**Title**

Examining correlates of self-reported and objectively-measured physical activity among retirement village residents

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# Examining correlates of self-reported and objectively-measured physical activity among retirement village residents


## Abstract

**Objective**: Physical activity (PA) patterns of retirement village residents were investigated using self-report and objective measures. **Methods**: Residents (*n*=323) from retirement villages in Perth, Australia were surveyed on PA behaviour and various demographic, residency, health-related, and mobility factors. Most participants wore accelerometers for seven days. Retirement village managers (*n*=32) were surveyed on village descriptive characteristics, including the provision of amenities and facilities. Logistic regression models examined village and resident characteristics associated with PA. **Results**: Based on objective measurement, only 27.1% of participants were sufficiently active (*n*=288). Walking was one of the most popular PA modes. Few village characteristics were associated with PA; however villages located in more walkable neighbourhoods increased participants' odds of transport walking. Travelling outside the village daily also increased PA odds. **Conclusions**: Most residents were insufficiently active to gain health benefits. Considering individual and environmental factors, within the retirement village and neighbourhood settings, and associations with PA warrants attention.



**Keywords**: physical activity; walking; neighbourhood; built environment; housing for the elderly

## Introduction

The health benefits of physical activity (PA) are comprehensive and well-documented; in addition to reducing chronic disease risk and falls, PA also delays functional limitations and mobility disability.[1] To promote health, participation in ≥150 weekly minutes of moderate-intensity PA is recommended.[2] However, approximately half of Australian seniors do not meet this recommendation, and a further 76% of adults aged ≥75 years are insufficiently active.[3]

PA is a behaviour shaped by the context it occurs in. Social-ecological models posit that multiple factors, including demographic and psychosocial, social and built environmental, and policy-related factors, interact to jointly influence PA.[4] Because of this, it is important to understand PA within the different living environments people reside in.

Retirement villages are emerging as a key service sector for Australian seniors, and while not all choose to live in them, current estimates suggest that 4.8% of over 65's reside in villages.[5] Because residents live independently and in close proximity to others of a similar age and have access to supportive village services, including recreational facilities, the setting appears to minimise some known PA barriers (e.g., lack of PA support, poor access to facilities).[6] However, little research has examined PA within the Australian retirement village context. Miller and Buys[7] found that residents participated in more leisure-time PA than community-dwelling older adults, however the study was limited in its use of self-reported PA, and did not consider total PA.

Self-reported PA is susceptible to recall and reporting bias and not as accurate for assessing low-intensity activity.[8] To overcome these limitations, objective measurement is growing in popularity. However, objective measures are unable to assess specific types of PA undertaken – an aspect that can be self-reported. Many researchers recognise that self-report and objective measures capture distinct and complementary aspects of PA, and a combination

of measures provides a more comprehensive PA assessment.[9,10] Therefore, our aim was to assess levels of PA among retirement village residents using both self-report and objective measurements, and explore individual and village factors associated with PA.

## Methods

The present analysis utilises data from a mixed-method, cross-sectional study examining PA among retirement village residents and the influence of village and neighbourhood environments. Ethics approval was granted by The University of Western Australia's Human Research Ethics Committee (RA/4/1/2151).

### Recruitment

There are 92 member villages of the Retirement Village Association located in the Perth metropolitan and Peel regions of Western Australia, with industry estimates suggesting between 15,000 to 16,000 residents.[11] Based on sample size calculations, the study required 32 retirement villages with ten participants per village to detect a 10% difference in PA due to differences between villages.

*Retirement villages*

The list of member villages was ranked by an objective neighbourhood walkability score, the details of which are published elsewhere.[12] Managers of the highest and lowest ranked villages were systematically contacted by mail and telephone, until 32 villages agreed to participate in the study (48.6% response rate).

*Participants*

Multiple strategies were employed to recruit residents, based on the issues identified by each village's manager. In some villages, invitation letters were delivered to randomly selected residents (48.4% response rate), whereas in other villages, residents volunteered for the study in response to an invitation from the village manager or from briefing sessions

conducted by the research team (i.e., convenience sampling). In total, 325 residents provided written consent (40.3% randomly selected, 59.7% conveniently sampled).

**Study Procedures**

Between July and December 2009, the research team visited each retirement village and participants completed a comprehensive questionnaire within a group setting. To objectively measure PA, most participants wore an accelerometer and completed a diary to monitor wear time (96.3% response rate).Village managers also completed a brief questionnaire on retirement village attributes.

