Spanish Journal of Statistics
Vol. 7 No. 1 2025, Pages 75–89
doi:https://doi.org/10.37830/
SJS.2025.1.04

Regular Article

Feasibility of Implementing Accelerometers in the Spanish Health Survey

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Received: July 28, 2025. Returned: -. Revised: -. Accepted: October 23, 2025.

Abstract: Accurately measuring physical activity, sedentary behavior, and sleep is vital for public health monitoring, but self-reported data are often biased. Accelerometers offer objective data, yet their feasibility within the Spanish Health Survey (ESdE) has not been assessed. This study evaluated the integration of thigh-worn accelerometers in ESdE by analyzing participant compliance, device usability, data return, and comparisons with self-reported measures. A total of 100 adults aged 30–90 were recruited through five provincial delegations of the National Statistics Institute (INE), with each delegation enrolling 20 participants equally split between home-based collection and prepaid return groups. All participants wore a thigh-mounted SENS accelerometer continuously for 7 to 10 days using a water-resistant patch, with two patches provided in case of replacement. INE staff administered the ESdE questionnaire and coordinated device logistics. Valid accelerometry data were obtained from 98 participants, with excellent compliance. Device return rates were 100collection and 85Comparison with self-reported data was only possible for sedentary behavior, where participants consistently underestimated sitting time. Agreement between self-reports and accelerometry was low (ICC = -0.05 to 0.43), and Bland-Altman plots revealed a clear negative bias. These findings demonstrate the feasibility of incorporating accelerometry into national surveys like ESdE, with high participant adherence and minimal operational issues. The objective data provided by accelerometers can complement self-reported measures and capture domains like sleep and incidental activity, which are often missed. Their inclusion in future surveys may enhance the accuracy and utility of lifestyle surveillance in Spain.

Keywords: accelerometry, physical activity, sedentary behavior, sleep, health survey, feasibility, self-report, objective measurement, public health surveillance

MSC: 62P10, 62C05, 62M20, 68T09

1 Introduction

A healthy lifestyle, characterized by regular physical activity, reduced sedentary behavior, and sufficient sleep, plays a crucial role in reducing morbidity and mortality DelPozoCruz2022.JAMAInternalMedicine, McGregor2021.EuropeanJournalOfPreventiveCardiology. The World Health Organization (WHO) and national guidelines recommend at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic physical activity per week, along with muscle-strengthening exercises twice a week (Bull et al., 2020), to promote health (López-Bueno et al., 2023). Additionally, limiting sedentary time (Bull et al., 2020) and ensuring 7–9 hours of sleep per night (Watson et al., 2015) are associated with a lower risk of chronic disease and improved quality of life.

Despite their well-documented benefits, accurately assessing these behaviors at the population level remains challenging. National health surveys, such as the Spanish Health Survey (ESdE), primarily rely on self-reported questions, which are currently the only widely available tool for assessing lifestyle behaviors at the population level. While these self-reported measures are cost-effective and provide valuable information, it is important to recognize their inherent limitations, such as recall bias, social desirability bias, and limited ability to capture incidental or unstructured movement. These limitations may lead to some degree of misclassification and potential underestimation of associations between lifestyle behaviors and health outcomes. Therefore, complementary objective measures, such as accelerometry, can enhance the accuracy and depth of data collected in national health surveys, improving public health monitoring and research (Pedišić and Bauman, 2015).

Accelerometers, commonly embedded in smartwatches, activity trackers, and smartphones, capture continuous movement data with high temporal resolution, enabling more precise detection of physical activity intensity, sedentary patterns, and sleep behaviors. Large-scale epidemiological studies, such as NHANES in the United States (Matabuena et al., 2022), the UK Biobank (del Pozo Cruz et al., 2022,?), and the SHARE study in Europe (del Pozo Cruz et al., 2023), have successfully incorporated accelerometry to enhance population-level lifestyle surveillance, demonstrating its feasibility and scientific utility.

