What Healthcare Professionals Should Know About Exercise

HOW TO RECEIVE CREDIT

- Read the enclosed course.
- Complete the questions at the end of the course.
- Return your completed Answer Sheet/Evaluation to NetCE by mail or fax, or complete online at www.NetCE.com. Your postmark or facsimile date will be used as your completion date.
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Faculty

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Prior to this, Dr. Whyte was in the Immediate Office of the Director at the Agency for Healthcare Research Quality. He served as Medical Advisor/Director of the Council on Private Sector Initiatives to Improve the Safety, Security, and Quality of Healthcare. Prior to this assignment, Dr. Whyte was the Acting Director, Division of Medical Items and Devices in the Coverage and Analysis Group in the Centers for Medicare & Medicaid Services (CMS). CMS is the federal agency responsible for administering the Medicare and Medicaid programs. In his role at CMS, Dr.Whyte made recommendations as to whether or not the Medicare program should pay for certain procedures, equipment, or services. His division was responsible for durable medical equipment, orthotics/prosthetics, drugs/biologics/therapeutics, medical items, laboratory tests, and non-implantable devices. As Division Director as well as Medical Officer/Senior Advisor, Dr. Whyte was responsible for more national coverage decisions than any other CMS staff.

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Faculty Disclosure

Contributing faculty, John J. Whyte, MD, MPH, has disclosed no relevant financial relationship with any product manufacturer or service provider mentioned.

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Division Planner/Director Disclosure

The division planner and director have disclosed no relevant financial relationship with any product manufacturer or service provider mentioned.

Audience

This introductory course is designed for all psychologists working with adult patients who are overweight or obese and should begin an exercise program.

A complete Works Cited list begins on page 25.

Accreditations & Approvals

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Course Objective

The purpose of this course is to supply the information necessary for psychologists to provide practical advice for patients beginning an exercise program.

Learning Objectives

Upon completion of this course, you should be able to:

1. Discuss the current epidemic of obesity.
2. Identify reasons why patients do not wish to exercise, including the need for information in the patients' native languages.
3. Discuss the physiology of exercise.
4. Identify the benefits of exercise.
5. Define contraindications to exercise.
6. Describe each type of exercise.
7. Discuss the guidelines for devising an exercise program, including recommendations by national specialty societies and government agencies relating to exercise.
8. Identify effective exercise regimens for patients with certain diseases, such as diabetes, osteoporosis, and HIV.

EVIDENCE-BASED PRACTICE RECOMMENDATION

Sections marked with this symbol include evidence-based practice recommendations. The level of evidence and/or strength of recommendation, as provided by the evidence-based source, are also included so you may determine the validity or relevance of the information. These sections may be used in conjunction with the course material for better application to your daily practice.

INTRODUCTION

Obesity is an epidemic in the United States. Estimates show that nearly 74% of the adult U.S. population 20 years of age and older are either overweight (31.8%) or obese (41.9%), with 42.8% of the population having grade 1 (mild) obesity (body mass index [BMI] 30.0–34.9), and 9.6% having grade 3 (severe) obesity (BMI at or greater than 40) [1]. While the overweight population percentage has remained essentially static for the last 50 years, the number of obese Americans has steadily increased. From 1999 to 2020, the prevalence of obesity increased from 30.5% to 41.9%, and the prevalence of severe obesity increased from 4.7% to 9.2% [1].

Obesity significantly increases the risk of cardiovascular disease, diabetes, kidney disease, and obesity-related cancers [77]. Estimates of excess mortality due to obesity range from 100,000 to 300,000 premature deaths annually, and 20% of premature deaths in the United States are attributable to overweight and obesity [2; 3; 5]. Calculations suggest that obesity-related costs are more than $315 billion excess per year [4].

One of the foremost causes of the obesity epidemic is the fact that few people engage in leisure-time physical activity. According to data published by the Centers for Disease Control and Prevention (CDC), nearly one-half of U.S. adults do not perform the minimum amount of exercise needed to prevent diseases such as diabetes and high blood pressure [1; 89]. One in four adults do not perform any exercise at all [6]. This is despite the fact that the benefits of exercise are well-documented, including reducing the risk of heart disease, improving glycemic control in diabetes, improving blood pressure, alleviating depression, and generally preventing morbidity and mortality.

Compounding this problem, a national study found that less than one-third of overweight patients reported receiving advice from their physicians or other healthcare professional to increase their physical activity [8]. Even when healthcare professionals do give advice, too often they simply admonish, "You need to exercise," which has been shown to have little, if any, effect. Of the individuals who did receive advice, only 38% received help in formulating a specific activity plan and only 42% received follow-up support [7; 16]. Much of this is due to the fact that most healthcare professionals have little knowledge about proper exercise techniques. Although there is discussion of exercise physiology in medical school, there is little information provided on how to give patients practical advice. Students may learn how the muscle uses adenosine triphosphate (ATP) but not how to explain to patients what exercises they should do to lose weight and become fit.

This course will review the physiology and mechanics of exercise, but more importantly, it will provide the information necessary for physicians and other clinicians to provide practical advice for patients on starting an exercise program. It will begin with exercise physiology and explain the different types of exercises with examples of the most important types. The clinical management of patients will be discussed in reference to current national guidelines.

The role of exercise in selected disease states such as diabetes, osteoporosis, and human immunodeficiency virus (HIV) will be discussed, highlighting the value of exercise on these conditions. Steps to address and treat patients with problems exercising will be explored. Finally, current reimbursement issues will be discussed. Although nutrition is an important component of weight management, it will not be addressed in this module.

The following case study will be referenced throughout the text to illustrate the challenges of developing an exercise program for patients.

CASE STUDY

Patient S is a non-Hispanic white man, 33 years of age, who presents for an annual physical examination. He has no major complaints, but he does report some intermittent right knee pain. Patient S reports that his wife has expressed concern over his weight gain during the past two years. He thinks it is probably "around 10 pounds." He comments that he tries to watch his diet but does not do a good job. He is often in a rush and typically uses fast food restaurants as his source of meals. Patient S also reports that he does not engage in any structured exercise program. He remarks that it is just "too boring" and he does not have any time to go to the gym; however, he does have a membership at the local health club. Patient S is not currently on any medications, and there is no history of heart disease, hypertension, or cancer.

EPIDEMIOLOGY OF OBESITY/OVERWEIGHT

The BMI, which uses weight adjusted for height, is used to indicate overweight and obesity. It is calculated by [weight in kilograms] divided by [height in meters]^2 or [weight in pounds]/[height in inches]^2 x 703. A BMI greater than 25.0 is considered overweight, and a value of 30.0 or more is considered obese (***Figure 1***) [9]. On average, a BMI >25.0 corresponds to about 10% more than one's ideal weight; a BMI >30.0 typically is an excess of 30 pounds for most people. These are only estimates due to individuals' variation in muscle mass. The term "morbid obesity" refers to grade 3 obesity, or a BMI equal to or greater than 40.0. Many clinicians prefer the term "severe obesity" for patients at this BMI level. (A BMI calculator can be found online at https://www.cdc.gov/healthyweight/assessing/bmi.)

BODY MASS INDEX

$$\frac{\text{Kilograms}}{(\text{Meters})^2} \quad \text{OR} \quad \frac{\text{Pounds}}{(\text{Inches})^2} \times 703$$

25–29 = overweight
30–39 = obese
40 or more = morbid obesity

Source: Author *Figure 1*

As noted, within the past few decades, the prevalence of overweight and obesity has increased dramatically. In 1980, the percentage of obese and severely obese adults was 15.1% and 1.3% of the total population, respectively; by 1994, these numbers increased to 23.3% and 3.1% [1]. In 2002, 31.1% of the adult population was obese and 5.2% were severely obese [1]. Data collected in 2017–2020 show that 41.9% are obese, 9.2% are severely obese, and an additional 32.1% of adults are overweight [1]. This means that roughly 7 out of 10 Americans 20 years of age and older are above a healthy weight and may be at an increased risk for disease and early death.

With race/ethnic origin not factored, the prevalence of overweight and obesity is higher for men than for women; moderate and severe obesity are more common in women [1]. In the overall population, 39% of men and 37% of women are obese, and approximately 5.5% of men and 9.8% of women have severe obesity [1].

When considered as a single race, the prevalence of obesity among individuals of African (49.9%) and Hispanic (45.6%) descent is greater than that reported among White Americans [1]. American Indian/Alaska Natives and Native Hawaiian/Pacific Islanders have an obesity prevalence of 39.1% and 51.7%, respectively [17]. Asian Americans are an exception, with a prevalence of 16.1%, much lower than in the general population.