**Measures**

*Objective physical activity*

Actigraph GT1M accelerometers were initialised to collect data in one minute epochs, and participants were given verbal and written instructions to wear the accelerometer over the right hip during waking hours (excluding water-based activity) for the next seven days.

Accelerometer data were scored and interpreted using MeterPlus v4.2 software from Santech, Inc. (www.meterplussoftware.com). Valid accelerometer data were required for at least five valid days; a valid day contained ≥10 valid hours, which were defined as <45 consecutive zero counts.[13,14] Distinguishing PA intensity levels from raw accelerometer data requires the use of cut-points, however no widely accepted cut-points specific for older adults exist. For younger adults, ≥1,952 counts per minute, which corresponds to ≥3 METs, is used extensively to determine moderate-to-vigorous PA (MVPA).[15] Only one study has sought to establish a threshold count for older adults' MVPA, finding it to be lower than younger adults (≥1,041 counts per minute).[16] Based upon these thresholds, and consistent with Buman and colleagues,[13] counts between 1,041 and 1,951 were defined as high-light intensity PA (HLPA) and counts ≥1,952 as MVPA. Minutes per valid wearing day were multiplied by seven to obtain mean weekly minutes of objective HLPA and MVPA.

*Self-report physical activity*

Self-report PA was measured using the Community Healthy Activities Model Program for Seniors (CHAMPS) instrument, which assesses prevalence, frequency and duration of 40 activities undertaken at least weekly during the past month.[17,18] Based on the work of Stewart et al.[17] and Hekler et al.,[19] CHAMPS items with an assigned MET value >2 and <3 were considered HLPA modes (e.g., light intensity housework or gardening, walking leisurely or to errands, stretching and flexibility exercises), and those with MET's ≥3 were categorised as MVPA modes (e.g., walking briskly or uphill, swimming, strength training).[17,19]

*Resident characteristics*

Socio-demographic characteristics such as age, sex, highest education level, marital status, and employment status were included in the resident questionnaire. Residency characteristics included the number of years participants had lived within the village and their previous suburb of residence (i.e., before moving to the village), which was used as a proxy measure for distance relocated. Self-rated health was measured by a single item ("in general would you say your health is excellent, very good, good, fair, or poor?").[20] The 10-item Medical Outcomes Study (MOS) physical functioning measure, score and transformed into a 0-100 scale, assessed the extent to which participants' health limited their PA, with a perfect score of 100 indicating no health-related limitations to PA.[21] Other characteristics included use of assistive devices (i.e., cane or walker, wheelchair, and motorised mobility scooter or gopher), access to a car when needed, and frequency of travelling outside of the village.

*Village characteristics*

Village manager questionnaire items included years of village operation, number of independent living units, weekly operating fee, and the presence of an aged care facility onsite. Two summary scores were computed from the list of 17 services and facilities

accessible within the retirement village. The presence of five recreational facilities (gymnasium, bowling green, swimming pool, golf course, and tennis courts) were summed to produce a score measuring access to village recreational facilities, and the presence of 11 services and facilities (convenience store, banking facilities, postal facilities, library, dining area, theatre or cinema, hairdresser, pharmacy services, doctor, other health services, and transport services) were summed to measure access to village amenities. The presence of a 'clubhouse' remained as a single item. In addition, aerial imagery was used to manually digitise village boundaries in ArcMap 10 allowing village site area (in $m^2$) to be calculated, and the objective neighbourhood walkability score used to select retirement villages for the study was included as a village characteristic.

**Data Analysis**

Descriptive statistics for village and resident characteristics, weekly minutes of objective HLPA and MVPA, and weekly prevalence of self-reported PA modes were computed using SPSS Statistics 19. Participants with and without valid accelerometer data were compared using independent *t*-tests and $\chi^2$ statistics to assess non-response bias. Separate binomial logistic regression models with generalised estimating equations (GEE) to adjust for village-level clustering examined the odds of participating in ≥150 weekly minutes of objectively-measured HLPA or MVPA (dichotomised to overcome non-normal distribution and in accordance with PA recommendations) and associations with village and resident characteristics. Similar models were fitted to predict weekly prevalence of popular PA modes, and all models adjusted for resident sampling method (i.e., random sampling vs. convenience sampling). Significant characteristics ($p<0.05$) were then fitted in adjusted multivariable models.

