11 Healthy Lifestyle Behaviors: Physical Activity to Fuel your Mind and Body

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The Basics of Physical Activity in Adults

Defining Physical Activity

Thinking about the multitude of information sources about physical activity can be overwhelming, and each one of us has our own knowledge and experience of what the continuum of physical activity actually encompasses. One may think of activity as anything beyond being sedentary, or as participating in

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sports and exercise, or as improving personal fitness. Before discussing current issues in maintaining physical activity during physician training, it is helpful to define what is meant by physical activity in this chapter, including measures, types, and intensities.

It is commonly believed that individuals just need to "move" their bodies. The World Health Organization maintains the definition of physical activity as "any bodily movement produced by skeletal muscles that results in energy expenditure," thus allowing for a wide range of activities [1]. There are various methods of measuring physical activity beyond subjective accounts, which is fortunate as one often overestimates the amount of physical activity that one does. A study found that participants who wore accelerometers reported an average of 49 minutes of physical activity per day, whereas their accelerometers captured an average of 23 minutes daily [2]. Individuals may use pedometers, accelerometers, heart rate monitors, or other technology to track activity, but researchers often prefer the use of direct observation as these devices are not always accurate.

Physical activity is generally divided into:

(i) Baseline activity (or our activities of daily life)
(ii) Health-enhancing activity (or activities one can add to specifically improve health outcomes)

Important factors in optimizing health-enhancing activity include specific *types* of physical activity and their *intensity*. Types of activities that are familiar from our medical school days include cardiovascular, strengthening, and balance or flexibility training. The authors will review their relevance later in this section. Intensity is defined as the rate at which an activity is being performed and it is classified as light, moderate, or vigorous [3]. One can estimate intensity by using the metabolic equivalent of tasks (METs) which is the energy expenditure of a physical activity as a multiple of our own resting metabolic rate (RMR) [4].

Did You Know?

One metabolic equivalent of task (MET) is equivalent to our resting metabolic rate (RMR), which is about 3.5 milliliters of oxygen per kilogram body weight per minute, and it represents the amount of oxygen used while being sedentary. As an example, reading this chapter is one MET, and this is considered to be of light intensity. Moderate and vigorous physical activity is between 3–6 METs and 7–10 METs, respectively, so one would need to expend at least 3 or 7 times as much energy as when sedentary [4].

There are a number of resources that identify METs for different physical activities. Table 11.1 documents the METs and intensities of common activities as well as simple physical signs and symptoms that indicate when we have entered each range [5]. Please be reminded that these are averages and do not take into account all individual factors.

The Current Physical Activity Guidelines

The majority of us likely received at least one lecture in medical school about health promotion that touched upon physical activity and the importance of incorporating this topic into patient care. Even if the topic was raised multiple times, it does not necessarily mean the information was absorbed, as it is often a "taken-for-granted" topic that seems too obvious to review. One likely recognizes that physical activity can be a preventative or even curative intervention, and may have intentions to address it with patients, although these discussions are often put aside.

Physical activity is not only relevant to patient care as it affects us all and yet many of us probably only have a general understanding of what is actually recommended. One study of Canadian

Table 11.1 Metabolic equivalent of tasks (METs) and intensities of popular activities [5]

METs	1–2 METs	3–6 METs	7–10 METs	11+ METs
Intensity of activity	Light	Moderate	Vigorous	Maximum
Activity examples	Walking	Brisk walking	Jogging	Activity within this range is not necessary to obtain common health outcomes; e.g., jumping rope, sprinting, mountain biking
	Yoga	Golfing	Cycling	
	Stretching	Dancing	Hockey	
	Gardening	Swimming	Basketball	
	Sitting	Weight training	Circuit training	
	Standing	Home activities	Hiking	
Temperature	No increase	Increased Lightly sweating	Hot Sweating	Very hot Heavily sweating
Respiration rate and functional impact	No increase Can sing	Increased Can talk	Difficulty talking to others	Too out of breath to talk

medical students found that while 70% of students were aware of the national guidelines, only 52% knew what the guidelines were [6]. Therefore, it is pertinent to review the latest Canadian Physical Activity Guidelines (CPAG), which were last reviewed by the Canadian Society for Exercise Physiology (CSEP) in 2011 [7]. Australia, the United States, and the United Kingdom have similar physical activity guidelines to Canada [8–10]. For example, the Physical Activity Guidelines for Americans (PAGA) stipulate that adults in the United States should do at least 150 minutes (2 hours and 30 minutes) to 300 minutes (5 hours) per week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) to 150 minutes (2 hours and 30 minutes) per week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity [9]. The CPAG and PAGA have guidelines for children/adolescents as well as for older adults, but the guidelines listed in Table 11.2 apply to adults between the ages of 18 and 64. They address three factors that can result in health benefits for this population [7, 9].

Table 11.2 Physical activity guidelines for adults [7, 9]

Duration	Approximately 150 minutes per week (in at least 10 minute increments)
Activity type	Aerobic physical activity
Activity intensity	Moderate to vigorous intensity

However the guidelines assume that individuals are in good general health, and they caution that these may not be appropriate if people are pregnant, have a disability, or a medical condition. It has become clear that many individuals do not meet these guidelines regularly, for example, only 17% of Canadian adults met these guidelines from 2015 to 2016 [2]. However, if individuals are not meeting the guidelines, not only are they unable to reap the full benefits that come with adequate physical activity, but they may also be at risk of particular harms.

