Addressing the Nonexercise Part of the Activity Continuum: A More Realistic and Achievable Approach to Activity Programming for Adults With Mobility Disability?

Patricia J. Manns, David W. Dunstan, Neville Owen, Genevieve N. Healy

Participation in physical activity is fundamental for the maintenance of metabolic health and the prevention of major chronic diseases, particularly type 2 diabetes and cardiovascular disease. A whole-of-day approach to physical activity promotion is increasingly advocated and includes not only increasing moderate-intensity physical activity but also reducing sedentary time and increasing light-intensity activity (the “nonexercise” part of the activity continuum). This whole-of-day approach to tackling the challenge of inactivity may be particularly relevant for adults with mobility disabilities, who are among the most inactive segment of the population. Focusing on nonexercise activity by striving to reduce sedentary time and increase light-intensity activity may be a more successful place to begin to change behavior in someone with mobility disability. This article discusses what is known about the metabolic health consequences of sedentary behavior and light-intensity activity in adults with and without mobility disability. The concept of inactivity physiology is presented, along with possible applications or evidence from studies with adults with mobility disability. Mobility disability discussions and examples focus on stroke and spinal cord injury. Finally, clinical implications and future research directions related to sedentary behavior in adults with mobility disability are discussed.
Nonexercise Activity and Mobility Disability

Participation in physical activity, for the general adult population and for those with mobility disabilities, is fundamental for the maintenance of metabolic health and the prevention of major chronic diseases, particularly type 2 diabetes and cardiovascular disease. Sedentary behavior, or prolonged sitting time, has been identified as a unique health risk, independent of leisure time physical activity levels. Recent position stands and advice from expert bodies identify the potential importance of reducing sedentary time and emphasizing a whole-of-life approach to physical activity promotion.

This article will discuss what is known about the metabolic health consequences of sedentary behavior and light-intensity activity (or nonexercise activity) in adults with and without mobility disability. The concept of inactivity physiology will be presented, along with possible applications or evidence from studies with adults with mobility disability. The term “mobility disability” throughout the article refers to impairments that limit or change the way these adults walk or move within the home and community; however, most of the discussion will focus on adults with stroke and spinal cord injury (SCI). The prevalence of stroke is high, and stroke is the leading cause of mobility disability. Individuals with SCI sit or lie down for all or most of the day, and they are identified as a group that may provide unique insights as human models for the study of inactivity physiology. Finally, clinical implications and future research directions related to sedentary behavior in adults with mobility disability will be discussed.

Nonexercise Behavior in Adults With and Without Mobility Disabilities Definition and Measurement of Sedentary Behavior

Although researchers frequently report sedentary behavior, what this term, in fact, means is not well defined. Being sedentary has been seen previously as synonymous with having a lack of moderate physical activity (typically, brisk walking or its equivalent); if adults were not classified as meeting the physical activity guidelines for moderate or vigorous activity, they were classified as sedentary. As we will demonstrate, the effects of sedentary behavior on health outcomes are not the same as those of a lack of moderate-intensity physical activity.

Sedentary behaviors are defined by both an individual’s posture (sitting or reclining) and his or her low energy expenditure (typically between 1.0 and 1.5 metabolic equivalents [METs]; multiples of the basal metabolic rate). Sedentary time can be measured across the whole day with specific domains (eg, work, leisure time, travel, domestic), or as time spent in specific behaviors (eg, sitting while watching television).

Although the majority of studies have utilized self-report methods to measure sedentary time, the concurrent use of device-based measures is becoming more common. The most common device-based measure utilized in population-based studies is the ActiGraph activity monitor (ActiGraph, Pensacola, Florida), worn at the hip. This monitor measures time-varying changes in force and can provide information about not only the amount of activity (primarily ambulatory activity) but also the intensity and the time at which the activity occurred. Activity levels typically are recorded as counts, which are summed over a user-specified time frame, or epoch (eg, counts per minute). Cutpoints then can be applied to classify time spent at different intensities of activity. For example, a cutpoint of greater than 1,951 counts/min typically is used to categorize time spent in activity of moderate-to-vigorous intensity, whereas cutpoints of fewer than 100 counts/minute are the most commonly used threshold for sedentary behavior. Counts less than 100 per minute typically correspond to sitting and lying (MET levels less than 1.5), but also can include standing still. Other authors have suggested that measurement of postural allocation (sitting or lying versus standing) is a more robust measure of sedentary behavior, and devices with inclinometers are available that accurately provide this information.

