


Activity Monitors Step Count Accuracy in Community-Dwelling Older Adults

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Abstract

Objective: To examine the step count accuracy of activity monitors in community-dwelling older adults. **Method:** Twenty-nine participants aged 67.70 ± 6.07 participated. Three pedometers and the Actical accelerometer step count functions were compared with actual steps taken during a 200-m walk around an indoor track and during treadmill walking at three different speeds. **Results:** There was no statistical difference between activity monitors step counts and actual steps during self-selected pace walking. During treadmill walking at $0.67 \text{ m}\cdot\text{s}^{-1}$, all activity monitors step counts were significantly different from actual steps. During treadmill walking at $0.894 \text{ m}\cdot\text{s}^{-1}$, the Omron HJ-112 pedometer step counts were not significantly different from actual steps. During treadmill walking at $1.12 \text{ m}\cdot\text{s}^{-1}$, the Yamax SW-200 pedometer steps were significantly different from actual steps. **Discussion:** Activity monitor selection should be deliberate when examining the walking behaviors of community-dwelling older adults, especially for those who walk at a slower pace.

Keywords

accelerometers, pedometers, physical activity, measurement, older adults

The current growth in the number and proportion of older adults in the United States is unprecedented in our nation's history. By 2030, one of every five Americans (age 65+) will be an older adult (Centers for Disease Control and Prevention [CDC], 2013). According to the 2008 Physical Activity Guidelines for Americans, regular physical activity (PA) is essential for healthy aging and is especially important for older adults because this population is the least physically active of any age group. Regular PA in older adults has been shown to prevent and delay the onset of age-related disease, promote physical and cognitive health, and delay functional loss (Aoyagi & Shephard, 2009; CDC, 2013; Lee & Buchner, 2008). With a greater emphasis on studies examining the relationship between PA and health comes the need for more accurate and reliable methods of estimating PA in this population.

Walking is the most common form of PA in the older adult population (Simpson et al., 2003; U.S. Department of Health and Human Services [USDHHS], 2008). Walking can be measured by many different methods including pedometry and accelerometry with varying levels of accuracy (Bassett, Mahar, Rowe, & Morrow, 2008). Activity monitors may not be accurate when assessing PA levels in individuals who walk slowly and/or have gait deviations, both of which are common mobility impairments in older adults (Storti et al., 2008). This issue is possibly more complex when we consider older adults residing in an assisted-living facility as opposed to community-dwelling older

adults. Techniques for measuring PA need to be able to distinguish different characteristics of activity, namely, the frequency, duration, intensity, and type, to further our understanding of population levels of PA (Bassett et al., 2008; Strath, Pfeiffer, & Whitt-Glover, 2012). Pedometers (spring-levered and piezoelectric) have been the primary tool to measure step counts, however, due to their inability to discriminate the intensity of various ambulatory movements; dual mode accelerometers have been developed to allow researchers to capture not only step counts but also more detailed information on PA intensity, frequency, and duration.

To date, there have been few studies that provide evidence of validity for pedometer type (spring-levered vs. piezoelectric) step count accuracy (Bergman, Bassett, & Klein, 2008; Cyarto, Myers, & Tudor-Locke, 2004; Grant, Dall, Mitchell, & Granat, 2008; Storti et al., 2008) and dual mode accelerometer step count function in older adults under controlled and field settings. The lack of data specific to this population means that conclusions have been drawn largely from the general adult literature and may lead to erroneous conclusions that

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Table 1. Demographic Characteristics of Participants.

	Female (n = 16)	Male (n = 13)	All participants (N = 29)
Age (years)	68.75 ± 1.79	66.38 ± 1.19	67.70 ± 6.07
Height (cm)	160.91 ± 1.31	171.21 ± 8.20	165.53 ± 20.40
Weight (kg)	71.48 ± 3.32	94.11 ± 4.62	81.62 ± 18.57
BMI (kg·m ⁻²)	27.38 ± 1.17	29.12 ± 0.97	28.15 ± 4.21
Waist circumference (cm)	84.56 ± 2.96	104.08 ± 3.24	93.31 ± 15.21
Self-selected pace (m·s ⁻¹)	1.37 ± 0.06	1.49 ± 0.06	1.42 ± 0.24

Note. ± = standard deviation; cm = centimeters; kg = kilograms; BMI = body mass index; kg·m⁻² = kilogram per meters squared; m·s⁻¹ = meters per second.

utilize these activity monitors in PA interventions targeting older adults (Strath et al., 2012). Therefore, the purpose of this study was to examine the step count function of pedometers and an accelerometer in a group of community-dwelling older adults.

Method

Participants

Twenty-nine participants (16 females and 13 males) aged 67.70 ± 6.07 participated in this study. Participants were recruited from various PA programs that focused on older adults (ages 60+) in the community. Height, weight, and waist circumference were assessed in light clothing and without shoes to the nearest 0.5 cm and 0.1 kg, respectively. Body mass index was calculated from height and weight measurements for all participants. Each participant completed a Physical Activity Readiness Questionnaire (PAR-Q). A positive response to one or more of the seven PAR-Q questions excluded a participant from the study. The PAR-Q is widely used as a screening tool for all PA participation. The PAR-Q is used in Canada and has been adopted widely throughout the United States (Adams, 1999; Thomas, Reading, & Shephard, 1992). Prior to participation, all participants had the research study and its potential risks and benefits explained fully before providing written informed consent. The Institutional Review Board approved all procedures. Characteristics of the study participants are provided in Table 1.

