

Physical Exercise and Health, 3:

The Health Care Professional and Patient's Guide to Understanding What to Do, How, and Why—Part 1

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Abstract

Physical activity and exercise are associated with important short- and long-term health benefits. It does not take much effort to reap these benefits; every little bit of activity counts, including activities that are performed as part of daily life. Everybody can exercise, even those with existing medical conditions, and even those with existing cardiac or orthopedic conditions; all that is necessary is to tailor the exercise to individual capacity with appropriate dos and don'ts. This article, addressed to

health care professionals, their patients, and the general public, provides practical guidance on exercise, mostly in the form of points and short paragraphs, so that the reader can easily understand and assimilate what to do, how, and why. The article explains what the health benefits of exercise are; how much exercise one ideally needs to perform for optimal health outcomes; what targets to set for exercise; what effects exercise has on muscles, bones, and the heart; and how these effects are beneficial. The article offers suggestions

on how to create time and opportunity for exercise, how to motivate oneself for exercise, and how to avoid boredom and discouragement. Most important of all, this article provides a detailed discussion on exercise-related risks, especially orthopedic risks, and how to avoid these risks. Protecting the knee joint from injury receives particular attention. Practical guidance on what to actually do appears in the next article in the series.

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This article and the next in the series provide practical notes on physical exercise; they are intended to help the reader understand what to do, how, and why.

The articles are written in simple language. Sections and paragraphs are short and the text is mostly in points that seek attention as separate thoughts. This will facilitate assimilation and make location of key messages easy.

You will find some repetition within and between these 2 articles. This is partly to emphasize important points and partly to make it unnecessary for you to go back and forth in the articles when you need to remind yourself of what you had earlier read.

Please keep in mind that even single sentences in these articles may be of substantial value to you, depending on your unique needs.

Article Content

Earlier articles in this column provided scientific discussions on issues related to physical exercise and health.^{1,2} This article and the next provide practical guidance on aspects of exercise for readers with

low as well as moderate aspirations. The focus is on exercise for current and future health and longevity and not on exercise for bodybuilding, competitive sports, or goals of a similar nature. The articles address what needs to be done, how, and why. Dos and don'ts are discussed with a view to reaching exercise targets without risking exercise-related injury.

These articles are not a comprehensive guide to exercise. Readers are encouraged to consult other sources for their individual needs and interests for specific as well as wider perspectives.

Target Audience

These articles were written for all those who want to improve physical fitness in themselves and in others; that is, for health care professionals, their patients, and the general public. In short, the target audience is everybody, including those who can do no more than just walk.

These articles will be most useful to those who currently exercise little. However, there could be points of benefit for even those who exercise regularly. These

Each month in his online column, Dr Andrade considers theoretical and practical ideas in clinical psychopharmacology with a view to update the knowledge and skills of medical practitioners who treat patients with psychiatric conditions.



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articles could also be helpful to persons, such as medical professionals, who recommend exercise.

Introductory Notes

The notes and tips provided are not exhaustive. More tips, specific to the nature of the workout that is being done, can be obtained from a multitude of online sites. Please use your judgment in choosing what to implement.

Specific exercise plans are not provided. This is because age, medical health, baseline abilities, baseline limitations, motivation, exercise goals, availability of facilities for exercise, and other variables will determine what is best for the individual; so, there is no exercise plan that is suitable for all.

The above notwithstanding, some generalizations are possible. For example, most persons can walk, move up and down on the balls of their feet, and lift light weights.

Exercise and Physical Activity: General Notes

Exercise usually refers to leisure time physical activity that is performed for pleasure, strength and appearance, and/or health.¹ However, medical research has shown that even small spurts of waking hours physical activity, such as brisk movement within or between buildings (eg, walking to and fro, climbing stairs, moving furniture) have health-related benefits. These benefits include a lower risk of many different kinds of cancer as well as living longer.

It is not necessary for physical activity or exercise to be performed for a minimum duration; even brief durations of everyday activities have been shown to benefit health. That is, whereas exercise is good for health, any physical activity is also good for health and is better than no physical activity. For the sake of convenience, the terms *physical activity* and *exercise* will be used interchangeably in this article and the next.