Although the rate of obesity is higher in many American racial/ethnic groups compared to non-Hispanic whites, white individuals make up the majority of cases (55.2 million out of 70.7 million total cases) [17].

Of particular concern is the increase in the number of children who have high BMIs. Data from 2017–2020 show that the prevalence is 19.7% and affects 14.7 million children and adolescents [1]. Presently, 12.7% of children 2 to 5 years of age, 20.7% of children 6 to 11 years of age, and 22.2% of adolescents between 12 to 19 years of age are obese [1]. The prevalence of obesity in adolescents has more than tripled since 1970 [39]. This is especially troubling because overweight adolescents have a 70% chance of becoming overweight or obese adults; if their parents are overweight or obese, this chance increases to 80% [14].

As with adults, racial/ethnic minority children tend to be impacted by overweight and obesity at greater rates than non-Hispanic White children. Studies have found that 22% to 25% of non-Hispanic black children and adolescents in the United States (2 to 19 years of age) and approximately 26% of Hispanic American children and adolescents (2 to 19 years of age) are overweight [1; 13].

These statistics should be tempered with the knowledge that there are variations in body types between different racial/ethnic groups and between individuals that can skew a calculation such as BMI. For example, black men and women typically have higher lean mass and lower fat mass compared with white individuals [11].

COST OF OBESITY AND RELATED ILLNESSES

The impact of obesity on general health is significant. It results in an estimated 100,000 to 300,000 preventable deaths a year [2; 3]. According to a 2004 study, deaths attributable to poor diet and inactivity were second only to deaths due to tobacco; however, a 2019 study has shown that poor diet is now responsible for 11 million deaths per year, making it the number one cause of preventable deaths [15; 28]. Obesity is a risk factor for heart disease, stroke, type 2 diabetes, and certain types of cancer. The economic costs are significant, as well. The estimated annual medical cost of obesity in the United States is nearly $173 billion in 2019 dollars [1]. Roughly 28.2% of the nation's healthcare expenses are obesity-related [4].

During the course of the COVID-19 pandemic in the United States, obesity emerged as an independent risk factor for severe disease, especially among adults younger than 60 years of age. Multiple reports, including single-center studies and data analysis from patient-care networks, found that moderate-to-severe obesity (BMI >35) was associated with higher rates of hospitalization, respiratory failure, need for invasive mechanical ventilation, and death from COVID-19 [89; 90]. The risk varies directly with degree of obesity and is independent of obesity-associated comorbidities. Mechanisms by which obesity may augment risk include impaired immune function and alterations in vascular endothelium that promote pulmonary inflammation and alveolar damage and obstructive pulmonary physiology, with decreased lung capacity and reserve, making ventilation more difficult in the presence of viral pneumonia and respiratory failure [89]. A study of COVID-19 cases found that risks of hospitalization, intensive care unit admission, mechanical ventilation, and death are higher with increasing BMI [90]. More than 900,000 adult COVID-19 hospitalizations occurred in the United States during the first year of the COVID-19 pandemic; models estimate that 271,800 (30.2%) of these hospitalizations were attributed to adverse effects of obesity on the natural history of SARS-CoV-2 infection [91]. Among childhood COVID-19 (age younger than 18 years of age), obesity is associated with 3 times higher risk of hospitalization and 1.4 times higher risk of severe illness leading to intensive care unit admission [89].

Although the impact of obesity on general health has become highly publicized, most overweight Americans do not consider themselves at higher risk for medical problems or premature death. Despite the evidence linking obesity and ill health, many Americans still consider excess weight to be only a cosmetic issue. However, more than 90% of persons with type 2 diabetes are overweight or obese; the link between obesity and type 2 diabetes is well known [12].

SURGEON GENERAL'S CALL TO ACTION TO PREVENT AND DECREASE OVERWEIGHT AND OBESITY

By 2001, the increase in obesity had become of such concern that the U.S. Surgeon General developed the *Call to Action (CTA) to Prevent and Decrease Overweight and Obesity*, which still continues to be used. It urges the community to help confront this issue by adopting a healthier lifestyle. The intent of the CTA is to "create a multifaceted public health approach capable of delivering long-term reductions in the prevalence of overweight and obesity" [18]. The *Call to Action* identifies areas in which collaborative work can address the national epidemic of overweight and obesity. In addition, the CTA serves as an impetus for the creation of partnerships that will improve the nation's health. Much of this call focuses on the need for people to become more physically active. More information on the Surgeon General's report can be found at https://www.ncbi.nlm.nih.gov/books/NBK44206.

ADULT INACTIVITY

Data from the 2020 National Health Interview Survey (NHIS) show that the majority of adults do not exercise enough, and more than half do not exercise at all [92]. About 76% of adults do not perform the minimum amount of aerobic exercise combined with the minimum amount of muscle strengthening exercise recommended in the second edition of *Physical Activity Guidelines for Americans*, released in 2018. According to the NHIS, the percentage of adults who met both physical activity recommendations was higher among men (28.3%) than women (20.4%) and decreased with age. Hispanic men (23.5%) were less likely to meet both physical activity goals than non-Hispanic White (30.5%), non-Hispanic Asian (30.2%), and non-Hispanic Black (29.7%) men [92]. Taken individually, the aerobic activity guideline was met by 46.9% of adults nationwide, and the muscle-strengthening guideline was met by 31.0%. Adults are classified as meeting aerobic exercise recommendations if they report engaging in moderate-intensity activity at least 150 minutes per week, vigorous-intensity activity at least 75 minutes per week, or an equivalent combination of the two [92]. Brisk walking is the common example of moderate exercise; swimming, biking, and playing tennis are examples of vigorous exercise. The muscle-strengthening recommendation consists of two days per week of moderate- or high-intensity exercise involving all major muscle groups. All of the survey data may actually be underestimates, because respondents often try to answer questions in a way that makes them appear healthy.

When discussing exercise with patients, healthcare professionals should stress that inactivity has significant consequences. For example, one study suggests that obesity is the cause of a significant increase in the disability rates among adults in their 30s and 40s [20]. Adolescents with obesity are significantly more likely to develop disability before 30 years of age [44]. One national study found that chronic obesity during middle age was associated with increased Medicare expenditures and risk of premature death later in life [36]. Preventive measures to reduce BMI earlier in life, such as exercise, are important in lessening the burden of disease.

REASONS FOR LACK OF EXERCISE

Numerous reasons for failure to exercise exist, including lack of interest, competing demands for limited leisure time, fear of injury or pain, no access to facilities, and lack of knowledge of proper technique. Clinicians should also bear in mind that segments of minority and low-income population

groups may live in unsafe environments and are fearful of walking in the neighborhood. Barriers to safe walking, such as local crime and aggressive dogs, may prevent people from being physically active. The 2015 NHIS found that non-Hispanic Black and Hispanic Americans were twice as likely than White Americans to report crime and animals as barriers to safe walking [93]. With education, encouragement, and selective involvement of social services, many impediments can be resolved so that patients will be able to incorporate exercise into their daily lives.

Clearly, physicians and other clinicians must be more involved. The U.S. Preventive Services Task Force (USPSTF) recommends that clinicians screen all adult patients for obesity and offer intensive counseling and behavioral interventions to promote sustained weight loss for obese adults [52]. Clinicians should either offer obese patients intensive counseling and behavioral interventions or refer obese patients to programs that provide such services. Intensive counseling is defined by the frequency of interventions; high-intensity is two or more person-to-person, individual, or group sessions per month for at least the first three months. A medium-intensity intervention is a monthly intervention. Anything less than once monthly is considered low-intensity. The Task Force found that high-intensity therapies were the most effective [52].

In 2020, following a review of the evidence, the USPSTF concluded with moderate certainty that behavioral counseling interventions to support healthy diet and physical activity have a moderate net benefit on cardiovascular disease risk in adults with known risk factors such as hypertension, dyslipidemia, and metabolic syndrome [94]. In 2022, following a similar review of evidence, USPSTF concluded that behavioral counseling interventions have a small net benefit in adults without cardiovascular disease risk factors. The USPSTF recommended that clinicians individualize the decision whether to offer, or refer, adults without risk factors behavioral counseling interventions designed to promote healthy diet and physical activity [86]. Behavioral counseling interventions combine counseling on diet and exercise, using multiple individual or group sessions over extended periods of time. Interventions usually involve about 12 contacts and 6 hours of contact time over 6 to 18 months. Included are motivational interviewing and behavioral change techniques such as goal setting, problem-solving, and effective self-monitoring [86]. Patient-tailored approaches are used to enhance understanding of food labels and prepare healthy meals of appropriate portion size. Physical activity counseling encourages patients to reduce sedentary time and low-energy activity in favor of gradually increasing aerobic physical activity to achieve the recommended 150 minutes per week of moderate-intensity exercise. Clinicians and patients should consider the following in determining whether behavioral counseling interventions are appropriate [86]:

- Persons who are interested and ready to make behavioral changes may be most likely to benefit from behavioral counseling.
- Higher-intensity counseling interventions may vary in availability and feasibility in clinical settings.
- Adoption of healthy behavior advice may be increased by individualizing behavioral counseling interventions to fit the patient's motivation and goals, activity level and ability, circumstances, preferences, and overall health status.