Equipment

The dual mode Actical accelerometer (Respironics Inc., Bend, Oregon), Yamax SW-200 (Yamax Corporation, Tokyo, Japan), Omron HJ-112 (Omron Healthcare, Vernon Hills, Illinois), and Walk4Life Elite (WALK4LIFE, INC, Plainfield, Illinois) were used to estimate steps registered by participants. The Yamax SW-200 is a spring-lever pedometer that includes a step counter, which accurately counts steps while walking, hiking, jogging, or running. A more detailed description of the Yamax SW-200 and its functions have been provided in previous research (Crouter, Schneider, & Bassett, 2005). The Yamax SW-200 pedometer has also been the pedometer of choice when

examining step count accuracy in older adults who either reside in assisted-living facilities or are community-dwelling (Bergman et al., 2008; Cyarto et al., 2004; Grant et al., 2008; Storti et al., 2008). The Walk4Life Elite is a spring-lever pedometer that includes a step counter, activity time, and distance displayed in miles walked. The Omron HJ-112 is a piezoelectric pedometer that records number of steps during walking and jogging activities. A more detailed description of the Omron HJ-112 and its functions have been described in previous research (Hasson, Haller, Poher, Staudenmayer, & Freedson, 2009). Very limited research is available on the Walk4Life Elite and Omron HJ-112 step count accuracy during walking at low treadmill speeds and no research is available involving community-dwelling older adults. All pedometers used in this study were checked for calibration using a shake test (Vincent & Sidman, 2003). These pedometers have been some of the more commonly used in recent research (Abel et al., 2011; Bassett et al., 2008; Feito, Bassett, & Thompson, 2012; Hasson et al., 2009).

The Actical (Respironics Inc., Bend, Oregon) is a dual mode accelerometer (registers accelerometer counts and step counts) that uses a piezoelectric accelerometer mechanism. A more detailed description of the Actical and its functions has been described in previous research (Esliger et al., 2007; Heil, 2006). The few studies that are available on the dual mode Actical step count function (Johnson, Meltz, Hart, Schmudlach, Clarkson, & Broman, 2014; Esliger et al. 2007; Feito, Bassett, & Thompson, 2012; Feito, Bassett, Thompson, & Tyo, 2012) have not included older adults (age ≥ 60). The Actical accelerometers used in this study were checked using manufacturer-recommended hardware and software, and calibrated if necessary. At the end of each test, accelerometer data were downloaded using manufacturer-recommended hardware and software. Data reduction focused on accelerometer-recorded steps for each epoch.

Protocol

The Actical step counts and three pedometer step counts were recorded while walking on an indoor track and walking on a motor-driven treadmill at various speeds. Directly observed step counts (recorded with a hand-tally device) served as the criterion. The testing took

place over the course of 6.69 ± 3.4 days, and each person wore the same pair of shoes for all trials. All devices were worn concurrently on an elastic belt on their right waist/hip, following the manufacturer's recommendations for placement on the body, during testing. Participants were first asked to complete a 200-m walk around an indoor track (field setting). Participants walked at a self-selected pace while two investigators using hand-tally counters walked behind the participant, to avoid influencing pace. The amount of time it took to complete the 200-m walk was measured to calculate each participant's self-selected pace (Schneider, Crouter, Lukajic, & Bassett, 2003; Storti, Pettee, Brach, Talkowski, Richardson, & Kriska, 2007). At the end of the 200-m walk, the participants were told to stand still, and the number of steps detected by each pedometer was then recorded.

Participants then walked on a treadmill at three different speeds: $0.67 \text{ m}\cdot\text{s}^{-1}$, $0.894 \text{ m}\cdot\text{s}^{-1}$, and $1.12 \text{ m}\cdot\text{s}^{-1}$ for 5 min at each speed with treadmill gradient set at 0. These treadmill speeds have been used previously to examine activity monitor accuracy in community-dwelling older adults (Grant et al., 2008) and healthy adults (Crouter, Schneider, Karabulut, & Bassett, 2003; Feito, Bassett, & Thompson, 2012; Le Masurier, Lee, & Tudor-Locke, 2004). The activity monitor placement was replicated for the treadmill trials. The participants received instructions for walking on the treadmill and were allowed time to adapt to the various walking speeds. Before each bout, participants stood still (straddling the treadmill belt) for a 2-min washout period. This was performed to ensure that any steps detected by the accelerometer before the official bout were not considered in the analysis (Le Masurier & Tudor-Locke, 2003). The 2-min washout period was repeated between each bout and after the last one. At the end of each bout, the number of steps detected by each pedometer was recorded and the units were reset to zero before the subsequent bouts. Observed steps were counted by two researchers, using hand-tally counters, with the average of the two being recorded if counted steps differed.

