

Cardiorespiratory Fitness and All-Cause Mortality in Men With Emotional Distress

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Abstract

Objective: Mental health and emotional disorders are often associated with higher mortality risk. Whether higher cardiorespiratory fitness (CRF) reduces the risk for all-cause mortality in individuals with emotional distress is not well known.

Patients and Methods: Participants were 5240 men (mean age 46.5 ± 9.5 years) with emotional distress (including depression, anxiety, thoughts of suicide, or a history of psychiatric or psychological counseling) who completed an extensive medical examination between 1987 and 2002, and were followed for all-cause mortality through December 31, 2003. Cardiorespiratory fitness was quantified as maximal treadmill exercise test duration and was grouped for analysis as low, moderate, and high. Cox proportional hazards regression was used to calculate hazard ratios (HRs) and 95% CIs.

Results: During a median of 8.7 years (range, 1.0-16.9 years) and 46,217 person-years of follow-up, there were 128 deaths from any cause. Age- and examination year-adjusted all-cause mortality rates per 10,000 person-years according to low, moderate, and high CRF groups were 64.7 (95% CI, 44.9-89.3), 28.0 (95% CI, 23.8-31.5), and 19.6 (95% CI, 17.1-21.6) (trend $P < .001$) in men who reported any emotional distress. Overall, the multivariable-adjusted HRs and 95% CIs across incremental CRF categories were 1.00 (referent), 0.54 (0.32-0.90), and 0.47 (0.26-0.85), linear trend $P = .03$.

Conclusion: Among men with emotional distress, higher CRF is associated with lower risk of dying, independent of other clinical mortality predictors. Our findings underscore the importance of promoting physical activity to maintain a healthful level of CRF in individuals with emotional distress.

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Mental health conditions represent the fifth greatest contributor to the global burden of disease, with an estimated economic cost of US \$2.5 trillion in 2010 and an expected US \$6.0 trillion by 2030.¹ The association between mental health issues and all-cause mortality has been explored in populations around the world. For example, in Norway, depression has been shown to be a risk factor for all-cause mortality at a similar level to smoking.² In Canada, major depressive episodes have been shown to be a strong predictor of all-cause mortality.³ In a clinic-based study from England, depression was associated with higher all-cause mortality decades after patients received treatment, even excluding factors such as suicide, accidents, and other nonnatural causes of death.⁴ In the United States, having both cancer and depression together has been associated with higher all-cause mortality, as opposed to having just

one.⁵ Depression is also associated with all-cause mortality among patients with cardiovascular disease (CVD).⁶ Finally, meta-analyses have demonstrated that even some forms of subclinical levels of depression are associated with a higher risk of all-cause mortality.⁷

These findings suggest that people with poor mental health have a shorter life expectancy. Physical inactivity⁸ or low cardiorespiratory fitness (CRF)⁹ has been linked to higher risk of all-cause and CVD mortality in healthy populations of men and women. This is significant in light of the evidence that negative emotions may play a role in all-cause mortality and CVD risk.¹⁰ The connection between CRF and negative emotions has been investigated in previous research.¹¹ Increasing fitness has been shown to ease depressive symptoms^{10,12-14} and help symptoms of anxiety.¹⁵ Therefore, a better understanding of

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the intercorrelations among CRF, emotions, and mortality can help us formulate a more specific strategy to promote longevity. The present study seeks to examine whether CRF could protect against premature all-cause mortality among men with emotional distress.

METHODS

Study Population

Participants were from the Aerobics Center Longitudinal Study (ACLS) at the Cooper Clinic in Dallas, Texas. Between January 27, 1987, and December 30, 2002, 43,459 men came to the clinic for a thorough preventive health examination and for counseling regarding diet, exercise, and other lifestyle factors associated with increased risk of chronic disease. Participants thus were volunteers (ie, were not paid for participation). Many were sent by their employers for the examination, some were referred by their doctors, and others were self-referred. Informed consent was obtained from each participant before beginning the study. The study was reviewed and approved by the Institutional Review Board at the Cooper Institute.

Only participants with a history of emotional distress were included in the present study (n=6660, 15.3%). The exclusion criteria included the following: at baseline, participants did not achieve at least 85% of aged-predicted maximal heart rate ($220 - \text{age}$) during the treadmill test (n=230); those who reported history of myocardial infarction (n=71), stroke (n=30), or cancer (n=376); who were underweight (body mass index [BMI] [calculated as the weight in kilograms divided by the height in meters squared] $< 18.5 \text{ kg/m}^2$) (n=318); or were followed for less than 1 year (n=395). These criteria resulted in 5240 men with emotional distress, aged 20 to 86 years, who were followed from the date of their baseline examination until their date of death, or December 31, 2003. Women were excluded because of the small number of deaths across CRF groups (3, 5, and 8 deaths across low, moderate, and high CRF, respectively).

Emotional distress was self-reported from the medical history questionnaire that asked participants whether they had ever experienced depression, anxiety, or thoughts of

suicide, or received psychological or psychiatric counseling. Participants were instructed to answer "yes," "no," or "don't know." If participants responded "yes" to any of the above questions, they were defined as having emotional distress. One person can report multiple types of distress; therefore, these categories were not mutually exclusive. There were 2229 (43%) men who reported more than 1 emotional distress item.

Clinical Examination

After an overnight fast of 12 hours, participants were given a baseline examination consisting of individual and family health history, a physical examination, a questionnaire to record demographic characteristics and health habits, anthropometry, blood chemistry tests, blood pressure, and, of particular note for this present study, a maximal treadmill exercise test. Details on the ACLS study have been described in previous literature.⁹ Smoking habits (current smokers or not), alcohol intake habits (heavy drinkers or not), physical inactivity (no leisure-time activities during the past 3 months), and parental history of CVD were assessed with a standardized questionnaire. Drinks per week were computed with 1 drink standardized to 12 oz of beer (3.41 dL), 5 oz of wine (1.421 dL), or 1.5 oz of liquor (0.4262 dL). Heavy drinking (in men) was defined as more than 14 drinks per week. *Hypertension* was defined as a physician diagnosis or measured blood pressure of 140/90 mm Hg or more. *Diabetes* was defined as a physician diagnosis, insulin usage, or fasting glucose of 126 mg/dL or more (7.0 mmol/L). Body mass index was calculated from the measured height and body weight. *Hypercholesterolemia* was defined as a physician diagnosis or fasting blood cholesterol measured at 240 mg/dL or more (6.20 mmol/L).¹⁶

Cardiorespiratory Fitness

Cardiorespiratory fitness was the primary exposure of interest and was determined by measuring the maximal amount of time participants ran on the treadmill until volitional exhaustion or physician intervention. Participants were divided into 3 categories. To determine physical fitness, the treadmill speed was first set at 88 m/min. The first minute the

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