Updating ACSM's Recommendations for Exercise Preparticipation Health Screening

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ABSTRACT

RIEBE, D., B. A. FRANKLIN, P. D. THOMPSON, C. E. GARBER, G. P. WHITFIELD, M. MAGAL, and L. S. PESCATELLO. Updating ACSM's Recommendations for Exercise Preparticipation Health Screening. *Med. Sci. Sports Exerc.*, Vol. 47, No. 8, pp. 2473–2479, 2015. The purpose of the American College of Sports Medicine's (ACSM) exercise preparticipation health screening process is to identify individuals who may be at elevated risk for exercise-related sudden cardiac death and/or acute myocardial infarction. Recent studies have suggested that using the current ACSM exercise preparticipation health screening guidelines can result in excessive physician referrals, possibly creating a barrier to exercise participation. In addition, there is considerable evidence that exercise is safe for most people and has many associated health and fitness benefits; exercise-related cardiovascular events are often preceded by warning signs/symptoms; and the cardiovascular risks associated with exercise lessen as individuals become more physically active/fit. Consequently, a scientific roundtable was convened by the ACSM in June 2014 to evaluate the current exercise preparticipation health screening recommendations. The roundtable proposed a new evidence-informed model for exercise preparticipation health screening on the basis of three factors: 1) the individual's current level of physical activity, 2) presence of signs or symptoms and/or known cardiovascular, metabolic, or renal disease, and 3) desired exercise intensity, as these variables have been identified as risk modulators of exercise-related cardiovascular events. Identifying cardiovascular disease risk factors remains an important objective of overall disease prevention and management, but risk factor profiling is no longer included in the exercise preparticipation health screening process. The new ACSM exercise preparticipation health screening recommendations reduce possible unnecessary barriers to adopting and maintaining a regular exercise program, a lifestyle of habitual physical activity, or both, and thereby emphasize the important public health message that regular physical activity is important for all individuals. **Key Words:** PRESCREENING, SUDDEN CARDIAC DEATH, PHYSICAL ACTIVITY, CARDIOVASCULAR DISEASE

Regular physical activity and structured exercise are associated with numerous health benefits including a lower risk of cardiovascular disease (CVD), type 2 diabetes mellitus, some forms of cancer, and age-adjusted all-cause mortality, among others (19,26,33,43). Despite these well-known health benefits, physical inactivity is a global pandemic that has been identified as one of the four leading contributors to premature mortality (22,26). Although efforts to promote physical activity at both the individual and community level have had some success, the prevalence of physical inactivity remains high (7,8,36,50). Physical activity is a complex behavior influenced by demographic, biological, cognitive, emotional, sociocultural, and environmental factors (3). Accordingly, individuals face numerous barriers in both the adoption and maintenance of a regular exercise program, as evidenced by high levels of physical inactivity (2,3).

A possible barrier to becoming physically active is the requirement for exercise preparticipation health screening, which may involve a visit to a health care provider and/or diagnostic testing to potentially identify underlying CAD and other occult CVD (3,16,46). Unnecessary referral to health care providers for screening may lead to a high rate of false-positive exercise test responses in some populations, necessitating medical follow-up and additional noninvasive/invasive studies when they are not needed. Such studies can place unnecessary financial and other burdens on the individual and health care system (16,32). Vigorous-intensity

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exercise does have a small but measurable acute risk of CVD complications; therefore, mitigating this risk in susceptible individuals is important (31,39,40). The exercise preparticipation health screening process should provide prudent assessment while minimizing barriers to adopting a physically active lifestyle.

The existing American College of Sports Medicine (ACSM) exercise preparticipation health screening recommendations stipulate that persons at moderate risk for CVD undergo a medical examination prior to starting a vigorous (achieving ≥60% oxygen uptake reserve ($\dot{V}O_2R$) or heart rate (HR) reserve (HRR), or ≥6 METs) exercise program (2,19). An individual is considered at moderate risk for CVD if he/she is asymptomatic and has two or more CVD risk factors (2). ACSM also recommends that persons at high risk for CVD undergo a medical examination and diagnostic exercise testing before beginning either a moderate-intensity (40% to <60% $\dot{V}O_2R$ or HRR; 3 to <6 METs) or a vigorous-intensity exercise program. Lastly, an individual is considered at high risk for CVD if they are symptomatic or have known cardiovascular, pulmonary, metabolic, or renal disease (2).