Statistical Analysis

One-way within-participants repeated measure analyses of variance (ANOVAs) were used to assess significant differences between actual steps taken and estimated step counts registered by the activity monitors for all four conditions (self-selected pace walking and three treadmill walking speeds). Post hoc analyses for the ANOVA procedures were performed if significance were found using pairwise comparisons with Bonferroni adjustments. The one-way ANOVA for treadmill walking speed at $1.12 \text{ m}\cdot\text{s}^{-1}$ only used 28 participants' data due to 1 participant unable to walk at this speed.

Mean absolute percent error (MAPE) was calculated between observed steps and Actical/pedometer-determined steps— $\text{MAPE} = \frac{(|\text{Actical/pedometer steps} - \text{observed}$

$\text{steps}| / \text{observed steps}) \times 100$ —and was used as another outcome measure. A smaller MAPE represents better accuracy, and less than 3% is considered acceptable pedometer accuracy (Bassett et al., 2008). Bland–Altman plots were also used to demonstrate level of agreement between criterion measures and estimated step counts registered by the activity monitors during self-selected pace walking and walking at three different treadmill speeds (Bland & Altman, 1986). These plots provide a visual illustration of mean error score and 95% prediction interval. Predictions equations that show a tight prediction interval around zero are deemed more accurate. Data points below zero signify overestimations, while points above zero signify underestimations. Statistical analyses were performed using SPSS 18.0 (Statistical Package for the Social Sciences, Inc, Chicago, Illinois). For all analyses, a p value $< .05$ was used to indicate statistical significance. Means and standard deviations were reported for descriptive data.

Results

There was no statistical difference between any of the activity monitors step counts and actual steps taken during self-selected pace walking, Wilks's $\lambda = 0.76$, $F(4, 25) = 2$, $p = .13$, and all MAPE values were acceptable ($\leq 2.62\%$). During treadmill walking at $0.67 \text{ m}\cdot\text{s}^{-1}$, all the activity monitors step counts were significantly different from actual steps taken, Wilks's $\lambda = 0.16$, $F(4, 25) = 33.58$, $p < .001$. Post hoc analysis revealed that the three pedometers and accelerometer step counts were significantly different (all $p < .001$) and all MAPE were unacceptable ($\geq 38.06\%$). During treadmill walking at $0.894 \text{ m}\cdot\text{s}^{-1}$, activity monitors step counts were significantly different from actual steps taken, Wilks's $\lambda = 0.27$, $F(4, 25) = 16.55$, $p < .001$. Post hoc analysis revealed that the Omron HJ-112 pedometer step counts were the only ones not statistically different from actual steps taken ($p = .16$), and the MAPE was 3.5%. The Yamax SW-200 and Walk4Life pedometers step counts were both significantly different at $p < .001$, while the Actical accelerometer step counts were significantly different at $p = .002$. During treadmill walking at $1.12 \text{ m}\cdot\text{s}^{-1}$ speed, activity monitors step counts were significantly different from actual steps taken, Wilks's $\lambda = 0.42$, $F(4, 24) = 8.24$, $p < .001$. Post hoc analysis revealed that the Yamax SW-200 step counts were significantly different from actual steps taken ($p = .012$) and had an unacceptable MAPE value = 11.48%. All other devices' step counts were not significantly different from actual steps taken and had acceptable MAPE values $< 2.58\%$. Post hoc power estimates = 1 for ANOVAs examining differences between actual steps taken and steps registered by activity monitors at treadmill walking speeds $0.671 \text{ m}\cdot\text{s}^{-1}$ and $0.894 \text{ m}\cdot\text{s}^{-1}$. Post hoc power estimates were .99 and .92 for ANOVAs examining differences between actual steps taken and steps registered by activity monitors at treadmill walking speed $1.12 \text{ m}\cdot\text{s}^{-1}$ and self-selected pace walking, respectively. Table 2 presents the MAPE

Table 2. Mean Absolute Percentage Error (MAPE) in Self-Selected Pace and Treadmill Walking.

	OM	YM	W4L	Actual
Self-selected pace	0.28	2.62	0.76	0.44
0.67 m·s ⁻¹	38.06	44.86	38.66	57.25
0.894 m·s ⁻¹	3.5	25.49	16.03	17.44
1.12 m·s ⁻¹	1.5	11.48	2.58	1.51

Note. OM = Omron HJ-112 model; YM = Yamax SW-200 model; W4L = Walk4Life Elite model; m·s⁻¹ = meters per second on treadmill. MAPE $\leq \pm 3\%$ is acceptable (in bold print).

