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Review Article (Meta-analysis)

Use of activPAL to Measure Physical Activity in Community-Dwelling Older Adults: A Systematic Review

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Jennifer Blackwood, PhD [a], Rie Suzuki, PhD [b], Noah Webster, PhD [c], Hannah Karczewski, BS [a], Tyler Ziccardi, BS [a], Shailee Shah, MPH [b]

[a] *Physical Therapy Department, University of Michigan-Flint, Flint, Michigan*
[b] *Public Health and Health Sciences Department, University of Michigan-Flint, Flint, Michigan*
[c] *Institute for Social Research, University of Michigan, Ann Arbor, Michigan*

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Abstract *Objective:* To perform a systematic review of the literature to describe how the activPAL accelerometer has been used to measure physical activity (PA) in community-dwelling older adults to standardize collection of PA data in this population using this thigh-worn accelerometer.

Data Sources: A comprehensive search of the following databases was completed: Cumulative Index to Nursing and Allied Health Complete, Embase, OVID Medicine, PubMed/Web of Science, and Scopus.

Study Selection: Studies were included if published before August 1, 2020, were written in English, and used activPAL to measure PA in community-dwelling, noninstitutionalized adults 65 years or older. Titles and abstracts were independently reviewed, and the decision to include or exclude was made by 100% consensus.

Data Extraction: Three research team members independently extracted the data from included studies. Extracted data were compared and discussed with relevant information included. Study quality was assessed using the Quality Assessment Tool for Observational Cohort and Cross-sectional Studies.

Data Synthesis: A total of 7 articles met the inclusion criteria. Three of the 7 studies used activPAL to report steps/d, ranging from 864-15847 steps/d. Time spent stepping or walking was reported by 4 studies using various units. Sit-to-stand transitions were reported by 4 studies, averaging 10-63 transitions/d. Sedentary time was assessed in 6 studies, whereas moderate to vigorous physical activity was not measured using activPAL in any study.

Conclusions: The activPAL is most often used to collect data on step count and walking, sit-to-stand transitions, and sedentary time in community-dwelling older adults.

List of abbreviations: LPA, light physical activity; MET, metabolic equivalent; MVPA, moderate to vigorous physical activity; PA, physical activity.

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As people age, taking care of their body becomes increasingly important and is essential to maintain their ability to live independently.[1-4] One of the easiest ways for older adults (65 years or older) to do this is to engage in daily physical activity (PA).[1,3,5,6] Doing so is associated with lower rates of chronic disease, greater bone health, healthier body composition, better cognitive function, lower risk of falling, and increased functional independence.[1,4,6] However, regardless of the health benefits of frequent PA, overall daily activity levels have been found to decrease with age.[2,7]

Older adults are less active than younger adults, and nearly 60% of older adults sit for more than 4 hours per day.[2,7-9] Sedentary behavior, independent of PA, has been linked to diabetes, obesity, morbidity, mortality, and cardiovascular disease.[2,4] Despite the higher prevalence of inactivity among older adults, this population is underrepresented in research focused on quantifying PA.[2,8,9]

PA is often measured using self-report or patient-reported outcome measures (eg, surveys, questionnaires), through observation, or through objective measurement (eg, accelerometers).[5,10] While each of those methods are used across studies, they each have limitations. Self-report measures provide less accurate and more biased measurements of PA than other methods.[5,10,11] Observation of PA is subject to human error and bias, and its use is still relatively new, especially in the older adult population.[5,10,11] While using accelerometers and other wearable monitors to measure PA in research studies has become more common, much of the work that has been done has not focused on older adults.[12,13] As a result, many of the established cutoff points for defining optimal activity are not meant for use in older adult populations because many studies have focused on moderate or vigorous intensity PA and not light intensity PA.[12,14]