The current ACSM exercise preparticipation health screenng recommendations were largely formulated to reduce the likelihood of "at-risk" individuals experiencing serious exercise-related cardiovascular events, including sudden cardiac death (SCD) and/or acute myocardial infarction (AMI). Although the risk of an acute cardiovascular event is transiently increased during vigorous-intensity exercise relative to rest, especially in habitually sedentary individuals with known or occult CVD who engage in unaccustomed strenuous physical exertion, the absolute and relative risks of a cardiovascular event during exercise are extremely low even during vigorous-intensity exercise in asymptomatic individuals (35,39,41). In addition, the risk of an acute cardiovascular event decreases with increasing volumes of regular exercise (31,39) and among people who are physically fit (40). Finally, recent reports have suggested that using current prescreening algorithms can result in excessive referrals to physicians for medical clearance, which could be a barrier to adopting and maintaining a regular exercise program (24,45,48).

Because motivating people to be physically active is a significant challenge, exercise preparticipation health screening recommendations should not present unnecessary obstacles that deter people from adopting and maintaining a regular exercise program. In addition, because of increasing evidence that exercise is safe for most people, it has many associated health benefits, exercise-related cardiovascular events are often preceded by warning signs/symptoms, and the cardiovascular risks associated with exercise lessen as people become more physically active/fit, leading experts from the College recognized the need for evaluation and refinement of the existing ACSM preparticipation health screening recommendations (5,19,40,44). Accordingly, in June 2014, the ACSM convened a scientific roundtable (i.e., expert panel) to establish best practices in the exercise preparticipation health screening process.

The scientific roundtable consisted of experts in risk assessment, preventive cardiology, general cardiology, public health, exercise physiology, and geriatrics as well as practitioners from the fields of medicine, clinical exercise physiology, and health fitness/prevention. After a review of the scientific literature and extensive discussion, members of the roundtable proposed an evidence-informed model for the new ACSM exercise preparticipation health screening recommendations described in this consensus statement. In this consensus statement, we present the new ACSM exercise preparticipation health screening recommendations, summarize the changes that were made from the previous ACSM recommendations, and provide the fundamental physiological and clinical reasons for the changes that were made. The new ACSM recommendations are not a replacement for sound clinical judgment, and decisions about referral to a health care provider for medical clearance before the initiation of an exercise program should continue to be made on an individual basis.

THE NEW ACSM EXERCISE PREPARTICIPATION HEALTH SCREENING RECOMMENDATIONS

The goals of the new ACSM exercise preparticipation health screening process are to identify individuals 1) who should receive medical clearance before initiating an exercise program or increasing the frequency, intensity, and/or volume of their current program, 2) with clinically significant disease(s) who may benefit from participating in a medically supervised exercise program, and 3) with medical conditions that may require exclusion from exercise programs until those conditions are abated or better controlled (2).

The new ACSM exercise preparticipation health screening recommendations differ from previous recommendations in several ways (Table 1). CVD risk factor assessment and risk classification are no longer part of the exercise preparticipation health screening process *per se*. Instead, the

TABLE 1. Summary of major changes in ACSM's exercise preparticipation health screening procedures.

- The previous ACSM exercise preparticipation health screening process was based on the following: 1) the number of CVD risk factors and 2) presence of signs or symptoms and/or known cardiovascular, metabolic, renal, and/or pulmonary disease. The new ACSM exercise preparticipation health screening process is now based on the following: 1) the individual's current level of physical activity, 2) presence of signs or symptoms and/or known cardiovascular, metabolic, or renal disease, and 3) desired exercise intensity, as these three factors have been identified as important risk modulators of exercise-related cardiovascular events.
- Identifying and controlling CVD risk factors continue to be important objectives of overall cardiovascular and metabolic disease prevention and management; however, the CVD risk factor profile is no longer included in the decision making for referral to a health care provider before initiating a moderate- to vigorous-intensity exercise program.
- The classification of individuals as having low, moderate, or high risk of CVD is no longer included in the new ACSM exercise preparticipation health screening process. Specific recommendations for a medical examination or exercise testing based on risk classification is no longer included. Instead, individuals are referred to their health care provider for medical clearance, defined as approval from a health care professional to engage in exercise.
- Individuals with pulmonary disease are not automatically referred for medical clearance before initiation of an exercise program.