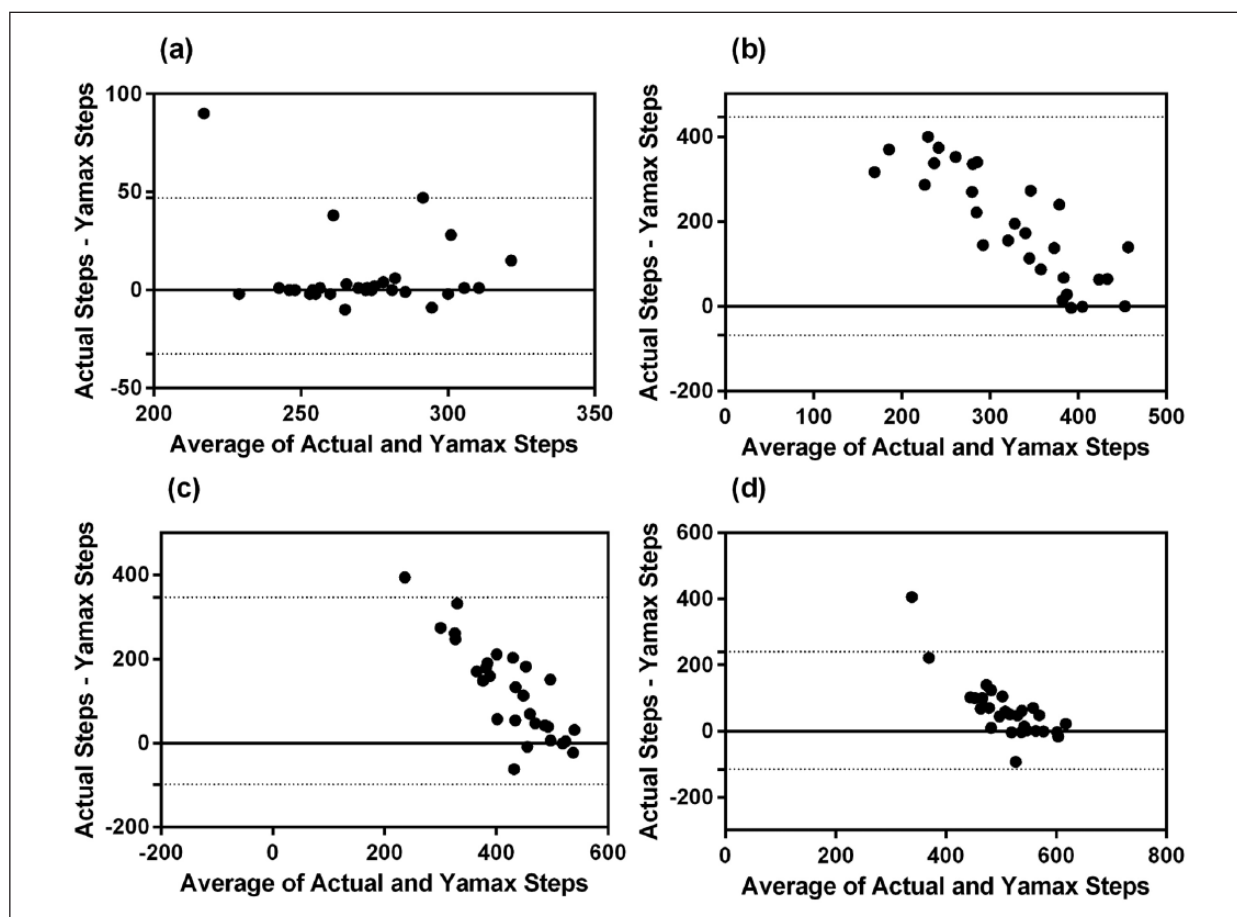


Figure 1. Bland–Altman plots depicting error scores (actual steps – estimated step) for the Yamax SW-200 during (a) Self-Selected Pace, (b) Treadmill Walking at 0.67 m·s⁻¹, (c) Treadmill Walking at 0.894 m·s⁻¹, and (d) Treadmill Walking at 1.12 m·s⁻¹. Note. Dashed lines represent 95% limits of agreement.

values for all activity monitors during self-selected pace and treadmill walking. Figures 1 to 4 display Bland–Altman plots for each activity monitors step count results for self-selected pace and treadmill walking. Table 3 presents the estimated step counts registered for all activity monitors during self-selected pace and treadmill walking.

Discussion

The purpose of this study was to examine the step count function of pedometers (spring-lever vs. piezoelectric) and an accelerometer in a group of community-dwelling

older adults during self-selected pace and treadmill walking in comparison with actual steps taken. All activity monitors performed exceptionally well for walking around an indoor track at self-selected pace. There was no statistical difference between the activity monitors step counts and actual steps taken during self-selected pace walking and all MAPE values were $<3\%$. Our results were similar to Grant et al. (2008) for the Yamax SW-200 who reported $<2\%$ MAPE values in a group of community-dwelling older adults ($M_{\text{age}} = 72$) with similar self-selected pace values during an outdoor walking protocol. Conversely, Cyarto et al. (2004) reported higher MAPE values for the Yamax in a group of