As a form of technology, accelerometers have been used to objectively measure PA through time spent in various positions (upright, sitting, lying, standing), duration of performing various activities (walking, sit to stands), or time spent completing a level of intensity of PA such as light PA (LPA) or moderate to vigorous PA (MVPA).[12] LPA is described in the literature as activity that requires <3.0 metabolic equivalents (METs) to complete.[15] MVPA is described as 3.0-5.9 METs and vigorous PA as >6.0 METs.[15] Accelerometers are able to measure PA without obstructing or limiting activity because they can be attached to the limb of an individual (eg, on the thigh) or worn around the wrist or waist.[12,16,17] A minimum of 13 hours per day is required to collect valid data on daily PA, which most accelerometers have the capability to do over many days.[14,18,19]

Initial studies that measured PA through accelerometry used triaxial devices secured on a belt around the waist or hip.[20] These studies were able to measure the frequency, intensity, and duration of PA, thus validating their use to calculate energy expenditure.[21] However, distinguishing between different postures or activity types (walking, stair climbing) was not easily performed using hip- or thigh-worn accelerometry data alone.[22] In studies that have measured PA using wrist worn accelerometers, such as the ActiGraph, greater compliance in wear time is reported, resulting in the ability to monitor PA over a 24-hour period.[23,24] However, similar to waist or hip devices, these accelerometers have difficulty distinguishing between components of PA including activity type (walking, transitional movements) and postures (standing/sitting/laying).[22,25] The accuracy of measuring PA in adults using hip or wrist accelerometer has been questioned, resulting in greater use of thigh-worn accelerometers because they reportedly have better sensitivity and specificity.[26] This has translated into an increased number of studies, including large population-based projects[27] that have used thigh-worn accelerometers to measure PA because they not only measure energy expenditure but also the amount of time spent in various postures and when performing different types of PA, thus quantifying components of PA in addition to sedentary time.

A scoping review of observational studies describing the use of thigh-worn accelerometers to measure PA in free-living adults reported that the most often used device was the activPAL3.[28] The activPAL accelerometer is a 43-mm long, 23.5-mm wide, and 5-mm thick device that is waterproofed and secured to user's thigh. This device records the amount of time spent lying, sitting, standing, and stepping.[29] Because data are collected every 20th of a second, activPAL has been used to quantify PA in field-based, free-living, and laboratory research settings.[30,31] Two versions are available: the lower-resolution activPAL3 released in 2014 and the higher-resolution activPAL4 released in 2018. The former has enough battery power to record data for 7 days, while the newer version can record data for up to 14 days.[29]

A search of the literature indicates that activPAL has been used to measure PA in both younger and older adult populations in more than 200 studies since 2017.[31-33] Using a thigh-worn accelerometer may be advantageous in older adults because it has established sensitivity and specificity and concurrent reliability for measuring LPA in that population.[3,16] However, the literature describing how activPAL has been used to report PA in community-dwelling older adults is limited. A rapid review of the literature performed in 2017 reported how activPAL has been used in studies with older adults. Yet, results are reported across a diverse mix of older adults, including those residing in institutionalized (nursing home, hospital) and community-based residential settings (senior housing) where PA behaviors likely differ.[34] While this review adds to our understanding of how this accelerometer has been used to characterize PA in older adults, it does not specifically distinguish how it should be used to measure PA in community-dwelling older adults.

Given the increased use of thigh-worn accelerometers in research studies with activPAL being the most commonly used device,[28] describing how this accelerometer has been used to quantify and categorize PA in community-dwelling older adults is needed. Therefore, the purpose of this systematic review is to describe how the thigh-worn activPAL accelerometer has been used to measure PA in community-dwelling older adults. Results of this review will aid in the design and use of this accelerometer in future research that measures older adults' PA.

Methods

Study design

This systematic review describes activPAL outcome data reported in studies with community-dwelling older adults. This includes data on steps/d, time spent walking, sit-to-stand transitions, sedentary time, and time spent upright. This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines[35] and was registered with PROSPERO (CRD4202123704).

Inclusion/exclusion criteria

Included studies were cross-sectional, cohort, descriptive, or prospective randomized control studies that were published before August 1, 2020, written in English, used activPAL, and reported data in community-dwelling, noninstitutionalized adults 65 years or older. No limit was placed on the initial date of publication. Methodological studies, previous literature reviews, case reports, and articles describing study protocols were excluded. Studies that reported using activPAL but did not include PA data were excluded.