Here is an important suggestion: If thinking of exercise is unpleasant, think of it as activity, instead. Exercise, to some, conjures images of domineering gym instructors and coaches; it seems like all discipline and work. Activity, instead, conveys a sense of being more voluntary, flexible, and enjoyable.

Why Exercise Is Important

Thousands of studies have identified health benefits associated with exercise. Exercise reduces anxiety and depression and improves the sense of confidence and well-being. Exercise benefits a range of everyday functioning, from sexual activity to sleep. Exercise strengthens muscles and bones and reduces the risk of falls and fractures. Exercise is protective against weight gain, diabetes, high blood pressure, and heart disease. Exercise has even been shown to protect against many different kinds of cancer, to reduce the risk of mental decline with age, and to reduce the risk of stroke. People

who exercise live longer and healthier lives (Box 1). Many other health benefits of exercise have been described.¹

Exercise as Part of Everyday Life

Nothing comes easy in life. We need to work hard to get a good education, to rise in our jobs, and to maintain our health.

Maintenance of health and prevention of disease require discipline and effort in many matters, including observing a healthy diet, getting enough of sleep, exercising regularly, and avoiding harmful habits such as smoking, drinking, and using illicit substances.

Some of these may seem like punishments. Importantly, these may no longer seem to be punishments when the cosmetic, physiological, medical, and other benefits become apparent.

Regular exercise, like eating healthy food and sleeping sufficiently, should become a non-negotiable part of daily life. That is, exercise needs to become a habit, or part of the daily routine, like other daily activities.

Important Effects of Exercise

We need to walk, climb stairs, and have good body stability all our lives. Our heart needs to beat without stopping so that we can continue to live. These needs are well served by exercise. Many of the points below are discussed in greater detail later in this article.

Exercise strengthens muscles; this is logical. When muscles are stronger, they can work harder and for longer; so, everyday activities, from walking to climbing stairs, become easier. When muscles of the lower limbs and trunk are stronger, control of movement improves, balance and stability improve, and the risk of falls reduces.

Exercise that is load-bearing strengthens bones. This includes exercise where the body is the load. When bones are stronger, they are less likely to suffer fracture due to falls or other injuries.

The heart is a muscle; so, exercise that makes the heart beat faster will strengthen the cardiac muscle. A stronger heart will beat more efficiently and for longer.

Exercise lowers blood pressure. This lowers the load on the heart and stresses the heart less.

Exercise improves circulation not just to muscles but also to vital organs such as the heart and brain. The improved circulation, such as to the heart, is not limited to periods of exercise. This is because exercise stimulates the formation of new blood vessels that connect with each other. So, if one blood vessel is blocked for whatever reason, the other blood vessels continue to supply blood to the tissue. This protects tissues such as the heart and brain.

The effect of exercise on muscles and the heart is revisited in later sections of this article.

Exercise: Targets

The World Health Organization³ has recommended exercise targets for children, adults, elderly persons,

Box 1.**Key Message**

Regular exercise improves health in the present. However, it is also an investment for the future. It reduces the risk of disease and disability and improves the chances of enjoyment of functional independence and good quality of life in the last decades of life.

and those with special conditions such as pregnancy, medical illness, and physical disability. Targets for adults are summarized in Box 2. Targets for other individuals can be obtained from the guidelines.³

Everybody Is Different

People vary in terms of age, sex, physical constitution, fitness level, body weight, health-related conditions, access to exercise facilities, motivation, goals, and other matters, and so exercise programs must necessarily be individualized.

This is important to people with special problems, such as conditions that affect the cardiovascular and musculoskeletal systems; examples are valvular heart disease and osteoarthritis of the knees. This also applies to people with structural deviations from the normal, such as bowlegs.

And, this is also true for persons who are taking medications that affect cardiovascular functioning. For example, antidepressant drugs, β -blockers, and many other medications can influence basal heart rate or peak heart rate. Heart rate is a determinant of exercise quality and capacity.

Finally, there are some conditions for which general guidance is not possible. These conditions include long COVID, fatigue associated with multiple sclerosis, myalgic encephalomyelitis/chronic fatigue syndrome, certain mitochondrial disorders, and certain neuromuscular disorders; the list is not exhaustive. Persons with such conditions need to obtain individual guidance for exercise.