## Results

Two participants with large quantities of missing survey data were excluded, thus producing an analytical sample of 323 participants from 32 retirement villages, with an average of 10.2 participants per site (range=2-28). Table 1 outlines retirement village and resident characteristics for the study sample. Mean village operation time was 14.6 years (SD=10.3, range=1-39), while most had a communal 'clubhouse' (84.4%) and access to approximately two recreational facilities onsite (SD=1.5, range=0-4). Around two thirds of participants were female (68.1%) and mean age was 76.9 years (SD=7.3, range=53-94). Physical functioning scores ranged from 36.7 to 100.0, with an average of 80.8 (SD=16.0), showing participants to have relatively high functioning (i.e., no physical activity limitations).

Overall, 288 participants had sufficient valid accelerometer data for analysis (92.0%). Participants with valid data were more likely to be married ($p$=0.031), to have lived in their village for fewer years ($p$=0.015), to have higher physical functioning ($p$=0.011), and to use no assistive devices ($p$=0.025).

Table 2 presents weekly prevalence and duration of specific, self-reported PA modes. In terms of activities engaged in at least once a week or more, the most popular modes of HLPA were light housework (e.g., sweeping, vacuuming; 85.8%), light gardening (e.g., watering plants; 70.6%), walking leisurely (61.6%), and walking to do errands (50.2%). The most popular MVPA mode was brisk walking (45.2%). Overall, tennis, running, team sports, golf, pool/billiards, and swimming were among the least reported activities. Median minutes per week of objectively-measured HLPA was 170.0 (IQR=153.5), with just over half undertaking 150 or more weekly minutes (55.9%). For objectively-measured MVPA, median minutes per week was 77.0 (IQR=136.5), with only 27.1% of participants achieving ≥150 minutes, thus reaching the recommended amount of weekly PA.

Table 3 reports the combined regression model odds ratios examining objectively-measured HLPA and MVPA. No village characteristics were significant in single factor models, hence their non-inclusion in Table 3. Age was significantly associated with both HLPA (OR=0.91, 95% CI=0.87-0.95) and MVPA (OR=0.91, 95% CI=0.88-0.95), as was physical functioning (HLPA: OR=1.02, 95% CI=1.01-1.05; MVPA: OR=1.07, 95% CI=1.04-1.11). Participants travelling outside the village daily were 3.36 times more likely to engage in ≥150 weekly minutes of HLPA than participants who left weekly or less (95% CI=1.20-9.37).

The combined odds of weekly walking are presented in Table 4. For every increase in year of village operation time, walking transport odds increased by 1.02 (95% CI=1.01-1.04). Higher neighbourhood walkability scores were also positively associated with transport walking (OR=1.19, 95% CI=1.01-1.39). In addition, the presence of a village clubhouse increased participants' odds of leisure walking (OR=1.52, 95% CI=1.05-2.20), however villages co-located with an aged care facility reduced participants' leisure walking odds (OR=0.63, 95% CI=0.41-0.97). Participants who did not always have access to a car were more likely to walk for transport than those that did (OR=2.07, 95% CI=1.17-3.68). Finally, compared with participants who only travelled outside the village weekly or less, those leaving daily were 4.23 (95% CI=1.26-14.12) and 8.28 (95% CI=2.12-32.36) times more likely to engage in transport and brisk walking respectively.

## Discussion

In contrast to previous work that has primarily relied on self-reported data to assess PA, we were able to combine self-reported and objective measurements to provide a more detailed description of PA among Australian retirement village residents. Only 27.1% of participants engaged in ≥150 minutes of objectively-measured MVPA per week, thus meeting the recommended amount for reducing chronic disease risk and disability.[1] Our sample

participated in more objectively-measured MVPA than continuing care retirement community residents[14] and community-dwelling older adults[22] in the United States, however this may relate in part to differences in participants' physical functioning status and possible self-selection into retirement villages. Nevertheless, our results highlight that approximately 70% of residents do not accrue sufficient amounts of weekly PA to benefit health.