Characterizing sedentary behavior in adults with mobility disability, particularly those who do not walk, is a bit more complicated. A measure of postural allocation (sitting versus standing) is easy to understand, but would not be accurate as an indication of sedentary behavior in people with SCI or stroke who use a wheelchair as their primary mobility mode. For wheelchair users, activity measurement tools are available to characterize duration of wheelchair propulsion, number of wheel revolutions, and accelerometer counts, but commonly time moving versus time not moving (ie, sedentary behavior) has not been measured. The accelerometer cutpoint of less than 100 counts/min, although not validated with adults with mobility disability, is
likely an accurate indication of sedentary behavior in this population. Depending on typical mode of locomotion (walking or wheeling), monitors may need to be worn in a different location. Regardless of disability, sitting still or lying down when not sleeping would be properly classified as sedentary.³¹

### Prevalence of Sedentary Behavior in Adults With Mobility Disabilities

Four recent adult population studies in Australia, Canada, Sweden, and the United States used accelerometry to characterize activity in a population sample.⁹,¹⁵,²⁵,³² All defined sedentary behavior as activity of fewer than 100 counts/min, and percentage of time spent in sedentary behaviors ranged from 57% to 72% (Table). The evidence available for sedentary behavior for people with mobility disability is limited, but not surprisingly, the percentage of time spent in sedentary behaviors is generally higher than reported percentages for people without disabilities (Table). Rand and colleagues³⁵ used the Activity monitor to characterize activity in a population sample of 18–75 years old (N=1,114) and reported that over 3 days of monitoring, individuals with stroke were sedentary (no accelerometer counts) for 86% of their waking hours (13 of 15 hours). Using behavioral monitoring, patients undergoing rehabilitation for stroke were found to be inactive (in bed or sitting in a chair) 88% of the time between 8 AM and 5 PM.³⁴ People with multiple sclerosis who had Expanded Disability Status Scale (EDSS) scores greater than 4.5, indicating the ability to ambulate but...
Light-intensity activity contributes to overall daily energy expenditure, but generally does not count toward the achievement of physical activity guidelines. Activity with MET levels between 1.6 and 3 characterize light-intensity activity, and accelerometer counts corresponding to those MET levels are published for adults and specifically for older adults.

Determination of what constitutes light-intensity activity for people with mobility disabilities is a research priority. Two studies have used the Step Activity Monitor (Orthocare Innovations, Oklahoma City, Oklahoma) with survivors of stroke and characterized low- and moderate-intensity activity according to steps per minute, with low-intensity activity defined as having fewer than 15 steps/min and moderate-intensity activity as having between 16 and 30 steps/min and 16 and 40 steps/min. These studies showed that more than 90% of activity involved counts of fewer than 40 steps/min, which fall into the light-intensity category for people without disabilities. There also is recognition that some activities that would be considered of light intensity for someone without disability may be considered of moderate intensity for someone who has muscle weakness or functional limitations. For example, energy expenditure for walking, even slowly, for someone who has had a stroke may be considered moderate-intensity activity. Dressing, for an individual with SCI who has no lower-extremity function, frequently falls into the moderate-intensity activity category. Progressively, as these issues become better understood through findings from accelerometer studies, it should be possible to clarify more precisely what constitutes sedentary versus light versus moderate activity for adults with mobility disability.
Being Sedentary and Being Inactive Are Distinct Classes of Behavior

In the last 10 years, the exercise-science research literature has emphasized that sedentary behavior should be regarded as unique, as the effects of sedentary time on health outcomes and risk for disease are separate from not getting enough exercise. Correlations between sedentary behavior and moderate-intensity activity are weak \( r = -.27 \), lending support for the independence of each in daily behavior. Researchers have reported independent associations of sedentary behavior and activity on health outcomes such as the metabolic syndrome and type 2 diabetes.