Cautionary Notes

Cardiac, orthopedic, and other medical conditions may limit but do not contraindicate exercise. Unless there is pain or discomfort, almost everybody can at least walk; for walking as exercise, no prior medical consultation is necessary.³ After all, it is impossible to conduct everyday activities without walking at least within the house; so, why not either inside or outside, for exercise?

If major medical conditions are present, and if exercise is of a nature that is different from walking or is more strenuous than walking, it is best to consult an appropriate medical specialist, depending on the existing medical condition and the nature of the planned exercise.

Older adults and those with medical conditions would benefit from learning dos and don'ts before starting on an exercise program. Dos could include starting at the lowest intensity of exercise for short durations, increasing

Box 2.**World Health Organization Guidelines for Exercise Targets in Adults¹**

All physical activity, no matter how leisurely or brief, is better than being inactive. Adults should strive to be active; more activity is associated with more health benefit.

Exercise targets for adults are at least 150–300 min of moderate intensity aerobic exercise per week, or at least 75–150 min of vigorous aerobic exercise per week, or equivalent combinations of moderate to vigorous exercise.

Adults should also engage in muscle-strengthening exercise at least twice a week. The intensity of exercise should be at least moderate, and all major muscle groups of the body should be exercised.

Explanatory notes:

1. Aerobic exercise is any exercise that increases the respiratory rate and makes the heart beat faster. Examples are brisk walking, running, and cycling.
2. If personal aerobic exercise capacity is rated as 0–10, a rating of 5–6 is moderate intensity exercise and 7–8 is vigorous exercise.
3. Muscle-strengthening exercise is any exercise that is intended to strengthen specific groups of muscles. Examples are weightlifting and doing squats or planks.
4. Everyday physical activities at home or at work, no matter how brief, can be summated to contribute toward meeting the listed targets.

very gradually and as tolerated to higher intensities and longer durations; periods of exercise could be spread across the day. Don'ts could include avoiding whatever causes pain or discomfort in the affected part of the body, except when prescribed, for example, as physiotherapy.

Requirements for Exercise

Most people are unenthusiastic about exercise; summoning the motivation to exercise is hard. Many people lead busy lives; work scheduling may leave them with little time to exercise. Many people spend hours watching television, playing video games, surfing the internet, or engaging with social media. Poor motivation and poor time scheduling are the most important barriers to exercise. These barriers require to be overcome.

Besides motivation and time, adequate sleep, adequate food and fluid intake, and proper clothing, including footwear, are requirements for exercise. Health status can also influence exercise. All of these are discussed in greater detail in the sections that follow.

Health and Exercise

Limit your exercise or do not exercise if you have suddenly fallen ill, such as with a cold, fever, or other infection. This is because exercising when you have fallen ill can stress a body that is already stressed by inflammatory and other pathology associated with the illness. As a result, recovery from illness may be delayed. For similar reasons, limit exercise that involves movement of a part of the body that is injured.

You can certainly exercise if you have a chronic medical condition, including conditions related to the

joints or heart. Such chronic conditions commonly accompany aging and should not result in physical activity grinding to a halt. The nature, intensity, and duration of activity sessions merely need to be scaled down to whatever the health condition permits.

Creating Time and Opportunity for Exercise

One way of creating an opportunity for exercise is to allot a specific time of day for it. This will allow exercise to become a part of the daily routine.

The time slot for exercise does not have to be a single session during the day. Exercise can be slotted into 2 or even more sessions per day, depending on convenience. Exercise can also be done in bits and pieces across the course of the day if budgeting for time is hard.

Different people have good mental preparedness for exercise at different times of day. For some, it is in the morning; for others, it is in the evening. For still others, it is only on weekends. Find what works best for you. It is desirable that, whatever the time slot, you are physically and mentally fresh at that time and ready for exercise.

Whatever the time slot(s), make sure that you're not cutting down on sleep to make time for exercise; never cheat your body of sleep. It is also best to avoid exercising on a full stomach or after a long period without food.

