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Leisure-Time Running Reduces All-Cause and Cardiovascular Mortality Risk

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ABSTRACT

BACKGROUND Although running is a popular leisure-time physical activity, little is known about the long-term effects of running on mortality. The dose-response relations between running, as well as the change in running behaviors over time, and mortality remain uncertain.

OBJECTIVES We examined the associations of running with all-cause and cardiovascular mortality risks in 55,137 adults, 18 to 100 years of age (mean age 44 years).

METHODS Running was assessed on a medical history questionnaire by leisure-time activity.

RESULTS During a mean follow-up of 15 years, 3,413 all-cause and 1,217 cardiovascular deaths occurred. Approximately 24% of adults participated in running in this population. Compared with nonrunners, runners had 30% and 45% lower adjusted risks of all-cause and cardiovascular mortality, respectively, with a 3-year life expectancy benefit. In dose-response analyses, the mortality benefits in runners were similar across quintiles of running time, distance, frequency, amount, and speed, compared with nonrunners. Weekly running even <51 min, <6 miles, 1 to 2 times, <506 metabolic equivalent-minutes, or <6 miles/h was sufficient to reduce risk of mortality, compared with not running. In the analyses of change in running behaviors and mortality, persistent runners had the most significant benefits, with 29% and 50% lower risks of all-cause and cardiovascular mortality, respectively, compared with never-runners.

CONCLUSIONS Running, even 5 to 10 min/day and at slow speeds <6 miles/h, is associated with markedly reduced risks of death from all causes and cardiovascular disease. This study may motivate healthy but sedentary individuals to begin and continue running for substantial and attainable mortality benefits. (J Am Coll Cardiol 2014;64:472–81)

Running is a popular and convenient leisure-time physical activity with a consistent growth, despite some public concerns about the possible harmful effects of running (1). It is well established that physical activity has substantial health benefits. The World Health Organization and the U.S. government have recently released evidence-based Physical Activity Guidelines, recommending at least 150 min of moderate-intensity or 75 min of vigorous-intensity aerobic activity per week, or an equivalent combination of both (2,3).

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However, compared with the compelling evidence on moderate-intensity activity and health (4), it is unclear whether there are health benefits to vigorous-intensity activity, such as running, for <75 min per week.

This study was conducted to investigate whether leisure-time running is associated with all-cause and cardiovascular disease (CVD) mortality risks, whether there is a dose-response relation between running and mortality, and whether different patterns of change in running behaviors are associated with mortality.

ABBREVIATIONS AND ACRONYMS

BMI = body mass index

CVD = cardiovascular disease

MET = metabolic equivalent

PAF = population attributable fraction

METHODS

STUDY POPULATION. The Aerobics Center Longitudinal Study is a prospective, observational cohort study designed to examine the effects of physical activity and fitness on various health outcomes. Participants are self-referred or are referred by their employers or physicians for periodic preventive medical examinations at the Cooper Clinic in Dallas, Texas. This cohort is primarily college-educated, non-Hispanic white adults from middle to upper socioeconomic strata (5). The current study participants were men and women 18 to 100 years of age (mean age 44 years) at baseline who received at least 1 extensive medical examination between 1974 and 2002. Among 60,603 participants, we excluded 3,294 individuals reporting myocardial infarction (MI), stroke, or cancer at baseline and 2,172 individuals with <1 year of mortality follow-up to minimize potential bias due to serious undetected underlying diseases on mortality. The final sample included 55,137 individuals (26% women) for analysis of all-cause mortality and 52,941 individuals for analysis of CVD mortality, after 2,196 individuals who died from causes other than CVD were excluded. The Cooper Institute Institutional Review Board reviewed and approved the study annually. All participants gave written informed consent for the examinations and follow-up study.

ASSESSMENT OF RUNNING. Running or jogging activity during the past 3 months was assessed at baseline by the physical activity questionnaire, including 4 questions about duration, distance, frequency, and speed as part of the medical examination. For calculation of the total weekly running time, the average duration of running was multiplied by the frequency. For calculation of the total amount of running, the metabolic equivalent (MET) value for a given speed was multiplied by the weekly running time (6). Participants were classified into 6 groups: nonrunners and 5 quintiles of weekly running time (minutes), distance (miles), frequency (times), amount (MET-minutes), and speed (miles/h) in runners. For complete analyses of running characteristics and mortality, we defined runners as those who reported all 4 detailed running questions and nonrunners as those who did not report any running questions. We also examined the associations between change in running behaviors and mortality in a subgroup of 20,647 participants from the overall sample of 60,603 who received at least 2 medical examinations between 1974 and 2002 and were free from MI, stroke, or cancer at both examinations. We defined 4 categories of change in running behaviors using the baseline and last follow-up examination: "remained nonrunners" were nonrunners at both examinations, "became nonrunners" were runners only at the baseline examination, "became runners" were runners only at the last examination, and "remained runners" were runners at both examinations. Total amount of other physical activities except running (cycling, swimming, walking, basketball, racquet sports, aerobic dance, and other sports-related activities) was classified into 3 groups: 0, 1 to 499, and ≥500 MET-minutes per week based on the Physical Activity Guidelines (3). To reduce confounding bias in the association between running and mortality, the total amount of other physical activities except running was adjusted in all multivariable regression models. Our physical activity assessment has been described elsewhere (7) and was formerly validated and shown to correlate to measured cardiorespiratory fitness and physiological variables (5,8).

CLINICAL EXAMINATION. Physicians conducted comprehensive examinations. Resting blood pressure was recorded using the standard auscultation method. Blood glucose and cholesterol were analyzed using automated bioassays after ≥12 h of overnight fast. Body mass index (BMI) was calculated from measured weight and height (kg/m^2). Cardiorespiratory fitness was assessed using a maximal treadmill exercise test (9). Standardized medical questionnaires were used to assess health behaviors (smoking, alcohol consumption, and leisure-time physical activity), physician-diagnosed medical conditions, and parental history of CVD.

MORTALITY SURVEILLANCE. Participants were followed for mortality from the baseline examination through the date of death for decedents or December 31, 2003, for survivors using the National Death Index. For the analysis of change in running behaviors and mortality, we followed for mortality from the last follow-up examination through the date of death or 2003. Death from CVD was defined by the International Classification of Diseases-9th edition (ICD-9) codes 390-449.9 and ICD-10 Revision codes I00-I78.