JACC: HEART FAILURE
VOL. 3, NO. 9, 2015

ISSN 2213-1779/$36.00
PUBLISHED BY ELSEVIER INC.
http://dx.doi.org/10.1016/j.jchf.2015.06.002

EDITORIAL COMMENT

Green Means Go … Physical Activity and the Prevention of Heart Failure*

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Up until the late 1990s, questions about the safety and benefit of exercise in patients with heart failure (HF) were common. As a result, patients with HF were not routinely asked to engage in regular exercise training. However, over time, much evidence emerged such that regular exercise now represents guideline-based care for patients with HF with reduced ejection fraction (1). In addition to improvements in functional capacity and quality of life and partial reversal of the many physiologic abnormalities that develop in patients with HF (e.g., endothelial function), regular exercise also reduces the risk for clinical outcomes (2–4). Also, the potential benefits of exercise training in patients with HF with preserved ejection fraction are now emerging (5,6).

The previously cited effects of exercise in patients with HF are also consistent with observational studies that evaluated the effects of physical activity or cardiorespiratory fitness on the development of HF (7–9). These studies uniformly report more favorable outcomes with a higher dose (volume) of exercise; however, exercise dose was usually qualified (e.g., low/high or active/inactive) rather than quantified (e.g., kilocalories or metabolic equivalent [MET] hours per week).

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In this issue of *JACC: Heart Failure*, Rahman et al. (10) provide insightful and somewhat provocative information about the dose-response relationship between physical activity and incident HF and do so using a standard marker (MET h/day) for exercise dose. In a retrospective analysis involving more than 33,000 Swedish men (mean = 60 years of age) surveyed in 1997 to 1998 and asked to recall their involvement in different types of physical activity within the past year and at 30 years of age, they observed (mean follow-up = 13 years of age) a *U*-shaped relationship between total daily physical activity and risk for developing HF. Specifically, there was a continuous reduction in the risk of incident HF up to 41 MET h/day of activity, with the least active group associated with a 69% (hazard ratio: 1.69; 95% confidence interval: 1.44 to 1.97) higher risk for developing HF. Paradoxically, 57 MET h/day of total activity was associated with a 31% higher risk of HF (hazard ratio: 1.31; 95% confidence interval: 1.07 to 1.59). When assessing type of activity, both walking/bicycling >20 min/day (which 75% of their "least active" subjects reported doing) and exercising >1 h/week were each associated with a meaningful decrease in risk. Concerning the latter, the type of exercise completed each week was not defined (e.g., calisthenics vs. Nordic skiing).

Before exploring some thought-provoking issues that arise from this paper, it is important to first review a few of its main strengths and shortcomings. First, we appreciate the authors' use of the Compendium of Physical Activities (11) as a means to account for the type and intensity of each activity when estimating total physical activity. Second, after accounting for sleep (8 h at 0.9 MET = 7.2 MET h/day) and daily walking/bicycling (assume 30 min of exercise at 3.6 METs or 1.8 MET h/day), we note that the remainder suggests a high volume of activity for the rest of the day [median total physical activity of 41 MET h/day - 7.2 (sleep) - 1.8 (bicycling/walking) = 32 MET h/day (performed over 15.5 h at ~2 METs)]. This high volume may reflect physical activity habits unique to residents of

*Editorials published in *JACC: Heart Failure* reflect the views of the authors and do not necessarily represent the views of *JACC: Heart Failure* or the American College of Cardiology.

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Sweden, partially supported by the fact that 87% of their cohort reported bicycling/walking >140 min per week, and/or an overestimation of daily physical activity that arises when subjects are asked to recall physical activity habits. Any potential overestimation may have less of an impact on an analysis aimed at describing the relationship between volume of total physical activity and outcomes because the potential bias would likely be similar across the entire cohort. However, over estimating physical activity would limit the generalizability of a given point estimate, despite use of a standardized unit (MET h/day).

Taken in sum, we feel the observations reported by Rahman et al. (10) stimulate 2 important lines of thinking. First, we are reminded that we still know relatively little about how variations in physical activity and exercise "dose" might affect disease onset. Relative to incident HF overall or sorted by type of HF, further information is needed about whether exercise and physical activity confer different levels of immunity based on the type and volume of exercise, as well as race, gender, and the presence of comorbidities. Differential effects due to physical activity or exercise in the prevention of a disease are not uncommon observations when sorted by these characteristics (12,13).

Second, and discordant from other observational studies (including 2 well-powered studies) (8,9) that also assessed the relationship between exercise or activity and the development of HF, the authors observed a paradoxical increase in risk for those reporting high levels of total activity. This observation might cause one to ask, "How much exercise is too much?" Performing ≥57 MET h/day of physical activity represents a very high volume of exercise, and the authors speculate that it may have been sufficient to induce an abnormality in myocardial function (14–16). Without weighing in on the debate, we simply acknowledge what the authors observed and ask that clinicians try to place all such information in proper context. Specifically, remember that for the vast majority of the patients we counsel about exercise and disease prevention, recommending the current exercise guidelines of 150 min or more of moderate-intensity exercise per week is prudent (17). Changing activity and exercise habits from inactive to regularly active (i.e., walking or bicycling 20 min or more per day) can have a favorable impact on an individual's health. For those people already active or seeking more vigorous exercise, 75 min or more of such exercise per week is safe and advisable. However, for those very few patients we encounter who are extremely high-level exercisers (e.g., ultramarathoners), it may be sensible to monitor them for symptoms and other risk factors and screen for abnormalities as clinically indicated.

In summary, we applaud the interesting work of Rahman et al. (10) and emphasize that similar to prior observational studies reporting on the association between physical activity and disease occurrence, it reinforces the main "take-home" message that a moderate level of total physical activity is an important behavioral strategy that assists with not only the treatment of HF but its prevention as well. A recommendation that should ring true for the vast majority of the patients we counsel.

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KEY WORDS exercise, heart failure, prevention