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new ACSM exercise preparticipation health screening process focuses on 1) the individual's current level of physical activity, 2) presence of signs or symptoms of known cardiovascular, metabolic, or renal disease, and 3) the desired exercise intensity, as these variables have been identified as risk modulators of exercise-related cardiovascular events (2,6,19). Several key findings formed the rationale for the current changes outlined in Table 1. They are presented as follows.

Risk of SCD and AMI. It is well established that the transient risks of SCD and AMI are substantially higher during acute vigorous physical exertion as compared with those during rest (1,31). Retrospective and prospective data suggest that vigorous-intensity physical activity transiently increases the risk of nonfatal AMI and SCD approximately sixfold (31) to 17-fold (1) as compared with resting behavior.

Although the *relative* risks of SCD and AMI are higher during sudden vigorous physical exertion versus those at rest, the *absolute* risk of these events is very low. Prospective evidence from the Physicians' Health Study and Nurses' Health Study suggests that SCD occurs every 1.5 million episodes of vigorous physical exertion in men (1) and every 36.5 million hours of moderate-to-vigorous exertion in women (47). Retrospective analyses also support the rarity of these events. Thompson et al. (41) reported one death per 396,000 h of jogging. An analysis of exercise-related cardiovascular events among participants at YMCA sports centers found one death per 2,897,057 person-hours, although exercise intensity was not documented (30). Kim et al. (25) studied more than 10 million marathon and half-marathon runners and identified an overall cardiac arrest incidence rate of one per 184,000 runners and an SCD incidence rate of one per 256,000 runners, which translate to 0.20 cardiac arrests and 0.14 SCD per 100,000 estimated runner-hours. Collectively, these studies illustrate the rarity of CVD events during exercise and suggest that exercise is safe for most people. Because there are few data regarding cardiovascular complications during resistance training, this risk cannot currently be determined but seems to be low (20,21,49).

Research into exercise-related SCD and AMI has revealed several variables associated with increased risk of cardiovascular events. Exercise-related cardiovascular events are often preceded by warning signs or symptoms (40). Autopsy studies of those who experienced SCD suggest that underlying CAD contributed to most cases among adults age 35 yr and older, whereas exertion-related SCD in younger people is often attributed to structural cardiovascular abnormalities, most notably, hypertrophic cardiomyopathy (27). However, research on exercise-associated SCD and AMI has focused primarily on the effects of vigorous- to near maximal-intensity physical activity (35). Less is known about the risks of SCD and AMI during light- to moderate-intensity exercise, but they are assumed to be substantially lower (44). Moreover, in virtually all studies, habitual physical activity was inversely related to the likelihood of SCD and/or AMI occurring during or immediately after vigorous-intensity exercise (1,12,31,39).

Although increasing age is a risk factor for CVD (men, ≥45 yr; women, ≥55 yr), there is no evidence that age *per se* is a strong predictor of exercise-associated SCD and AMI (20), and the referral of individuals for medical clearance solely on the basis of age has been shown to result in superfluous health care referrals (6,19,46).

Physical activity status. Physically inactive individuals are at greater total risk for acute cardiac events than their physically active counterparts (18,44). To put the risk versus protective benefit of exercise into perspective, it is important to reemphasize that the absolute risk of exercise-related acute cardiac events is extremely low. The relative risk of SCD and AMI during vigorous- to near maximal-intensity exercise is directly related to the presence of CVD and/or exertional symptoms and inversely related to the individual's habitual level of physical activity. For example, the Onset Study (31) showed that the risk of AMI during vigorous intensity exercise was almost twice that at rest even for individuals who exercised vigorously for 1 h on 5 or more days per week. However, this study also showed that the risk of AMI for habitually inactive individuals was 50 times higher than that for the most physically active individuals (Fig. 1). Regular exercise reduces the 24-h risk of CVD events by approximately 50% (4,34), meaning that the regular exerciser's relative risk is significantly lower during both vigorous-intensity exercise and over the remainder of the day, highlighting the clear net benefit of regular physical activity.