Motivating Yourself: 1

Lack of motivation is one of the most important barriers to exercise. There are different ways of overcoming this barrier. Think of the health benefits, including benefits related to body image and sexual functioning. Think of the benefits related to mood and self-confidence. Form self or peer comparisons mentally, such as "I am doing something that I could not do before" or "I am doing something that [people whom you know] aren't doing or can't do." Use ego-boosting cognitive strategies, such as saying to yourself, "I am a runner."

If you have the opportunity, do whatever activity you enjoy to meet your exercise targets. Thus, you could swim, cycle, or play outdoor sports. All of these count as exercise.

Do not get into the habit of finding excuses to skip an exercise session. Skipping sessions should be the exception rather than the rule.

If you must skip a session because the reason is valid, try and do at least half a workout, or quarter of a workout, so that you have not broken your habit of regular exercise.

Finding excuses to skip a session can happen if you exercise alone. If you need the impetus, rope in a companion for your exercise session. You can exercise with family, friends, or others who are working out in the gym or park. You can form a group of persons of similar age, interests, and limitations in exercise. You can join a club.

Motivating Yourself: 2

When you work out with companions, don't compare performances. Physical capacity, like intelligence, shows

variations in the population. So, don't feel inferior to somebody who does more than what you can do, and don't make anybody else feel inferior to you.

Start with small targets for exercise so that there is room for improvement across time. Count steps, time the minutes and seconds that it takes you to cover a distance, or measure how far you walk or run in a set period so that you can record improvement and so that such improvement motivates you to continue exercising.

Understand the stepladder pattern of improvement. Improvement does not occur day by day. There are frequent plateaus followed by sudden gains. Such gains are often seen after a day of rest. Aim to sustain gains. Recognize that there will be an eventual plateau beyond which you may not progress, and beyond which it may not be necessary to progress if you are exercising for health.

Overcoming Boredom: 1

Some people chat with friends or listen to music on headphones while walking in the park or on a treadmill; others watch television while exercising. This is good in a way; it helps pass time so that exercising does not feel tedious. This is also reasonable when you perform low intensity workouts in safe zones.

Listening to music or watching television is not a good idea if the distraction puts you at risk of injury, as when you walk on a public road or on uneven ground; or when you do vigorous exercise anywhere, especially in a gym.

At lower intensities, you could pay attention to your surroundings, or make exercise a meditative experience, such as when you walk in a park. However, shut off distractions and learn to "listen to your body" when you exercise vigorously.

Overcoming Boredom: 2

Exercise sessions can become tedious, especially if they are low in intensity and long in duration. Motivating yourself for such sessions can be hard. There are different ways to deal with this. One way is to do different workouts on different days; the difference can lie in the intensity of the workout, the duration of the workout, the route that you take, and what you actually do during the workout.

You can vary the workout by walking, jogging, sprinting, and resting at different times during the session. You can stop and do a few pushups, squats, and planks, or merely bounce up and down on the balls of your feet. The idea is to complete your exercise session.

Finally, you can set different targets or try to beat your personal records to make the workout interesting.

Staying Motivated

A good way to stay motivated is to quantify your workout. You can measure the workout in terms of number of steps walked, distance covered, or time taken. In the initial stages, you can aim to improve on baseline scores. Next, you can aim to improve on

averages from the previous weeks or months. Finally, you can set achievable targets and work toward them.

When you are comfortable with what you have achieved, aim to stabilize your workouts at between 60% and 80% of what your maximum capacity is; aim for the higher rather than the lower number. The benefits of exercise are dose-dependent.

There are 2 reasons for not exceeding 80% capacity. One is that it can be difficult to sustain motivation for a hard workout. The other is that at >80% capacity, the risk of exercise-related injury increases.

Monitor your progress by keeping a record of steps, distance, timings, body weight, waist circumference, and other parameters. This can help you stay motivated when you meet targets, and encourage you to make more effort if you are not meeting targets.

Dealing With Discouragement

Most people who exercise feel discouraged from time to time; there is a feeling that one is not achieving anything, that one is not making progress. Here are ways to deal with discouragement.

Many people exercise to lose weight. They feel discouraged if they do not lose weight despite dieting and exercising, or if the weight loss is less than anticipated, or if the weight loss levels off earlier than hoped. If this happens, it is indeed disappointing. However, losing weight is just one purpose for exercise; the main purpose of exercise is to promote health. By continuing to exercise, health gains will continue to accrue. Never forget this.