In adults with stroke and SCI, the onset of the disability is a transition from active (or at least ambulatory) to completely sedentary. No studies to date have set out specifically to examine the potential effects of sitting versus exercising on health outcomes in adults with mobility disability. However, observation of the time course of health outcomes suggests that incident stroke or SCI leads to accelerated disease and health outcomes. The role that increased sitting or lack of exercise or both plays in these outcomes is not known, but the effects are likely to be multifactorial (although acute onset of sedentary behavior may be the genesis).

Cellular and Molecular Responses to Sedentary Behavior and Exercise Are Different

Research suggests that the cellular and molecular processes underlying sedentary behavior and exercise may differ in important ways. One specific example that has been discussed extensively is the action of the enzyme lipoprotein lipase (LPL). This enzyme is essential for the metabolism of fat, and decreases in LPL are associated with less triglyceride uptake and lower levels of high-density lipoprotein cholesterol (HDL-C). Decreased LPL activity at the vascular endothelium and resultant decreased uptake of fatty acids contribute to increased risk of diabetes and heart disease. In animal studies, sedentary time and exercise have differential, not inverse, effects on muscle LPL activity. Sedentary time is associated with a 10-fold decrease in LPL activity, whereas exercise results in a 2.5-fold increase in LPL activity. Moreover, the muscle fiber types affected during sedentary time and exercise are different, with sedentary time decreasing LPL activity primarily in oxidative muscle fibers and exercise increasing LPL activity primarily in glycolytic fibers. Lipoprotein lipase gene expression is increased with exercise but unchanged with sedentary time.

Adults with SCI who use wheelchairs as their primary mode of locomotion (and thus sit all day) have increased triglyceride and glucose intolerance and decreased HDL-C in comparison with age-matched controls. Lipid levels in people with SCI are graded and deteriorate in those with increasing amounts of muscle paralysis. Patients poststroke have varying ambulatory abilities, but also consistently demonstrate lipid and glucose abnormalities compared with age-matched controls. These 2 populations are characterized by high volumes of sitting and decreased muscle activity, both of which are likely to play important roles in LPL activity.

Examining the time course of changes in lipid profiles in people with new SCI or acute stroke provides some insight into changes that may result, at least in part, from high volumes of sedentary behavior. Two research groups examined lipid profiles of individuals with SCI in the first 6 weeks after injury and reported extremely low HDL-C levels of approximately 28 mg/dL. Both samples were small, but the age of participants was generally less than 45 years. Although lipid levels were not available in the pre-SCI time period, for this age group these
levels are undoubtedly lower than preinjury levels. The HDL-C levels then increase over the first year post-SCI, but remain lower than those of age-matched controls. One study of adult patients with stroke measured HDL-C prior to stroke as well as immediately after stroke and showed an 18% decrease in HDL-C immediately after stroke, which was independent of stroke severity. The HDL-C levels then increased by 29% at follow-up (on average, 2.6 months poststroke). Generally, HDL-C levels following acute SCI and stroke are low and rise slowly over the recovery period; however, in both populations, especially people with SCI, levels remain lower than in age-matched controls. Although this discussion may infer a relationship between low HDL-C levels and sedentary behavior in people with mobility disability, that relationship is speculative at this point and warrants further study.

It will be crucial to determine the mechanisms behind the lipid abnormalities in adults with stroke and SCI. For example, Nash and colleagues examined postprandial lipemic responses in individuals with paraplegic SCI and reported that they had elevated triglyceride levels for up to 6 hours in comparison with controls, with area under the curve for baseline-adjusted triglyceride levels 46.5% greater in those with SCI. Generally, HDL-C levels following acute SCI and stroke are low and rise slowly over the recovery period; however, in both populations, especially people with SCI, levels remain lower than in age-matched controls. Although this discussion may infer a relationship between low HDL-C levels and sedentary behavior in people with mobility disability, that relationship is speculative at this point and warrants further study.