However, the feasibility of integrating accelerometry into ESdE remains unexplored, limiting the expansion of objective lifestyle data at the population level. Given that self-reported data inherently depend on respondents' recall and perception, complementary objective measurements could provide valuable additional insights. This study assessed the feasibility of implementing accelerometers in ESdE to objectively measure physical activity, sedentary behavior, and sleep patterns. Specifically, we evaluated participant compliance, device usability, and adherence to wear protocols, while also comparing accelerometer-derived data with self-reported measures to identify potentential discrepancies between subjective and objective assessments. Additionally, we examined operational and logistical challenges, including device distribution, retrieval methods, and data processing, to assess the practicality of large-scale implementation. By addressing these objectives, this study provides insights into the feasibility of using accelerometers in national health surveys, identifying potential barriers and facilitators for their future application in large-scale public health monitoring.

2 Methods

2.1 Study Design and Participants

This feasibility study was conducted within the framework of ESdE to assess the integration of accelerometers into routine population health data collection. The study was carried out in collaboration with the Spanish National Statistical Institute (INE) and implemented across five provincial INE delegations. Each delegation recruited 20 volunteers, resulting in a total sample of 100 participants. Participants were recruited through the INE network and volunteers from each delegation. While this was a convenience sample, efforts were made to ensure an even distribution of participants across age groups (30–90 years) and sex. The study was conducted in accordance with the principles of the Declaration of Helsinki. Participants signed an informed consent form before taking part in the study and were informed verbally about its details.

To evaluate different data collection approaches, the first 10 participants recruited in each delegation were assigned to the home-based collection group, while the remaining 10 participants were assigned to the prepaid return group. In the home-based collection group, trained INE personnel visited participants' homes, administered the ESdE questionnaire, provided the accelerometer, and returned after the monitoring period to collect the device. In the prepaid return group, participants received the accelerometer during the ESdE visit, along with a prepaid envelope to return the device by mail after the monitoring period. All participants were instructed to wear a SENS accelerometer on their thigh continuously for 7 to 10 consecutive days, day and night, without removal.

2.2 Training and Data Collection Procedures

A standardized training session was conducted at the central INE offices to ensure adherence to study protocols across all delegations. Fieldworkers from the five provincial delegations participated in face-to-face hands-on training, where they received all necessary materials and devices. The session covered proper accelerometer placement, participant guidance, device retrieval logistics for home visits and prepaid returns, and quality control measures for data validation. Additionally, participants attended a remote session on administering the ESdE questionnaire.

Participants were instructed to wear the device continuously without removal, as the patch was water-resistant, allowing them to wear it while showering and engaging in daily activities. To account for potential adhesion issues, each participant received two patches, enabling them to replace the device if detachment occurred. Compliance was monitored through self-reported adherence logs, and participants were encouraged to report any issues with device wear.

2.3 Accelerometer Device and Data Processing

The SENS accelerometer was selected for its validated capability to measure physical activity, sedentary behavior, and sleep patterns. This waterproof triaxial accelerometer (45 × 23 × 5 mm, 6 g) was designed to be worn on the thigh, approximately 10 cm above the lateral epicondyle, using a skin-attached patch specifically designed for the device. It recorded acceleration at 12 Hz, capturing orientation and movement intensity. Data were transmitted wirelessly to a smartphone application every 10 minutes when within range or stored for later transmission. Anonimized raw data were automatically uploaded to a secure web server for processing. A previously validated rule-based, activity pattern recognition algorithm was used to process the data (Pedersen et al., 2022; Milther et al., 2023; Bartholdy et al., 2018; McGrosky et al., 2025). Recorded data were analyzed in 5-second epochs, categorizing each interval into one of nine predefined activity categories based on movement frequency, intensity, and sensor orientation using a validated pattern-recognition algorithm. These categories included Resting (lying or sitting rest), Lying or Sitting Movement, Standing, Sporadic Walking, Walking, Moderate Intensity, High Intensity or Running, Cycling, and Steps Taken. Step detection was based on FFT frequency-domain analysis, differentiating between sporadic, continuous, and high-intensity steps. The intensity count, ranging from 0 to 100, was derived from high-pass filtered accelerometer data, subtracting noise to ensure accurate classification. Standing was identified with intensity values below 2, sporadic walking fell between 2 and 10, continuous walking was detected between 10 and 50, moderate-intensity activities such as slow running ranged between 50 and 75, and high-intensity activities such as fast running exceeded 75.