Search strategy

A comprehensive search of the following databases was completed: Cumulative Index to Nursing and Allied Health Complete, Embase, OVID Medicine, PubMed/Web of Science, and Scopus. Search entries included activPAL AND (older adults or elderly or seniors or geriatrics), activPAL AND (older adults or elderly or seniors or geriatrics) AND physical activity, activPAL AND (older adults or elderly or seniors or geriatrics) AND accelerometer, activPAL AND physical activity, and activPAL AND accelerometer. A duplicate search for titles was completed by 2 researchers (J.B., T.Z.) who each independently performed a search of the literature using the same search engines and search criteria. Titles obtained for each search were provided to another researcher (S.S.) who then reviewed and compared both lists. After duplicates were removed, the complete list of titles was checked against inclusion/exclusion criteria by 2 others (T.Z., H.K.), and all studies that met the above criteria were included in the abstract review. Three study team members (H.K., T.Z., S.S.) independently reviewed abstracts, and each abstract was reviewed by 2 team members. The decision to include or exclude the article was made by 100% consensus, with any conflicts being decided by another research team member (J.B.). Data were extracted from the included studies by 3 researchers and were double-checked and discussed prior to including them on the data extraction sheet.

Assessment of methodological quality

The Quality Assessment Tool for Observational Cohort and Cross-sectional Studies from the National Institutes of Health was used to assess the quality of included studies.[36] With this tool, quality is rated based on meeting criteria for thirteen different items and a response of "yes," "no," "not reported," "not applicable," or "cannot determine" was assigned. The quality review of included studies was also performed by research team members reaching consensus, and another researcher (J.B.) served as a tiebreaker. No articles were removed from this review based on study quality because this measure is suggested to be used to identify risk of bias of included studies and not as a tool to provide a summative judgment of quality.[36]

Results

The initial search resulted in a total of 3917 articles, of which 986 remained after removal of duplicates (n=2931) (fig 1). After titles were reviewed, another 687 articles were excluded. Reasons for exclusion of studies were the study was done in children (236), did not use activPAL (68), was not done in community-dwelling adults (48), or did not include adults 65 years or older (98) or because of study design (237). After the screening phase, 299 articles were found to initially fit the inclusion criteria. These articles were then subjected to abstract review and compared with inclusion and exclusion criteria, resulting in 292 additional articles being removed, resulting in a total of 7 eligible articles. The reasons and prevalence for exclusion at this final stage were as follows: did not report data from activPAL (119), were not done in community-dwelling older adults (8), or did not include adults 65 years or older (80) or study design (85). Data extraction was performed using the 7 remaining studies.[37-43]

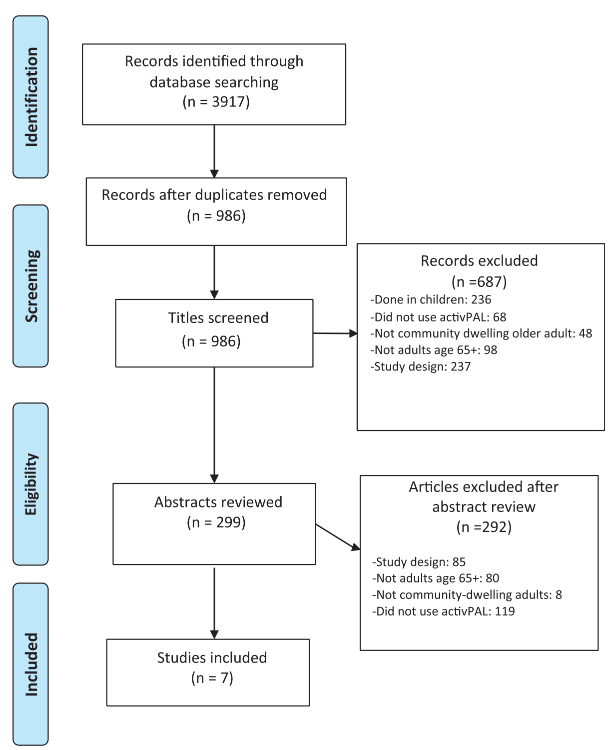

Fig 1 Flow diagram of study selection.