Further Increases in Disease Not Explained by Less Exercise
Finally, inactivity physiology researchers argue that in people who are already inactive, declines in health (ie, increased heart disease, type 2 diabetes) in the future will be caused by something other than exercise deficiency. This tenet may be less applicable to adults with mobility disability, as many are already at the least active end of the activity continuum and often have concomitant disease (ie, they have limited capacity to be less active or to have more disease). However, future studies can consider this tenet, maybe particularly in individuals with stroke, who are typically inactive poststroke.

Findings From Sedentary Behavior and Light-Intensity Activity Studies
Cross-sectional Studies
The recent understanding about sedentary and light activity behavior and the associations with metabolic health risk factors has been informed by the Australian Diabetes, Obesity and Lifestyles Study (AusDiab), a population-based study designed to estimate the prevalence of diabetes and associated health conditions in Australian adults older than 25 years. In a large sample of middle-aged adults who were healthy (2,761 women, 2,103 men), sitting time was deleteriously associated with several metabolic risk factors, including waist circumference, body mass index, systolic blood pressure, fasting triglycerides, HDL cholesterol, 2-hour post-load plasma glucose, and fasting insulin. Additionally, a subset of AusDiab participants wore ActiGraph accelerometers for 7 days to measure sedentary, light-intensity, and moderate-intensity activity. Device-based measures of sedentary time (accelerometer counts of fewer than 100 per minute) were deleteriously associated with waist circumference, higher clustered metabolic risk scores, and triglycerides, independent of moderate-intensity activity. Recent findings from the population-representative National Health and Nutrition Examination Survey (NHANES) similarly showed deleterious associations between sedentary time and metabolic risk factors, including C-reactive protein, triglycerides, and markers of insulin resistance, independent of moderate-intensity activity. For adults with mobility disability, there are currently no studies that have specifically examined associations between sedentary time and such metabolic risk factors.

The potential importance of light-intensity activity in relation to metabolic biomarkers was first highlighted within the AusDiab, in which light-intensity activity was inversely associated with 2-hour post-glucose levels, waist circumference, and clustered metabolic risk. Research using NHANES data similarly showed beneficial associations between light
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intensity activity (760–2,019 counts/min by ActiGraph) and triglycerides, HDL-C, and waist circumference, independent of moderate-intensity activity.65 Research findings related to the potential importance of light-intensity activity may be, in part, a function of strong inverse associations between light-intensity activity and sedentary time ($r=-.96$),18 suggesting that when light-intensity activity is increased, detrimental sedentary time is reduced. Sedentary time generally is not replaced with moderate-intensity activity.6 In one study of people with SCI, increased mobility activities of daily living (ie, transferring, wheeling) that fell into the light activity category31 were shown to be beneficially associated with lower total cholesterol and LDL cholesterol.66

Studies utilizing objective measures of sedentary and physical activity also have provided information about pattern of activity accumulation and its associations with health markers. Individuals who have the same amount of sedentary time, but are different in the way they accumulate that sedentary time, have different metabolic risk factors. For example, middle-aged adults who are healthy and who break up their sedentary time more (“breakers”) have smaller waist circumference17,24 and lower 2-hour glucose levels,24 compared with those who do not break up their sedentary time (“prolongers”). Pattern of activity accumulation has been studied in adults with mobility disability, but to date, only descriptively.