A recent meta-analysis reported a fivefold increased risk of SCD and 3.5-fold increased risk of AMI during vigorous-intensity physical activity (≥6 METs) (12). However, in cohorts with the lowest habitual physical activity levels, the

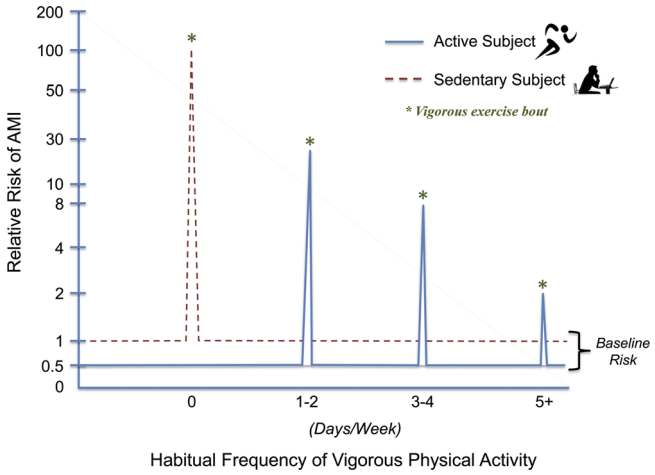

FIGURE 1—Relative risk of AMI at rest (baseline risk) and during vigorous physical activity (≥6 METs) in sedentary and physically active individuals, with specific reference to the habitual frequency of vigorous exertion (d·wk^{-1}). (Adapted from Mittleman MA, Maclure M, Tofler GH, Sherwood JB, Goldberg RJ, Muller JE. Triggering of acute myocardial infarction by heavy physical exertion. Protection against triggering by regular exertion. Determinants of Myocardial Infarction Onset Study Investigators. N Engl J Med. 1993;329(23):1677–1683. Used with permission. Adapted from Franklin BA. Preventing exercise-related cardiovascular events: is a medical examination more urgent for physical activity or inactivity? Circulation. 2014;129:1081–1084. Used with permission.)

SPECIAL COMMUNICATIONS

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relative risk for exertion-related AMI ranged from 4.5 to 107, indicating a substantial increased risk in physically inactive individuals; in contrast, the corresponding relative risk in the groups with the highest habitual physical activity levels was only 0.86–3.3, suggesting much smaller increases in risk in active individuals. Furthermore, these authors found that for every additional exercise bout per week, there was 30% reduction in the risk of SCD and 45% reduction in the risk of AMI during physical activity (12).

The previously referenced findings are consistent with the conclusion of the 2008 Physical Activity Guidelines Advisory Committee and ACSM that the overall cardiovascular benefits of regular physical activity far outweigh the modestly increased acute exercise risks (44). These findings are also consistent with the recommendations of Bredin et al. (6) and Warburton et al. (46). Collectively, these studies suggest that the risk of exercise is highest among inactive individuals and those with known or occult CAD who perform unaccustomed vigorous-intensity physical activity.

CVD risk factor assessment. Two important considerations led to removing CVD risk factor assessment from the new ACSM exercise preparticipation health screening process. First, the high prevalence of CVD risk factors among adults, combined with the extreme rarity of exercise-related SCD and AMI, suggests that the ability to predict these rare events by assessing CVD risk factors is low (42). For example, the Centers for Disease Control and Prevention estimate that 65 million US adults have hypertension (11) and 71 million adults have high LDL cholesterol (9). In contrast, 600,000 people die from heart disease each year and only a small fraction of those are due to exercise-associated SCD and AMI (10). Therefore, using CVD risk factors to identify those susceptible to exercise-associated SCD or AMI as ACSM has done in the past is unlikely to be effective in achieving its intended purpose. Second, recent evidence suggests that conventional CVD risk factor-based exercise preparticipation health screening may be overly conservative because of the high prevalence of CVD risk factors. A recent study found that 95% of men and women over 40 yr of age would be advised to consult a physician before exercise based upon the previous risk factor-based exercise preparticipation health screening process (48).