Demographic data for included studies are found in table 1. Three studies were conducted in the United Kingdom,[37-39] 1 in the United States,[43] 2 in Germany,[40,41] and 1 in Australia.[42] Studies were published between 2011 and 2019.[37-43] Study duration ranged from 6 months to 7 years.[40,42] Three were cohort studies,[37,40,43] 3 were cross-sectional studies,[37,39,42] and 1 used data from a randomized controlled trial.[42] Sample sizes ranged from 44-1333 participants. Across all studies, the majority of participants were White. Two studies used the same cohort to comprise the sample, the Lothian Birth Cohort 1936.[38,39] The average age across studies ranged from 70.9-79.0 years. All but 1 study[37] reported comorbidity in participants either in categorical data[40-42] or through using a comorbidity index.[38,39,43]

Risk of bias information is presented in table 2. None of the studies reported blinding the assessors, and attrition could not be determined in 2 articles. Research objectives were clearly stated for all studies. A 20% or less loss to follow-up after baseline was reported in 5 studies,[37,38,40-42] and loss to follow-up could not be determined in 2 studies because of their cross-sectional design.[39,43]

The activPAL data reported are presented in table 3. Although all studies reported placing the device on the participants' thigh, only 4 reported securing the accelerometer on the front of the dominant thigh.[37-39,42] All studies indicated that participants were fitted with the accelerometer by a research team member. Only 1 study indicated that participants were fitted with the accelerometer in the home.[37] One study provided instruction to participants to take the accelerometer off in situations where it might become wet.[37]

Studies differed in what was considered to be a valid wear day because 2 studies defined it as a day that included a full 24 hours of accelerometer wear time.[40,41] One study considered a valid wear day if participants wore the monitor for >80% of reported waking hours or ≥10 hours if participants did not record awake time in their diary.[42] All studies required participants to wear the accelerometer for 7 days. However, 2 studies reported only using data over 5 days and were the only studies to report the percentage of participants (91.2%-95.0%) who wore the accelerometer for 5 or more days.[40,41]

Two studies identified how the duration of PA was quantified using activPAL software. In those 2 studies, activity duration was estimated for the whole day (24 hours) as well as during 6-hour intervals.[40,41]

Three studies used activPAL to report the number of steps completed per day. Average daily step count ranged from 864.8-15847 steps.[38,39,43] Two studies[38,39] reported step counts using the median and IQR, while the other study reported step counts using the mean average and SD.[37]

Four studies used activPAL to report the amount of time spent walking, which was reported in either minutes per day[40,41,43] or hours per day.[42] Two studies reported walking as the average of time, in minutes per day, across a full week of accelerometer wear time.[40,43] Another study reported walking in minutes per day by reporting the amount of time walked by each day of the week, rather than a weekly total or average across the week.[41]

Sit-to-stand transitions (number/d) were measured in 4 studies and averaged between 10.0-63.4 completed per day.[38,39,42,43] One study reported the number of sit to stands per day by male or female sex.[42]

Six studies used the accelerometer to measure sedentary time.[37-40,42,43] Two studies measured sedentary time as a percentage of total time awake,[38,39] while 4 measured sedentary time in either total minutes[40,43] or hours per day.[37,42] One study reported sedentary time per day using a questionnaire and accelerometer measurements.[37] That same study used activPAL data to calculate the amount of sedentary breaks taken per day and sedentary break duration.[37]

One study used activPAL data to assess activity intensity in METs as a total number of METs per day ranging from 23.1-29.6.[43] High-intensity physical activity in older adults, specifically MVPA, was not objectively measured using the accelerometer in any included study. However MVPA was measured by self-report in 1 study[42] in min/d and through the use of another accelerometer, the wrist-worn ActiGraph GT3X, in total min/wk in another study.[37]

Three studies described using the activPAL 3c uniaxial accelerometer,[38,39,42] while the other 4 studies did not indicate what activPAL version was used. One study reported using activPAL software version 6.3.1,[42] while the other studies did not indicate what version of the professional software was used to assess PA data.

