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Research Article

Physical Activity and Subjective Vitality in Older Adults From Community-and Assisted-Living Settings

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SUMMARY

Purpose: There is a growing number of older adults moving into assisted-living facilities to maintain their independence while being assisted with certain tasks and having convenient access to services. Physical activity (PA) and vitality play an important role in independence, as well as in mental health, of older adults. However, no research has examined the difference in older adults' levels of vitality (defined as the state of feeling alive and alert) between those living in assisted-living facilities and those from community-living settings. This study also explored sociodemographic predictors of PA and vitality among older adults living in two different types of housing.

Methods: This cross-sectional study examined differences in PA levels and vitality between older adults (aged $\geq$ 60 years; n = 148, mean age = 74.70 years) living in assisted-living facilities (n = 85, mean age = 77.46 years) and those in community-living settings (n = 63, mean age = 70.98 years). PA was assessed by accelerometry, and vitality was measured using the subjective vitality scale.

Results: Engagement in light PA and moderate to vigorous PA was higher in individuals living in community-living settings after controlling for sociodemographic variables. However, vitality was not significantly different between the two types of housing after controlling for sociodemographic variables. Marital status, education, and number of diagnosed diseases were associated with vitality.

Conclusion: The support is needed for designing strategies to increase PA in older adults living in assisted-living facilities. More attention should be paid to increasing subjective vitality of older adults in both types of housing to promote healthy aging.

Introduction

The aging population is a global phenomenon, with dramatic increases in the proportion of individuals aged 60 years and older [1]. In 2015, older adults accounted for almost one-tenth (8%) of the world's population [1], which is expected to increase to 24.2% by 2040 [2,3]. Old age is associated with biological and cognitive degeneration, increasing the risk of the development of chronic conditions, such as cardiovascular disease, type 2 diabetes, and cancer, as well as increasing risk of disability due to injury and trauma [4]. Poor mental health is also a concern, with approximately 15% of older people diagnosed with a mental health disorder worldwide, including depression and dementia [5].

It is well documented that regular engagement in physical activity (PA) contributes to important determinants of healthy aging including good physical and mental function, managing or coping with illness and functional limitations, and better social interaction among others [6]. Older adults are encouraged to achieve a minimum of 150 minutes of moderate to vigorous PA (MVPA; e.g.,

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running) per week [7] and break up prolonged periods of sedentary time with light PA (LPA). [7,8] Although LPA (e.g., low-intensity walking) does not provide the same level of health benefits as MVPA (i.e., cardiometabolic health) [9], LPA does provide important health benefits over being sedentary [6]; for instance, participation in LPA for at least 300 min/wk has been shown to be associated with lower body mass index values and insulin resistance [10]. Despite the benefits, many older adults do not meet the recommended levels of PA [11]. This has negative implications for physical and psychological health and places a huge economic burden on the wider society [12].

When older adults no longer feel able to remain living in community-living settings (CLSs), they may choose to move to assisted-living facilities (ALFs) [13]. The purpose of ALFs is *"to provide supportive housing and meals and some assistance with daily living activities"* (p. 25) [14]. In the United Kingdom, the number of older adults moving to ALFs increased by 7.8% from 55,675 in 2012 to 60,022 in 2015 [15,16]. Older adults in ALFs tend to be frailer than those living in CLSs [17], but healthier than those in nursing homes [18]. In addition, individuals residing in ALFs are less likely to engage in both MVPA and LPA than those living in CLSs. For instance, community-dwelling older adults have been found to spend only 4% of their waking hours in objectively measured MVPA and 39% of their waking hours in objectively measured LPA [19]. Older adults residing in ALFs have even lower levels of MVPA (2%) and LPA (17.7%) [20]. However, direct comparisons between studies are difficult owing to different PA cutoff points used when assessing objectively measured PA, particularly MVPA (e.g., $\geq$ 1,952 vs. 2,020 counts per minute). Moreover, previous studies including those conducted on nonindependent older adults did not distinguish between those living in ALFs and those living in institutionalized settings (e.g., nursing homes) [21] and/or used self-reported measures of PA, which can lead to inaccurate findings [22].