How Physical Activity Guidelines Correlate to Known Physical Health Outcomes

In 360 B.C., Plato stated, "Lack of activity destroys the good condition of every human being, while movement and methodical physical exercise save it and preserve it" [11]. Positive outcomes associated with physical activity often refer to physical health because most of the existing research has focused on this relationship and so there is significant evidence. The existing CPAG and PAGA guidelines set out to answer three main questions, including:

(i) What is the relationship between physical activity and major physical health indicators?
(ii) If a relationship is found, does it increase in a dose-dependent manner?
(iii) To what degree are these guidelines evidence-based? [12].

The CSEP working group completed a systematic review of 254 journal articles up to the year 2008 that were relevant to 18–64 year-old adults and found that the literature supports the Canadian guidelines [12]. Please refer to Table 11.3 for a review of physical health benefits of physical activity. There is evidence of an inverse relationship between physical activity and all-cause mortality, cardiovascular disease, stroke, hypertension, colon cancer, breast cancer, type 2 diabetes mellitus, osteoporosis, and obesity. Specifically, there is Level 2, Grade A evidence to support between 150 and 180 minutes of moderate-intensity activity per week or 90 minutes of vigorous-intensity activity per week, with the most evidence supporting aerobic activity, to be completed throughout the week, for at least 10 minutes at a time [13].

In terms of other types of physical activity, the guidelines provide further recommendations. There is Level 2, Grade A evidence to support doing resistance training to strengthen bones and muscles at least 2–4 days a week. Having good musculoskeletal fitness can reduce premature mortality and risk of falls as well as improve blood pressure, bone mineral density, mobility, functional independence, and general quality of life [13]. Finally, there is Level 3, Grade A evidence to support doing flexibility

Table 11.3 Physical health outcomes of physical activity

Physical health outcomes with moderate-vigorous activity		Average reduced risk
Mortality	Premature all-cause mortality	30%
Neurological	Cerebrovascular accidents	25–30%
Cardiac	Hypertension	32%
	Cardiovascular disease	33%
Endocrine	Overweight and obese	N/A
	Type 2 diabetes mellitus	42%
Oncological	Breast cancer	20–30%
	Colon cancer	30%
Musculoskeletal	Increased bone mineral density and decreased bone loss	N/A

Data derived from [12]

training at least 4–7 days a week as it can reduce risk of falls as well as improve mobility and functional independence [13]. Of note, although these recommendations apply to adults ages 18–64, the study did not find evidence to support balance training in addition to the above [13].

Skill-Building Exercise: Physical Activity Self-Assessment

In order to assess your current level of physical activity and whether it meets the CPAG or PAGA guidelines, consider the following questions regarding types and intensities of activities, which are adapted from the International Physical Activity Questionnaire [14].

Types of physical activity	**Duration**
In a usual week, how many days do you do aerobic activity?	days
On those days, how long do you spend doing this?	minutes/day
In a usual week, how many days do you strength-train?	days
On those days, how long do you spend doing this?	minutes/day
In a usual week, how many days do you stretch?	days
On those days, how long do you spend doing this?	minutes/day
Intensities of physical activity	**Duration**
In a usual week, how many days do you do light-intensity physical activity?	days
On those days, how long do you spend doing this?	minutes/day
In a usual week, how many days do you do moderate-intensity physical activity?	days
On those days, how long do you spend doing this?	minutes/day
In a usual week, how many days do you do vigorous-intensity physical activity?	days
On those days, how long do you spend doing this?	minutes/day

Key Points

- Physical activity is "any bodily movement produced by skeletal muscles that results in energy expenditure."
- Health-enhancing physical activity should be added to achieve positive health outcomes.
- The North American physical activity guidelines are evidence-based recommendations to optimize particular physical health outcomes.
- At minimum, one can benefit from 150 minutes of physical activity per week, preferably aerobic at moderate to vigorous intensity.

Physical Activity During Physician Training and Beyond

Resident Physicians Falling Short of Guidelines

Now that the basics of physical activity are known, along with the fact that most adults are not meeting the physical activity guidelines, we will shift our focus more specifically to resident physicians. Despite the health literacy physicians are privileged to have from undergraduate studies and medical training, resident physicians are a population that struggle to engage in adequate physical activity. As physicians, the importance of physical activity as a means to promote health and wellness is well known, but there are barriers that make it difficult for residents to attend to this area of self-care.

Several studies have reported a concerning trend regarding physical activity in medicine. One study found that 84% of medical students and 84.8% of attending physicians met US physical activity guidelines with students reporting an average of 2.5–4 hours of exercise per week. In contrast, 73% of residents and 67.9% of fellows met the guidelines, although, overall, both

medical students and physicians participated in more physical activity than the general US population as only 43.5% of US adults were meeting the guidelines [15, 16]. Regardless, this prompts the question: what about postgraduate training makes it harder for resident physicians to achieve recommended levels of physical activity?

Another study focused on family medicine residents and attending physicians and found similar findings, albeit to a more extreme degree depending on inpatient or outpatient clinical rotations. While on inpatient rotations, none of the residents met US physical activity guidelines compared to 18.4% of attending physicians. While on outpatient or community rotations, only 6.9% of residents met the guidelines compared to 25% of attending physicians. These percentages are lower than those of the previously discussed study, and while the authors did not address the discrepancy explicitly, they caution against generalizability given their focus on one specialty at one location, a smaller sample size, and selection bias. In most cases, resident physicians wanted to be physically active and not being so contributed to further stress [17].

Physical Activity as a Wellness Marker in Physicians

While there is an emphasis on promoting wellness during postgraduate medical education, the reality is that resident physicians continue to encounter challenges in this regard. The Canadian Medical Association (CMA) released the results of their 2018 National Physician Health Survey in which 60% of physicians indicated that they have "flourishing" mental health. Eighty-two percent of resident physicians reported having "high" resiliency; however, as a group they were more likely to report symptoms of burnout and depression as well as suicidal ideation. There is also a major transition from training to independent practice and newer attending physicians as a group were also more likely to report lower resiliency and higher burnout [18].