Recognize that discouragement is something that almost everybody who exercises experiences. Recognize that such feelings have no basis. Every exercise session helps to keep you fit and keep you in current health. Every exercise session also contributes to your future health (review the health benefits of exercise listed in previous sections).

You can also consider whatever you have done as a personal achievement; as a conquest of self. You can welcome aches and pains as the reward for a good workout.

If you are doing a vigorous workout, don't focus on the end; focus on staying in the zone. It's like climbing a mountain. We do not look at the summit; it is discouragingly distant. Instead, we look at our feet. We take one step at a time and the next step will follow. The summit will eventually reach our feet.

Setting Targets

What should the target of a workout be? Take a look at the WHO recommendations in Box 2 again. Here are other suggestions.

Do whatever you can as vigorously as you can for as long as you can. Or, just do whatever you can whenever you can anywhere you can during the course of the day.

All movement, even if spread out in bits and pieces across the day, qualifies as exercise. Movement within

and between buildings, housework and gardening, and other daily activities also qualify as exercise.

If you can, walk briskly for 40 min a day or longer in one or more sessions. If you cannot, walk at whatever speed you can for whatever duration you can.

Walking for 8,000–10,000 steps a day is a good target. If this is not achievable, whatever you can do contributes to short- and long-term health and is better than doing nothing.

If you have no time to exercise during the week, do harder or longer sessions during the weekend.

Note that wearable devices that measure heart rate, number of steps, and other parameters are not accurate and can vary from device to device as well as on how you move or how much you sweat.

The Importance of Sleep

If you have slept well, your body will be able to handle a vigorous exercise session. If you have not slept well, you will tire faster and achieve less during the workout.

If you have not slept well, you are at risk of injury during the workout. For example, you may be more likely to lose balance when running on a treadmill. Or, you may run with poorer technique, and this could harm your knees.

Good sleep is also necessary for recovery from the previous workout.

Never cheat your body of sleep to find time to exercise.

The Importance of Food

For many people, one reason to exercise is to lose weight. So, restricting food intake is reasonable and even helpful. However, some food is necessary to fuel a good workout. This "some" is not "much." As an example, nothing is necessary to fuel a walk in the park, even if the walk is an hour long. However, for a vigorous workout, a light snack, such as a banana eaten about 30–120 min before the workout, may be sufficient. A little more food may be necessary for long and high intensity workouts, but such workouts are rarely performed for health reasons.

Doing a high intensity workout without having eaten may rarely trigger hypoglycemia.

Exercise on a full stomach is best avoided unless the workout is easy, such as just walking. A full stomach will restrict diaphragmatic respiration during the workout; additionally, the feeling of heaviness will limit the quality of the workout.

In order to lose weight or maintain optimum weight, food intake to fuel a workout must be balanced against food restriction across the rest of the day.

Whereas carbohydrate is the immediate source of fuel for a workout, protein is necessary to build and sustain muscles that are exercised during the workout, especially during muscle-strengthening workouts.

Special nutrients are unnecessary when exercising for health; following recommendations for a healthy

diet will suffice. Special diets and nutrients may only be necessary for those who participate in competitive sporting and athletic events, or those who are bodybuilding.

Caffeine and Energy Drinks

Coffee, tea, and cola and energy beverages can enhance performance in a workout. Using these is not necessarily a good idea because the better performance is due to the caffeine and not to the intrinsic capabilities of the body. It could be simpler to fuel the workout by eating a light, healthy snack an hour or two before the workout.

Drinking too much of caffeinated and energy drinks can have adverse health effects. For one, these drinks usually contain much added sugar. For another, their stimulant effects can rarely trigger cardiac arrhythmias.

Proper Clothing

Clothing hardly matters when exercise is light. For example, you can wear whatever you are comfortable with if you merely walk. However, clothing is important when exercise is vigorous.

Cotton clothing absorbs sweat and becomes heavy and uncomfortable; so, synthetic clothing is better when exercise is vigorous. Women should select sports bras that fit comfortably.

When exercise involves impact, as with running, each time the body hits the ground (that is, with every stride) the weight of the body is taken by the feet, ankles, and knees. The knees are particularly vulnerable to injury. So, shoes with good shock-absorbent soles are necessary for protection.