The U.S. Preventive Services Task Force recommends that clinicians individualize the decision to offer or refer adults without cardiovascular disease risk factors to behavioral counseling interventions to promote a healthy diet and physical activity.

(https://jamanetwork.com/journals/jama/fullarticle/2794558. Last accessed November 22, 2022.)

Strength of Recommendation: C (Offer or provide this service for selected patients depending on individual circumstances)

Healthy People 2030, a set of health objectives developed by the U.S. Department of Health and Human Services' Office of Disease Prevention and Health Promotion, specifically recommends that physicians routinely counsel their patients to be physically active as a way to combat the growing epidemic of obesity [69]. Healthcare professionals should counsel patients about the need for exercise at each interaction, especially because the average person makes three office visits per year. Giving information about diet and exercise should not be left to health clubs and fad diets; effective counseling can be provided within five minutes [21].

Competence in patient education and counseling is often mastered in the context of clinical practice following completion of formal medical training. In a survey of graduating medical students' competence prescribing exercise to patients, only 10% of deans said their students were competent to prescribe exercise effectively [22]. In a survey of family medicine residents, only 14.9% of respondents perceived that their training in exercise prescription was adequate, and 91% desired more training. In addition, 98% of residents reported that physical activity is integral to their patients' health [23]. An analysis of data from the National Ambulatory Medical Care Survey found that only 1.9% of all ambulatory care visits in 2012 included counseling about weight reduction [24]. The increasing prevalence of obesity and cardiovascular disease over the past decade should prompt all clinical care providers to regularly counsel patients on the benefits of diet and exercise.

INTERVENTIONS FOR NON-ENGLISH-PROFICIENT PATIENTS

As a result of the evolving racial and immigration demographics in the United States, interaction with patients for whom English is not a native language is inevitable. Because patient education is such a vital aspect of the promotion of physical activity, it is each practitioner's responsibility to ensure that information and instructions are explained in such a way that allows for patient understanding. When there is an obvious disconnect in the communication process between the practitioner and patient due to the patient's lack of proficiency in the English language, an interpreter is required.

In this multicultural landscape, interpreters are a valuable resource to help bridge the communication and cultural gap between clients/patients and practitioners. Interpreters are more than passive agents who translate and transmit information back and forth from party to party. When they are enlisted and treated as part of the interdisciplinary clinical team, they serve as cultural brokers, who ultimately enhance the clinical encounter. In any case in which information regarding the benefits of physical activity and its necessity in health promotion are being provided, the use of an interpreter should be considered.

EXERCISE PHYSIOLOGY

MUSCLE FIBERS

There are two types of motor units in skeletal muscle, Type 1 and Type 2. Type 1 has a small cell diameter, with a high excitability and fast conduction velocity. It has an oxidative profile with moderate contraction velocity and low fatigability. There are few muscle fibers of this type. In contrast, Type 2 has a large cell diameter, with low excitability but a very fast conduction velocity. Type 2 fibers are numerous in quantity, with a glycolytic profile and high fatigability. The small motor units, with Type 1 (also known as "slow-twitch") fibers, are recruited first and are frequently active, while the large motor units, with Type 2 ("fast-twitch") fibers, are used infrequently, in forceful contractions. Maximal efforts, in which fast motor units are recruited, cannot be sustained because of the rapid depletion of glycogen.

When exercising, the "size principle" should be considered in developing muscle mass. This refers to the fact that slow-twitch muscle fibers are the first fibers recruited to do an activity, while fast-twitch fibers are recruited after the majority of slow-twitch fibers have been recruited. Therefore, if a small or moderate amount of force is needed to perform an activity, slow-twitch fibers will primar-

ily be used. Fast-twitch fibers will only be recruited if the slow-twitch fibers cannot generate enough force to fully perform the exercise. In order to make continued progress, both slow-twitch and fast-twitch fibers must be recruited. If a muscle fiber is not recruited, it will make no adaptation, such as an increase in size. In general, these two types of fibers are not different in the amount of force they produce, but rather differ in rate of force production. The "overload principle" refers to the idea that one must increase the resistance, frequency, or duration of an activity beyond that which would normally be expected. Overload will result in strength development.

During physical activity, the amount of blood pumped out by the heart is increased. The cardiac output (stroke volume x heart rate) increases in accordance with the degree of exercise. At rest, the stroke volume of an average-sized man is approximately 70 mL. With a heart rate of 72 beats/min, the cardiac output is about 5 L/min. The term "cardiac index" refers to cardiac output per square meter of body surface.

With exercise, the initial increase in cardiac output is due to an elevation in both stroke volume and heart rate. With maximal exercise, the increase is accomplished by a more rapid heart rate. To help produce a greater blood flow to the muscles, there is a corresponding decrease in perfusion of the kidneys, liver, and other internal organs.

Exercise training can also lead to reduced heart rate at rest. This occurs as a result of an increased left ventricular end diastolic volume. In this scenario, the heart pumps more blood each time it beats, and therefore it can beat at a slower rate while maintaining the same degree of perfusion.

The effects of exercise on the body's cells are significant. Physical activity increases the size and number of mitochondria, increases muscle's ability to use fat as a source of energy, increases the size of muscle fibers, and increases the content of myoglobin in muscle fibers. Exercise also results in increased fat oxidation. All of these increases lead to hypertrophy of the muscle, which leads to an increase in strength of the muscle.

OXYGEN CONSUMPTION (VO_2 MAX)

VO_2 max is the maximum volume of oxygen consumed by the body each minute during exercise. Oxygen consumption is equal to cardiac output multiplied by arterial-venous oxygen difference. It often is used as a measure of a person's maximal capacity to do aerobic exercise because oxygen consumption is linearly related to expenditure of energy. In general, exercise increases heart rate, which will then increase oxygen consumption. A rough correlation shows 65% of maximal heart rate correlates to 50% VO_2 max.

BENEFITS OF EXERCISE

The benefits of exercise (regular physical activity) on amelioration of disease are extensive and well-established. These include cardiovascular, endocrine, psychologic, and possible immunogenic benefits.

EVIDENCE-BASED PRACTICE RECOMMENDATION

According to the U.S. Department of Health and Human Services, strong scientific evidence shows that physical activity delays death from all causes. This includes the leading causes of death, such as heart disease and some cancers, as well as other causes of death.

(https://health.gov/sites/default/files/2019-09/Physical_Activity_Guidelines_2nd_edition.pdf. Last accessed November 22, 2022.)

Level of Evidence: Consensus Statement/Expert Opinion

CARDIOVASCULAR

Numerous studies have documented the benefits of exercise as an effective strategy for both primary and secondary prevention of heart disease. Physical activity is known to induce numerous physiologic adaptations of benefit to general and cardiovascular health. Regular physical exercise has been shown to normalize blood pressure, improve insulin sensitivity, alleviate hyperlipidemia, decrease blood viscosity and promote endothelial nitrous oxide production, all of which protect the heart and vascular system [88]. Higher levels of physical

activity, exercise training, and cardiorespiratory fitness have been found to correlate with reduced risk of cardiovascular disease, myocardial infarction, heart-related death, and all-cause mortality [25; 88]. Moreover, patients with established heart disease experience an improvement in activity tolerance and quality of life after beginning an exercise program. The benefits of exercise are far greater than the cardiac risks, and sudden cardiac death from exercise is extremely rare [70].

Exercise also improves lipid profiles. Research has indicated a dose-response relationship between increases in physical activity and improvements in triglycerides and high-density lipoprotein (HDL) cholesterol [26]. Other research has demonstrated that both younger and older men achieved improvements in lipid profile following an exercise program, although younger patients typically experienced greater improvements [27]. A meta-analysis of more than 50 trials involving exercise showed an average increase of nearly 5% in HDL, a 5% decrease in low-density lipoprotein (LDL), and a 3.7% decrease in triglycerides [26]. Another meta-analysis looked at studies of exercise in people diagnosed with cardiovascular disease. Among a total of 580 subjects and 680 controls, the researchers found statistically significant reductions in triglycerides and elevations in HDL [29]. For overweight and obese patients, a meta-analysis of nine studies with a total of 619 subjects found a significant reduction in triglycerides [30].