Identifying and controlling CVD risk factors continue to be important objectives of overall cardiovascular and metabolic disease prevention and management, and exercise professionals are encouraged to complete a CVD risk factor assessment with their patients/clients (2,14). However, risk factor profiling is no longer included in the exercise preparticipation health screening process as a determinant of medical clearance for exercise. Nonetheless, some evidence suggests that diabetes mellitus and renal disease may be associated with exercise-related SCD and AMI (1,31), and specific recommendations for individuals with these comorbid conditions are incorporated into the new procedures.

Risk classification and medical clearance. The previous ACSM exercise preparticipation health screening recommendations classified individuals as having low, moderate, or high risk for CVD on the basis of the number of CVD risk factors and the presence of signs or symptoms and/or cardiovascular, metabolic, renal, or pulmonary disease (2). The recommendation for a medical examination or diagnostic exercise test before engaging in exercise was then based on this risk classification scheme. Because CVD risk factor profiling has been removed as part of the new ACSM exercise preparticipation health screening process, individuals no longer need to be classified into risk categories. Instead, individuals are referred to health care providers for medical clearance, defined as approval from a health care professional to engage in exercise, on the basis of the presence of signs or symptoms and/or known cardiovascular, metabolic, or renal disease and physical activity status. The term "medical clearance" has replaced specific recommendations for a medical examination or exercise test because it should be the health care provider who decides what evaluation, if any, is appropriate before the initiation of a moderate- to vigorous-intensity exercise program.

There is a lack of evidence that medical clearance and exercise testing (28) are effective in mitigating the risk of exercise-related cardiovascular events. There is also a lack of consensus among major organizations regarding the extent of medical evaluation needed as part of the exercise preparticipation health screening process (2). The American College of Cardiology/American Heart Association recommend exercise testing before engaging in moderate- or vigorous-intensity exercise when the risk of CVD is increased but recognize that these recommendations are based on conflicting evidence and divergent expert opinions (15). The 2008 Physical Activity Guidelines Advisory Committee report to the Secretary of Health and Human Services (44) states that "symptomatic persons or those with CVD, diabetes, or other active chronic conditions who want to begin engaging in *vigorous* physical activity and who have not already developed a physical activity plan with their health care provider may wish to do so," but does not mandate such medical contact. More recently, the U.S. Preventive Services Task Force recommends against the use of routine diagnostic resting or exercise electrocardiography as a screening tool in asymptomatic individuals who are at low risk of CVD events and concluded that there is insufficient evidence to evaluate the benefits and harm of exercise testing before initiating a PA program and did not make specific recommendations regarding the need for exercise testing for individuals at intermediate and high risk for CVD events (32). The ACSM does not recommend abandoning all medical evaluation as part of the exercise preparticipation health screening process. Rather, the new recommendations provide guidance to identify those at highest risk for exercise-related AMI or SCD for referral to a health care provider to recommend medical clearance on the basis of their clinical judgment.

Pulmonary disease. Individuals with pulmonary disease are no longer automatically referred for medical clearance because pulmonary disease does not increase the risks of nonfatal or fatal cardiovascular complications during

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or immediately after exercise; in fact, it is the associated inactive and sedentary lifestyle of many patients with pulmonary disease that may increase the risk of these events (23). However, chronic obstructive pulmonary disease (COPD) and CVD are often comorbid because of the common risk factor of smoking, and the presence of COPD in current or former smokers is an independent predictor of overall cardiovascular events (13). Thus, careful attention to the presence of signs and symptoms of cardiovascular and metabolic disease is warranted in individuals with COPD during the exercise preparticipation health screening process. Nevertheless, despite this change, the presence of pulmonary or other diseases remains an important consideration in determining the safest and most effective exercise prescription.