Exercise and Muscles

Exercise strengthens muscles. Lifting dumbbells strengthens mainly muscles of the upper limbs and shoulders. Climbing stairs strengthens mainly gluteal muscles and muscles of the thigh. Doing biceps curls strengthens mainly the biceps, but also the muscles of the wrist.

Different muscles of the body serve you for different functions in everyday life. You therefore need to do specific exercises that strengthen all muscle groups of the body: neck, shoulders, front and back of the arm, forearm, wrist, pectorals, abdominal muscles, muscles of the back, gluteal muscles, front and back of the thigh, and back and side of the legs.

Some exercises, such as planks and pushups, strengthen many different groups of muscles at the same time. You need to be aware of what exercise strengthens which muscles so that no muscle group is neglected. This is not rocket science; a little bit of attention will make you notice what muscles tense, and to what extent, with different muscle strengthening exercises.

When muscles are thus strengthened, many purposes are served. Everyday activities that use these muscles become easier to perform. Muscle

sprains associated with infrequent activity, such as moving heavy furniture, are less likely.

Importantly, when muscles are strengthened, aerobic (cardiorespiratory) exercise becomes easier to perform. Cardiorespiratory exercise that strengthens the heart is more important than muscle strengthening exercise that strengthens other muscles of the body.

Exercise and the Heart: 1

The heart is a muscle. Life ends when the heart stops beating; so, the heart muscle must be kept fit and strong for it to function well and for long. In fact, the heart muscle must be prepared for unexpected exertion of any duration due to any cause. This means that, more important than exercising the muscles of the body, we must exercise the muscles of the heart.

People worry when the heart beats faster during exercise. They worry that the heart is under strain and that there may be adverse consequences. This worry is unfounded. A key goal of exercise is to exercise the heart; that is, to make the heart rate and blood pressure increase during exercise. This increase means that the heart is working harder. In other words, we know that the heart is getting a good workout when the heart rate rises.

In persons who do regular exercise, and especially those who do longer sessions of more vigorous exercise, the heart rate and blood pressure drop between exercise sessions. This is because exercise improves circulation, lowers blood pressure, and strengthens heart muscle. As a result, the heart can pump blood to the tissues with less effort. This promotes cardiovascular health.

Exercise and the Heart: 2

This section will help you understand when increased heart rate and blood pressure is good and when it is not.

When muscles are briefly exercised during workouts, muscles are strengthened. If muscles are exercised for prolonged periods without opportunity to rest, muscles can suffer injury.

Likewise, when the heart rate and blood pressure increase during exercise, the brief workout that the heart receives during the session contributes to cardiac fitness. However, if the heart rate is increased for long periods, such as because of the effects of drugs or disease, and if the heart has to work harder for long periods, such as because of high blood pressure, then the heart is stressed and will eventually suffer disease or fail.

Exercise, Breathing, and Sweating

The respiratory rate increases with exercise; we gasp for breath when exercise is vigorous. Increased respiratory rate is not an important target for exercise; it is merely a useful proxy for increased effort.

Likewise, increased sweating is a proxy for effort. It is a poor proxy because sweating depends

on ventilation, wind, clothing, season of year, air-conditioning (if indoors), and other factors.

Risks Associated With Exercise

Everything in life is associated with risk, from using a necessary medicine to crossing the road. Exercise is also associated with risk.

It is key to understand that when exercising at up to moderate intensities for health purposes, the risks are negligible. Risks emerge when exercise is intense or prolonged. Few people exercise at these levels.

You are at risk of muscle, joint, and other orthopedic injuries if

- your starting point is too ambitious
- you raise your targets too soon
- you exercise vigorously without having sufficiently warmed up
- your exercise session is intense
- your exercise session is long
- you push through pain
- you ignore, during exercise, warning twinges and pain in muscles and joints
- you perform high impact exercises such as hopping and skipping
- you use equipment as in lifting heavy weights or running on the treadmill
- you are careless while exercising
- your exercise technique is poor

Nature of Exercise-Related Risks

Exercise-related risks are mostly orthopedic; that is, they affect muscles, tendons, ligaments, joint cartilage, intervertebral disks, and bones. The knees and back are most vulnerable to exercise-related injury. Injury is more likely if the workout is harder, faster, longer, or associated with greater impact on joints. Injury is also possible if the body is contorted and held in difficult positions, as in yoga.

