

Effects of Physical Activity on Cardiovascular and Noncardiovascular Outcomes in Older Adults

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• Aging • Cardiovascular • Elderly • Exercise • Physical activity

Although physical activity benefits adults of all ages, its advantages to older adults are especially noteworthy. Aging is associated with a cascade of morphologic and physiologic changes that naturally predispose older adults to progressive weakening, functional decline, morbidity, disability, poor quality of life, and increased mortality.¹ Physical activity moderates such insidious aging patterns, and exercise training, therefore, is vital therapy that can be used to resume or maintain active, healthful lifestyle patterns.² Physical activity not only brings about physiologic benefits but also reduces risk of disease outcomes (eg, cardiovascular events and falls) and triggers important psychological gains (eg, vitality, self-efficacy, mood, and quality of life). Advanced age, however, presents distinctive obstacles to physical activity and exercise training.³ Multiple chronic medical conditions, limited access to appropriate programs, and fear of injury and logistic obstacles are among the common hindrances to initiating and sustaining active lifestyle patterns.⁴

This review begins by focusing on specific age-related physiologic gains associated with exercise and some of the diseases and affective implications. The spectrum of

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elderly individuals is considered, from those who are relatively robust to those who are frail and debilitated, and how physical activity may be useful in relation to each condition. Furthermore, given the notorious obstacles to physical activity among the elderly, this review also provides some recommendations to help facilitate activity-enhancing lifestyle changes.

PHYSIOLOGY OF AGING

To appreciate the utility of physical activity to older adults, it is important to first understand some of the aspects of normal aging and the common vulnerabilities that result. Aging is associated with pervasive changes to all physiologic systems, which are broadly categorized in this article as cardiovascular and noncardiovascular changes.

Cardiovascular Physiology of Aging

Vascular

Typical age-related cardiovascular changes include transformations of the large central arteries from pulsatile, dynamic vessels in most young adults to stiff, pipe-like cylinders in most elderly.⁵ The pulsatile character of youthful arterial function serves to propel blood forward as vessels distend and recoil. The stiffer vessels of older adults lose this capacity, and the burden of pushing blood forward rests more completely on the heart.

In addition to constitutional changes in vessel media and intimal layers that lead to stiffening, the capacity of endothelial cells aligning vessel lumen to synthesize vital vasodilating peptides diminishes with age.⁶ This compounds declines in vascular distensibility and adds to the tendency for cardiac workload to increase with age. Such changes also contribute to reduced cardiac reserve, increased vulnerability to instability in the midst of any clinical perturbation (eg, illness or physical stress), and erosion of exercise tolerance.

Cardiac

As the senescent central vasculature stiffens, the hearts of older adults must pump against increased afterload—a physiologic property that is independent of blood pressure (ie, blood pressure is contingent on flow dynamics of smaller resistance vessels). Therefore, even in normotensive elderly, myocytes in the left ventricle typically hypertrophy to moderate the resultant myocardial wall stress. Such myocyte growth stimulation, however, also increases the likelihood of apoptosis with associated fibrosis and stiffening of the ventricular walls. The hearts of most elderly have mild hypertrophy but the ventricles are distinctively stiff and particularly prone to diastolic filling abnormalities and arrhythmias.⁷ All these factors increase the likelihood of reduced cardiac output and increased functional impairment.⁸ In addition, aging is associated with diminished autonomic regulation of cardiac rhythm with a predominant down-regulation of β -adrenergic responsiveness,⁹ less favorable indices of heart rate variability, and additional susceptibility to arrhythmias.¹⁰

Noncardiovascular Physiology of Aging

Skeletal muscle

Sarcopenia is a term used to describe age-related atrophy of skeletal muscle mass and strength, and it entails reduced number and size of skeletal muscle cells and intrinsic declines in their contractile performance. Changes in muscle mass are considerable, with 0.5% to 1% of muscle mass usually lost per year from ages 20 to 50 and accelerating in the years thereafter.¹¹ Such declines in muscle mass and performance predispose to several types of risk.¹² Resultant functional limitations

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