Cavanaugh and colleagues examined ambulatory activity in 3 groups of adults and reported that the group of older adults with functional limitations demonstrated less variability in their daily activity. They found less variability to be associated with potentially detrimental functional outcomes, including limiting the ability to react to changing environmental demands.67 In survivors of stroke, changes in length of activity bouts (breaks in sedentary time) have been examined over 3 time periods: immediately prior to hospital discharge and 2 and 6 weeks post-discharge. Length of activity bouts significantly increased over the 3 time periods and amounted to an additional 30 minutes of activity per day (albeit, mostly light activity).42

Finally, 2 recent reports showed that adults with stroke and Parkinson disease accumulated activity differently than individuals who were healthy, despite similar amounts of sedentary time.55,68 Sedentary bouts were longer in those with Parkinson disease,68 and those with stroke had half the number of daily sit-to-stand transitions as did controls, indicating fewer breaks in sedentary time.35 None of the studies with adults with mobility disability, discussed above, explored the associations of activity variability or pattern of activity with health or function outcomes.

Prospective Studies
Several prospective studies of people without disabilities have demonstrated the detrimental effect of sitting on mortality and other health outcomes.2,4,20,69 These studies are thoroughly reviewed in recent articles by Katzmarzyk70 and Thorp et al71 and will not be discussed here. There are no studies that have tested the effect of more or less sedentary time on mortality outcomes in people with mobility disability.

Intervention Studies
Few studies have tested the effects of an intervention to reduce sedentary behavior in adults. Using a group behavior change intervention based on social-cognitive theory, Gardiner et al72 reported a 3.2% reduction in sedentary time 1 week post-intervention. Another study used a randomized design that tested the effect of reduced television time on sedentary time and energy intake and expenditure in adults who were overweight or obese.73 A 3-week intervention that reduced television viewing time by 50% from baseline demonstrated a 3.8% decrease in time spent in sedentary activities.73 There is no research to date that has specifically tested an intervention with adults with mobility disability targeting the reduction of sedentary behavior.

Clinical Implications
A Whole-of-Day Approach to Health Promotion for Adults With Mobility Disability
More than a decade ago, Rimmer discussed health promotion for people with physical disabilities and the potential role of physical therapy.74 One of the goals of the American Physical Therapy Association is that “physical therapists are universally recognized and promoted as providers of fitness and health promotion programs.”75 The success of physical therapy in health promotion settings depends on a large degree on appropriate and well-tested physical activity interventions and recommendations. There are specific physical activity recommendations available for people with stroke76 and SCI77; they focus on aerobic and strengthening activities, and there is a recognition that activity can be accumulated in 10-minute bouts,76 similar to recommendations for people without disabilities.1 Despite these well-promulgated recommendations, adults with mobility disability have more sedentary time and lower levels of physical activity than those without disability.35,56,45,78 A change in focus related to physical activity recommendations may be in order. With large amounts of sedentary time, and often low capacity to participate in and sustain moderate-intensity activity, adults with mobility disability may be uniquely suited to physical activity recommenda-
tions with a focus on the nonexercise part of the activity continuum.

Focusing on the nonexercise part of the activity continuum means intervening to increase breaks in sedentary time, increase light-intensity activity, and decrease sedentary time. It is part of a whole-of-day approach to activity promotion and does not preclude inclusion of moderate-intensity activities. However, we propose that focusing on nonexercise activity in adults with mobility disability is the most appropriate place to start and may more readily lead to behavior changes that are sustainable and can be built on as appropriate. When addressing nonexercise activity, simple, succinct messages regarding behavior change can be easiest for the therapist to convey and, as a result, may be more likely to result in behavior change.

An example of a short, straightforward message is “sit less, move more” from a recent National Heart Foundation of Australia healthy living information sheet. Moreover, a focus on nonexercise activity is not dissimilar in some ways to advice to stay active for people with back pain. A more systematic focus on nonexercise activity may have broader implications for physical therapy interventions in adults with musculoskeletal pain and others with chronic conditions.