Musculoskeletal injuries are of concern. A strained muscle can take weeks to heal. A ligament injury can also take weeks, or longer, to heal, and that ligament may forever be vulnerable to recurrent injury. Full recovery may never occur from injuries to joints or intervertebral disks.

Respiratory and other infections are slightly more common in elite athletes, perhaps because of decreased immunity associated with high physiological stress.

Rarely, among those engaged in long and grueling exercise sessions over many years, cardiac risks arise; these include risks related to myocardial scarring, atrial fibrillation, ventricular fibrillation, and sudden cardiac death.

Sudden Cardiac Death

This is a slightly technical section for readers with concerns about risk. Sudden cardiac death with exercise is a very rare event. It may occur in young persons who have

uncommon, preexisting, unrecognized heart conditions (eg, hypertrophic cardiomyopathy, long QT syndrome, or congenital heart anomalies) and who perform intense exercise. It can occur in anybody who suffers a violent chest injury during sports (*commotio cordis*).⁴ Among older subjects, it can occur due to dislodging of atherosclerotic plaque from coronary arteries due to turbulent blood flow during vigorous exercise.

However, data from prospective studies show that the risk of sudden cardiac death is actually reduced and by as much as up to 50% in those who exercise.⁵ Also, to provide a sense of perspective, the risk of sudden death during sporting activity is very rare and ranges from 4.6 to 21.7 deaths per million per year; that is, roughly 1 in 46,000 to 1 in 217,000 per year.^{6,7}

In summary, exercise protects against sudden cardiac death but, very rarely, may be associated with sudden cardiac death. Advice for those who exercise for health is that limiting the intensity and duration of exercise sessions is desirable if cardiovascular risk factors (eg, older age, high blood pressure, diabetes mellitus, and known heart disease) are present.

Obtaining Guidance Before Starting Exercise

No special guidance, beyond the application of commonsense, is necessary for those who exercise for health and at low to moderate levels. Walking is an excellent example of such activity.

Obtaining individualized advice regarding correct technique and regarding dos and don'ts is helpful when using gym equipment, lifting weights, or performing vigorous exercise.

Obtaining individualized advice is desirable if a medical condition is present, especially if the condition is orthopedic or cardiac in nature. The guidance should consider what exercise is appropriate, what degree of exercise is appropriate, and what exercise program is best.

Guarding Against Musculoskeletal Risks

At the risk of sounding repetitive, the best way to guard against exercise-related musculoskeletal and other risks is to start at a low intensity of exercise; to escalate the intensity very gradually, across weeks; and to never overdo exercise; that is, to avoid exceeding 80% capacity and to never exceed 90% capacity (unless you are training for competition, usually under the supervision of a qualified coach).

Note that, if you do not intend to become a professional sportsperson, by the law of diminishing returns, it is unlikely that there will be additional benefit from workouts that push beyond 80% capacity; and there is risk of injury if you push too hard.

Warning signs of pushing too hard are a feeling that the lungs are bursting, that the heart is thumping madly in the chest, and that there is pain anywhere in the body.

When exercising, you may hear gym instructors or others say, “No pain, no gain.” This is not true. For one, when exercising for health, pain is completely unnecessary for benefit. For another, pain is usually a danger signal that is unwise to ignore.

Distinguishing between pain and fatigue can be hard if you are inexperienced with exercise, especially because there can be some overlap between the two. Pain is sharper, may be sudden, and may be felt as twinges localized to a small area. Fatigue is more gradual in onset, is generalized, and is experienced as tiredness in the muscles, or as a sensation that you cannot do any more exercise.

You can push through fatigue but do not push through strain or pain. The key idea here is, “No pain, no injury.” Pain in a joint should especially never be ignored. When in doubt, stop.

If you are fatigued, stopping for a minute and then resuming is better than stopping and giving up. If you are out of breath, just slow down. This will allow you to complete your planned workout without quitting.

Wherever possible, complete the planned workout; don't quit. If you do, quitting can become a habit.