ENDOCRINE

There is little doubt that exercise improves glycemic control in patients with diabetes and those with impaired glucose tolerance (i.e., persons who are at risk for diabetes). Exercise has been shown to reduce baroreflex sensitivity and heart rate variability in patients with type 2 diabetes and to reduce glycated hemoglobin (A1C) by approximately 1% [31; 32]. A Cochrane Review concluded that exercise significantly improves glycemic control, lowers plasma triglycerides, and reduces visceral adipose tissue in people with type 2 diabetes. These improvements appear to occur independently of weight loss [33]. In addition, because nearly 75% of the risk of type 2 diabetes is attributable to overweight/obesity, the reduction in body weight and body fat through exercise also improves glycemic control and reduces the complications of diabetes.

Exercise is also well-known to ameliorate osteoporosis [71]. Exercise can place physical stress on the body, causing the bones to become stronger. Brief, high-intensity periods of loading that generate a diversity of strain patterns on the bones provide the maximal osteogenic response, which can delay the onset of osteoporosis.

PSYCHOLOGIC

Anecdotal reports and well-designed clinical trials support the conclusion that exercise reduces stress, improves depression, and helps with overall, general well-being [34; 35]. Although the precise mechanism is unknown, the improvements may be the result of endorphin release. Interestingly, the word endorphin is abbreviated from "endogenous morphine," which refers to morphine being created naturally in the body. This endorphin release may help with stress, pain relief, and mood. All of these can have an impact on morbidity.

A 2014 systematic review found evidence in several inpatient studies supporting the short- and long-term efficacy of exercise therapy for people hospitalized due to depression [79]. However, it is unclear whether exercise has a similar effect in elderly individuals, as one study of 900 nursing home residents found that a moderately intense exercise program did not improve symptoms of depression in this population [80].

POSSIBLE IMMUNOGENIC AND OTHER BENEFITS OF EXERCISE

Various studies suggest a possible link between excess body weight and cancer, including colon, breast, endometrial, and possibly other cancers. Possibly the largest study to date was a 16-year prospective study that enrolled nearly one million participants (405,000 men and 495,000 women) from the Cancer Prevention Study II. The results showed that there were positive linear trends in death with increasing BMI values for esophageal, stomach, colon, rectal, liver, gallbladder, pancreas,

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PHYSICAL ACTIVITY READINESS QUESTIONNAIRE

- Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
- Do you feel pain in your chest when you do physical activity?
- In the past month, have you had chest pain when you were not doing physical activity?
- Do you lose your balance because of dizziness or do you ever lose consciousness?
- Do you have a bone or joint problem (e.g., back, knee, or hip) that could be made worse by a change in your physical activity?
- Is your doctor currently prescribing drugs (e.g., water pills) for your blood pressure or heart condition?
- Do you know of any other reason why you should not do physical activity?

If you answered yes to one or more questions, if you are older than 40 years of age and have recently been inactive, or if you are concerned about your health, consult a physician before taking a fitness test or substantially increasing your physical activity.

Source: [70] *Table 1*

prostate, cervical, ovarian, and kidney cancers, as well as non-Hodgkin lymphoma, multiple myeloma, and leukemia; there was no significant association with melanoma or cancers of the brain or bladder [37]. Other studies have indicated a slightly increased risk of melanoma and non-melanoma skin cancers [76]. A 2018 study estimated that cancers attributable to excess weight ranged from 3.9% to 6% in men and 7.1% to 11.4% among women [72]. It is suspected that most, if not all, cancers, while perhaps not directly caused by obesity, can be linked to lifestyles associated with obesity, including a diet high in fat and sugar and a marked lack of exercise.

Weight gain in adulthood is considered a risk factor for breast cancer, particularly in postmenopausal women. This is supported by research including the Nurses' Health Study, which found that women who gained 25 kgs or more after 18 years of age had a relative risk of 1.45 (95% confidence interval: 1.27–1.66), and by a secondary analysis of Women's Health Initiative trials, which found a BMI of 35.0 or higher was strongly associated with risk for estrogen receptor-positive and progesterone receptor-positive breast cancers [38; 73]. Obesity is also strongly correlated with endometrial cancer in women and colorectal cancer in men [74]. More studies are being conducted to further analyze the association between obesity and certain cancers.

Educating patients about the benefits of exercise is an important task. Although many patients may be aware of these benefits, it is encouraging for them to hear it directly from their healthcare providers. When patients fully appreciate the potential benefits of exercise, they are more likely to engage in activities that produce those benefits. It is also important for patients to realize that it is not necessary to begin an extensive exercise regimen to gain fitness. Even small increases in physical activity are associated with measurable health improvements. For example, weight reduction of 5% body weight is associated with lower incidence of diabetes, improved lipid profile, and reduced blood pressure.

ASSESSMENT PRIOR TO EXERCISE

Most people who are in good health will not need an extensive medical workup before starting an exercise program; a simple self-assessment should be sufficient [70]. The American College of Sports Medicine (ACSM) provides a physical activity readiness questionnaire to help individuals determine whether medical clearance is necessary (***Table 1***). This series of questions can be adapted for use by clinicians or provided to patients seeking advice.

In 2015, the ACSM updated its recommendations for exercise participation screening, partly because previous recommendations were viewed as unnecessarily strict and as a possible barrier to exercise participation [84]. The new ACSM exercise preparticipation health screening process focuses on the individual's current level of physical activity; the presence of signs or symptoms of known cardiovascular, metabolic, or renal disease; and the desired exercise intensity. The cardiovascular disease risk factor profile is no longer included in the decision-making for referral for exercise prescreening. Instead, the ACSM has developed a health screening algorithm to guide participation in aerobic exercise [84].

When appropriate, a physical exam may be conducted in order to clear patients for physical activity. Although all elements of a physical exam are important, careful auscultation of lungs and heart is important to assess for rales, wheezes, and murmurs. Measuring blood pressure and pulse in resting, supine, and standing positions is useful, as is the assessment of carotid, abdominal, and femoral pulses. One should not omit a thorough neurologic exam, including assessment of motor strength, deep tendon reflexes, and cerebellar function.

CONTRAINDICATIONS TO EXERCISE

There are a few contraindications to exercise that clinicians should recognize; several are listed in ***Table 2***. These patients should wait to begin an exercise program until they are medically cleared. Many people believe they cannot exercise due to certain health conditions, but the reality is that many of those persons are the ones most likely to benefit. Their health risks are actually greater for habitual inactivity and obesity than they are for initiating an exercise program.

CONTRAINDICATIONS TO BEGINNING AN EXERCISE PROGRAM

Recent myocardial infarction (two weeks)
Unstable angina
Severe aortic stenosis
Decompensated congestive heart failure (low ejection fraction)
Left ventricular outflow obstruction
Uncontrolled dysrhythmias
Uncontrolled diabetes or diabetic complications
Uncontrolled hypertension

Source: Compiled by Author *Table 2*

CASE STUDY

Patient S's height is 6'1", and his current weight is 240 pounds, with a calculated BMI of 31.7. His blood pressure is 135/85 mm Hg, and his heart rate is 84 beats per minute (bpm). A review of his medical chart from last year shows a 22-pound weight gain. The physical exam is largely unremarkable. There is full range of motion and normal strength of his knees, with no anterior/posterior drawer sign or fluid collection. His lab work is as follows:

- Sodium (Na): 140 mEq/L
- Potassium (K+): 4.2 mEq/L
- Chloride (Cl): 109 mmol/L
- Carbon dioxide (CO_2): 22 mmol/L
- Creatinine (Crt): 1.1 mg/dL
- Fasting blood glucose: 120 mg/dL
- Total cholesterol: 220 mg/dL
- HDL: 30 mg/dL
- LDL: 150 mg/dL
- Triglycerides: 200 mg/dL

Patient S is obese, as demonstrated by a BMI >30. In addition, he has hyperlipidemia. With a fasting blood glucose of 120 mg/dL, he may also have prediabetes. He should be counseled on the benefits of regular physical activity and a healthy diet and provided guidance on an exercise regimen. Given his age and general medical health, Patient S does not need to undergo any further diagnostic testing before proceeding. His right knee pain is likely due to early arthritis, a result of his excess weight. Intensive counseling regarding exercise and lifestyle change should be initiated as the first part of his treatment.