Bedtime was detected within a predefined nighttime window between 6:00 PM and 1:00 AM, ensuring a focus on nocturnal rest while excluding daytime naps. Sleep onset was estimated as the last walking episode lasting more than one minute between 6:00 PM and 1:00 AM, while wake time was identified as the first walking episode lasting at least 30 seconds between 5:00 AM and 12:00 PM. Once these parameters were established, sleep was further classified into three categories based on movement patterns: Sleep No Movement, Sleep Movement, and Sleep Active. Sleep No Movement was characterized by a horizontal body position within ±45 degrees, with an intensity count below 2, indicating minimal or no movement. Sleep Movement occurred when the participant remained in a lying position but exhibited low-to-moderate movement, classified by an intensity count above 2. To improve classification accuracy, detected movements were assigned an additional 30 seconds before and after the event. This category primarily represented lighter sleep stages, where movement was more frequent. Sleep Active identified episodes in which the participant was standing upright within ±45 degrees during sleep periods, regardless of whether movement occurred. This classification was indicative of brief awakenings or nighttime restlessness.

2.4 Feasibility Assessment

Feasibility was evaluated by assessing compliance rates, return rates, participant burden, and operational challenges. Compliance was monitored through self-reported adherence logs, and participants were encouraged to report any issues with device wear. Compliance rates were determined by the percentage of participants who wore the accelerometer continuously for at least 7 valid days (or 10 days when applicable), without non-wear periods. Return rates were measured as the percentage of devices successfully retrieved. Participant burden was assessed through self-reported feedback on ease of use, comfort, and willingness to participate in future similar studies. Operational challenges were documented based on fieldworker feedback regarding recruitment, device management, and logistical difficulties. A focus group was conducted with the interviewers involved in data collection to discuss practical challenges and perceptions of feasibility.

2.5 Comparison with Self-Reported Measures

To evaluate potential discrepancies between subjective and objective assessments, participants completed a questionnaire as part of the ESdE survey, which inquired about their physical activity and sedentary behavior. The questionnaire included questions about the number of days per week they engage in moderate-to-vigorous physical activities (MVPA) such as sports, gymnastics, cycling, or brisk walking for at least 10 consecutive minutes, as well as the total amount of time dedicated to these activities in a typical week, reported in hours and minutes. Sedentary behavior was measured by asking participants to report the total amount of time they spend sitting on a typical day, including time spent at work, home, studying, reading, commuting, or engaging in leisure activities such as watching television.

In this study, we focused on comparing sedentary time between self-reported and accelerometer-derived data, as sedentary behavior represents a comparable construct across both methods. Sedentary time was estimated from accelerometry using the sum of time spent resting while sitting or lying down and moving while sitting.

In contrast, accelerometer-derived physical activity and self-reported MVPA represent different but complementary constructs. Accelerometry captures a continuous and comprehensive spectrum of movement intensity and patterns throughout the day, including incidental and unstructured activities that are not fully captured by questionnaire items focused on specific types of physical activity performed in bouts of at least 10 minutes. Therefore, direct comparison between accelerometer-measured physical activity and selfreported MVPA is not appropriate. Instead, these methods provide complementary insights that together offer a more complete understanding of participants' activity behaviors.

2.6 Statistical Analysis

Descriptive statistics were used to summarize participant characteristics, wear-time compliance, and device return rates. Compliance and return rates were reported separately for each data collection. Agreement between self-reported and accelerometer-derived sedentary time was assessed using Bland-Altman plots, intraclass correlation coefficients (ICC), and Spearman's correlation coefficients. All analyses were conducted in R (v4.3.1), and statistical significance was set at $p < 0.05$.

3 Results

3.1 Feasibility and Implementation Outcomes

The study initially enrolled 100 participants, all of whom were given the option to wear the device for 7 to 10 days. Compliance was excellent, with no data loss except for one participant who only wore the device for 2 days, leading to their exclusion from the final dataset and reducing the number of valid participants to 99. Additionally, one participant lost the device before wearing it, meaning they were recruited but did not contribute usable data, further reducing the dataset to 98 participants with valid measurements. Table 1 and Table 2 shows the participants characteristics and accelerometer-derived lifestyle behaviors measurements, respectively.

For data collection, devices were either picked up at home or returned via mail. While no devices were lost during home-based pickups (100returned via mail (85devices were lost, all data were successfully recovered. As a result, the final dataset consisted of 98 participants, all with complete and usable data for analysis.

