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Objective measurement of free-living physical activity (performance) in lumbar spinal stenosis: are physical activity guidelines being met?

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Abstract

BACKGROUND—Research suggests that people with lumbar spinal stenosis (LSS) would benefit from increased physical activity. Yet, to date, we do not have disease-specific activity guidelines for LSS, and the nature of free-living physical activity (performance) in LSS remains unknown. LSS care providers could endorse the 2008 United States Physical Activity Guidelines; however, we do not know if this is realistic. The goal of the present study was to determine the proportion of individuals with LSS meeting the 2008 Guidelines. A secondary goal was to better understand the nature of physical performance in this population.

STUDY DESIGN—Retrospective study.

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PATIENT SAMPLE—People from the Lumbar Spinal Stenosis Accelerometry Database, all of whom have both radiographic and clinical LSS and are seeking various treatments for their symptoms.

OUTCOME MEASURES—Seven-day accelerometry (functional outcome) and demographics (self-reported).

METHODS—For the present study, we analyzed only baseline data that were obtained before any new treatments. Patients with at least 4 valid days of baseline accelerometry data were included. We determined the proportion of individuals with LSS meeting the 2008 US Physical Activity Guidelines of at least 150 minutes of moderate-vigorous (MV) physical activity per week in bouts of 10 minutes or more. We also used the novel Physical Performance analysis designed by our group to determine time spent in varying intensities of activity. There are no conflicts of interest to disclose.

RESULTS—We analyzed data from 75 individuals with a mean age of 68 (SD 9), 37% of whom were male. Three people (4%) were considered Meeting Guidelines (at least 150 MV minutes/week), and 56 (75%) were considered Inactive with not even 1 MV minute/week. With the 10-minute bout requirement removed, 10 of 75 (13%) achieved the 150-minute threshold. The average time spent in sedentary activity was 82%, and of time spent in nonsedentary activity, 99.6% was in the light activity range.

CONCLUSIONS—In conclusion, the present study confirms that people with symptomatic LSS, neurogenic claudication, walking limitations, and LSS-related disability are extremely sedentary and are not meeting guidelines for physical activity. There is an urgent need for interventions aimed at reducing sedentary behavior and increasing the overall level of physical activity in LSS, not only to improve function but also to prevent diseases of inactivity. The present study suggests that reducing sedentary time, increasing time spent in light intensity activity, and increasing time spent in higher intensities of light activity may be appropriate as initial goals for exercise interventions in people with symptomatic LSS and neurogenic claudication, transitioning to moderate activity when appropriate. Results of the present study also demonstrate the importance of employing disease-specific measures for assessment of performance in LSS, and highlight the potential value of these methods for developing targeted and realistic goals for physical activity. Physical activity goals could be personalized using objective assessment of performance with accelerometry. The present study is one step toward a personalized medicine approach for people with LSS, focusing on increasing physical function.

Keywords

Accelerometry; Exercise; Lumbar spinal stenosis; Performance; Physical activity; Physical activity guidelines

Introduction

Lumbar spinal stenosis (LSS) is a painful, debilitating condition [1–8] with an estimated prevalence of 9% in the general population, and up to 47% in people over age 60 [9]. Lumbar spinal stenosis is the most common reason for spine surgery in patients over 65 [10], with a current estimated 2-year cost of $4 billion in the United States [11,12]. Given the aging population, both the prevalence and economic burden of LSS are expected to increase [10–16].

Lumbar spinal stenosis is characterized by neurogenic claudication and mobility limitations [1–3,17,18]. Yet, despite the fact that neurogenic claudication is the hallmark of LSS, the effects of symptoms on free-living physical activity (performance) are not well understood. This lack of understanding is in part due to a dearth of objective measures of function in LSS and the reliance on inaccurate self-report tools [19]. Fortunately, recent advances in wearable technology have provided us with the tools to objectively measure free-living physical activity (performance) in people with LSS. Using accelerometers, we are beginning to understand more about performance in this population [1–3,20,21]. Some preliminary work with pedometers demonstrated that people with LSS take an average of around 4,000 steps/day [17], which is considered sedentary [22]. This research is supported by other pedometer-based studies suggesting that people with LSS are severely inactive [2,3,23]. This symptom-related sedentary behavior has many implications for overall health, obesity, and risk for diseases of inactivity [24].