EXERCISE MOTIVATION

In addressing the issue of exercise with patients, there are two fundamental issues:

- How to get people motivated
- How to organize a routine

One of the most important steps in getting people motivated is to set both short-term and long-term goals. Goals must be specific, clear, and moderately difficult to achieve but attainable with effort. Too often, patients either set no specific goals (e.g., "lose weight") or they set highly unrealistic ones (e.g., "lose 30 pounds in a month").

Healthcare professionals should encourage patients to set short-term goals for two, four, and six months. Anything earlier than two months does not give enough time to see significant change, resulting in discouragement. A realistic goal regarding weight loss from an exercise program is for patients to lose 1 pound every two weeks. At two months, patients should strive for a 4-pound weight loss, and at six months, a 10- to 12-pound weight loss would be realistic. In terms of strength improvement, patients should see a 5% improvement in two months and a 10% improvement in six months. A realistic goal regarding length of exercise would be to start with 20 minutes, three times per week, increasing to 40 to 60 minutes, three to four times per week at six months.

The long-term goal must be to maintain the program, with incremental improvements. Patients should be encouraged to keep their focus on short-term accomplishments—this will minimize frustration and provide encouragement to sustain the routine. Patients should remember that this is a lifestyle change, and they must change behavior for the long term by making small changes over time.

In helping patients set exercise goals, it is critical to determine a patient's current fitness level. Some information will be obtained by measuring body weight, percent body fat, BMI, and resting heart rate. However, more relevant information can be obtained by asking patients specific questions about their activity levels, recognizing that many patients will overestimate their activity. It may be useful to have patients fill out a questionnaire relating to physical activity prior to the visit. Questions may include:

- What types of physical activities do you enjoy?
- What exercises do you perform regularly? How often and for how long?
- How much do you walk every day?
- Do you own any exercise equipment?
- What gets in the way of consistently exercising?
- Have you thought about increasing the amount of your activity?

For those patients who are currently active, it is important to review their routine and make refinements. For those patients who are primarily sedentary, the key is to get them to start with some type of exercise.

In motivating patients, it is helpful to acknowledge and address impediments to fitness. As discussed earlier, there are many reasons why people do not exercise, including lack of time, fear of injury, belief that exercise is too boring, and a feeling of being too old. It is important for the healthcare provider not to ignore these concerns, but rather address them and offer alternatives. For example, "lack of time" can be addressed by explaining to patients that they can simply exercise for 10 to 20 minutes two to three times per day, a few times per week. "Too boring" can be addressed by choosing an enjoyable activity. As for being "too old" to exercise, the healthcare provider should share with them the significant data that shows elderly patients improve strength and balance and decrease morbidity with exercise programs.

It is also useful for patients to develop support systems. Several studies show patients to be more successful with long-term exercise programs if they involve family, friends, or a training partner. One is less inclined to avoid going to a gym or fitness facility if other people are waiting there for them.

For some patients, it may be useful to keep a journal of their physical activity. There are also numerous computer programs and mobile applications that help track progress. For some people, a journal can be a great motivator, keeping them on-track in reaching their goals. Journaling will not be for everyone, but it is certainly worth suggesting to patients. A written record is also a way for physicians to monitor a patient's progress.

In assessing a patient's ability and interest in changing his or her lifestyle, one can also refer to the Stages of Motivational Readiness for Change model developed by Prochaska and DiClemente. This model consists of the following stages [41]:

1. Precontemplation
2. Contemplation
3. Preparation
4. Action
5. Maintenance

Those in the precontemplation stage are not physically active and have not given much thought to becoming active. Patients who are in the contemplation stage are currently inactive but are thinking about becoming physically active. Those patients who are in the preparation stage may be physically active, but not at the recommended level; these patients are ready to make a plan to increase activity. Those in the action stage are physically active at the recommended levels but typically have been doing so for only a short time. Finally, those in the maintenance stage have typically been at the recommended level for at least six months. These stages can be used as a framework to assess people's readiness for change, recognizing that these are not truly linear stages, but more likely iterative. Most people make multiple attempts before they are able to achieve significant change.

For example, when examining patients who seem to be in the precontemplation stage, it is important for healthcare providers to discuss the benefits of exercise and address any concerns patients have about initiating an exercise program. The goal is to convince patients to start thinking about change. For contemplators, it is useful to give more encouragement. The goal is to move them toward preparing for change. Healthcare providers can provide specific information about becoming more physically active, perhaps through information about a structured program or a how-to book. When seeing patients in the preparation stage, the goal should be to increase their physical activity level. This may be done by discussing any barriers and helping the patient develop strategies to overcome them. For those in the action and maintenance stages, the goal is to maintain changes; one should praise efforts, help with any obstacles, and aim to minimize setbacks. Again, this model serves as a general framework in helping motivate patients to adopt healthy behavior.

CASE STUDY

Discussion with Patient S reveals that he is in the contemplation stage. He is currently inactive but is thinking about becoming active. His reasons for not going to the gym, although he has a membership, should be explored. For example, Patient S says he does not have time and exercise is too boring. One should point out that he could simply start with 10 minutes of exercise two days per week, and then slowly build up to the recommended levels. He should realize that exercise does not have to take place at the gym. He should focus on activities that he might enjoy, such as swimming or brisk walking, and possibly partner with his wife or friends to make workouts more interesting.

TYPES OF EXERCISE

Healthcare providers must understand some basic exercise principles to properly advise their patients. These principles will allow them to guide patients to an exercise program. Remember, patients often need specific instructions with examples of exercises.

In organizing a routine, one must keep in mind that there are essentially three types of exercises:

- Stretching
- Aerobic
- Anaerobic

Patients should try to incorporate all three types into a routine. Not all exercises affect the same muscle groups, and each type of exercise does not provide the same benefit.

STRETCHING

Stretching involves the ability to move joints and muscles through their full range of motion. It is a neglected area of most fitness routines. Stretching must be an integral part of a workout because it keeps the muscles and joints loose. In addition, it protects against injury, improves blood flow, and increases tendon flexibility. Stretching can be performed at any time of the day and practically anywhere. All one needs is a padded surface or exercise mat.

Stretching should be done for about 10 to 12 minutes and should cover all the muscle groups. Patients should be encouraged to stretch to the point that they can feel some minor discomfort, hold the stretch for 15 to 20 seconds, and repeat two to three times. Stretching should be done at least two to three times per week. The following are some basic stretches targeting the major muscle groups:

- **Pike stretch (hamstrings, lower back)**: Sit on the floor with your legs outstretched in front of you and your feet together. Bend forward at the waist and reach toward your toes with your hands.
- **Straddle stretch (groin, upper back, obliques)**: Sit on the floor and spread your legs apart. Reach your right hand toward your left foot. Hold for 15 to 20 seconds. Reach your left hand toward your right foot.
- **Cat stretch (back, triceps, laterals)**: Kneel on the floor with your forearms and hands outstretched on the floor in front of you. Slide your forearms forward as far as possible while trying to keep your thighs perpendicular to the floor. Maintaining this position, while supporting yourself with your arms and shoulders, attempt to lower and press your abdomen to the floor. Try to hold this position for 15 to 20 seconds.
- **Door push (chest)**: Stand in front of a doorway, step slightly in, and press both hands and arms against the door frame. Lean forward.
- **Shoulder stretch**: In a seated position with your back upright, grab your elbow with the opposite hand. Gently pull across your body. Hold for 15 to 20 seconds. Repeat with the other arm.

AEROBIC

Aerobic activity is typically known as "cardio" because it strengthens the heart and improves overall fitness by increasing the body's ability to use oxygen. Aerobic activities are any activities that use large muscle groups, are maintained continuously, and are rhythmic in nature. They use muscles at a lower intensity for a more prolonged period of time. These activities require the muscles to consume a considerable amount of oxygen.

There is a wide range of aerobic activities from which patients can choose. These include swimming, brisk walking, stair climbing, running, cycling, skiing, tennis, and racquetball.

ANAEROBIC

Anaerobic activities focus on muscular strength and muscular endurance. These activities, which involve major muscle groups, are typically known as "resistance training." Muscular strength relates to exerting maximum force for a brief time period with repeated contractions until the muscle becomes fatigued. Weightlifting is a good example.

Muscular endurance involves sustaining repeated contractions or applying force against a fixed object for an extended period of time. Push-ups are an example of a muscular endurance exercise. Oxygen is not used, and the muscles produce lactic acid as a by-product.