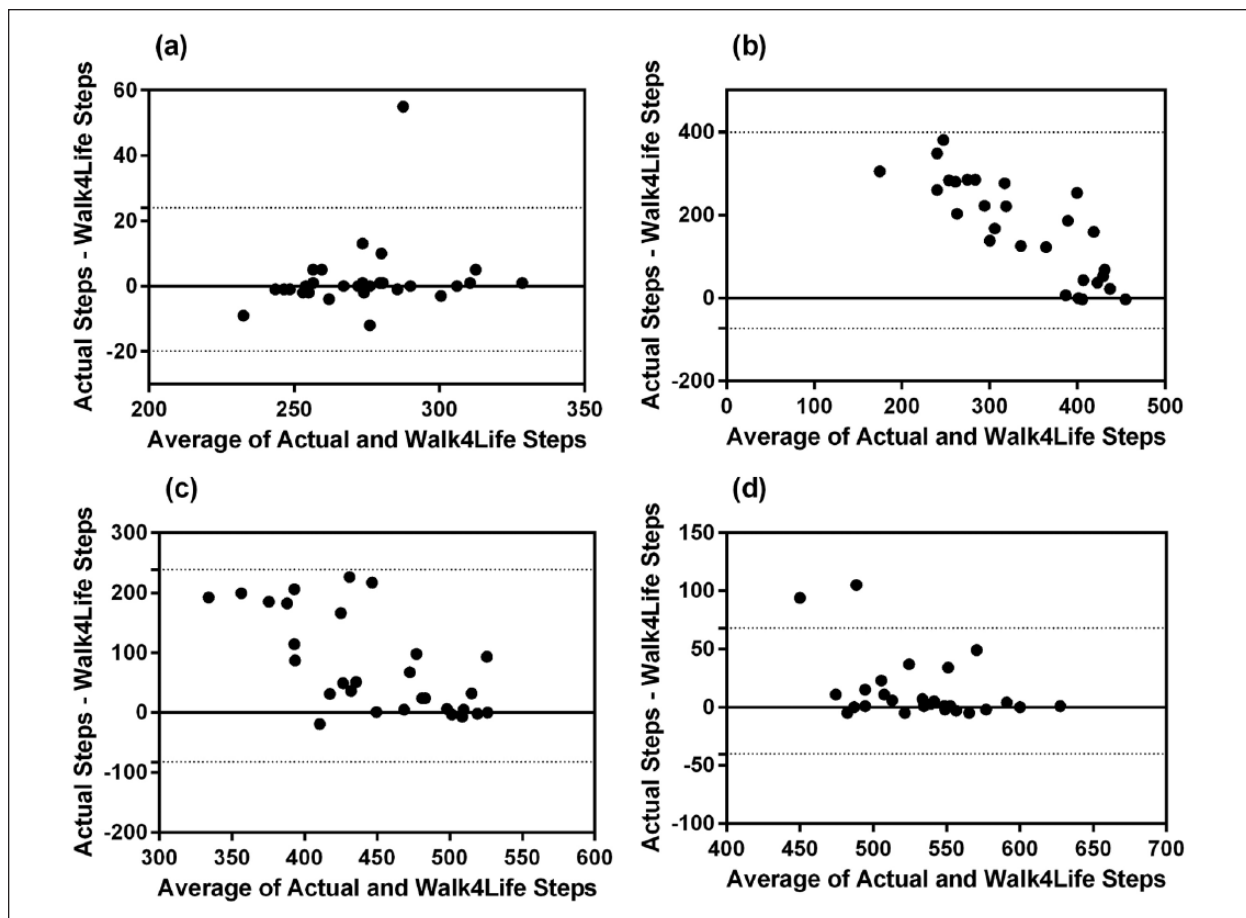


Figure 2. Bland–Altman plots depicting error scores (actual steps – estimated step) for the Walk4Life Elite during (a) Self-Selected Pace, (b) Treadmill Walking at $0.67 \text{ m}\cdot\text{s}^{-1}$, (c) Treadmill Walking at $0.894 \text{ m}\cdot\text{s}^{-1}$, and (d) Treadmill Walking at $1.12 \text{ m}\cdot\text{s}^{-1}$.

Note. Dashed lines represent 95% limits of agreement.

community-dwelling older adults ($M_{\text{age}} = 71$) walking a 13-m course with self-selected pace values ranging from $0.95 \text{ m}\cdot\text{s}^{-1}$ to $1.61 \text{ m}\cdot\text{s}^{-1}$. Storti et al. (2008) also reported higher MAPE values for the Yamax SW-200 in a group of community-dwelling older adults ($M_{\text{age}} = 79$) during a 100-step walking test. The reported self-selected pace values ranged from $<0.80 \text{ m}\cdot\text{s}^{-1}$ to $>1.0 \text{ m}\cdot\text{s}^{-1}$, which were slower than the values in the current study. Bergman et al. (2008) reported a low relationship between the YamaxSW-200 and actual steps taken over a 161-m walking trial by older adults ($M_{\text{age}} = 77$) living in assisted-living facilities. The reported average self-selected pace of participants in their study was much slower than the participants in the current study. This supports the notion that older adults who reside in an assisted-living facility walk at a slower pace than community-dwelling older adults. Cyarto et al. also demonstrated that community-dwelling older adults walk at a faster pace when compared with older adults residing in a nursing home. Schneider et al. (2003) and Melanson et al. (2004) also reported acceptable MAPE values for the Walk4Life Elite pedometer for self-selected pace walking in adults. In contrast, Abel et al. (2011) found

that the Omron HJ-112 did not have superior step counting accuracy at self-selecting walking speed in adults. The Actical accelerometer self-selected walking results from this study were similar to those of Authors (2014) who reported no differences between actual steps and Actical-recorded steps while walking around a track in young adults. Previous studies that have examined the Actical step count function in children and adults in a controlled setting (treadmill walking) have shown it to perform exceptionally well at walking speeds $>1.12 \text{ m}\cdot\text{s}^{-1}$ and $\leq 2.19 \text{ m}\cdot\text{s}^{-1}$ (Authors, 2014; Colley et al., 2013; Esliger et al. 2007; Feito, Bassett, & Thompson, 2012; Feito et al., 2012). Our results suggest that this is also true for older adults in a free-living setting as well.