There is an obvious need to intervene in people with LSS to prevent or improve sedentary behavior. Increased physical activity in daily life would not only help to prevent diseases of inactivity, but could also positively impact symptoms [23,24]. Research to date investigating physical activity for LSS has demonstrated that physical activity is effective for improving pain and function [25–27]. Additionally, preliminary data suggest that a pedometer-based physical activity intervention is effective for improving pain, mental health, and fat mass in people with LSS [23].

Although there are some data suggesting that people with LSS could benefit from physical activity, there are no disease-specific guidelines available. The dose-response relationship between physical activity and other outcomes in LSS remains unclear. Given the lack of clinical guidelines for physical activity, it may be practical for care providers to follow the 2008 American Physical Activity Guidelines [28]. The guidelines recommend participation in 150 minutes of moderate-vigorous (MV) physical activity per week, accumulated in bouts of 10 minutes or more. Moderate-vigorous activity is considered to be movement that increases both heart rate and breathing rate, and is generally equivalent to brisk walking, whereas light activity is equivalent to leisurely walking [29]. These guidelines are endorsed for older adults by the American Geriatrics Association [30], and are recommended for older adults living with osteoarthritis [31]. Yet, while the recommended 150 minutes of MV activity may be realistic for some individuals with LSS, it is likely an inappropriate goal for most. In fact, given the clinical presentation of LSS, and the functional impacts of neurogenic claudication, it is likely that a focus on light intensity activity is more appropriate for this population [18,21,32]. However, until we understand the nature of performance in LSS, we do not know what represents a realistic physical activity goal, and whether promotion of moderate activity is appropriate. To date, it remains unclear whether people with LSS are meeting Physical Activity Recommendations.

There is an opportunity to make use of existing accelerometry data from individuals with LSS to better understand performance in this population. Over the past decade, our group has developed the Lumbar Spinal Stenosis Accelerometry Database (LSSAD). Using these data, we can determine the proportion of individuals meeting Physical Activity Recommendations, and assess whether these goals are appropriate for people with LSS. There is also an opportunity to better understand the characteristics of performance in LSS. In particular, our aim is to apply new methods designed by our group to interrogate accelerometry data from mobility-limited pain populations [33]. These new methods may provide insight into the performance characteristics of LSS, and define targets for physical activity interventions. Analysis using these new thresholds, called "Physical Performance analysis," improves focus within the ranges of light intensity physical activity, where LSS is likely to have the greatest impact [24].

Therefore, the goal of the present study was to leverage existing accelerometry data to determine the proportion of individuals with LSS meeting the 2008 Physical Activity Guidelines. Asecondary goal of the present study was to better understand the nature of performance in this population, including the distribution of activity among intensity intervals. This will act as a first step toward developing disease-specific physical activity recommendations for LSS, by providing a deeper understanding of the nature of free-living physical activity (performance) in this population.

Materials and methods

Study design

This was a retrospective study of accelerometry data for individuals with LSS.

Lumbar Spinal Stenosis Accelerometry Database

In an effort to improve the understanding of performance in LSS, our group has created the largest known database of accelerometry data from people with LSS, the LSSAD. This database includes accelerometry data for 125 unique individuals with LSS. Individuals in the database were all undergoing treatment as part of multiple LSS treatment studies, including a lifestyle intervention [23], epidural steroid injections [17], and surgery [18,32,34]. All participants in these studies were included in the database. Therefore, the sample includes only people who were seeking care for symptomatic LSS. All participants were tested with accelerometry for 7 days before any treatment.