Before beginning resistance training, patients should become familiar with two important concepts: correct form and breathing technique. Form is broken down into repetition rhythm, range of motion (ROM), and proper angle. The rhythm should be controlled and consistent throughout the entire set of repetitions. One should resist the temptation to jerk the weight up or use momentum to move the weight. ROM simply means to fully extend or flex the muscle being worked. One should allow the muscle targeted to fully stretch at the bottom of the movement. Each exercise has two phases: the eccentric and concentric motion. The concentric is the pushing part of the motion and the eccentric is the resistance portion. Contrary to popular opinion, muscles get stronger from the eccentric part of the movement, or the stretch, not the push. Therefore, patients must go through the full range of motion to benefit. Each motion should be fluid, with equal time (e.g., three seconds up, three seconds down) given to the eccentric and concentric motions.

With respect to breathing, patients should exhale during the push phase of each exercise and inhale during the resistance phase. For example, during a bench press exercise, one would inhale while lowering the weight to one's chest and exhale as one pushes it back up. Doing this allows the best possible flow of oxygen-rich blood to the working muscles. Patients should be cautioned not to hold their breath during any exercise because Valsalva maneuver, which increases intra-abdominal pressure, may occur. This happens when patients close the glottis and activate abdominal muscles. This increase in abdominal pressure causes an increase in blood pressure and should be avoided. One trick to encourage patients to breathe is to ask them to count the number of repetitions out loud.

EXERCISE EXAMPLES

An adequate resistance training program could include the following types of exercise, focusing on the major muscle groups. One can use dumbbells in the 5- to 10-pound range for those exercises that require the use of weight. Even this light weight can make a significant difference. At home, one can use a household item that provides a comfortable weight, such as a milk carton or beverage container. These exercises can also be performed without weights.

- **Chest (Bench Press)**: Hold the weights with your hands. Lying on a flat surface, with knees bent and feet flat, slowly bring the weights to the chest area with palms facing upward. Begin to exhale and press the weights up, fully extending the arms, and keeping them above your eyes. Inhale as you lower them to the starting position and repeat the movement.
- **Back (Bent-Over Row)**: Start by placing your feet shoulder-width apart. Grip a weight with each hand just outside the knees. Keeping the back straight and the knees flexed, slightly bend forward at the waist. Let the arms hang naturally while holding the weights. From this starting position, pull the weights to the lower abdomen, keeping the elbows close to the body. Exhale as you pull. Return to the starting position, inhaling as you go.
- **Arms (Bicep Curls)**: Hold a weight in each hand, with elbows at your sides, palms facing forward. The back should be straight, the chest flared outward. Begin to bend your right arm up first while exhaling, keeping the elbow totally stationary. Wait until the right arm goes completely down to the fully extended position, and then begin to curl the left arm. Each arm curled completes one full repetition.

- **Shoulders (Lateral Raises)**: Place the feet a few inches apart with the knees bent slightly. Keep the back erect as you lean forward slightly. With the weights in front of your thighs and palms facing together, begin to slowly raise them up to the side until parallel with the floor. Lower the weights to your thighs, and repeat.
- **Legs (Stiff Leg Dead Lift)**: Start by standing straight, holding the weights close to your sides, nearly touching your thighs. Keep the weights close to the body—this protects the back. The back must stay straight. Bend at the waist as far forward as you comfortably can while keeping your legs straight, and begin to feel the pull in your hamstrings as you lower the weights toward the ground. Slowly return to the starting position, keeping the back straight.
- **Legs (Dumbbell Lunge)**: Hold a weight in each hand, arms hanging at your sides. Step out with one leg, keeping the back straight. It is important to step out far enough so that the knee does not extend over the toe. This puts too much stress on the knee. Go down far enough so that the opposite knee nearly touches the ground. Keep this stance and repeat the lunging motion for several repetitions.
- **Abdominals**: Do not perform standard sit-ups as these could hurt the lower back. Rather, focus on the following two exercises:
  - Obliques: Lie on your back with the knees flexed in the bent sit-up position. From this position, bring both knees down to the ground. With the back remaining flat, begin to flex your body toward your toes ("crunch"). Bring your shoulders up off the ground, but go slowly, controlling your momentum. Repeat this 10 to 15 times.
  - Seated bench kicks/jack knives: Sit on the end of a bench or chair with the hands placed behind the buttocks. Begin to kick the legs outward with the knees bent slightly—at the same time, lean back to extend the torso. Come back to the beginning position and repeat this motion 10 to 15 times.

Although these exercise examples are useful, encouraging patients to simply walk more can achieve some health benefits.

DEVELOPMENT OF AN EXERCISE PROGRAM

Any workout program or schedule should address the duration of the workout, the frequency of the workout, and its intensity. Each is discussed below.

DURATION/FREQUENCY

The current recommendation by the Institute of Medicine is for adults to set a long-term goal of at least 60 minutes per day of moderate-intensity physical activity (e.g., brisk walking) or shorter periods of more intense daily activity [42].

The 2018 Physical Activity Guidelines for Americans sets a minimum goal of at least 150 minutes (2.5 hours) per week of moderate-intensity, or 75 minutes (1.25 hours) per week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. Aerobic activity should be spread throughout the week, and even five minutes of physical activity at a time has been shown to have health benefits [19].

For many patients, these goals may seem unattainable and, as a result, they may be discouraged. Therefore, explain that if the patient cannot be active for 60 minutes at a time, he or she can start with shorter sessions, gradually building up to the total of 60 minutes for maximum benefit. In addition, patients can start with exercising two days per week and gradually build up to the recommended level.

INTENSITY

Intensity refers to relative load or resistance against which the muscle works. In general, intensity reflects the energy requirements of the activity, the amount of oxygen consumed, and the calories of energy expended. It is a critical factor in the development of the VO_2 max.

The key criterion is for patients to elevate their heart rate. Patients should calculate their maximal heart rate as 220 - age. For example, a patient 45 years of age has a maximal heart rate of 175 bpm. For patients having difficulty finding their pulse, a pulse monitor, which is available at most gyms and health stores, can be used.

Low-intensity exercise is defined as exercising at <50% maximal heart rate; moderate-intensity is defined as exercising at 50% to 70% of maximal heart rate. Vigorous exercise generally involves a heart rate about 70% to 85% of a person's maximum [43].

For those patients not wishing to measure heart rate, there are other indicators of activity. One is a subjective report of psychologic strain associated with exercise, based on rate of perceived exertion as measured by the Borg scale. This numerical scale goes from 6 to 20, with a value of 6/7 correlated with very, very light exertion, 8/9 very light, 10–12 fairly light, 13/14 somewhat hard, 15/16 hard, 17/18 very hard, and 19/20 very, very hard [45]. A score of 12–16 correlates to moderate intensity.

The ACSM/American Heart Association (AHA) guidelines attempt to simplify the descriptions of exercise intensity. They describe moderate-intensity aerobic exercise as raising the heart rate noticeably, with exertion equivalent to a brisk walk. Vigorous exercise causes a substantial heart rate increase with rapid breathing and for many people is equivalent to jogging [40].

For patients who want to add up different types of exercise to meet the daily goal, metabolic equivalent tasks (METs) are useful. METs are simply a shorthand measure of the effort involved in any activity. Moderate activity uses 3 to 6 METs and burns 3.5 to 7 kcals per minute. Vigorous activity uses greater than 6 METs and burns more than 7 kcals per minute [43]. To meet a goal of 30 minutes of moderate-intensity activity five days per week, a person would need to accumulate at least 30 x 3 x 5 = 450 METs. A detailed list of moderate and vigorous activities, classified by METs, is available at the CDC website at https://www.cdc.gov/nccdphp/dnpa/physical/pdf/PA_Intensity_table_2_1.pdf.

With resistance training, one can alter the desired result while employing varying intensity levels. For example, those patients who aspire to obtain larger muscles should utilize heavy, more intense lifts in the range of six to eight repetitions. For those patients who desire a slight increase in muscle mass, a lighter, less intense level in the 12 to 15 repetition range is appropriate.

Some patients will be fearful of lifting weights, although this is a generally safe activity. Interestingly, weight training has been in practice in some form for eons, with its evolution as an ancient tradition of stone lifting to its implementation in the fitness programs of today. Many people have been misinformed about the benefits that a resistance training program can offer. Some of the more common misconceptions include:

If you stop lifting weights, the muscle turns to fat.

Patients should understand that muscle does not turn directly into fat and fat does not turn directly into muscle. Fat is used to store energy that can be used to build muscle. When people do decide to stop training with weights, their muscles will usually decrease in size. This accounts for the concept of the muscles turning to fat.