THE NEW EXERCISE PREPARTICIPATION HEALTH SCREENING PROCESS ALGORITHM

The new logic model for the exercise preparticipation screening process is presented in Figure 2. In this model, regularly physically active asymptomatic individuals without known cardiovascular (i.e., cardiac, peripheral artery, cerebrovascular), metabolic (i.e., type 1 or 2 diabetes mellitus), or renal disease may continue their usual exercise and progress gradually as tolerated according to the accepted ACSM exercise prescription guidelines (2,19). Physically active asymptomatic individuals with known cardiovascular, metabolic, or renal disease whose health care provider has cleared them to exercise within the last 12 months do not need to revisit their health care provider to continue a moderate-intensity exercise

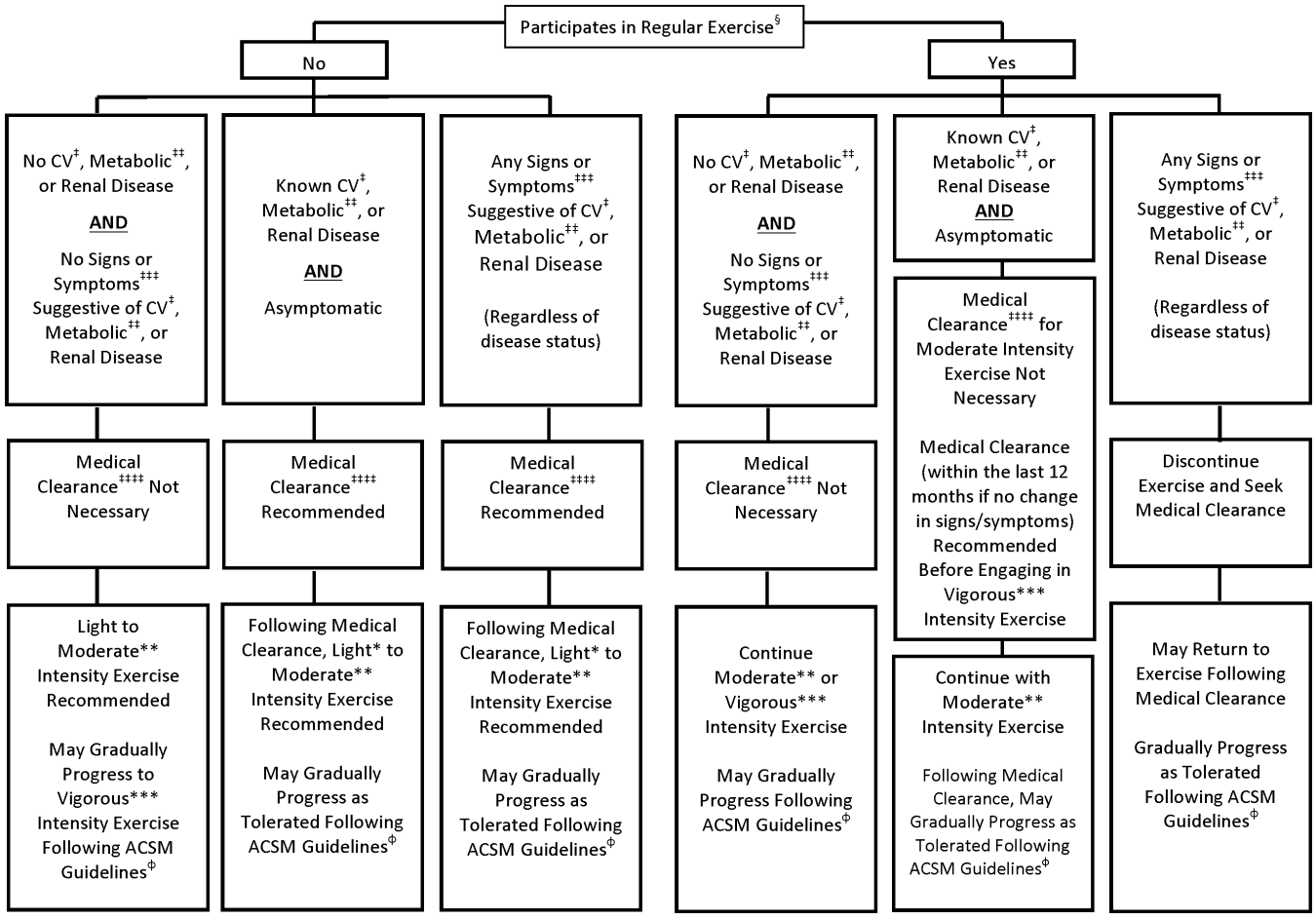

FIGURE 2—Exercise preparticipation health screening logic model for aerobic exercise participation.
§Exercise participation, performing planned, structured physical activity at least 30 min at moderate intensity on at least 3 $d \cdot wk^{-1}$ for at least the last 3 months.
***Light-intensity exercise, 30% to <40% HRR or $\dot{V}O_2R$, 2 to <3 METs, 9–11 RPE, an intensity that causes slight increases in HR and breathing.**
****Moderate-intensity exercise, 40% to <60% HRR or $\dot{V}O_2R$, 3 to <6 METs, 12–13 RPE, an intensity that causes noticeable increases in HR and breathing.**
*****Vigorous-intensity exercise ≥60% HRR or $\dot{V}O_2R$, ≥6 METs, ≥14 RPE, an intensity that causes substantial increases in HR and breathing.**
‡CVD, cardiac, peripheral vascular, or cerebrovascular disease.
‡‡Metabolic disease, type 1 and 2 diabetes mellitus.
‡‡‡Signs and symptoms, at rest or during activity; includes pain, discomfort in the chest, neck, jaw, arms, or other areas that may result from ischemia; shortness of breath at rest or with mild exertion; dizziness or syncope; orthopnea or paroxysmal nocturnal dyspnea; ankle edema; palpitations or tachycardia; intermittent claudication; known heart murmur; or unusual fatigue or shortness of breath with usual activities.
‡‡‡‡Medical clearance, approval from a health care professional to engage in exercise.
ΦACSM Guidelines, see *ACSM's Guidelines for Exercise Testing and Prescription, 9th edition*, 2014.

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program, unless they develop resting or exertional symptoms of cardiovascular, metabolic, or renal disease or experience a change in health status. Finally, it is recommended that physically active individuals who develop signs or symptoms of cardiovascular, metabolic, or renal disease discontinue exercise and seek medical clearance before resuming exercise of any intensity.