A Key Role for the Comprehensive and Accurate Assessment of Patients

Prior to a physical therapy intervention in which the goal is to sit less and move more, appropriate assessment of activity and sedentary time is necessary. An accelerometer that can provide minute-by-minute data is required so that patterns of activity behavior can be characterized. Some accelerometers also include inclinometers and provide important postural allocation information about patients. Although physical therapy departments or clinics more typically spend equipment dollars on treatment tables and stationary exercise equipment, if physical therapists are to play a more prominent role in community-based health promotion settings with adults with mobility disability, some budget dollars will need to be allocated for devices that can accurately measure various components of activity. Assessment with an accelerometer provides information about general activity behavior (amount of sedentary, light-intensity, or moderate-intensity activity), average length of sedentary bouts (ie, if bouts are broken up frequently or not), number of breaks in sedentary time, and objective information about times during the day when patients are particularly sedentary. An example of results of an assessment for someone with stroke is provided in the Appendix. This baseline information is essential to appropriately individualize goal setting. The assessment results displayed in the Appendix identify particular areas to target (eg, few breaks in sitting, 87% sedentary time, long sedentary bouts), and those areas, in many ways, can be addressed by increasing the number of sit-to-stand transitions daily.

Uptime, Postural Transitions, and Increased Mobility for Adults With Mobility Disabilities

From the modest body of available research, we know that people with stroke make significantly fewer sit-to-stand transitions during the day compared with people who are healthy. Our example patient indeed corroborates that research and demonstrates only 23 transitions from sitting to standing compared with 103 transitions for a control group of individuals who were healthy. Increasing sit-to-stand transitions is not only a functional way to break up sedentary time but also leads to light-intensity activity (standing instead of sitting), which theoretically reduces sedentary time. We already know that extra sit-to-stand practice leads to a better quality of life and improved physical mobility, but it is not known whether more sit-to-stand transitions have health implications for people with mobility disability. This is an important area of future research. Standing, or uptime, is light-intensity activity, and part of a physical therapy intervention may be problem solving with the patient in terms of what activities could be safely done while standing as opposed to sitting. Telephone conversations may be conducted standing up, people could read the newspaper standing up, and exercises for the weaker arm, in the case of people with stroke, might be done while standing.

For wheelchair users, the simple, succinct message would have to be limited to moving more, as sitting less is not possible. The energy expenditure required for wheeling on any type of surface, or for day-to-day activities such as dusting or washing dishes, falls into the light-intensity activity category. In essence, for someone with SCI, almost any type of upper-extremity activity is a break in sedentary time and represents light-intensity activity. It may be possible to incorporate breaks in sedentary time with a pressure relief schedule (ie, every 15 minutes). These clinical suggestions may incorporate some of what physical therapists currently do with patients with mobility disability. However, a need for a more systematic assessment and intervention approach is highlighted, along with a targeted and intentional focus on the nonexercise part of the activity continuum.

Research Directions

In a recent exercise science Perspectives for Progress article, a behavioral epidemiology framework to
guide the population health science of sedentary behavior was proposed (Fig. 2). This framework also should help to guide sedentary behavior research in adults with mobility disability. Four important research areas specifically related to individuals with mobility disability and identified in the behavioral epidemiology framework are advanced:

1. **Relationships.** What is the association between sedentary behavior and health outcomes for adults with mobility disability? There is a strengthening evidence base for adults without disability, but there is very little evidence in adults with mobility disability. Research examining relationships also should examine associations between pattern of activity (eg, breaks in sedentary time) and health and functional performance. Currently, no research addresses this question with adults with mobility disability. Short activity bouts may be used by people with mobility disability as a strategy to conserve energy and reduce fatigue; however, it is unknown how this strategy may be associated with metabolic health and function.

2. **Measuring sedentary behavior.** Future studies may help to determine the validity of device-based measures to capture patterns of sedentary and physical activity behavior and of sitting time in people with mobility disability. Sedentary behavior self-report measures for use with people with mobility disability also need further development.

3. **Prevalence and variation in sedentary behavior in populations.** Using larger and more impairment-diverse samples of both children and adults with mobility disability, what is the volume and pattern of sedentary behavior?

4. **Interventions.** Research questions include: “What is the health and functional effect of an intervention targeting **reduction of sedentary time**?” and “What is the health and functional effect of an intervention to **increase breaks in sitting time**?”