I'm too old to start weight training.

The truth is that it is never too late to start lifting weights. Studies have shown that regular mild resistance training helps prevent osteoporosis and maintain functional status. In addition, resistance training improves strength. This is especially helpful for older, inactive patients who typically have difficulties with endurance, balance, strength, and flexibility. Weight training can help to reduce these deficits.

Women get big, bulky muscles lifting weights.

In general, women have smaller muscle groups and also lack significant testosterone production. This prevents them from developing large muscles. In addition, muscle size is a function of exercise intensity. Current recommendations do not suggest an intensity that would be required to develop large, bulky muscles.

Lifting weights makes one very stiff and hinders flexibility.

Studies have shown that strength training can increase flexibility by as much as 200% when performed correctly. When a joint is being moved from beginning flexion to complete extension, the muscles used are being stretched. This stretching leads to improved flexibility.

Although it may seem obvious, it is important to discuss with patients the normal responses to exercise. They should expect to have an elevated heart rate, increased breathing, perspiration, and mild muscle aches. Typically, patients will experience muscle soreness 48 hours after exercising, which is known as delayed onset muscle soreness. This is an expected process as cells deteriorate and regenerate, eventually leading to increased strength.

At the same time, patients should be aware of the warning signs of excessive intensity, too frequent, or improper exercise. These include severe dyspnea, chronic coughing, chest discomfort, dizziness, prolonged muscle ache (exceeding 72 hours), and intense joint pain. If patients experience these symptoms, they should consult a healthcare provider to review why these symptoms occurred.

As noted earlier, patients should understand that even moderate amounts of exercise can make a significant difference in their health status. Numerous trials have demonstrated that even low amounts of moderate exercise, lasting 30 minutes, can be sufficient to prevent weight gain. In the Studies of Targeted Risk Reduction Interventions through Defined Exercise (STRRIDE), 182 patients who were overweight with mild to moderate dyslipidemia were randomized to: (1) no exercise, (2) supervised low-dose/moderate-intensity exercise (at 40% to 55% peak oxygen consumption) equivalent to walking 12 miles per week, (3) low-dose/vigorous-intensity exercise (at 65% to 80% peak oxygen consumption) equivalent to jogging 12 miles per week, or (4) high-dose/vigorous-intensity exercise (at 65% to 80% peak oxygen consumption) equivalent to jogging 20 miles per week. The exercise was conducted on treadmills, elliptical trainers, and stationary bikes. The study lasted eight months, and patients were instructed not to alter their diet during this time period. Therefore, this study looked only at the effect of exercise. At the conclusion of the study, the high-dose/vigorous-intensity group had the greatest weight loss; the control group actually gained weight. All the exercise groups demonstrated decreased abdominal, hip, and waist circumference. More importantly, there was a dose-response relationship between amount of exercise and amount of weight and fat loss. The authors concluded that significant benefit can be achieved with 30 minutes of walking daily [46].

EXERCISE MAINTENANCE, ADHERENCE, AND FAILURE

It is estimated that approximately 50% of people who start an exercise program will have quit within six months. The people who are most successful demonstrate some of the following characteristics:

- They have chosen a convenient, inexpensive activity that is pleasurable and safe.
- They have set realistic goals, both short-term and long-term, that they track over time.
- They structure exercise within their schedule.
- They receive encouragement from family, friends, and healthcare providers.

It is important to emphasize to patients that initiating and maintaining an exercise program can be very difficult, and they should expect to experience setbacks. These setbacks should not be viewed as failure, which for many people will serve as additional discouragement. Rather, healthcare providers should explore why the patient could not maintain the program and determine methods to achieve success. For instance, if the patient could not find time to exercise, one might emphasize the need to schedule it, with the understanding that exercise can be broken into 10-minute intervals.

It is important for the physician to review exercise advice and/or prescriptions with the patient. Giving such advice should not be viewed as a single event but rather one that must be discussed at each office visit, just as current medications would be reviewed.

SPECIALTY SOCIETY POSITION STATEMENTS

Numerous specialty societies support the need for exercise and the role of physicians and other healthcare providers in encouraging physical activity.

AMERICAN HEART ASSOCIATION

The AHA strongly recommends physical activity counseling as an important strategy for implementing primary and secondary prevention guidelines. The AHA believes that healthcare providers should deliver counseling systematically, including asking specific questions about the kinds of activity and how much activity each patient is getting [47].

The AHA specifically advises that in the patient-visit setting, physicians and their staff should discuss physical activity and provide exercise prescriptions for patients and their families. At times, implementing physical activity at the workplace should be discussed. The AHA recommends at least 30 minutes of moderate-intensity physical activity five days per week, or 25 minutes of vigorous exercise at least three days each week [81]. Moderate and vigorous activities can be combined to meet the goal, and moderate-intensity activities can be performed in 10-minute segments if necessary. They also recommend resistance training using free weights or gym equipment be done at least twice per week, with 8 to 10 exercises working different muscle groups repeated on non-consecutive days, starting with 10 to 15 repetitions and building to three sets of 15 repetitions for each body area [82]. For older adults, the AHA also advises stretching for flexibility, about 10 minutes at least twice per week [40; 48].

AMERICAN MEDICAL ASSOCIATION

The AMA supports educating physicians about exercise, including instruction on the role of exercise prescription in medical practice and in medical student instruction. Physicians are encouraged to prescribe exercise to their patients and to shape programs to meet each patient's capabilities and level of interest [49; 83].

AMERICAN CANCER SOCIETY

The ACS recommends that patients maintain a healthy body weight, avoid weight gain, exercise for at least 150 minutes of moderate activity (in addition to usual activities, such as work and chores) per week (30 minutes five or more days every week), or 75 minutes vigorous intensity exercise per week, or a combination of both, and to eat a variety of healthy foods [50]. Forty-five to 60 minutes of intentional exercise at least five days per week is preferable for increased health benefits, including lowered cancer risk. Children and adolescents should engage in at least 60 minutes of physical activity at least five days per week.

AMERICAN DIABETES ASSOCIATION

The ADA has published guidelines for patients regarding exercise. The ADA recommends that patients with diabetes undergo a detailed medical exam prior to beginning an exercise program. Specifically, they recommend screening for macrovascular and microvascular diabetic complications that could be exacerbated by exercise. They also suggest considering an exercise test for patients at high risk of underlying cardiovascular disease. In general, however, the ADA recognizes that both type 1 and type 2 diabetics can and should participate in physical activity [51]. The ADA recommends at least 30 minutes of moderate-to-vigorous intensity activity at least five days every week for all adults, including adults with prediabetes or diabetes, and at least 60 minutes daily for children and teens [10]. It is important to not go more than two days in a row without exercise. Resistance exercise is recommended two to three days per week, aiming for three sets of 8 to 10 repetitions for each muscle group targeted. People with diabetes should check blood glucose before, after, and several hours following exercise, at least in the beginning of an exercise program.

SPECIFIC DISEASE CONDITIONS

As noted, exercise provides numerous health benefits. Because the different types of exercises have a different impact on the body, patients with some disease conditions are likely to benefit more from one type of exercise than another. It is important to be familiar with the latest data, especially with respect to three diseases: diabetes, osteoporosis, and HIV and acquired immunodeficiency syndrome (AIDS).

DIABETES

As of 2020, 10.5% of the U.S. population, or 34.2 million Americans, have a diagnosis of diabetes. In addition, an estimated 7.3 million people have diabetes but remain undiagnosed [75]. The vast majority of persons with diabetes (approximately 95%) have type 2 diabetes, and the majority of patients with diabetes are overweight or obese.

Until recently, many medical professionals believed that patients with diabetes should not engage in exercise programs. This was due to a belief that exercise increases the risk of hypoglycemia, especially in patients with type 1 diabetes. Although there is a risk of hypoglycemia, for most patients the benefits of physical activity exceed this risk. Patients taking insulin or insulin secretagogues may need to take extra carbohydrate before physical activity if blood glucose is low; adjustments may also be needed for patients taking exenatide or pramlintide.

In patients with diabetes, exercise can improve peripheral insulin sensitivity and enhance insulin binding. One meta-analysis followed 2,509 patients who underwent supervised exercise training programs. At the end of the study, individuals in the exercise training group had a significantly lower mean fasting insulin level (6.8 mU/L) compared with controls (7.9 mU/L) [53].