One of the indicators of physician health and wellness on this 2018 CMA survey is physical activity and while physicians completed questions on this topic, the results were not released with

the report. As much of the data thus far is American or specific to Canadian medical students, one wonders if Canadian resident physicians are also struggling to meet physical activity guidelines as seen with their counterparts. Resident Doctors of Canada (RDoC), a not-for-profit organization that represents Canadian residents on issues such as patient care, resident wellness, and medical education, has also released the results of their latest 2018 National Resident Survey. They found that 47% of residents believe their work schedule does not leave adequate time for personal life. Moreover, a large number of residents considered themselves to have negative work-life integration and the limiting factor was their work roles and hours [19].

Case Vignette: "All Work and No Play"

Jake is a first-year internal medicine resident who was previously involved in fitness, personal training, and varsity sports during his undergraduate degree. While he did not have time for the latter two activities in medical school, he continued to participate in intramural sports. Through hockey he met a peer who he considered a role model, eventually joining him at the gym each morning to exercise. Jake adopted a routine of going to bed by 9:30 PM and waking up at 5:30 AM, and while it was difficult to establish at first, he could not imagine a better start to his day. He was getting enough activity without compromising his sleep, which he needed for long days of either work or study. He was feeling more alert, energized, and efficient during the day, no matter how stressful life seemed. Most of all, he was happy and this translated into how well he interacted with the healthcare team, his patients, and his peers.

Jake was ecstatic to be accepted in the internal medicine residency program. He felt his cohort was very similar to him – they worked hard and were motivated and involved. He was doing a range of inpatient and outpatient rotations around the city as well as 1 in 4 in-house on-call shifts. He took on teaching and leadership roles in his program that, while extra work, were rewarding. At some point, Jake realized that he was skipping his workouts more often on weekdays. He had always thought that he was fairly active during the workday but when reviewing his step counts

realized that in fact, he was actually not. In reality, he spent a lot of time sitting with patients, charting, teaching, and in meetings. He tried to make up for it by doing longer workouts on the weekend but this gradually became more difficult as well. He always felt tired and as though he had too much work to do and could not spare a moment for himself.

Case Analysis

In Jake's case, he was used to daily physical activity and he had the freedom to maintain a high level of activity during medical school. Not only was this important to him, it also helped to make him a better provider and colleague. What happened during residency is that physical activity became less important than other responsibilities and his wellness routine fell to the wayside. Surely most of us can relate to being successful in implementing healthy behaviors at earlier levels of training, whether it was getting enough sleep, eating healthily, or being active. Yet, as soon as work responsibilities intensified, whether through clerkship or into residency, many of us scramble to maintain our habits or reluctantly sacrifice them. In Jake's case, he was at a crossroads where he had insight into his lack of physical activity and reasons for it (i.e., lack of time), but he was unsure of how to rectify it. If you were in his shoes, would you be likely to remake physical activity a priority in your schedule, or would you continue like Jake and hope you had more time in the future? Of course, it is not always a simple answer.

Recognizing Unique Barriers to Physical Activity in Medicine

In a 2018 survey, the CMA asked about barriers that prevent physicians and residents from being more active, specifically inquiring as to whether time is a significant barrier [18]. Relatedly, a US study found that resident physicians worked an average of 60–69 hours per week and that there was an inverse relationship between the number of work hours per week and whether residents met physical activity guidelines; 85% of resident physicians

who worked less than 40 hours per week met the guidelines as compared to only 70% of those who worked more than 80 hours a week [15].

It is well known that resident physicians do not have much control over their schedules, and, in addition to clinical work, there are other mandatory activities such as research and teaching. Attending physicians also work variable hours, though they have greater control over the total number of hours worked per week, a privilege that is not always afforded to residents. Other barriers to physical activity that resident physicians identify are level of fatigue, lack of access to facilities, programs, or equipment, fear of injury, and disability, current injury, or illness. Lastly, it is interesting to note that it was more common for resident physicians to consider barriers to physical activity as insurmountable as opposed to their more optimistic attending physicians [17].

Skill-Building Exercise: Identifying Common Barriers and Solutions

If you are not meeting physical activity guidelines, it may be important for you to identify in the following table what barriers are unique to your life and how you can overcome them at individual and systemic levels.

Barriers	Individual solutions	Systemic solutions
No time		
No energy		
No motivation		
No support		
Inconvenient		
Too expensive		
Fear of injury		
Current injury, disability, or medical illness		
Other		

Key Points

- Resident physicians are less likely than medical students and attending physicians to meet physical activity guidelines.
- Residents are more likely to feel they have negative work-life integration and not enough time for self-care.
- Resident physicians have unique barriers to achieving adequate physical activity, especially their lack of control over work hours.

The Risks of Moving Less

Being Sedentary at Baseline

As mentioned previously in this chapter, there can be harm in reducing physical activity in those who were once more active, as well as harm in continuing to be sedentary. Depending on the type of medicine one practices, one can spend a large proportion of time being sedentary, sitting to review charts and investigations, interviewing patients, or documenting. When resident physicians return home, there is a tendency to want to spend more time in physical relaxation, even in those with less active days, to eat, to study, to socialize, to watch media, and to sleep.

Did You Know?

Research has found that sedentary behavior constitutes 55–65% of the general adult population's waking hours [20], and thinking back to our definition of METs, being sedentary is any activity below 1.5 METs such as sitting, reclining, or lying down [21].