Physically inactive but otherwise healthy asymptomatic persons may begin light- to moderate-intensity exercise without medical clearance and, in the absence of symptoms, progress gradually in intensity as recommended by current ACSM exercise prescription guidelines (2,19). Physically inactive individuals with known cardiovascular, metabolic, or renal disease and/or those with signs or symptoms suggestive of these diseases should seek medical clearance before starting an exercise program, regardless of the intensity.

CONCLUSIONS

There is voluminous evidence that risks of remaining physically inactive, especially in those with chronic disease, are substantial (38,45). The new ACSM exercise preparticipation health screening recommendations emphasize the important public health message of regular physical activity for all and seeks to remove unnecessary barriers to adopting and maintaining a structured exercise program, a lifestyle embracing habitual physical activity, or both. The risk for acute exercise-related cardiovascular events is highest among habitually sedentary individuals with known or occult CVD who perform unaccustomed vigorous-intensity physical activity. Hence, the new ACSM exercise preparticipation health screening guidelines focus on assessing 1) the individual's current level of physical activity, 2) presence of signs or symptoms and/or known cardiovascular, metabolic, or renal disease, and 3) desired exercise intensity.

In addition, the hazard of exercise-related cardiovascular events may more likely be reduced by careful attention to a safe and effective exercise prescription that 1) addresses the *f*requency, *i*ntensity, *t*ime, and *t*ype—*v*olume and *p*rogression or FITT-VP principle of exercise prescription, incorporating a progressive transitional phase (i.e., 2–3 months), during which the duration and intensity of exercise are gradually increased, 2) advocates appropriate warm-up and cooldown procedures, 3) promotes education of warning signs/symptoms (e.g., chest pain or pressure, lightheadedness, heart palpitations/arrhythmias, unusual shortness of breath), 4) encourages sedentary individuals to engage in regular brisk walking so as to move them out of the least physically fit and least physically active cohort, and 5) counsels physically inactive individuals to avoid unaccustomed vigorous- to near maximal-intensity physical activity (6,17,19,29,37,46).

The new ACSM exercise preparticipation health screening recommendations are research informed when available and seek to simplify the process by eliminating the need for medical clearance and/or exercise testing in many individuals, especially when low- to moderate-intensity exercise is contemplated. The upcoming *ACSM's Guidelines for Exercise Testing and Prescription, 10th edition*, will provide updated and expanded information on the new ACSM exercise preparticipation health screening process and recommendations.

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