Inclusion criteria for database

All individuals included in the source studies, and therefore the database were required to have symptomatic lumbar spinal stenosis diagnosed clinically, and confirmed on imaging by a spine specialist physician. Aclinical presentation of neurogenic claudication, including self-reported walking limitations, was required for inclusion. Although the degree of anatomical stenosis on imaging was not recorded, evidence of anatomical stenosis corroborating the clinical findings was required as part of the diagnosis.

This database represents a population of individuals with symptomatic LSS and neurogenic claudication who were seeking care for their symptoms. Of the 125 individuals in the database, 75 met the strict accelerometry wear time inclusion criteria set for the present study. The clinical characteristics of the excluded individuals did not differ from the 75 who were included. The mean age for the group of 75 patients in the present study was 68 ± 8 years. All participants had self-reported walking limitations and neurogenic claudication, with an average measured walking distance on the Self Paced Walking Test of 1254 ± 457 m. The mean score on the Oswestry Disability Index was 45 ± 11 (considered severe disability). The mean score for leg pain was 4.2 ± 3.0 on a 10-point visual analog scale score, and 3.7 ± 2.9 for back pain. Therefore, results of the present study can be generalized to individuals with symptomatic LSS, neurogenic claudication, walking limitations, and LSS-related disability.

Approval for human research was obtained before all data collection from the University of Calgary and Stanford University Human Research Ethics Boards.

Accelerometry details

Accelerometry data were collected in a standard way for all individuals included in this database. Approximately 1 week before treatment, all individuals were instructed to wear an Actigraph GT1M (Actigraph LLC, Pensacola, FL, USA) on a belt, at the natural waistline on the right hip in line with the right axilla, upon rising in the morning and continuously until going to bed at night, for 7 consecutive days. Devices were only to be removed when bathing or swimming. These devices measure acceleration, and filter these raw acceleration data into a metric known as activity counts, which represent the intensity of physical activity. We used the variable of activity counts for our analysis. Accelerometers have been shown to be valid and reliable for assessment of free-living physical activity (performance) in people with mobility limitations [35–39]. The accelerometer used for the present study, the Actigraph GT1M, is widely accepted in the field as the industry gold standard, and as a valid and reliable tool for assessing ambulatory physical activity [37,39–47].

Data analysis

Inclusion criteria

We included data from individuals with at least 4 days of accelerometry data, defined using wear-time analysis at 10+ hours of wear per day. We defined nonwear periods as at least 90 minutes with zero activity counts, allowing for 2 consecutive interrupted minutes with counts <100, when defining the 10-hour valid day [42]. For all individuals who met minimum wear-time criteria, the weekly values were averaged to get a mean daily value for all accelerometry features (variables).

Accelerometry analysis

Accelerometry data for each participant were analyzed to see whether he/she met the 2008 US Physical Activity Guidelines. These guidelines recommend 150 minutes of MV physical activity per week, accumulated in bouts of 10 minutes or more. Given symptoms of neurogenic claudication, it is unlikely that individuals with LSS would accumulate activity in bouts of 10 minutes or more. Therefore, we also determined the total number of MV minutes for each individual, with the bout requirement removed.

Specifically, the accelerometry data were analyzed to categorize activity on a minute-by-minute basis into different intensities. To do this, we used intensity thresholds as defined by the National Cancer Institute (NCI) [48]. The intervals were sedentary (0–99 counts), light (100–2,019 counts), moderate (2,020–5,998 counts), and vigorous (5,999 counts). Total daily time in each of these intervals was calculated (minutes). Then, to conform to the NCI standards around meeting physical activity recommendations, we determined the number of minutes meeting bout criteria for each individual [48]. About is a 10+ minute window of consistent activity above a certain intensity threshold, allowing for interruptions of 1 or 2 minutes below the threshold, consistent with the NCI methods [48].