The Actical accelerometer, Walk4Life Elite, and Omron HJ-112 pedometers performed well for walking on a motorized treadmill at $1.12 \text{ m}\cdot\text{s}^{-1}$ speed, and MAPE values were $<3\%$. The Actical treadmill walking at $1.12 \text{ m}\cdot\text{s}^{-1}$ results from this study are supported by Feito, Bassett, and Thompson (2012) and Feito et al. (2012), who reported no differences between actual steps and Actical-recorded steps while walking on a treadmill at $1.12 \text{ m}\cdot\text{s}^{-1}$ in normal and overweight adults. Previous

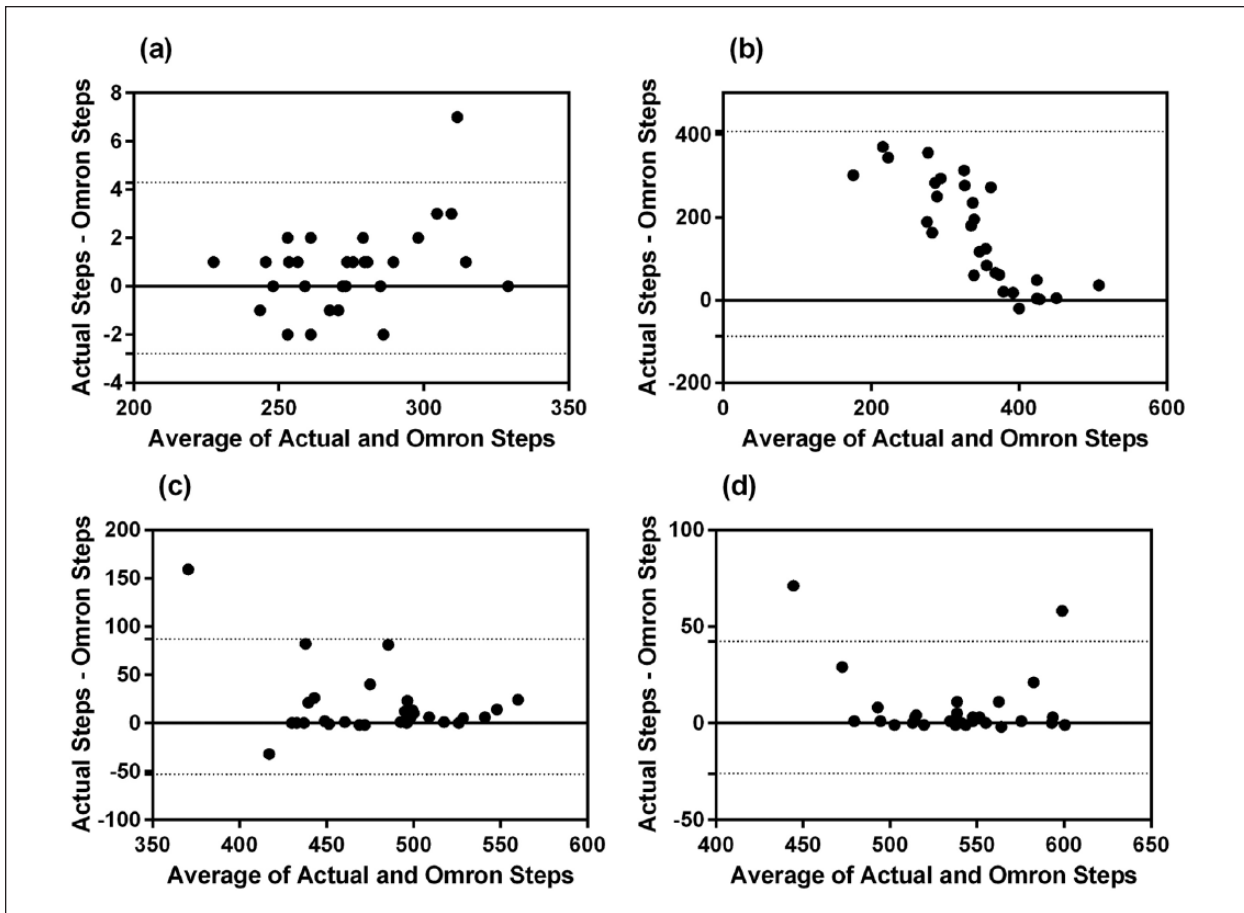


Figure 3. Bland–Altman plots depicting error scores (actual steps – estimated step) for the Omron HJ-112 during (a) Self-Selected Pace, (b) Treadmill Walking at $0.67 \text{ m}\cdot\text{s}^{-1}$, (c) Treadmill Walking at $0.894 \text{ m}\cdot\text{s}^{-1}$, and (d) Treadmill Walking at $1.12 \text{ m}\cdot\text{s}^{-1}$. Note. Dashed lines represent 95% limits of agreement.