Discussion

With decreased levels of activity with age, accelerometers have been used to objectively measure PA in older adults. The use of thigh-worn accelerometers have increased in the literature because of their ability to quantify and categorize PA.[27] The activPAL accelerometer has been identified as one of the most commonly used thigh-worn research grade accelerometers.[28] This systematic review found that in studies with community-dwelling older adults, activPAL was most commonly used to measure time spent walking, the number of sit-to-stand transitions per day, and also the amount of sedentary time per day. Although studies performed with healthy younger adults have used this accelerometer to quantify higher level PA activities, such as MVPA in free-living environments,[44] none of the included studies utilized the device in this manner.

The activPAL accelerometer has been validated to collect data on walking, standing, sitting, lying time, upright transitions, and sedentary time.[29] Using an algorithm from PAL Technologies, this uniaxial accelerometer is able to properly categorizes energy expenditure of low-intensity activities.[3,45-48] In addition, previous studies suggest that this accelerometer is more appropriate to use at slower walking speeds than other devices.[3] Although activPAL has better accuracy at slower walking speeds, other studies have reported that its data are compromised at walking speeds <0.5m/s.[31,45] Additionally, other researchers have reported that activPAL underestimates higher levels of PA[3,49] but has good accuracy when assessing sedentary time.[49] Within this review, this accelerometer was most often used to collect data on walking, sit-to-stand transitions, and sedentary time. Because of its ability to reliably categorize low-intensity activities,[49] activPAL should be considered for use to measure low-intensity activities or sedentary time in community-dwelling older adults whether in laboratory, free-living, or clinical based settings.

Table 1 Demographic information and characteristics of included studies

Author	Location	Length of Study	Total Sample Size	Female, n (%)	Age (y), mean ± SD	Setting	Study Design	Study Purpose	Comorbidity Reported
Gale et al[38]	United Kingdom	7 y	248	122 (47.1)	79.0±0.45	Community	Cross-sectional	To investigate the cross-sectional relationship between epigenetic age acceleration measures and objectively measured sedentary behavior and physical activity.	Chronic physical illness, mean: 2 Range: 1-3
Gale et al[39]	United Kingdom	7 y	271	131 (48.3)	79.1±0.44	Community	Cross-sectional	To investigate the relationship between attitudes to aging and objectively measured sedentary time and walking behavior.	Chronic physical illness, mean: Range: 1-2
Gennuso et al[37]	United States	8 mo	44	28 (63.6)	Median, (range) Female: 71, (69-74) Male: 70, (67-78)	Community	Cohort	To investigate the relationship between objectively measured sedentary behavior and performance-based physical function measures in community-dwelling older adults.	NR
Klenk et al[40]	Germany	13 mo	1271	554 (43.6)	75.6±6.51	Home visits/ community	Cohort	To analyze the effect of objectively measured sedentary behavior and walking duration on 4-y mortality in community-dwelling older adults.	Hypertension: 53.7% Cardiovascular disease: 25.0% Cancer: 18.3% Diabetes: 14.1% Chronic kidney disease: 3.4%
Klenk et al[41]	Germany	13 mo	1333	584 (43.8)	75.5±6.5	Home visits/ community	Cohort	To assess the effect of the day of the week on objectively measured physical activity in community-dwelling older adults.	Cardiovascular disease: 25.0% Cancer: 17.9% Diabetes: 13.9%
Lord et al[43]	United Kingdom	6 mo	56	30 (53.6)	79.9±4.9	Community	Cross-sectional	To quantify and describe sedentary behavior and habitual physical activity in community-dwelling older adults.	Cornell Medical Index, mean: 1.7±1.5 Range: 0-6
Reid et al[42]	Australia	2 y	123	78 (63.4)	70.9±4.2 Male: 71.7±4.8 Female: 70.4±3.7	Community	Randomized controlled trial	To examine the associations between objectively measured total daily sitting time and objectively measured number of sitting time breaks with muscle mass, strength, function, presarcopenia, and markers of systemic inflammation in community-dwelling older adults.	Presarcopenic: Total: 16.3% Male: 22.2% Female: 12.8%

Abbreviation: NR, not reported.