Weekly totals were calculated as 7 times the average daily total for persons with at least 4 valid days of monitoring. Each person was classified according to the 2008 Physical Activity Guidelines into the following physical activity levels: Meeting Recommendations (≥150 bouted MV activity minutes per week), Low Active (1–149 bouted MV activity minutes per week), or Inactive (zero bouted MV activity minutes per week). The inactive classification does not indicate the absence of any activity, but specifically the absence of MV activity bouts (eg, zero MV activity occurring in bouts of at least 10 minutes over 7 days).

Physical performance analysis

Because existing analytic methods, including the NCI cutpoints, were not designed to examine data from mobility-limited populations, we employed new methods recently developed by our group to interrogate accelerometry data in musculoskeletal pain populations. These new methods provide increased granularity in the light intensity range of activity where LSS is expected to have the greatest impact on performance. This is important because when employing the traditional NCI cut-points that define light versus MV activity, the nuances of performance in the light range may be missed. This new analysis is known as the Physical Performance analysis [33], and employs accelerometry thresholds that were empirically derived based on the relationships between physical activity and musculoskeletal pain. Expressed in counts/minute, the Physical Performance intervals are: Performance Sedentary (PSE) = 1–99, Performance Light 1 (PL1) = 100–349, Performance Light 2 (PL2) = 350–799, Performance Light 3 (PL3) = 800–2,499, and Performance Moderate/Vigorous (PMV) = 2,500–29,999. The data were analyzed using these thresholds, following the same methods described above for the NCI cut-points.

Results

Of the individuals in the database, 75 were eligible for analysis. Of these 75, 28 were male and 47 were female, with a mean age of 68 years (SD 9, range 49–85). Of the 75 individuals, 3 (4%) were considered as Meeting Guidelines (at least 150 minutes of MV minutes per week) (Table 1). Sixteen individuals (21%) were considered Low Active (1–149 bouted MV minutes per week), and 56 (75%) were considered Inactive (zero bouted MV minutes per week). With the 10-minute bout requirement removed, 10 of 75 (13%) were considered as Meeting Guidelines (7 males and 3 females) (Table 1). Analysis using these NCI thresholds showed that 82% of time was spent in sedentary activity, and 15% of time was spent in light intensity activity (Table 2). The percent of time spent in MV activity was 0.26% for males, 0.13% for females, and 0.14% overall. Because there was negligible activity in the vigorous range, we collapsed moderate and vigorous intervals into one interval (≥2020 counts).

Using the Physical Performance analysis to examine sedentary and light intensity activity, the amount of time spent in the PSE range was 82% for males, 83% for females, and 82% overall (the NCI range for light activity is the same as PSE) (Table 3). When examining the three light intensity ranges, 7% of time was spent in PL1 for males, 8% for females, and 8% overall. PL2 represented 5% of time for males, 5% for females, and 5% overall. Finally, PL3 represented 2.5% of time for males, 2.1% for females, and 2.2% overall. Of time spent in nonsedentary activity, 52.8% was PL1, 31.9% PL2, and 15.0% PL3 (Table 3). Overall, 99.6% of nonsedentary time was spent in light activity.

Discussion

The goal of the present study was to leverage existing accelerometry data to determine the proportion of individuals with LSS meeting the 2008 US Physical Activity Guidelines. We also aimed to better understand the nature of free-living physical activity (performance) in this population, including the distribution of activity among intensity intervals. Given the population sampled, results of the present study apply to people with symptomatic LSS and neurogenic claudication, with walking limitations and LSS-related disability. Results of the present study suggest that people with LSS are extremely sedentary, with only 4% of individuals meeting the Guidelines of 150 minutes of MV physical activity per week. The vast majority of time (82%) was spent in sedentary behavior. Of time spent in nonsedentary behavior, 99.6% was in light activity, with 53% of this time in PL1 (the lowest of light intensities).