There are other research questions, not specifically identified in the behavioral epidemiology framework that would advance our knowledge of the potential benefits of addressing the nonexercise part of the activity continuum. Mechanistic questions include: (1) What is the effect of long bouts of sedentary time versus frequent interruptions to sedentary time or activity on LPL, triglyceride, and HDL-C levels in adults with SCI and stroke? and (2) Is LPL response to activity or sedentary behavior different in quadriplegic versus paraplegic SCI, or is LPL activity more closely related to pattern of activity or sedentary behavior accumulation? Finally, from a qualitative perspective, do adults with mobility disability perceive that it is easier to change their behavior by becoming less sedentary, as opposed to striving to meet physical activity guidelines?

More such research with people with mobility disability, as described in the behavioral epidemiology framework (Fig. 2), will lead to knowledge and evidence that may inform new public health guidelines for adults with mobility disability and provide crucial evidence for physical therapy interventions. These research directions also may be applicable more generally to older adults, as sedentary time and impairments that may result in mobility disability both increase with age.

**Conclusions**

Physical activity recommendations that place more emphasis on changing the nonexercise activity portion of a person’s day (ie, decreasing sed-
entary time and increasing light-intensity activity) may be particularly relevant to adults with mobility disability. In adults without disabilities, there is accumulating evidence of the potential metabolic health benefits of decreasing sedentary time or breaking up sedentary time. Clinical physical therapy interventions designed to help patients with mobility disability reduce sedentary time and increase light-intensity activity may produce even greater benefits than for adults without disabilities because of the former’s generally greater magnitude of sedentary behavior. Future sedentary behavior research will provide important information for physical therapists as they work with adults with mobility disability to improve their health.

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Appendix.
Example of Physical Activity Assessment, Interpretation, and Plan for an Individual With Stroke

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<th>Client Characteristics</th>
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<td>Fifty-six-year-old woman, 3.5 years post–ischemic stroke. Client takes medication for high blood pressure and abnormal cholesterol levels. Walks independently on level surfaces using quad cane and nonarticulating ankle-foot orthosis. Gait speed is 20.8 m/min, body mass index = 40 m/kg². Lives with husband in accessible home; no home care services.</td>
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<tr>
<th>Physical Activity Assessment</th>
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<tr>
<td>Measurement tool: StepWatch Activity Monitor (Orthocare Innovations LLC, Oklahoma City, Oklahoma)</td>
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<tr>
<th>Dose</th>
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<tr>
<td>● Total steps/day = 3,696</td>
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<tr>
<td>● Total active minutes = 106 of 824 minutes monitored (active 13% of time)</td>
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<td></td>
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<tr>
<td>● Total sedentary minutes = 718 of 824 minutes monitored (sedentary 87% of time)</td>
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<tr>
<th>Intensity</th>
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<tr>
<td>● Average intensity (all monitored minutes) = 4.5 steps/min (SD = 14.0)</td>
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<tr>
<td>● Average intensity (active minutes) = 30.2 steps/min (SD = 23.3)</td>
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<tr>
<th>Breaks</th>
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<tr>
<td>● Total number of breaks in sedentary time = 23</td>
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<tr>
<td>● Average length of breaks in sedentary time = 5.1 min (SD = 3.6)</td>
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<tr>
<td>● Average length of sedentary bouts = 34.0 min (SD = 46.4). Three sedentary bouts longer than 2 hours.</td>
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<th>Interpretation</th>
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<tr>
<td>High percentage of time spent sedentary, few breaks in sedentary time</td>
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| Plan—Work with client to identify strategies to break up sedentary time. Target sit-to-stand transitions to increase breaks in sedentary time. Goal: increase breaks to 30 daily in 2 weeks. | | |

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*a* Active minutes characterized as minutes with >1 stride.
*b* Sedentary minutes characterized as minutes with ≤1 stride.
*c* Compares with 9.6 steps/min in Canadian Health Measures Survey. 
*d* Compares with a mean of 63 sit-to-stand transitions in a population of people with stroke; sit-to-stand transitions may not be completely analogous to breaks in sedentary time.