Table 11.4 Known health risks of sedentary behavior by system [22]

Health risks of sedentary behavior	
Mortality	All-cause mortality
	Premature mortality
	Cardiovascular disease mortality
Psychological	Depression
Neurological	Stroke
Cardiac	Hypertension
	Cardiovascular disease
Endocrine	Obesity
	Type 2 diabetes mellitus
Oncological	Colon cancer
Musculoskeletal	Osteoporosis

Time spent being sedentary, as opposed to just low physical activity, has been shown to increase our risk of poor physical health outcomes and particularly chronic disease such as diabetes mellitus. Table 11.4 summarizes some of the major risks according to bodily system. A 2019 review found a strong dose-response association between being sedentary and all-cause mortality, cardiovascular disease mortality, and incident cardiovascular disease [22].

In addition to physical health outcomes, there is evidence to suggest that sedentary behavior can impact mental health. One study looked at the relationship between subjectively reported sedentary time, objectively measured sedentary time using accelerometers, and psychological distress among UK participants of the 2008 Health Survey. They found that those in the top 33% of both subjective and objective reports of sedentary time were at highest risk of reporting psychological distress. Specifically, subjective moderate-to vigorous-intensity physical activity and objective light-intensity physical activity were correlated with lower risk of distress. They concluded that sedentary time may put adults at risk of poor mental health [23], which is similar to other studies that have linked it to symptoms of anxiety, depression, and somatization [24].

Being in Exercise Withdrawal

Beyond sedentary behavior, there has been interest in what happens when one decreases physical activity from usual standards in what researchers have termed "exercise withdrawal." Individuals who normally engage in physical activity regardless of intensity appear to be at risk of poor mental health if they are not able to maintain their previous levels of activity for whatever reason. In one study, young adults who were initially physically active were randomly assigned to a "no exercise" group, a "reduced moderate to vigorous physical activity" group, or to "normal activity" for 1 week. Their physical activity, anxiety, and depression scores were measured at baseline, after the intervention for intervention groups, and then 1 week following return to normal activity. Participants' depressive symptoms significantly increased if doing no exercise or reduced exercise, but once being able to resume their normal activity, symptoms dissipated and their mental status returned to baseline. Interestingly, participants did not have a significant change in anxiety in either intervention group [25]. Considering that these psychological changes happened over an acute withdrawal period of 1 week, one wonders what the long-term effects would be for previously active resident physicians.

Case Vignette (Continued): "All Work and No Play"

Jake initially felt that giving up physical activity was not that significant. However, now in his second year as a senior internal medicine resident, he was starting to regret it. Jake had gained 10 pounds and while it did not look like much on his body, he was winded with even taking the stairs. He struggled to wake up, he was drinking more coffee, and he felt drained by the afternoon. Jake napped when he came home, and by the time he awoke, he had to stay up late to complete work. He felt he had over-committed himself as every role seemed arduous to him. Jake thought his performance was mediocre when compared to his peers who "did it all." Overall, he felt in a bad mood every

day, had little patience, and was easily irritated. An inpatient even complained to him one day, saying that Jake had no bedside manner.

Halfway through his second year, Jake received his worst evaluation. The staff felt that Jake had the skills and knowledge to succeed, but noted he was not performing like he used to. Most concerning was the fact that several colleagues and patients had complained about him. It is not that Jake made any medical errors, but he was unpleasant to work with. Concerned about this change, his staff suggested he speak to the counsellors at the postgraduate medicine office. Jake felt that this was unnecessary, but he went anyways, not wanting to appear difficult. He vented his frustrations with work, his schedule, and his apparent lack of control. The counsellor pointed out the challenges in caring for others when we are not caring for ourselves. Jake had heard this all before, but given the recent situation, this resonated with him more substantially.

Thinking back to when he felt his best, it was when he was sleeping, eating well, being active, and being social. Not only was activity good for him physically, but cognitively and psychologically as well. Moreover, he was considered easygoing and good-humored back when he was more active and healthier. Taking all of these reasons into account, he was determined to get back into physical activity and more healthy daily routines. Over several sessions, he worked with the counsellor to set goals and create an action plan. Rather than jumping into the deep end right away, and potentially being frustrated with the results, he decided to ease back into it. By the end of his second year, he felt satisfied with the progress he was making, he was better able to balance self-care with other work and personal responsibilities, and above all, he felt like himself again.

Case Analysis (Continued)

In Jake's case, despite his insight into the fact that he was becoming less physically active, he continued on without making changes in hopes that his schedule would lighten up eventually. Physicians are vulnerable to falling into similar patterns of thinking at times, but often our schedules never just "lighten up" with-

out us reconsidering what is valued most in life and making it a priority in our schedules. In this case it took an objectively "bad" outcome (i.e., a concerning evaluation) not only to draw Jake's attention to the issue and how he felt, but also for others to notice him struggling and to offer support. Not only is it easy to let good habits slide when faced with more pressing tasks, but there can be risks that accompany giving up healthy behaviors such as physical activity. For Jake, he was not at his best physical, emotional, or mental health without an active lifestyle and so it was easy for him to find motivation to get back into routine. Similarly, if we feel we are struggling to be physically active, it is also important for us to think about why physical activity is valuable to us before we can consider making positive and sustainable change.

Key Points

- Being sedentary increases the risk of a variety of physical and mental health conditions, the latter including anxiety and depressive symptoms.
- Being in withdrawal from one's usual physical activity also increases mental health risk, particularly for the development of depressive symptoms.

The Benefits of Moving More

Physical Activity as Preventative Medicine

The main physical health benefits of activity are reflected in the North American physical activity guidelines as discussed previously. However, mental health benefits were excluded due to "weak" evidence at the time. Fortunately, there is now more evidence to support that adequate activity can positively affect cognitive and psychological outcomes for the general population as well as for resident physicians, as detailed below. Additionally, there is evidence to support that physically active physicians can

be role models for their patients, to the point where patients are more receptive to counselling and more likely to be successful in becoming more active, as discussed later in this chapter.