It appears that people with LSS are substantially less active than the US general population of the same age [49]. Based on accelerometry data from the National Health and Nutrition Examination Survey (NHANES), between 9% and 26% of individuals aged 60 to 69, and 6% to 10% of adults aged 70 or older are meeting current recommendations for physical activity (depending on cut-points used) [49]. Using 2003–2004 NHANES data with the NCI cut-point of at least 2020 counts/minute, MV activity among 60-to 69-year-olds averaged 12.4 minutes per week for women and 16.7 minutes per week for men, in contrast to the average of 2 minutes for LSS [48]. The average time spent in sedentary behavior for people over 60 is 35% [50], compared with 82% for LSS. Even compared with individuals with osteoarthritis of the hip and knee, the LSS population is less active [2]. Based on accelerometry data, 12.9% of men and 7.7% of women with radiographic knee osteoarthritis are meeting the current US Physical Activity Guidelines [51].

This sedentary behavior has a number of important implications for people with LSS, including functional decline, decreased autonomy, and strength deficits [23]. Weight gain associated with inactivity has the potential to limit treatment options, including surgery for people with severe LSS [52–54]. Continued sedentary behavior may lead to diseases of inactivity, including cardiac disease, diabetes, metabolic syndrome, and certain forms of cancer [55]. There is an urgent need for management strategies aimed at reducing sedentary behavior and increasing activity in this population. Increasing physical activity in people with LSS would not only improve physical function but also prevent these individuals from re-entering the health-care system with diseases of inactivity.

Unfortunately, there are no clinical guidelines for prescribing physical activity in LSS. As mentioned, it may seem reasonable for care providers to endorse the 2008 US Physical Activity Guidelines, which prescribe 150 minutes of MV physical activity per week. However, results of the present study suggest that this recommendation may not be realistic as a starting goal for people with symptomatic LSS. Only 3 individuals of 75 (4%) met the guidelines when using 10-minute bouts of activity to reach 150 minutes, and when the bout requirement was removed, 10 of 75 (13%) met the guidelines. The vast majority of people (75%) were considered “inactive,” with not even 1 minute of MV activity recorded.

These results suggest that we need to start thinking about appropriate disease-specific approaches to both assessing and prescribing physical activity for people with LSS. In particular, when assessing people with LSS, and when designing disease-specific approaches to activity prescription, we could begin to increase focus on light intensity activity. In this LSS sample, 99.6% of nonsedentary time was spent in light activity, whereas less than 1% of time was spent in MV activity. It is apparent that people with symptomatic LSS are almost never active in the moderate range, and even less so in the vigorous range.

From an analytic perspective, these results confirm the need for methods tuned to interrogate performance in the light intensity ranges, such as the Physical Performance analysis [33]. This type of analysis allows us to better probe the impacts of LSS on free-living physical function by focusing on the spectrum of activity where people with LSS spend most of their time (sedentary and light activity). As mentioned, when employing the traditional cut-points that define light versus MV activity, such as the NCI cut-points, the nuances of performance in the light range may be missed. This is extremely important when studying conditions like LSS, given that the impacts of LSS symptoms on function are expected to be manifested in this range [21].

From an exercise prescription perspective, these results suggest that disease-specific interventions may need to focus on decreasing sedentary behavior and increasing the time spent in any type of activity. Given that people with LSS are largely sedentary, and almost never active in the moderate range, it may be unrealistic to prescribe moderate intensity activity as an initial goal, or as the only goal for exercise prescription. It may be more appropriate for new interventions to target reductions in sitting time, and to promote increased time in the higher ranges of light activity, transitioning to moderate activity when appropriate. It may be feasible to employ the Physical Performance analysis as a baseline for prescribing exercise in people with LSS. This analysis could be used to identify current activity patterns, and to set personalized and realistic goals for physical activity. Because these new intervals provide greater granularity in the light intensity range, we can get a clearer picture of baseline physical performance characteristics, and use this information to target small but important changes in physical activity. For example, an individual who is primarily sedentary, with some activity in the PL1 range, may be capable of increasing time spent in the PL1 range by 10 minutes, and perhaps add 3 minutes of activity in the PL2 range. However, it would be unrealistic to expect that individual to suddenly become active in the MV range, and definitely not realistic to expect him/her to do 150 minutes of MV activity per week initially. The goal would be to increase time spent in his/her current intensity ranges, while attempting to add time in activities at a higher intensity. Simply breaking up periods of sitting, or increasing leisurely walking time by a few minutes could have important impacts on overall health, weight loss, and risk for disease. For example, in arthritis research, although there is no minimum dose of MV activity that results in health benefits, just moving from the inactive category to low active (1– 149 bouted MV minutes per week) has been shown to have substantial benefits including reduced mortality, as well as reduced risk for coronary heart disease, hypertension, and diabetes [51].