A virtual focus group was conducted with the interviewers involved in device placement and retrieval to assess feasibility. Interviewers reported that, overall, the study procedures were feasible and well-received by participants. However, several operational challenges emerged. Some participants, particularly older adults, required in-person assistance for device placement despite receiving written instructions. Participants with hairy thighs reported difficulties with adhesion, which sometimes led to early detachment or discomfort. In some cases, individuals initially hesitated to wear the device due to concerns about having an unfamiliar object attached to their body, but most reported that they stopped noticing it after a few days. Some participants also requested reminders to remove the device at the end of the monitoring period, although this was not strictly necessary since the device automatically stopped recording on the programmed date.

3.2 Device Placement and Technical Issues

During the implementation of the preference-based device placement method, several minor incidents were reported. Three participants required assistance with device attachment due to physical limitations or lack of confidence with the device, but the remaining 95 participants were able to self-administer it successfully.

Adhesion issues were reported in two cases, particularly after prolonged wear or water exposure, requiring device replacements. Although the device was water-resistant, some detachment incidents (e.g., swimming, clothing changes) suggest that improved guidance on device maintenance and reattachment could enhance compliance.

Additionally, some participants reported skin-related or usability concerns, including mild irritation, difficulties in device removal due to strong adhesion, and interference caused by body hair affecting proper placement. Furthermore, some older participants expressed reluctance to use the device due to perceived discomfort. In general, however, most participants reported that, after the initial adjustment period, wearing the accelerometer was not bothersome.

Lastly, two MRI scans had to be repeated because participants did not remove the device, highlighting the need for clearer instructions regarding MRI compatibility.

3.3 Comparison with Self-Reported Measures

For sedentary time, Bland-Altman plots revealed a systematic underestimation of sitting time in self-reported measures, with the mean difference significantly below zero (Figure 1). This suggests that individuals tend to report less sitting time compared to accelerometer-derived estimates. The limits of agreement were wide, reinforcing the high variability of self-reported sedentary time (Figure 1). Intraclass correlation coefficients (ICC) were notably lower than for physical activity, with ICC values ranging from -0.05 (single absolute agreement) to 0.43 (average fixed raters), indicating poor agreement (Table 3). Spearman's correlation coefficient (rho = 0.39, $p < 0.001$) further supported this finding, suggesting that self-reported sedentary time is a weak proxy for objectively measured sitting time.

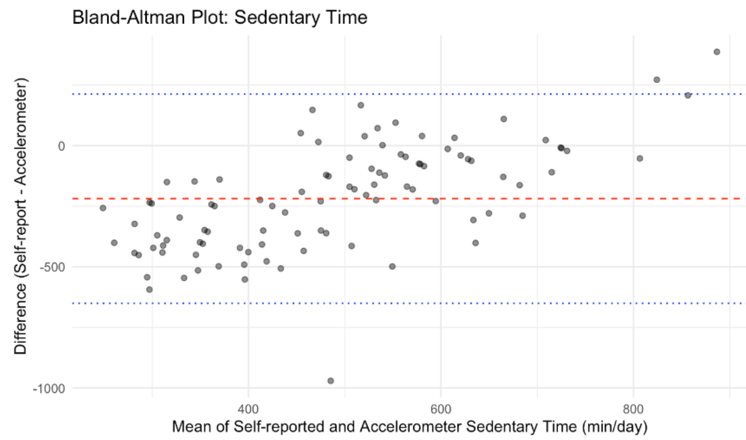

Figure 1: Mean of self-reported and accelerometer sedentary time (min/day)

4 Discussion

This study support preliminary evidence of feasibility of integrating thigh-worn accelerometers into ESdE, with high compliance, minimal data loss, and effective logistics for device placement and retrieval. However, certain practical challenges emerged that should be considered for future large-scale implementation.

One of the main challenges identified was related to device placement and participant adherence. While most participants self-administered the device, some required assistance, particularly older adults. This aligns with previous research, where older individuals have shown greater difficulty following placement instructions, often requiring additional guidance to ensure compliance (Alaqil et al., 2024). Similarly, past studies have highlighted adhesion issues, particularly with prolonged wear and exposure to water (Alaqil et al., 2024). Although providing two patches in this study helped address some of these challenges, improved guidance on reattachment and skin preparation could further reduce these issues.