Becoming Physiologically More Resilient

A normal physiological stress response is important to survival in the face of acute stressors, and as resident physicians, one can probably think of many day-to-day stressors in work roles. One knows that when we identify a threat, our body goes into a fight or flight response. Our pituitary gland secretes adrenocorticotropic hormone which stimulates the release of cortisol and adrenaline, with the former resulting in various physical effects such as increased heart rate, blood pressure, tunnel vision, and tensed muscles. Normally, one would exert some sort of effort (e.g., fight or flight) that is short-lasting, resulting in a dampening of our physiological stress response and our stress hormones returning to baseline levels. Unfortunately, one often activates the first part of the response which increases cortisol, and as we are exposed to chronic stress, our body does not have the opportunity to return to baseline. This puts us at risk of stress-related disorders including mental illness such as depression [26].

Studies have shown that physical activity can enhance resilience to the stress response by decreasing our hypothalamus-pituitary-adrenal axis response to acute stressors, in part by mediating stress hormones and thereby countering the harmful effects of chronic stress. One study found that trained athletes had lower cortisol levels as well as a dampened physiological (e.g., heart rate) and psychological response to psychosocial stress (e.g., public speaking) versus untrained participants [27]. There is still hope for those who are not elite athletes – as another study showed that if sedentary people participated in a structured treadmill exercise program for 6–12 weeks, then their stress response became significantly lower than prior to training [28]. Physical activity does not prevent us from experiencing a normal stress response in the first place, but rather, the response is far less in magnitude and recovery to baseline occurs more quickly with less adverse effects.

Effect on Mental Health, Especially Mood

Considering the risk of psychological distress among resident physicians, it is important to consider what modifiable factors to target to support good mental health. In 2018, a study was published in *Lancet Psychiatry* that looked at the association between physical activity and mental health in a US sample of 1.2 million individuals from 2011 to 2015. Using data from the Behavioral Risk Factors Surveillance System Survey, they compared the days of self-reported poor mental health between those who exercised and those who did not. They found that those who exercised had significantly less poor mental health days, especially if they reported doing at least 45 minutes, 3–5 times weekly of either aerobics, gym activities, or team sports [29]. Not only does research show that all types of exercise are associated with less mental health burden, but also that there is evidence to support specific duration and frequency of activity [29].

Medical students are taught that physical activity can influence mood, to the extent of both preventing and treating depression. The 2018 CMA survey found that 34% of physicians screened positive for depression, and that this percentage far surpassed that of the general population [18]. While there is debate regarding the magnitude of effect, guidelines published by the Canadian Network for Mood and Anxiety Treatments recommend exercise as first-line treatment for major depressive disorder of mild to moderate severity [30]. A 2013 Cochrane review determined that exercise is moderately more effective than no therapy, exercise is no more effective than psychotherapy for reducing symptoms, and exercise is no more effective than antidepressants for reducing symptoms in milder episodes. Mechanisms proposed for the effectiveness of exercise include increase of neurotransmitters (e.g., serotonin, dopamine, norepinephrine) associated with depression, increased endorphins, increased neurotrophic factors, and reduced cortisol levels [31].

Effect on Cognitive Performance

Numerous studies have shown that physical activity has a positive impact on our immediate and long-term cognitive performance at various ages. Research has determined that in order to learn, the

brain needs to grow, develop, and prune itself so that neurons can fire more efficiently. One factor that is implicated in learning is brain-derived neurotrophic factor (BDNF). BDNF is known to improve the function of neurons, stimulate growth, and protect against cell death [32].

Did You Know?

One study found that 20–40 minutes of aerobic exercise increased serum BDNF levels by 32% in participants, whereas levels decreased by 13% in sedentary participants [33].

Another study found that participants who completed high-intensity aerobic activity learned vocabulary words 20% faster than sedentary participants. Neurotrophic and catecholamine levels were measured before and after each intervention as well as after the learning activity. There were significant increases in dopamine, epinephrine, and BDNF for each intervention. An increase in BDNF was associated with better short-term learning and an increase in dopamine and epinephrine was associated with better intermediate and long-term learning, respectively [34]. Moreover, the hippocampus, which is the center of memory and learning, is also positively affected by physical activity. For example, after doing high-intensity physical activity, our ability to focus, concentrate, problem-solve, and remember things is improved [35]. Moreover, as one continues to engage in this type of physical activity, the hippocampus grows, which likely helps to explain the long-term effects on memory and learning [36].

Effect on Quality of Life

Resident physicians often discuss quality of life as it relates to their choice of career early on and there is evidence to support that those who engage in physical activity enjoy good quality of life. One study looked at this relationship among resident physicians who participated in an exercise program. Initially, many residents were not meeting the US guidelines for physical activity. Residents who reported higher quality of life before the intervention main-

tained this throughout, and those who reported lower quality of life began to report higher values by the end of the study [37].

Effect on Patient Care

Engaging in adequate physical activity has been proven to not only positively affect physicians, but also patients. Several studies have shown that physicians who participate in physical activity are not only more likely to discuss the topic with patients, but also to feel more confident in counseling and to prescribe it to patients as medicine, and that their patients are more likely to follow their recommendations [38, 39]. Unsurprisingly, research has demonstrated similar findings with the adoption of various healthy lifestyle behaviors, underlining the value of spending time in patient encounters talking about activity levels. This is one of many reasons why postgraduate medical education offices should be encouraging physical activity in resident physicians as it not only benefits them, but also their patients. Table 11.3 summarizes the results of a systematic review of physical activity and the primary prevention of health outcomes by the Canadian Society for Exercise Physiology [12].