Try to not even entertain the thought of quitting. The thought is the father of the deed.

When exercising vigorously, try to learn the difference between fatigue in the mind and true fatigue. The body can go on longer after the mind wants to stop.

If you exercise vigorously, learn to listen to your body as you exercise. This way, you recognize true pain early, and you get to know when muscles or joints are at risk of being strained to the point of injury.

When you listen to your body, it is easier to detect when muscles not directly involved in the exercise are at risk. For example, you can sprain your neck while lifting weights or even when sprinting; this is because the head is held rigid during such exercise. This is why all muscles of the body must be exercised/strengthened even if your main form of exercise focuses on only one group of muscles.

Exercise small muscle groups more lightly. For example, use lighter weights when exercising the wrist and do not squeeze rubber balls too hard or too many times when exercising the muscles of the hand.

Rotate exercises; that is, unless you are just walking, do different workouts on different days. This will not only ensure uniform strengthening of all groups of body muscles but will also reduce the risk of increased wear and tear limited to one set of joints.

The Knees Are at Risk

The knees are vulnerable to exercise-related injury. This is especially true in older persons in whom age-related degenerative knee joint disease inevitably occurs even in the absence of exercise. Knee joint disease does not contraindicate exercise. In fact, specific forms of exercise can strengthen the muscles around the knees and reduce arthritic pain.

Most forms of exercise, even walking, involve movement and load-bearing at the knees. With some forms of exercise, the knee experiences repetitive impact, taking the weight of the body, as with every stride when running. This may risk internal damage to the knees.

The knees can even be strained when there is no impact, such as when cycling or working out on an elliptical trainer; this is because there is rapid, repetitive movement at the knee joints, and because pressure is applied on the knees, especially when cycling uphill or exercising against resistance on an elliptical.

Ligaments of the knees come under strain and may be injured during sharp rotatory movements, as when playing soccer.

Persons at increased risk of knee joint injury during exercise are those who are older, those who are heavier, those with existing knee disease, those with bad exercise technique, and those who perform high-impact exercises such as hopping, skipping, and running, especially on hard surfaces.

Persons who have improperly aligned knees (eg, bowlegs, knock knees) or other anatomic deviations are at increased risk of exercise-related knee injury because of uneven distribution of load; so, for example, cartilage will wear out faster in one part of the knee joint than in other parts. This applies to other joints, too, and, in fact, to exercise related to any site of anatomic deviation in the body.

Protecting the Knees

If your knees are at risk, avoid risk factors such as performing high impact exercises. If you hop, skip, jog, or run, make sure that your shoes have soles that absorb impact well. Run on surfaces that are soft (eg, favor mud or grass over asphalt or concrete) provided that these surfaces are not uneven and do not increase your risk of losing balance and falling.

Learn to climb stairs (both up and down), jog, run, hop, skip, and even just walk with the knee slightly flexed. Do not straighten the knees fully. When the knees are fully straightened, the load is taken by the surface of the bones; this, in time, will wear away the cartilage. When the knees are kept flexed, the load is taken by the muscles of the thigh rather than by the knee.

Keeping the knees slightly flexed can be especially relevant when pedaling on an elliptical. The classical position is to stand upright, knees and back straight, and to pedal with the lower limbs while pulling at the hand levers with the upper limbs. Better would be to ignore the hand levers, to lean forward and rest the forearms on the display panel, and pedal with the knees always bent. The classical position loads the knees; leaning forward loads the muscles of the thigh. Furthermore, in the classical position the spine may sag. It is almost impossible for the spine to sag when leaning forward and pedaling.

Use the gears when cycling, especially when cycling uphill. This will strain the knees less.

Parting Notes

Think of exercise as an activity that is easy to do, not as something to dread. When exercising for health, it suffices to just walk at any pace for any duration; however, brisker walking and for longer periods is associated with better health outcomes.

More vigorous exercise and for longer periods is associated with greater health benefit. Exercising at 60%–80% of maximum capacity is the sweet spot.

When exercising for health, there is no need for the exercise to be intense. This minimizes the risk of exercise-related injury.

When exercising for health, and when following the precautions described in this article, the risk of exercise-related injury is low to negligibly small.

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