Complementing our objective data with self-reported data allowed examination of the specific PA modes that residents engaged in. Walking, together with light-intensity household chores, was the most popular mode of PA undertaken, replicating past findings.[7,23] Except for lawn and carpet bowls, residents rarely engaged in other leisure activities on a regular, weekly basis. In addition to aerobic PA, older adults are also recommended to participate in strength, flexibility, and balance exercises to promote good health.[1,2] We found that participants did very little of these activities, consistent with other studies.[24]

The extent to which village and resident characteristics influenced residents' PA was also examined. Few village characteristics were significantly associated with PA. We found the presence of recreational facilities within the village to be unrelated to PA in our sample. This contrasted findings by Joseph et al.,[25] though in some ways our finding was unsurprising given that walking was the most popular PA mode participants engaged in. Moreover, the PA types that would occur in the recreational facilities provided (i.e., swimming, tennis, golf) were among the highest proportion of activities not participated in. Surprisingly, the presence of a clubhouse was positively associated with leisure walking, even though the provision of village amenities and recreational facilities, which are often located in the clubhouse, were not. It appears that having a destination or place to walk to within the village promotes PA, but what to provide within that destination in terms of amenities and facilities warrants further investigation. For example, it may be that residents walk to the clubhouse in order to meet and socialise with fellow residents, and not necessarily to engage in PA.

We also found participants' odds of transport walking increased when their village was situated in a neighbourhood with higher walkability, as in the neighbourhood was more conducive to walking. This is consistent with a growing body of evidence highlighting walkable environments to be positively associated with PA among community-dwelling older adults.[26,27] Notably, residents travelling outside the village daily were more likely to engage in objectively-measured HLPA, transport walking, and brisk walking. This builds on similar reports by Davis and colleagues[28] on the importance of seniors taking daily trips outside of the home, using active travel modes, by showing the added importance of retirement village residents leaving not only their home, but also the village vicinity.

Despite its being largely descriptive, some implications and areas requiring further research arise from our findings. First, given the insufficient levels of PA observed, encouraging greater PA participation among retirement village residents is warranted. We found participants spent more time in objectively-measured HLPA than MVPA, and this may be a reflection of increasing age and declining physical functioning. Seeking ways to increase the intensity of activities undertaken, but at the same time recognising reduced capacity, could assist in promoting sufficient amounts of health-enhancing PA among residents. In addition, there is a need to promote more diversity in the types of PA residents engage in, given the predominance of aerobic PA participation and the importance of other strength, flexibility, and balance exercises to overall health.

The presence of recreational facilities within the village did not appear to be related to PA. In the exploratory qualitative work underpinning this study, mixed views were raised as to how important recreational facilities were for residents' PA, and these themes may provide some insight into the quantitative findings presented here. For example, some focus group participants considered recreational facilities to be unimportant for PA because their presence did not equate to their use.[29] Further research should consider use of recreational facilities,

not simply the presence of facilities and associations with PA, while investigating ways in which to encourage greater use of recreational facilities when accessible within villages also warrants attention. Another issue raised in the qualitative enquiry was that some residents who preferred access to recreational facilities within the village also wanted the same facilities located in the wider community.[29] Miller and Buys[7] found that most retirement village residents used recreational facilities outside the village for PA, with only 20% using village infrastructure. This suggests that future research into the use of village recreational facilities and village environment characteristics influencing PA should be studied alongside the importance of neighbourhood features, and how these jointly impact PA. In other words, the presence of recreational facilities within the village may be unrelated to PA when the same facilities are accessible in the surrounding neighbourhood, but positively associated with PA if no other proximate options exist.

Given the possibility that the way in which supportive village environments relate to residents' PA may differ according to wider neighbourhood characteristics, future research should also consider the role played by neighbourhood environmental attributes in residents' PA in greater detail. This thinking is consistent with social-ecological models of behaviour, which emphasise PA to be associated with multiple levels of interacting factors.[4] Greater knowledge and understanding in this area could contribute to designing pedestrian-friendly environments surrounding retirement villages that encourage residents to take daily trips outside the village on foot.