Initial reluctance to wear the device was reported by some participants, primarily due to concerns about having an unfamiliar object attached to their body for an extended period. However, most reported that these concerns diminished after a few days, which is consistent with findings from previous feasibility studies on wearable accelerometers (Hamer et al., 2020). Furthermore, several participants requested reminders about when to remove the device at the end of the study period. While this did not impact data collection due to the device's pre-programmed recording period, it suggests that additional communication strategies could enhance participant engagement and adherence in future large-scale implementations.

The high compliance and feasibility outcomes observed in this study are in line with previous research examining accelerometer wear time and usability (Milther et al., 2023; Alaqil et al., 2024;

Hamer et al., 2020). Studies evaluating accelerometer feasibility in population-based surveys have consistently shown high adherence, particularly when devices are comfortable, waterproof, and accompanied by clear instructions. Research on thigh-worn accelerometers has demonstrated their capacity to reliably capture physical activity and sedentary behavior, reinforcing their suitability for large-scale public health surveillance.

Our results suggest that some discrepancies may exist between self-reported and accelerometer-derived sedentary time. We found that our participants tended to self-report less sedentary time compared to the sedentary time recorded by the accelerometer. This finding is consistent with previous evidence showing a systematic underestimation of sedentary time in undergraduate students (Nelson et al., 2019), adults (Arango Vélez et al., 2020), or older women (Shiroma et al., 2015), where self-reported sedentary time was underestimated when compared with accelerometer measurements.

However, it is important to recognize that self-reported questionnaires and accelerometry capture different yet complementary aspects of physical activity and sedentary behavior. Questionnaires, such as those used in ESdE, provide valuable contextual information about the type, setting, and subjective experience of physical activity, which cannot be fully captured by accelerometers. Conversely, accelerometers offer continuous, objective data on movement patterns, intensity, and duration, including incidental and unstructured activities often missed by self-report. Integrating self-reported and accelerometer-derived data can enrich our understanding of lifestyle behaviors. This combined approach enhances the precision and contextualization of physical activity and sedentary behavior assessment, providing a more comprehensive foundation for public health monitoring of lifestyles.

Implications for Future Research and Policy

If confirmed in larger studies, our results may support the potential scalability of accelerometry in national health surveys. However, several refinements should be considered for future implementation. First, improving instructions on device placement—particularly for older adults and those with long body hair—may enhance adherence. Additionally, the study highlights the importance of participant education to address trust issues and initial hesitation regarding the device.

From a methodological perspective, integrating accelerometers into national surveys presents clear advantages over including self-reported measures only. The current approach in ESdE relies on self-reported assessments of physical activity and sedentary behavior. Although the physical activity questions included in the ESdE are standardized within the European Health Interview Survey (EHIS), they do not originate from a full validated questionnaire—i.e., a tool rigorously tested for reliability and accuracy across populations but rather consist of a set of independent questions designed to capture selected aspects of activity patterns. This limits their ability to comprehensively assess movement behaviors and introduces challenges when comparing results with studies using validated instruments.

One of the key features of the current ESdE approach is its use of a 10-minute bout criterion for physical activity reporting, which aligns with the standardized methodology agreed upon by EHIS and member states. While this approach provides a consistent framework for data collection and comparison across countries, recent evidence suggests that accumulating shorter bouts of movement throughout the day may also contribute significantly to health benefits (Stamatakis et al., 2025; Ahmadi et al., 2022). Incorporating accelerometry into the survey offers an opportunity to capture these shorter, incidental, and unstructured activities, thereby enhancing both the quantity and quality of information on real-world movement patterns and overall energy expenditure.

Additionally, current self-reported measures primarily capture structured physical activities, such as sports participation and active transportation, which provide valuable information within these domains. However, a wide range of daily movements—including household chores, occupational movement, and spontaneous short bouts of physical activity—may not be fully captured by questionnaires. These types of activities can be objectively recorded using accelerometers (Stamatakis et al., 2025). Given the growing evidence supporting the health benefits of lightintensity activities (del Pozo Cruz et al., 2021),integrating objective measures alongside self-reports can provide a more complete picture of overall physical activity levels.

Another important consideration is the inherent limitations of self-reported methods in accurately assessing sedentary behavior. While the ESdE includes questions on total sitting time, self-reported sedentary behavior is subject to recall bias and may underestimate true sedentary time. Accelerometry offers continuous, objective data on sedentary patterns, including prolonged bouts of uninterrupted sitting, which are particularly relevant due to their association with adverse health outcomes (Saunders et al., 2020).