Key Points

- Physical activity can mediate our physiological stress response, making us more resilient to acute and chronic stressors.
- Being active is associated with decreased risk of psychological distress in general and has a preventative and treatment effect on depression.
- Physical activity, through mediators such as brain-derived neurotrophic factor, can improve our learning, memory, and concentration.
- Being active is associated with higher quality of life in resident physicians and enhances the likelihood that it is included in health promotion for patients.

Facilitating Physical Activity During Physician Training

Physical Activity Strategies in Medicine

There is an awareness of barriers preventing resident physicians from being more physically active, but considering the potential benefits described previously, program, hospital, and clinic administrators should be implementing strategies to remove these barriers, including addressing culture, environment, and opportunity. In terms of culture, physicians are more likely to be physically active if peers have positive attitudes toward exercise; getting active with a partner is associated with increased exercise adherence [17].

Workplace Strategies for Hospitals and Clinics

Given that physicians spend most "awake" time at work and are notably sedentary there, the CMA lists a variety of ways to increase physical activity in the workplace. Hospitals and clinics can provide features such as bicycle racks and showers should physicians choose to run, walk, or bike to work. Workplaces can have designated walking paths outside or through the hospital should people choose to go for a brisk walk before or after work or during nutrition breaks. It is not uncommon to see interdisciplinary colleagues speed walking at lunch! Also, workplaces can provide an exercise room with basic equipment, offer instructor-led classes of different intensities, or provide an outside gym membership – ideally for no fee or a nominal fee [40]. In many medical programs, there are opportunities to participate in intramural sports.

Novel Interventions for Resident Physicians

There have also been creative efforts to create physical activity programs specifically for physicians. One study implemented a wellness program for neurosurgery staff and residents at the Medical University of South Carolina. Participants were provided

with wrist monitors, a healthy breakfast, fitness/nutrition/health lectures, 60 minutes of group moderate-intensity physical activity per week, and progressive goals throughout the program. Not only did researchers identify undiagnosed medical conditions at the start (e.g., hypertension), but 4 months into the program, 64% of participants felt it improved both their physical and mental health. Importantly, no participant felt that it interfered with their clinical duties, the program fostered a sense of camaraderie, and it further motivated staff and residents to pursue wellness goals [41]. Other studies have used formal programs and made them competitive and incentivized, playing to those traits common in many physicians. An example of a more informal and opportunistic strategy comes from Stanford University, where residents from one program frequent the exercise room during overnight call for a short, but effective use of time where they can move their bodies, de-stress, and reenergize [42].

Key Point

Programs and workplaces should implement physical activity strategies for resident physicians and other clinicians that promote physical activity via culture, environment, and opportunities.

Creating an Action Plan to Move More Now

Bridging the Intention-Behavior Gap

As useful and inspiring as it can be to read about physical activity and how it relates to our health as physicians, it is important to put goals into action. It can be difficult to transform our hope to be more active into a changed behavior, which is referred to in the literature as the "intention-behavior gap" [43]. Research has shown that "action planning," a self-regulatory technique, is a moderator of this gap as it applies to physical activity [44]. A

meta-analysis of 23 correlational and 21 experimental studies determined that action planning has a moderate effect on physical activity behavior, suggesting that it can be a valuable strategy [45]. In the next section, the authors will discuss what an action plan is, how to complete one, and how to review it.

Creating a Simple but Comprehensive Action Plan

Action planning considers both quantity [46] and quality [47] of goals, and there is evidence to support that including both can result in improved physical activity behavior. These generally refer to:

(i) The number of action plans created
(ii) The specificity and instrumentality of parts within the action plan

Broken down further, specificity of our actions plans often refers to the following questions:

- What is the activity?
- Where will it take place?
- When will it happen?
- How long will it last?
- How intense will it be?
- With whom will I do this?

The Importance of Reviewing the Action Plan

It is important that one uses tools to review action plans when one first creates them and to monitor progress so that if difficulties arise one can identify which aspects to change. In doing so, action plans become more robust and likely to achieve satisfactory results.

For example, one study examined the relationship between booster sessions delivered over the telephone and maintenance of self-regulated physical activity among cardiac and orthopedic

patients who completed standard rehabilitation. Among other outcomes, at 6 weeks and 6 months post-rehab, researchers assessed: (i) patients' action plans, (ii) sense of self-efficacy, and (iii) satisfaction – three factors known to positively affect the maintenance of healthy lifestyle behaviors. At the 6-week mark, patients were asked to identify their least successful action plan relating to physical activity using a tool developed by researchers. Patients were given the chance to identify barriers to physical activity that they missed initially when action planning or new ones that had arisen. As such, they were able to revise their action plans so that they could continue to make progress and be successful in maintaining physical activity levels [48].

SMART Goal Setting in the Context of Physical Activity

A popular tool known as SMART goals helps facilitate healthy behavioral changes including increased physical activity. This method was first referenced by George Doran in 1981 in a paper called "There's a S.M.A.R.T. way to write management's goals and objectives." His intention was for those in leadership positions who followed this method to be better able to achieve positive outcomes, although use of this method has broad applicability [49]. This acronym generally stands for *s*pecific, *m*easurable, *a*ttainable, *r*ealistic, and *t*imely goals, although you may come across other subtleties in what each letter signifies. Table 11.5 summarizes common factors associated with SMART goals; the process itself is a useful approach to making and reviewing your physical activity action plans to set you up for success.

Redefining What "Success" Is When Discussing Physical Activity

There is a propensity for physicians to be perfectionistic both in- and outside of work, and while this motivates them to excel in many areas, there is a risk that success can be viewed narrowly.

Table 11.5 What are SMART goals?