Using self-report and objective PA measures was a study strength that allowed a more detailed and comprehensive understanding of overall behaviour together with specific PA modes, which gave better knowledge of PA within the retirement village setting. However, an important study limitation for consideration relates to the generalisability of findings. No comprehensive or standardised data on retirement villages or village residents exists in

Australia.[5] Thus, we were unable to formally assess the representativeness of our sample. Given that participant recruitment involved both random selection and convenience sampling, and despite efforts to adjust for sampling method in regression analyses, it is possible that our sample was still biased towards more active residents with higher physical functioning, and therefore, may not be a true representative sample of Australian retirement village residents. Nevertheless, the study did also include a fairly large sample of retirement villages, thus providing greater variability across villages, which is a further strength. Other study limitations include the cross-sectional design, meaning causality cannot be inferred, and the differences found between participants with and without valid accelerometer data suggest that those without valid accelerometer data may be less active, thus observed PA levels could be slightly overestimated.

In conclusion, older adults residing within the retirement village setting are insufficiently active, and there is a need to increase levels of health-enhancing PA among residents. Future research should more explicitly examine individual, social, environmental, and policy-related factors, both within the retirement village setting and the surrounding neighbourhood context, and how these factors interact to jointly influence PA behaviours. Greater understanding in this area has the potential to inform population-based behaviour change interventions and health promotion programs and policies seeking to increase PA in retirement village residents.

**Key Points**

- Participation in sufficient amounts of PA was low among residents of Australian retirement villages.
- Walking was the most popular PA type and was positively associated with higher neighbourhood walkability and travelling outside the village daily.

- Greater understanding is needed on multilevel factors within the retirement village and neighbourhood contexts that influence PA among residents.

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**Table 1**: Description of village (*n*=32) and resident (*n*=323) characteristics

| | |
|---|---|
| **Village characteristic** | |
| Operation time (years; range=1-39) | |
| Mean, SD | 14.6, 10.3 |
| Independent living units (count; range=15-326) | |
| Mean, SD | 108.8, 69.9 |
| Site area ($m^2$; range=5 006-146 392) | |
| Mean, SD | 39 091.7, 34 344.1 |
| Onsite aged care facility (%) | |
| No | 62.5 |
| Yes | 37.5 |
| Clubhouse present (%) | |
| No | 15.6 |
| Yes | 84.4 |
| Amenities (score; range=0-9)† | |
| Mean, SD | 4.4, 2.8 |
| Recreational facilities (score; range=0-4)‡ | |
| Mean, SD | 1.9, 1.5 |
| Weekly operating fee ($; range=50-378) | |
| Mean, SD | 89.4, 62.0 |
| Neighbourhood walkability (score; range=-3.8-7.8)§ | |
| Mean, SD | -0.2, 1.8 |
| **Resident characteristic** | |
| Age (years; range=53-94) | |
| Mean, SD | 76.9, 7.3 |
| Sex (%) | |
| Male | 31.9 |
| Female | 68.1 |
| Education level (%) | |
| Secondary or less | 47.7 |
| Trade/Certificate | 41.2 |
| Bachelor or higher | 11.1 |
| Marital status (%)* | |
| Married | 52.9 |
| Not married | 47.1 |
| Employment status (%) | |
| Not retired | 16.7 |
| Retired | 83.3 |
| Duration of village residency (years; range=0.04-21.75)* | |
| Mean, SD | 5.6, 4.6 |
| Distance relocated (%) | |
| Same or bordering suburb | 27.6 |
| Further | 72.4 |
| Self-rated health (%) | |
| Fair or poor | 14.2 |
| Good | 31.9 |
| Very good | 39.6 |
| Excellent | 14.2 |
| Physical functioning (score; range=36.7-100.0)* | |

| | |
|---|---|
| Mean, SD | 80.8, 16.0 |
| Use of assistive devices (%)* | |
| No | 85.4 |
| Yes[¶] | 14.5 |
| Access to car (%) | |
| Always | 76.5 |
| Not always | 23.5 |
| Frequency of travelling outside village (%) | |
| Weekly or less | 6.2 |
| Few times a week | 43.0 |
| Daily | 50.8 |

SD=standard deviation.

[†]Presence of gymnasium, bowling green, swimming pool, golf course, and tennis courts summed.

[‡]Presence of convenience store, banking facilities, postal facilities, library, dining area, theatre or cinema, hairdresser, pharmacy services, doctor, other health services, and transport services summed.

[§]*Z*-scores for objective residential density, street connectivity, and land-use mix measures within 400m service area summed; a higher score indicates a service area relatively more conducive to walking.

[¶]Assistive devices included wheelchair, cane or walker, and motorised mobility scooter or gopher.

*Difference between objective physical activity data sub-sample ($n$=288) and other participants significant at $p<0.05$.