Beyond physical activity and sedentary behavior, sleep duration and patterns are not currently assessed in the ESdE, despite being a key component of lifestyle and health. Accelerometers offer the advantage of capturing both movement and sleep parameters, providing a more complete picture of daily behaviors that impact health. The inclusion of sleep monitoring in future national health surveys could offer valuable insights into its interaction with physical activity and sedentary time, further strengthening public health surveillance.

Despite these advantages, it is important to acknowledge that accelerometers cannot measure all aspects of physical activity, particularly muscle-strengthening exercises, which are included in the current survey, albeit only the number of days dedicated to it and not time. Resistance training activities often involve minimal movement at the acceleration level detectable by these devices, making it necessary to maintain a complementary role for selfreported information in certain domains. However, combining accelerometry with contextual self-reported data would enhance the interpretability of results, allowing for a better understanding of when, where, and why individuals engage in specific movement behaviors.

Given its ability to objectively and comprehensively assess movement behaviors, policymakers should consider the long-term integration of accelerometry into national health surveillance. This would improve the precision of lifestyle behavior monitoring, provide stronger epidemiological evidence, and support the development of more effective public health strategies to promote physical activity and reduce sedentary time at the population level.

4.1 Conclusions

This study provides preliminary evidence of the feasibility of using thigh-worn accelerometry for objective lifestyle monitoring within ESdE. Despite minor adhesion and usability challenges, compliance was excellent, and no data loss occurred among participants who met the minimum wear-time criteria. Most participants successfully self-administered the device, reinforcing its scalability for large population-based surveys. Self-reported measures tend to overestimate physical activity and underestimate sedentary time, reinforcing the importance of integrating accelerometry into future national surveys. Moving forward, a combined approach using both self-reported and objective measures may enhance the accuracy of population-level lifestyle assessments.

Acknowledgments

We sincerely thank the interviewers from the participating delegations of the National Department of Statistics (Susana María Morales Jiménez, Guadalajara; Antonio Luna Gomez, Madrid; Carmen Soriano Martín, Granada; Raúl Sala Gómez, Alicante; Angel Manuel Estévez Rivera, Alicante; and Rafael Ferrer Chamorro, Málaga) for their support in data collection and participant engagement. We also extend our gratitude to all participants for their commitment to this study.

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Table 1. Characteristics of participants in the study (n=100)

Variable	Value
Age (yrs.)	53.48 (14.78)
Female, n, %	56 (56.0%)
Employed, n, %	70 (70.0%)
University graduate or above, n, %	53 (53.0%)
Spanish, yes, %	96 (96.0%)
Married, n, %	61 (61.0%)
Self-reported health status, n, %	
Very good	21 (21.0%)
Good	48 (48.0%)
Fair	27 (27.0%)
Bad	3 (3.0%)
Very bad	1 (1.0%)
Body Mass Index (Kg/m²)	25.40 (4.04)
No smoker, n, %	55 (55.0%)
Alcohol intake, n, %	
5-6 days per week	14 (14.0%)
3-4 days per week	4 (4.0%)
1-2 days per week	10 (10.0%)
1-2 days per week	31 (31.0%)
2-3 days per month	12 (12.0%)
Once per month	6 (6.0%)
Less than once per month	11 (11.0%)
None in the last 12 months	4 (4.0%)
Never	8 (8.0%)
Chronic disease, yes, n, %	65 (65.0%)
No limitations, n, %	66 (66.0%)
Difficulty walking 500 meters, no difficulty, n, %	94 (94.0%)
Difficulty climbing up or down 12 steps, no difficulty, n, %	91 (91.0%)
Physical activity main occupation, n, %	
Sitting most of the time	63 (63.0%)
Standing up most of the time	21 (21.0%)
Walking most of the time	10 (10.0%)
Engaging in tasks that require high physical effort	2 (2.0%)
Not applicable	2 (2.0%)
Do not know/do not answer	2 (2.0%)
Frequency of leisure time physical activity, n, %	
Never	14 (14.0%)
Physical activity occasionally	19 (19.0%)
Physical activity several times per month	17 (17.0%)
Physical activity several times per week	50 (50.0%)
Walking for transport 10 minutes or more, days, n, %	
0	4 (4.0%)
1	0 (0%)
2	4 (4.0%)
3	9 (9.0%)
4	6 (6.0%)
5	6 (6.0%)
6	4 (4.0%)
7	67 (67.0%)
Cycling for transport 10 minutes or more, days, n, %	
0	84 (84.0%)
1	5 (5.0%)
2	3 (3.0%)
3	2 (2.0%)
4	1 (1.0%)
5	2 (2.0%)
7	3 (3.0%)
Moderate-to-vigorous physical activity (min/day)	36.62 (37.95)
Sitting time (min/day)	379.32 (233.50)
Values are mean (SD) unless otherwise stated	