Table 2 Risk of bias of included studies

Criteria	Gale et al[38]	Gale et al[39]	Gennuso et al[37]	Klenk et al[40]	Klenk et al[41]	Lord et al[43]	Reid et al[42]
Research question or objective clearly stated	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Study population clearly defined	Yes	Yes	Yes	Yes	Yes	No	Yes
Participation rate of eligible persons described	No	Yes	CD	Yes	Yes	CD	CD
Participant selection and recruitment described	Yes	Yes	No	Yes	Yes	Yes	Yes
Sample size justification, power description, or variance and effect estimates provided	Yes	Yes	Yes	No	No	No	No
Exposure(s) of interest measured prior to outcome(s) being measured	No	No	No	No	No	No	No
Time frame sufficient between exposure and outcome	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Independent variables clearly defined, valid, reliable, and implemented consistently across all study participants	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exposure(s) assessed more than once over time	No	No	No	No	Yes	No	No
Dependent variables clearly defined, valid, reliable, and implemented consistently across all study participants	Yes	Yes	No	Yes	Yes	Yes	Yes
Blinding of outcome assessors	No	No	No	No	No	No	No
Attrition reported	Yes	CD	Yes	Yes	Yes	CD	Yes
Potential confounding variables measured and adjusted statistically for analyses	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Abbreviation: CD, cannot determine.

Like their younger peers, older adults benefit from completing the recommended 150 minutes of MVPA each week.[50] As many health-related benefits exist as a result of completing high-intensity PA, quantifying the amount of MVPA completed should be performed when measuring older adults' overall activity levels.[51] In this review, only 1 study reported MVPA, but those data were collected via self-report, not through the use of an accelerometer.[42] Studies indicate that when PA data are collected via self-report, they are often overestimated in older adults, thus affecting the validity of these measurements.[52] A different study in this review reported activity intensity in the form of energy expenditure from activPAL data; however, this was reported as the total number of METs achieved per day and not as a percentage of time spent completing higher-intensity activities, such as MVPA.[43] When considering measurement of MVPA, data from activPAL are reported to overestimate energy expenditure in adults and therefore invalidate the categorization of high-intensity PA.[44,49] The current algorithm to calculate MVPA from activPAL data are based on the step rate and METs relationship. In contrast, the literature calls for an algorithm that is based on accelerometry count and METs because the count-METs relationship is stronger than that of the step rate-METs relationship.[44,45] Therefore, we suggest that when measuring MVPA in community-dwelling older adults, other accelerometers should be considered.[3,53] Additionally, if a large variation

Table 3 Characteristics of activPAL use and outcomes measured of included studies