**Table 2**: Weekly participation and minutes of self-reported physical activity modes (*n*=323)

| **HLPA modes** | **Never participate (%)** | **Participate <weekly (%)** | **≥Weekly participation (%)** | **Minutes per week (Mean, SD)** |
|---|---|---|---|---|
| Light housework | 5.3 | 9.0 | 85.8 | 197.2, 224.4 |
| Light gardening | 16.1 | 13.3 | 70.6 | 81.7, 115.8 |
| Walk leisurely | 24.1 | 14.2 | 61.6 | 117.4, 196.8 |
| Walk to errands | 29.1 | 20.7 | 50.2 | 50.4, 78.0 |
| Stretching/flexibility exercises | 50.2 | 9.6 | 40.2 | 32.3, 59.0 |
| Volunteer work | 45.5 | 17.3 | 37.2 | 110.0, 236.4 |
| Yoga/tai chi | 91.3 | 1.5 | 7.1 | 6.6, 35.7 |
| Shoot pool/billiards | 87.9 | 6.5 | 5.6 | 9.8, 47.8 |
| Golf, riding cart | 97.2 | 1.9 | 0.9 | 1.9, 20.0 |
| **MVPA modes** | | | | |
| Walk briskly | 42.1 | 12.7 | 45.2 | 81.4, 194.3 |
| Light strength training | 66.9 | 9.9 | 23.2 | 15.6, 43.9 |
| Lawn/carpet bowls | 73.4 | 5.3 | 21.4 | 58.3, 146.9 |
| Walk uphill | 57.6 | 21.7 | 20.7 | 17.8, 57.8 |
| Riding bicycle | 74.3 | 7.7 | 18.0 | 19.0, 58.2 |
| Heavy gardening | 49.5 | 33.4 | 17.0 | 40.5, 132.7 |
| Heavy housework | 44.6 | 38.7 | 16.7 | 29.0, 85.0 |
| Water exercises | 79.9 | 5.6 | 14.6 | 13.3, 41.1 |
| Aerobic machines | 81.1 | 5.0 | 13.9 | 10.5, 45.0 |
| Moderate strength training | 88.2 | 2.5 | 9.3 | 7.2, 30.4 |
| Dance | 87.3 | 4.6 | 8.0 | 13.8, 57.6 |
| Aerobics | 91.0 | 2.2 | 6.8 | 6.7, 27.2 |
| Swim gently | 77.7 | 15.8 | 6.5 | 5.7, 27.6 |
| Swim moderately/fast | 84.8 | 9.3 | 5.9 | 6.6, 32.2 |
| Golf, carrying equipment | 93.2 | 2.2 | 4.6 | 15.9, 83.0 |
| Team sports | 97.5 | 0.3 | 2.2 | 8.4, 69.6 |
| Jog/run | 94.7 | 3.4 | 1.9 | 1.1, 10.1 |
| Doubles tennis | 98.8 | 0.6 | 0.6 | 1.4, 20.6 |
| Singles tennis | 99.1 | 0.9 | 0.0 | 0.0, 0.0 |

SD=standard deviation. HLPA=high-light physical activity. MVPA=moderate-to-vigorous physical activity.

**Table 3**: Combined logistic regression models examining village and resident characteristics associated with objective physical activity (*n*=288)

| **Resident characteristic** | **≥150 weekly minutes of HLPA†** | | | **≥150 weekly minutes of MVPA†** | | |
|---|---|---|---|---|---|---|
| | **OR** | **95% CI** | **p** | **OR** | **95% CI** | **p** |
| Age (years) | 0.91 | 0.87, 0.95 | *** | 0.91 | 0.88, 0.95 | *** |
| Education level (%): Secondary or less | 1.00 | | | ‡ | | |
| Trade/Certificate | 0.48 | 0.29, 0.81 | ** | ‡ | | |
| Bachelor or higher | 0.55 | 0.25, 1.24 | | ‡ | | |
| Self-rated health (%): Fair or poor | 1.00 | | | 1.00 | | |
| Good | 1.55 | 0.72, 3.34 | | 1.43 | 0.48, 4.21 | |
| Very good | 1.39 | 0.66, 2.95 | | 1.12 | 0.35, 3.53 | |
| Excellent | 4.57 | 1.03, 20.24 | * | 1.15 | 0.34, 3.90 | |
| Physical functioning (score) | 1.02 | 1.00, 1.05 | * | 1.07 | 1.04, 1.11 | *** |
| Use of assistive devices (%): No | 1.00 | | | 1.00 | | |
| Yes | 0.78 | 0.25, 2.38 | | 0.90 | 0.20, 4.06 | |
| Frequency of travelling outside village (%): Weekly or less | 1.00 | | | 1.00 | | |
| Few times a week | 2.08 | 0.77, 5.62 | | 3.23 | 0.21, 49.38 | |
| Daily | 3.36 | 1.20, 9.37 | * | 5.65 | 0.44, 72.21 | |