Table 2. Accelerometer-derived descriptive statistics (n=98)

Valid days	8.39 (1.22)
Sitting (min/day)	569.05 (114.95)
Sitting with movement (min/day)	29.03 (14.24)
Standing (min/day)	106.52 (40.10)
Sporadic walking (min/day)	104.14 (25.92)
Walking (min/day)	126.00 (35.28)
Moderate-intensity activity (min/day)	21.82 (20.10)
High-intensity activity-running (min/day)	3.48 (7.17)
Cycling (min/day)	3.39 (6.72)
Restorative sleep (min/day)	389.91 (66.14)
Restless sleep (min/day)	76.67 (33.07)
Active while sleep (min/day)	3.20 (4.21)
Sit-to-stand transitions (count)	72.95 (21.01)
Daily steps, brisk walking	10710.13 (4281.88)
Daily steps, slow walking	2465.07 (608.54)
Daily steps, sporadic walking	3339.82 (905.53)
Valid days, weekdays	6.15 (1.17)
Sitting (min/day), weekdays	572.54 (118.31)
Sitting with movement (min/day), weekdays	29.47 (14.33)
Standing (min/day), weekdays	107.75 (41.92)
Sporadic walking (min/day), weekdays	104.41 (27.70)
Walking (min/day), weekdays	127.04 (38.12)
Moderate-intensity activity (min/day), weekdays	23.32 (21.46)
High-intensity activity-running (min/day), weekdays	3.55 (7.31)
Cycling (min/day), weekdays	2.79 (4.51)
Restorative sleep (min/day), weekdays	382.64 (63.47)
Restless sleep (min/day), weekdays	73.96 (33.44)
Active while sleep (min/day), weekdays	2.39 (2.65)
Sit-to-stand transitions (count), weekdays	74.58 (22.13)
Daily steps, brisk walking, weekdays	10922.88 (4478.43)
Daily steps, slow walking, weekdays	2465.87 (648.95)
Daily steps, sporadic walking, weekdays	3365.33 (972.98)
Valid days, weekend days	2.23 (0.55)
Sitting (min/day), weekend days	555.67 (150.46)
Sitting with movement (min/day), weekend days	28.02 (17.31)
Standing (min/day), weekend days	105.16 (46.60)
Sporadic walking (min/day), weekend days	105.31 (35.08)
Walking (min/day), weekend days	125.94 (44.60)
Moderate-intensity activity (min/day), weekend days	17.35 (19.46)
High-intensity activity-running (min/day), weekend days	3.28 (8.45)
Cycling (min/day), weekend days	4.80 (14.08)
Restorative sleep (min/day), weekend days	409.16 (93.77)
Restless sleep (min/day), weekend days	84.88 (40.51)
Active while sleep (min/day), weekend days	4.89 (12.83)
Sit-to-stand transitions (count), weekend days	69.78 (25.35)
Daily steps, brisk walking, weekend days	10247.68 (4919.97)
Daily steps, slow walking, weekend days	2509.35 (837.73)
Daily steps, sporadic walking, weekend days	3351.33 (1121.57)
Values are mean (SD) unless otherwise stated	

Table 3. Intraclass correlation coefficients, Sitting time (n=98)

Type	ICC	Value	p-value	Lower Bound	Upper Bound
Single raters, absolute	ICC1	-0.055	0.70	-0.248	0.14
Single random raters	ICC2	0.163	<0.01	-0.055	0.37
Single fixed raters	ICC3	0.277	<0.01	0.086	0.45
Average raters, absolute	ICC1k	-0.117	0.70	-0.658	0.25
Average random raters	ICC2k	0.280	<0.01	-0.116	0.54
Average fixed raters	ICC3k	0.434	<0.01	0.159	0.62