Author	activPAL Placement	activPAL Instructed Wear Time	Actual Wear Time	activPAL Outcomes Reported Per Day*				
				Steps	Time Spent Walking	No. of Sit to Stand Transitions	Sedentary Time	Other Outcomes
Gale et al[38]	Anterior of dominant thigh	7 d, 24 h/d	NR	Steps completed: Median: 6509 IQR: 4945-8662	NR	Median: 43.2 IQR: 35.3-51.2	62.8%±10.4% of waking time	-
Gale et al[39]	Anterior of dominant thigh	7 d, 24 h/d	NR	Steps completed: Median: 6539 IQR: 4951-8761	NR	Median: 43.1 IQR: 35.3-51.4	62.5%±10.4% of waking time	-
Gennuso et al[37]	Midline front thigh	All waking hours except during situations where they might get wet	NR	NR	NR	NR	Male:† 9.6 (8.7-11.1) h Female:† 9.3 (7.9-10.3) h	Sedentary breaks per day:† Male: 45.5 (31.9-52.7) Female: 52.0 (41.2-61.3) Sedentary break length (min): Male: 12.7 (10.7-16.0) Female: 10.7 (8.7-13.4)
Klenk et al[40]	Thigh	7 d, 24 h/d	95% had ≥5 d measured	NR	104.0±40.3 min	NR	1060.1±109.5 min	-
Klenk et al[41]	Thigh	7 d, 24 h/d	91.2% had ≥5 d measured	NR	Reported time (min) spent walking by day of the week Monday: 104.2±48.3 Tuesday: 105.8±49.5 Wednesday: 108.3±49.0 Thursday: 108.1±49.9 Friday: 105.2±47.8 Saturday: 104.4±49.8 Sunday: 92.5±49.5	NR	NR	-
Lord et al[43]	Thigh, fitted on the second visit	7 d, 24 h/d	NR	Steps completed: 6343.2±2807.1 Range: 864.8- 15,847.1 steps	80.9±31.4 min Range: 12.2- 173.6 min *Walking time also reported in quartiles	Mean: 39.0±10.7 Range: 10.0-63.4	747.3±116.5 min Range: 340.2-971.6 min *Sedentary time also reported in quartiles	Upright time: 250.9±103.7 min/d Range: 94.1-666.5 min/d Activity intensity: 25.6±1.1 METs/d Range: 23.1-29.6
Reid et al[42]	Anterior midline of right thigh	7 d, 24 h/d	NR	NR	Reported time (h) Total sample: 1.8±0.6 Male: 1.9±0.6 Female: 1.8±0.6	No. completed: Total sample: 47.8±12.4 Male: 47.7±12.4 Female: 47.8±12.4	Hours: Total sample: 9.7±1.8 Male: 9.9±1.9 Female: 9.6±1.8	-

Abbreviation: NR: not reported.

* Reported as mean ± SD unless otherwise noted.

† Expressed as median (25%-75 %).

in PA within their sample is expected, researchers should consider using both the activPAL and a wrist-worn accelerometer.

Accelerometers objectively measure energy expended during PA.[54] Although activPAL underestimates energy expenditure in higher-intensity activities, it is appropriate for use when measuring energy expenditure for low intensity activities.[46,49,55] While the data from this device conveniently categorize type of PA performed such as sitting, walking, and other activities, the energy expenditure of the tasks was only reported in 1 study.[43] Although additional steps would have to be taken to calculate energy expenditure via METs from activPAL raw data, it would improve the measurement of LPA and sedentary behavior to truly capture the level of activity or inactivity of community-dwelling older adults.[49,54] Future studies that use this thigh-worn accelerometer should consider calculating energy expenditure to quantify METs used by activity.

Similar to other literature reviews that describe how accelerometers are used to measure PA across populations, we also found inconsistencies in reporting of time spent in PA and categories of PA completed.[34] Although activPAL conveniently categorizes activity type into groups and can be measured across different time periods ranging from small epochs of time to the percentage of time per day spent doing an activity, a standardized method of reporting PA when using this accelerometer is needed.

Study limitations

Limitations of this systematic review exist. First, despite conducting 2 separate searches using reputable search engines, it is possible that some articles may have been missed during the search because they may have not been indexed in the databases used. Second, data from qualitative or mixed-methods studies were not included, which may have provided additional information for the review. Included studies generally had a low degree of comorbidity or disability, and the use of activPAL to measure PA in those groups may differ in their reporting of outcomes. Lastly, for those with comorbidities, the completion rate or compliance with PA monitoring may not be consistent with those reported in the included studies.

Conclusions

In studies involving community-dwelling older adults, the thigh-worn activPAL uniaxial accelerometer is most often used to measure low-intensity PA, such as walking, step counts, and sit-to-stand transitions, and to quantify sedentary behaviors. We suggest that this accelerometer be considered when prescribing and assessing the amount of time older adults spent walking or stepping as well as assessing periods of inactivity. Because of reported inaccuracies calculating MVPA, we recommend using activPAL only to measure low-intensity activities and sedentary time in community-dwelling older adults. Studies that aim to measure sedentary time, LPA, and MVPA may need to consider use of multiple types of accelerometers.

Corresponding author

Jennifer Blackwood PT, PhD, Department of Physical Therapy, University of Michigan-Flint, 2157 William S. White Bldg, 303 East Kearsley St, Flint, MI 48502-1950. *E-mail address:* jblackwo@umich.edu.

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