Results of the present study also support the notion that when prescribing exercise for people with symptomatic LSS, a focus on extended bouts of ambulatory activity may not be appropriate. It is recognized clinically that neurogenic claudication limits consecutive walking in people with LSS [56]. In studies of LSS, individuals walk until forced to stop because of symptoms, and almost never sustain physical activity over a long period of time [2,3,17,56]. It follows that recommending an increase in physical activity throughout the day, in whatever way possible (shorter bouts), may be more realistic than requiring an activity to be over an extended period of time, like 10 minutes. Results of the present study suggest that in real life, people with LSS almost never have extended bouts of activity, and definitely not bouts of MV activity over 10 minutes. It is possible that the traditional bout metrics employed in the present study (10 minute bouts of MV activity) may not be appropriate for studying people with LSS. Future research could aim to define disease-specific bout metrics that would be realistic in an LSS population, and sensitive to small but important changes in performance.

Strengths and limitations

This is the first study of which we are aware to leverage a large set of objectively measured physical activity data (accelerometry) from a sample of individuals with symptomatic LSS and neurogenic claudication. The present study provides valid information on what people with LSS are actually doing in their day-to-day life. One limitation of the present study is the inability of accelerometers to capture nonambulatory activities such as swimming or cycling. This type of analysis will become possible as technology for measurement of such activities becomes available. It may be that people with LSS are physically active in modes not captured by these devices. Accelerometers are also unable to provide context on where activities are taking place (eg, where do people walk, with whom). This type of information would be important in designing physical activity interventions. Finally, results of the present study are limited to people with symptomatic LSS, neurogenic claudication, walking limitations, and LSS-related disability seeking care in either Canada or the United States who had 4 valid days of accelerometry data. Future research aims to continue this investigation in a larger sample of people with LSS, with a broader international representation.

Future research

The present study represents an important first step in the development of physical activity guidelines for LSS. However, to develop true evidence-based physical activity guidelines, we need to understand the dose-response relationships between activity and important clinical outcomes in people with LSS. Therefore, the next step is to understand how changes in performance relate to changes in other clinical outcomes including pain, disability, and quality of life. The goal is to conduct prospective trials that study the effects of varying doses of physical activity on these important clinical outcomes.

Conclusions

In conclusion, the present study confirms that people with symptomatic LSS, neurogenic claudication, walking limitations, and LSS-related disability are extremely sedentary, and are not meeting the guidelines for physical activity. There is an urgent need for interventions aimed a reducing sedentary behavior and increasing the overall level of physical activity in LSS, not only to improve function but also to prevent diseases of inactivity. The present study suggests that reducing sedentary time, increasing time spent in light intensity activity, and increasing time spent in higher intensities of light activity may be appropriate as initial goals for exercise interventions in people with symptomatic LSS and neurogenic claudication, transitioning to moderate activity when appropriate. Results of the present study also demonstrate the importance of employing disease-specific measures for assessment of performance in LSS, and highlight the potential value of these methods for developing targeted and realistic goals for physical activity. Physical activity goals could be personalized using objective assessment of performance with accelerometry. The present study is one step toward a personalized medicine approach for people with LSS, focusing on increasing physical function.