SMART goals are:		
Specific	What physical activity are you going to do?	What? Where? When? How long? How intense? With whom? (This is your *Action Plan*)
Measurable	How will you measure your personal progress?	By duration? Frequency? Distance? Repetitions? Weight? Circumference?
Attainable	Is this a challenging, but reasonable activity goal?	This refers to making goals that reflect where you are now
Realistic	Why is making this change relevant to you?	This refers to your motivation for making this change and if this change fits into your life
Timely	What is a realistic deadline to make this change?	This refers to days, times, and the overall period over which you expect to make the change

Studies mentioned earlier in this chapter show that physicians tend to be more physically active than the general population; however, in reality, not every physician is very active at baseline [15, 16]. Physicians who are more sedentary should not be considered as "failing" by any means and "success" can be viewed as incorporating more activity regardless of type or intensity alone.

There are simple actions that can be incorporated into work to increase overall levels of activity whether it is parking farther from work, taking the stairs, using a standing or treadmill desk, or scheduling a walking meeting. Beyond work, activities such as walking the dog, doing yard or house work, or playing with children all count toward daily levels of physical activity and help further illustrate that we do not need to be elite athletes or fitness gurus to be "successful." If the overall goal is to be more physically active and there is flexibility in what this looks like, then we are likely to find satisfaction in all successes, even the small ones.

Skill-Building Exercise: Action Planning

Below is an example of an action plan template that you can work through for yourself. Remember that you can create several action plans to target different aspects of physical activity. For example, you might have one each for cardiovascular, strengthening, and flexibility-enhancing activities.

Action plan	Cardiovascular activity	Strengthening activity	Flexibility activity
What?			
Where?			
When?			
How long?			
How intense?			
With whom?			

Skill-Building Exercise: SMART Goal Setting

Below is an example of a SMART goal template that you can complete after your action plan. Make sure that each activity goal is specific, measurable, attainable, realistic, and timely. Again, this can be done for each type of activity you intend to start or increase.

Goal setting	Cardiovascular activity	Strengthening activity	Flexibility activity
Specific?			
Measurable?			
Attainable?			
Realistic?			
Timely?			

Key Points

- An action plan is an effective means to bridge the gap between intentions to be more active and actual physical activity. You can have more than one and be as detailed as possible.
- It is important to review your action plan at the start and at regular intervals to assess what is and is not working for you. You can use SMART goals as one tool to help you review.
- Setting realistic and incremental goals to gradually build self-efficacy and motivation can help to maintain healthy behavioral changes over the long term.

Check Your Learning

Case Study: "Running on empty"

Case Part I

Elena is 3 months into her first year as an orthopedic surgery resident in a program where the majority of rotations are spent on service in orthopedics. For the most part, she enjoys her day-to-day work as she gets to see a range of patients in clinic, in the OR, and on the unit, in addition to mandatory teaching. She also does 1 in 4 home call and depending on the hospital she is rotating through, some nights are fairly quiet after midnight and she is able to go home to sleep. Outside of work, she also teaches clinical skills for medical students who are currently learning about the musculoskeletal system and she is hoping to be involved in a research project. She considers herself fairly active and healthy, still going to the gym often, especially to lift weights, an activity she has been passionate about for years.

Question. True or false: **Resident physicians typically have lower levels of physical activity compared to both medical students and staff physicians.**

A. **True**
B. **False**

Answer: A ✓
Early on in her program, Elena is maintaining her usual level of physical activity; however, she can already see factors that put her at risk of inadequate activity. Several studies have replicated findings that resident physicians are less likely to meet national guidelines for physical activity than their junior and senior counterparts. Time is one of the most cited barriers by resident physicians, as they have more mandatory clinical and non-clinical duties than medical students, while also having little control over their work schedules compared to staff physicians.

Case Part II

Elena is now 6 months into the year and has just started her trauma rotation, a block that is known to be grueling for residents given the acuity of cases they see. She is now starting her workday earlier and staying longer into the evening with hardly any breaks during the day to eat or hydrate, let alone having a moment to relax. Moreover, "home" call is now more of a misnomer and she is spending her shifts in the hospital overnight actively working on cases. By the time she arrives home, she feels both mentally and physically depleted, often collapsing onto the couch to watch TV or surf the Internet. The most she feels capable of doing is to warm up a microwave dinner, try to study, and do some chores. She hardly thinks about exercising anymore.

Question. **In considering Elena, which factors may be contributing to her overall health risk?**

A. **Exercise withdrawal**
B. **Low physical activity**

C. **Sedentary behavior**
D. **All of the above**

Answer: D ✓
*All three factors are contributing to Elena's current presentation. To start, she was a highly active individual, engaging in personal fitness of at least moderate intensity regularly. However, her routine fell to the wayside as she struggled to manage all of her responsibilities. Then, she developed a low baseline of physical activity, doing light intensity activity regularly at work (*e.g.*, walking between units) and at home (*e.g.*, housework) instead. However, as her exhaustion built, even this became difficult. She increased her sedentary behavior such as watching TV or going on the Internet to the detriment of other activities. All three factors are independently associated with negative physical, cognitive, and psychological health outcomes, explained in detail earlier in this chapter and also reflected in Elena's case.*

Case Part III

Halfway through Elena's trauma rotation, she is finding it harder to focus, it is taking her longer to learn new procedural skills, and she feels she has lost her physical stamina. At home one night, her roommate comments that Elena is looking gaunt lately and asks if she has been unwell or if there are any other stressors. Elena brushes her roommate's comments off, stating that she has "typical" work stress but it is not any worse than her orthopedic peers, and she thinks she is handling it. Despite this, she steps on the weight scale the next morning and is shocked to see she has unintentionally lost 12 pounds. Thinking back over the past few months, she realizes that not only has she has been too tired to eat much at night, she often skips meals at work, and she also stopped weight lifting and has lost muscle mass.