research (Crouter et al., 2003; Hasson et al., 2009; Melanson et al., 2004) has shown the Walk4Life Elite and Omron HJ-112 pedometers to accurately detect steps at this treadmill speed in adults. In contrast, Abel et al. (2011) reported that the Omron HJ-112 did not accurately detect steps at this treadmill speed in adults. Our results support previous findings regarding the Yamax SW-200 susceptibility in registering steps while walking at this treadmill speed in adults and older adults (Colley et al., 2013; Feito, Bassett, & Thompson, 2012; Grant et al., 2008; Horvath, Taylor, Marsh, & Kriellaars, 2007; Melanson et al., 2004).

The Actical step count function did not perform well while walking on a motorized treadmill at $0.67 \text{ m}\cdot\text{s}^{-1}$ and $0.894 \text{ m}\cdot\text{s}^{-1}$ speeds and had unacceptable MAPE values. Our results support those of Feito et al. (2012), who reported a significant difference between actual steps and Actical-recorded steps while walking on a treadmill at $0.67 \text{ m}\cdot\text{s}^{-1}$ in adults. Previous studies have demonstrated the Actical step count function susceptibility to walking at similar slow speeds on a treadmill for children and adults. It appears that regardless of age group, the Actical step count function may be susceptible to registering steps at slow treadmill walking speeds

$\leq 1.05 \text{ m}\cdot\text{s}^{-1}$ (Authors, 2014; Colley et al., 2013; Esliger et al., 2007). These walking speeds may be indicative of older adults who reside in assisted-living facilities or nursing homes (Bergman et al., 2008; Cyarto et al., 2004). All pedometer-registered steps were significantly different from actual steps during treadmill walking at $0.67 \text{ m}\cdot\text{s}^{-1}$ and had unacceptable MAPE values. Our results support those of Grant et al. (2008), who reported a significant difference for the Yamax SW-200 pedometer in older adults at the same treadmill walking speeds. This relationship has also been previously shown in the adult population as well for both the Yamax SW-200 and Walk4Life Elite pedometers (Colley et al., 2013; Crouter et al., 2003; Feito, Bassett, & Thompson, 2012; Melanson et al., 2004). During treadmill walking at $0.894 \text{ m}\cdot\text{s}^{-1}$, the Omron HJ-112 pedometer was the only activity monitor with registered steps not significantly different from actual steps and an MAPE value slightly above acceptability (3.5%). This is the first study to demonstrate this relationship in older adults, and it is supported by Authors (2014) who reported a similar relationship in young adults at this treadmill walking speed. These results support previous research that indicated that piezoelectric pedometers

