—)
Age 35 to 44	1.2	(.62–1.5)
Age 45 to 54	1.8**	(1.2–2.7)
Age 55 to 64	2.1***	(1.4–3.2)
Age 65 to 74	3.3***	(2.1–5.2)
12 Years (GED) or Fewer Education	1.4*	(1.0–2.0)
13 to 15 Years of Education	1.3	(1.0–1.9)
16 or More Years of Education	1.0	(—)
Married	1.4*	(1.1–1.8)
Unmarried (includes Separated)	1.0	(—)
Unemployed	1.8***	(1.4–2.4)
Employed (part- or full-time)	1.0	(—)
Smoked or Smokes Cigarettes	1.3*	(1.0–1.7)
Never Smoked Cigarettes	1.0	(—)
Diabetic (taking medication)	2.2***	(1.4–3.4)
Not Diabetic (no medication)	1.0	(—)
Exercise	1.1*	(1.0–1.2)

Nagelkerke's $R^2$	.13
Model $\chi^2$	196.9***

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*Note:* †  $p < .07$ ; \*  $p < .05$ ; \*\* $p < .01$ ; \*\*\*  $p < .001$  (two-tailed).

Table 3.  
*Risk of Any CVD (Simple Logistic Regression) for Mental Health Status by Sex and by Age (sample unweighted)*

	Males				Females			
	Ages 25-44 N=648		Ages 45-74 N=755		Ages 25-44 N=651		Ages 45-74 N=838	
<i>Complete Mental Health Status</i>	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Languishing and Depressed	.42	(.04–3.6)	3.0†	(.98–9.2)	3.2	(1.0–14.0)	5.7***	(2.0–16.4)
Pure Major Depression Episode	1.3	(.34–4.5)	1.6	(.76–4.0)	1.7	(.50–6.1)	3.8**	(1.4–9.8)
Minor Depression	5.6*	(1.1–27.7)	1.0	(.21–5.0)	.06	(.01–24.5)	1.5	(.29–8.3)
Languishing	1.1	(.33–3.5)	1.6	(.95–3.8)	1.1	(.24–4.5)	2.4†	(.91–6.2)
Moderately Mentally Healthy	.75	(.28–2.0)	1.1	(.21–5.0)	1.6	(.50–4.5)	3.2**	(1.5–6.8)
Mentally Healthy: “Flourishing”	1.0	(—)	1.0	(—)	1.0	(—)	1.0	(—)

*Note.* †  $p < .07$ ; \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$  (two-tailed). All logistic regressions included controls for race, employment, marital status, education, diabetes status, smoking status, and amount of exercise.