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Table 1

Meeting activity guidelines

	Bouted activity			Nonbouted activity	
	0 Bouts (Inactive)	**1–149 Minutes (Low active)**	**150+ Minutes (Meeting guidelines)**	**0–149 Minutes (Inactive/Low active)**	**150+ Minutes (Meeting guidelines)**
Females	38 (81%)	8 (17%)	1 (2%)	44 (94%)	3 (6%)
Males	18 (64%)	8 (29%)	2 (7%)	21 (75%)	7 (25%)
Combined	56 (75%)	16 (21%)	3 (4%)	65 (87%)	10 (13%)

Bouted activity indicates moderate-vigorous activity minutes counted only when they occur within a minimum 10-minute sustained activity bout. Nonbouted activity includes all moderate-vigorous activity minutes.

Table 2

Minutes spent per week in each intensity interval: National Cancer Institute intervals and Physical Performance intervals

		PSE_1-99	PL1_100-349	PL2_350-799	PL3_800-2499	PMV_2500+	NCI_0-99	NCI_100-2019	NCI_2020+
Female	1st quartile	1124.6 (78.1)	94.76 (6.58)	43.8 (3.04)	16.67 (1.16)	0.14 (0.01)	1124.6 (78.1)	180.46 (12.53)	0.76 (0.05)
	Median	1194.17 (82.93)	117.2 (8.14)	67.83 (4.71)	30.5 (2.12)	0.6 (0.04)	1194.17 (82.93)	219.83 (15.27)	1.83 (0.13)
	3rd quartile	1247.21 (86.61)	131.46 (9.13)	88.36 (6.14)	51.3 (3.56)	1.63 (0.11)	1247.21 (86.61)	266.85 (18.53)	5.44 (0.38)
Male	1st quartile	1153.58 (80.11)	73.96 (5.14)	38.25 (2.66)	18.19 (1.26)	0.29 (0.02)	1153.58 (80.11)	120.32 (8.36)	1 (0.07)
	Median	1180 (81.94)	101.95 (7.08)	69.04 (4.79)	36 (2.5)	1.76 (0.12)	1180 (81.94)	219.67 (15.25)	3.79 (0.26)
	3rd quartile	1252 (86.94)	124.13 (8.62)	88.38 (6.14)	67.25 (4.67)	8.35 (0.58)	1252 (86.94)	262.22 (18.21)	20.76 (1.44)
Combined	1st quartile	1133.68 (78.73)	86.43 (6)	42.31 (2.94)	16.67 (1.16)	0.15 (0.01)	1133.68 (78.73)	164.5 (11.42)	0.86 (0.06)
	Median	1186.14 (82.37)	113.83 (7.91)	68.75 (4.77)	32.25 (2.24)	0.75 (0.05)	1186.14 (82.37)	219.83 (15.27)	2 (0.14)
	3rd quartile	1249.21 (86.75)	129.42 (8.99)	88.42 (6.14)	60.76 (4.22)	3.5 (0.24)	1249.21 (86.75)	266.68 (18.52)	9.92 (0.69)

PSE_1-99: Performance Sedentary Interval; PL1_100-349: Performance Light 1 Interval; PL2_350-799: Performance Light 2 Interval; PL3_800-2499: Performance Light 3 Interval; PMV_2500+: Performance Moderate-Vigorous Interval; NCI_0-99: National Cancer Institute Sedentary Interval; NCI_100-2019: National Cancer Institute Light Intensity Interval; NCI_2020+: National Cancer Institute Moderate-Vigorous Interval.

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Table 3

Total activity time and percent of time spent in different physical performance intervals

	PL1_100-349 (%)	PL2_350-799 (%)	PL3_800-2499 (%)	PMV_2500+ (%)	Total Activity Minutes
Female	54.23	31.38	14.11	0.28	216
Male	48.84	33.07	17.25	0.84	209
Combined	52.80	31.89	14.96	0.35	216

PL1_100-349: Performance Light 1 Interval; PL2_350-799: Performance Light 2 Interval; PL3_800-2499: Performance Light 3 Interval; PMV_2500+: Performance Moderate-Vigorous Interval.