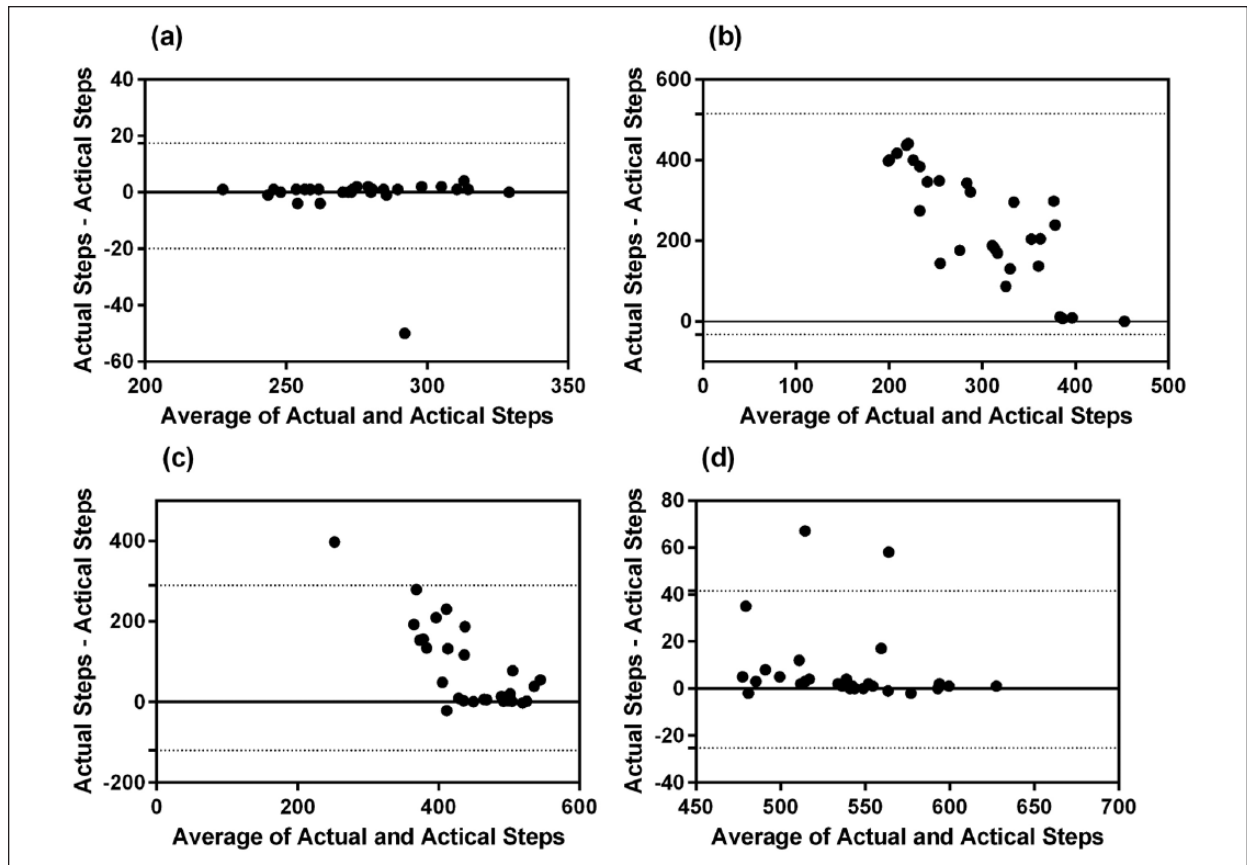


Figure 4. Bland–Altman plots depicting error scores (actual steps – estimated step) for the Actual during (a) Self-Selected Pace, (b) Treadmill Walking at $0.67 \text{ m}\cdot\text{s}^{-1}$, (c) Treadmill Walking at $0.894 \text{ m}\cdot\text{s}^{-1}$, and (d) Treadmill Walking at $1.12 \text{ m}\cdot\text{s}^{-1}$. Note. Dashed lines represent 95% limits of agreement.

Table 3. Step Counts Registered by Four Different Devices, for Overground Walking at a Self-Selected Pace (SSP) and Treadmill Walking at Three Speeds.

	Actual	OM	YM	W4L	Actual
SSP	274.86 ± 24.46	274.10 ± 23.75	267.66 ± 28.08	272.76 ± 23.33	276.07 ± 25.15
$0.67 \text{ m}\cdot\text{s}^{-1}$	421.14 ± 42.21	260.86 ± 129.58	232.21 ± 138.62	258.34 ± 131.58	180.03 ± 133.37
$0.894 \text{ m}\cdot\text{s}^{-1}$	487.07 ± 41.02	470.03 ± 52.42	362.90 ± 127.42	408.97 ± 86.77	402.14 ± 111.72
$1.12 \text{ m}\cdot\text{s}^{-1}$	541.71 ± 38.83	533.57 ± 42.58	479.50 ± 104.30	527.75 ± 49.48	533.54 ± 41.51

Note. OM = Omron HJ-112 model; YM = Yamax SW-200 model; W4L = Walk4Life Elite model; \pm = standard deviation; $\text{m}\cdot\text{s}^{-1}$ = meters per second on treadmill.

are more accurate in detecting steps at slower walking speeds in normal, overweight, and obese adults when compared with spring-lever pedometers (Crouter et al., 2005; Melanson et al., 2004). This walking speed was indicative of some older adults, who resided either in assisted-living facilities or nursing homes (Bergman et al., 2008; Cyarto et al., 2004). The Yamax SW-200 and Walk4Life Elite pedometer-registered steps were significantly different from observed steps during treadmill walking at $0.894 \text{ m}\cdot\text{s}^{-1}$. Results are inconclusive for the Walk4Life Elite pedometer at this treadmill speed in adults (Crouter et al., 2003; Melanson et al., 2004) and the Yamax SW-200 has shown similar susceptibility in both the older adult and adult populations

(Authors, 2014; Colley et al., 2013; Feito, Bassett, & Thompson, 2012; Grant et al., 2008; Horvath et al., 2007; Melanson et al., 2004).

Conclusion

To gain a better understanding of the relationship between PA and health for the aging population, epidemiologists, exercise scientists, clinicians, and behavioral researchers must rely on objective measures of PA with supportive evidence specific to that population of interest. All activity monitors provided valid estimates of step counts during self-selected pace walking. The Walk4Life Elite (spring-lever), Omron HJ-112 (piezoelectric), and

Actical accelerometer provided valid estimates of step counts walking at a constant speed of 1.12 m·s⁻¹. The Omron HJ-112 pedometer was the only monitor that provided valid estimates of step counts walking at a constant speed of 0.894 m·s⁻¹. It is recommended that pedometer and accelerometer be used in tandem (if feasible) to capture ambulatory behavior in community-dwelling older adults walking at this pace if the focus is on capturing steps, intensity, duration, and frequency of PA (Authors, 2014; Hooker et al., 2011). None of the activity monitors provided valid estimates of step counts walking at a constant speed of 0.67 m·s⁻¹, which may be indicative of older adults residing in an assisted-living facility. It is recommended that a different device be used to capture ambulatory behavior in this group such as the Step Watch 3 (Bergman et al., 2008). This study provides some preliminary evidence of validity for the Actical accelerometer, Walk4Life Elite, and Omron HJ-112 pedometers step count function in community-dwelling older adults where studies have been distinctly lacking.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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