Question. **Which of the following positive outcomes are associated with physical activity?**

A. **Less anxiety**
B. **Lower risk of lung cancer**

C. **Improved cognitive performance**
D. **Enhanced work satisfaction**

Answer: C ✓
*Elena is struggling with cognitive performance on her trauma rotation, noting difficulties in focus, concentration, learning, and memory, all of which can greatly impact her work. If she could increase her current physical activity levels, she might benefit from improved cognitive performance. For example, higher intensity physical activity has been associated with short- and long-term cognitive improvements due to increases in neurotrophic factors (*e.g.*, BDNF), catecholamine levels (*e.g.*, dopamine, epinephrine), and an overall increase in the size of the hippocampus. As for the other answers, physical activity is associated with less depressive symptoms, lower risk of breast and colon cancers, and increased overall quality of life rather than less anxiety, lower risk of lung cancer, or enhanced work satisfaction, more specifically.*

Case Part IV

Elena thinks back to earlier in the year when she was managing clinical and teaching duties while also investing more in her personal wellness and feeling happier and healthier. At the next academic day, she asks some of her peers how they manage to keep active, as many of them were highly active in medical school and continue to be so during residency. One signed up for the hospital gym that is fairly basic but has enough equipment for a good workout after work. Elena had no idea that there was a gym at the hospital, and that it was affordable to join. Her friend encourages her to sign up so they can work out together, help hold each other accountable, and motivate each other. Although difficult at first, exercising after work soon becomes routine for Elena, and not only is it fun to do with her friend, but she also feels physically stronger and healthier, and better able to handle daily stressors. She hopes to return to weight lifting one day, but feels this is a good alternative in the meantime.

Question. **Which of the following are systemic strategies to encourage physical activity in resident physicians?**

A. **Telling residents to be more active outside of work**
B. **Providing psychoeducation about physical activity to residents**
C. **Residents joining a community gym or attending specialized classes**
D. **None of the above**

Answer: D ✓
In this case, none of the above answers are considered systemic strategies. In fact, these strategies individualize the problem of low physical activity to resident physicians rather than addressing unique resident barriers and problem-solving at a systems level. Of course, there are many things one can do at an individual level to increase physical activity, but considering the benefits that it provides to resident physicians and their patients, it is worthwhile for programs and workplaces to change culture and provide opportunities for activity. Systemic strategies may include having an exercise room in the hospital, offering specialized classes with trainers, organizing intramural sports, and having running/walking groups. In Elena's case, once she realized that she had access to a staff gym for a nominal fee and that peers were using it regularly, it provided an opportunity to realistically incorporate physical activity into her busy daily schedule.

Key Takeaways

- The hope is that in reading this chapter, individuals have been motivated to reflect on their current physical activity level, the value currently placed on it, and what, if any, changes to make.
- The authors have covered the basics of what physical activity is, including its types and intensities, and have also reviewed the North American physical activity guidelines and its evidence base for adults.

- The guidelines recommended participating in approximately 150 minutes of preferably aerobic activity at moderate intensity each week. In following these recommendations, there are a plethora of physical health benefits.
- Resident physicians are less likely to meet national physical activity guidelines for a variety of reasons, the most commonly cited barrier being lack of time due to long work hours with schedules that may be beyond their control. Work roles often involve and encourage sedentary behavior, and even those who started residency as physically active individuals find it difficult to maintain their usual levels of activity.
- Physical activity is a marker of physician wellness and that can have positive effects on cognitive and psychological outcomes, both highly relevant given heightened resident rates of burnout and depression in physicians.
- As a group, resident physicians, their staff, program director, and other administrators should continue to advocate for physical activity strategies to improve their workplace culture, environment, and opportunities, with a common goal to enhance resident resilience and well-being.
- Individual strategies such as action planning with SMART goals can help to incorporate regular physical activity into each week.

Additional Resources

Additional resources about physical activity are illustrated in Table 11.6.

Table 11.6 Selected physical activity resources

Resources	Description
World Health Organization: "Physical activity" https://www.who.int/news-room/fact-sheets/detail/physical-activity	A webpage detailing physical activity definitions, global statistics, benefits of activity and risks of being sedentary, guidelines, strategies, and WHO responses (e.g., global recommendations, monitoring, action plan)
Canadian Society for Exercise Physiology (CSEP) https://csepguidelines.ca/	Summarizes the Canadian Physical Activity Guidelines (CPAG) for major age groups and in certain populations, as well as linking to evidence-based resources that support them
Physical Activity Guidelines for Americans (PAGA) https://health.gov/paguidelines/default.aspx	Summarizes the US Physical Activity Guidelines for major age groups and populations, as well as the proven benefits of physical activity
Handbook for Canada's Physical Activity Guide to Healthy Active Living https://www.physicalactivityplan.org/resources/CPAG.pdf	A handbook created by CSEP and the Public Health Agency of Canada to provide education regarding physical activity, CPAG, and how to incorporate more physical activity into everyday life
ParticipACTION https://www.participaction.com/en-ca	A movement that advocates for making physical activity part of everyday life for Canadians through providing education, resources, and programs for individuals, workplaces, and communities
ParticipACTON App https://www.participaction.com/en-ca/programs/app	A free phone app that reflects current Canadian guidelines and behavior change science, as well as tracking, instructional articles and videos, and a rewards program to help people make and achieve their physical activity goals
Your local clinic or hospital website	Check online for employee wellness opportunities including classes, indoor exercise rooms and equipment, gym membership discounts, and outdoor opportunities such as walking or running groups

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