Most patients with diabetes can safely exercise. Certainly, patients with uncontrolled diabetes should not begin an exercise program until glucose levels are stabilized. Patients with proliferative or severe nonproliferative retinopathy are advised to avoid vigorous exercise, because there is a potential risk of vitreous hemorrhage or retinal detachment. Patients with nephropathy or peripheral neuropathy have traditionally been told to avoid vigorous exercise. However, ADA recommendations state that both aerobic exercise and resistance training may actually be beneficial in patients with nephropathy. These patients do, however, need careful workup for cardiovascular risks, including a stress test. For patients with peripheral neuropathy, non-weight-bearing exercise is advised as a common-sense precaution, as limited sensation could increase the risk of injury. Autonomic neuropathy in diabetes is closely tied to cardiovascular disease and carries a risk of postural hypotension, impaired thermoregulation, and other serious problems; for these patients, a thorough cardiac investigation is recommended before starting an exercise program [51].

Although all types of exercises should be discussed with patients with diabetes, it is important to emphasize aerobic activities for this population. Numerous studies have documented the benefit of such exercise. In a meta-analysis, it was found that exercise training reduced glycosylated hemoglobin by an amount that should decrease the risk of diabetic complications; greater intensity activities were associated with greater reductions in glycosylated hemoglobin [54]. Elsewhere, the relationship of total physical activity and incidence of type 2 diabetes in women was examined as part of the Nurses' Health Study, a large prospective cohort study [55]. Study subjects were asked about levels of aerobic activity, such as walking, and vigorous activities, such as jogging, bicycling, swimming, or squash. At the end of the study time, aerobic exercise decreased the risk of type 2 diabetes, with greater physical activity level associated with a substantial reduction in diabetes risk. In another study, increased levels of exercise correlated with lower mortality risk in individuals with diabetes [56]. However, the researchers noted that even moderate amounts of activity decreased the risk for early death compared with inactivity.

The ADA, in a 2016 position statement, reiterates the benefits of exercise to improve both glycemic control and insulin sensitivity. The statement also notes the increasing evidence that lifestyle changes, including exercise, can slow or prevent the onset of diabetes in patients with impaired glucose tolerance [51].

OSTEOPOROSIS

Osteoporosis is a major health problem in the United States. Approximately 54 million patients have osteoporosis or osteopenia (low bone mass) [58]. One in 2 women and 1 in 4 men older than 50 years of age will break a bone due to osteoporosis, resulting in 2 million fractures each year [58]. This number is expected to increase to 3 million fractures annually by 2025. The morbidity and mortality is significant, with about 20% of patients who were ambulatory prior to hip fracture dying within a year due to complications of the injury or surgery [58]. Many more survivors require long-term care in a nursing home.

It is critical that clinicians focus on prevention of these conditions. Although there has been significant discussion about discontinuing the use of hormone replacement therapies in women, there is considerable data demonstrating the effectiveness of exercise in preventing and treating osteoporosis for both men and women.

Although patients should include all types of exercises in a program, as discussed, it is important for them to perform resistance training to prevent and treat osteoporosis. This is because it is weight-bearing exercises—not aerobic or stretching—that increase bone mineral density (BMD).

The increase in BMD subsequently reduces fracture risk. In order to increase BMD, there should be a physical stress on the muscles/bones. Brief, high-intensity periods of loading that generate a diversity of strain patterns on the bones provide an osteogenic response. Low-impact exercises do not create enough stress to increase muscle mass or BMD.

EVIDENCE-BASED PRACTICE RECOMMENDATION

The Institute for Clinical Systems Improvement asserts that weight-bearing and muscle-strengthening exercises have been shown to be an integral part of osteoporosis prevention, as well as a part of the treatment process. All three components of an exercise program are needed for strong bone health: impact exercise such as jogging, brisk walking, or stair climbing; strengthening exercise with weights; and balance training, such as Tai Chi or dancing.

(https://www.icsi.org/wp-content/uploads/2019/01/Osteo.pdf. Last accessed November 22, 2022.)

Level of Evidence: Consensus Statement/Expert Opinion

One study showed that greater BMD is associated with physical exercise (independent of sex and vitamin D level) in young healthy adults [59]. Among adults, participation in activity at or near levels recommended in the 2018 Physical Activity Guidelines for Americans can attenuate age-related decreases in BMD and, optimally, increase BMD 1% to 2% per year [60].

Other researchers studied the effects of a year's length of weight-bearing and resistance exercises on BMD in two groups of postmenopausal women with and without hormone replacement therapy. Although the combination of exercise and hormone replacement therapy produced the greatest increase in BMD, exercise alone resulted in modest site-specific increases in BMD [61].

Another study gauged the impact of a resistance training program and calcium supplementation on BMD in postmenopausal women over a two-year period. Patients completed three sets of nine resistance-type exercises three times per week. At the end of the study period, the exercise group showed a significant increase in bone density at the hip measuring site [62].

A systematic review of literature showed that postmenopausal women with osteoporosis who engaged in regular physical activity had a small, but statistically significant, improvement in BMD when compared with control groups. This study also noted the most effective types of exercise to increase BMD in specific areas. For example, progressive resistance strength training of the lower limbs seemed to be most effective for the neck and femur, while the spine seemed to be most positively affected by a multicomponent exercise program that may include aerobics, strengthening, progressive resistance, balancing, and/or dancing. There was also evidence that weight-bearing aerobic exercise and training with vibrating platforms may have a positive impact in improving BMD [57]. The National Osteoporosis Foundation recommends regular weight-bearing, muscle-strengthening exercise to reduce the risk of fractures and falls. Patients at high risk for fracture should avoid forward bending and exercising with trunk in flexion, especially in combination with twisting [63; 64].

HIV/AIDS

HIV/AIDS is a significant public health problem. For many years, patients with HIV/AIDS were counseled not to engage in exercise. This was due to the belief that intense or prolonged exercise could lead to decreased immune function in a population that was already immunocompromised and/or immunodepressed. This belief has not been supported in the literature. Physical activity may in fact offer substantial health benefits for persons with HIV. Data suggest that exercise can improve HIV patients' quality of life and improve overall strength.

The effects of an exercise training program on aerobic fitness, immune indices, and quality of life in adults with HIV were studied in 15 patients living with HIV who participated in a program of resistance exercise. Significant changes were observed in scapular force and hand strength as well as in the following areas in the quality-of-life domains: environment, spirituality/religion/personal beliefs, and perception of quality of life and overall health [65].

Other researchers studied whether aerobic exercise training would improve cardiovascular health and CD4 counts in patients with HIV taking antiretroviral therapy. Fifteen adults living with HIV participated in moderate-intensity continuous exercise training for 45 to 60 minutes three times per week for eight weeks. Participants in the exercise training program showed improvements in blood pressure, VO_2 max, and CD4 cell count, with changes in VO_2 max significantly correlated with changes in CD4 cell count [66]. Cochrane Reviews addressing exercise and HIV, published in 2004, 2010, and 2017, addressed resistance exercises and aerobic exercise, respectively. Both reviews noted that although sample sizes tended to be small and dropout rates high, the sum of the evidence supported exercise as both safe and beneficial for people with HIV [67; 68; 85].

CONCLUSION

Obesity is a significant health problem, and data indicates that the majority of adults in the United States are overweight. Physical inactivity is one of the major causes leading to obesity. Although exercise is an effective therapeutic intervention for most patients, vast numbers of people do not engage in any significant exercise. Various reasons exist, including the fact that healthcare professionals, in general, do not discuss the benefits of or need to exercise. Healthcare professionals must learn more about exercise physiology and provide patients with counseling on the different types of exercises, including stretching, aerobic, and anaerobic activity. Workout length, frequency, and intensity are also important to discuss, with a general recommendation of at least moderate activity for 30 to 60 minutes most days of the week. The majority of patients will experience difficulty in initiating and sustaining exercise. Therefore, careful follow-up at subsequent office visits is necessary to reinforce the information. Patients should understand that incorporating exercise is a lifestyle change. Clinicians should provide the guidance to make these changes.

RESOURCES

President's Council on Sports, Fitness, and Nutrition
https://health.gov/our-work/nutrition-physical-activity/presidents-council

CDC Overweight and Obesity Resources
https://www.cdc.gov/obesity/resources

Exercise and Physical Activity
https://www.nia.nih.gov/health/exercise-physical-activity

Society of Health and Physical Educators
https://www.shapeamerica.org

American Heart Association
https://www.heart.org

American College of Sports Medicine
https://www.acsm.org

Physical Activity Guidelines for Americans, 2nd edition
https://health.gov/sites/default/files/2019-09/Physical_Activity_Guidelines_2nd_edition.pdf

CDC Active People, Healthy Nation Initiative
https://www.cdc.gov/physicalactivity/activepeoplehealthynation

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