HLPA=high-light physical activity. MVPA=moderate-to-vigorous physical activity. OR=odds ratio. CI=confidence interval.
†Characteristics significant in single models ($p<0.05$) modelled jointly, adjusted for village-level clustering, sampling method, and other characteristics in model. ‡Characteristic not significant in single model, thus excluded from combined model.
*Significant differences at $p<0.05$. **Significant differences at $p<0.01$. ***Significant differences at $p<0.001$.

**Table 4**: Combined logistic regression models examining village and resident characteristics associated with self-reported walking (*n*=323)

| **Village characteristic** | **≥Weekly participation in leisure walking**[†] | | | **≥Weekly participation in transport walking**[†] | | | **≥Weekly participation in brisk walking**[†] | | |
|---|---|---|---|---|---|---|---|---|---|
| | **OR** | **95% CI** | **p** | **OR** | **95% CI** | **p** | **OR** | **95% CI** | **p** |
| Operation time (years) | ‡ | | | 1.02 | 1.01, 1.04 | * | 0.98 | 0.95, 1.00 | |
| Site area ($m^2$) | ‡ | | | 0.01 | 0.00, 4.66 | | ‡ | | |
| Onsite aged care facility (%): No | 1.00 | | | 1.00 | | | ‡ | | |
| Yes | 0.63 | 0.41, 0.97 | * | 0.60 | 0.36, 1.00 | | ‡ | | |
| Clubhouse present (%): No | 1.00 | | | ‡ | | | ‡ | | |
| Yes | 1.52 | 1.05, 2.20 | * | ‡ | | | ‡ | | |
| Weekly operating fee ($) | ‡ | | | ‡ | | | 1.00 | 0.99, 1.00 | |
| Neighbourhood walkability (score) | ‡ | | | 1.19 | 1.01, 1.39 | * | ‡ | | |
| **Resident characteristic** | | | | | | | | | |
| Age (years) | 0.97 | 0.93, 1.00 | | ‡ | | | 1.00 | 0.97, 1.03 | |
| Self-rated health (%): Fair or poor | ‡ | | | ‡ | | | 1.00 | | |
| Good | ‡ | | | ‡ | | | 0.99 | 0.42, 2.31 | |
| Very good | ‡ | | | ‡ | | | 1.07 | 0.39, 2.90 | |
| Excellent | ‡ | | | ‡ | | | 0.88 | 0.32, 2.44 | |
| Physical functioning (score) | 1.01 | 1.00, 1.02 | | ‡ | | | 1.03 | 1.01, 1.05 | ** |
| Use of assistive devices (%): No | ‡ | | | ‡ | | | 1.00 | | |
| Yes | ‡ | | | ‡ | | | 0.73 | 0.33, 1.64 | |
| Access to car (%): Always | ‡ | | | 1.00 | | | ‡ | | |
| Not always | ‡ | | | 2.07 | 1.17, 3.68 | * | ‡ | | |
| Travelling outside village (%): Weekly or less | ‡ | | | 1.00 | | | 1.00 | | |
| Few times a week | ‡ | | | 2.44 | 0.74, 8.06 | | 4.45 | 1.13, 17.52 | * |
| Daily | ‡ | | | 4.23 | 1.26, 14.12 | * | 8.28 | 2.12, 32.36 | ** |

OR=odds ratio. CI=confidence interval.

[†]Characteristics significant in single models ($p<0.05$) modelled jointly, adjusted for village-level clustering, sampling method, and other characteristics in model. [‡]Characteristic not significant in single model, thus excluded from combined model.

*Significant differences at $p<0.05$. **Significant differences at $p<0.01$. ***Significant differences at $p<0.001$.