Physically active older adults reported better vitality than their sedentary counterparts [23]. Subjective vitality is the state of feeling alive and alert [24] and is positively related to mental health [24] and physical health [25]. Loss of vitality is a common complaint of older adults. Engagement in PA and vitality may play an important role in the health of older adults. However, no research has examined the difference in older adults' levels of vitality between those living in CLSs and those living in ALFs. Therefore, the aim of the present study was to compare levels of objectively measured PA and subjective vitality between older adults from CLSs and those living in ALFs.

Methods

Study design and participants

To participate in this cross-sectional study, participants had to be aged 60 years or older and able to walk and stand by themselves with a walking aid; wheelchair-bound individuals were excluded from this study. Participants' contact information was obtained from the Birmingham 1000 Elders group: a group of older adults registered as volunteers for aging-related studies. Potential participants from the group were contacted via e-mail, post, or phone by the first author. To recruit participants living in ALFs, access to ALFs was obtained by contacting the managers who agreed to share the information of the study to their clients through their newsletters and monthly meetings. Individuals who volunteered to participate were either visited at the location of their choice or invited to university facilities.

To calculate the sample size, the G*power 3.1.9.4 program (Universitat Kiel, Kiel, Germany) [26] was used. For a two-tailed analysis using multiple regression (under the presumption of an α-level of .05, a power of 90%, seven predictors, and an effect size of 0.15), the estimated sample size was 130 participants. The final sample size in the study comprised 148 older adults (mean age = 74.70 years, standard deviation = 8.28; 68.2% women), with 63 participants living in CLSs (mean age = 70.98 years; 68.3% women) and 85 living in ALFs (mean age = 77.46 years; 68.2% women).

Data collection

In the first visit, the participants were asked to complete a questionnaire pack to collect sociodemographic and vitality data. Subsequently, an accelerometer was given to each participant. Researchers (one to six persons) instructed the participants to wear the accelerometer on their right hip for a period of 7 days, only removing for sleeping, bathing, and swimming. In addition, the participants were asked to record start- and stop-wearing times in a daily activity log. At the second visit, the participants returned the accelerometer, the activity log, and the questionnaire pack. Each consultation lasted 10–20 minutes.

Measures

Uniaxial accelerometers (GT3X+, WGT3X-BT; ActiGraph, Pensacola, FL, USA) were used to objectively measure PA for a period of seven days at 60 Hz. The accelerometers were set to recognize the nonwear time with a consecutive zero time for 90 minutes, but interruptions were allowed for 1 to 2 minutes for less than 100 counts [27]. To be included in the analysis, the participants had to wear the accelerometer for at least 3 days and for at least 10 hours/day of valid wear time derived from ActiLife software from ActiGraph (version 6.13.3) [28].

In the analysis of accelerometer data, this study used the most common times that the participants recorded as start- and stop-wearing times. We found that 7:00 am to 10:30 pm (CLS) and 7:30 am to 10:30 pm (ALF) were the best fit based on the time frames reported in the participants' activity logs. Cutoff points to determine time spent in various levels of PA were as follows: sedentary, 0–99 counts/min; light activity, 100–1951 counts/min; moderate activity, 2,020–5,998 counts/min, and vigorous activity, > 5,999 counts/min [29]. Because older adults are unlikely to engage in vigorous activity, this study merged moderate and vigorous activity into one category defined as MVPA. To adjust the variability of accelerometer wear times, the proportion of time spent in LPA and MVPA was calculated additionally by multiplying the values where time spent in PA was divided by accelerometer wear time [30].

Vitality was measured using the subjective vitality scale [22] over the last 4 weeks. The scale consists of 5 items on a 7-point Likert scale (not at all true = 1, very true = 7; "I felt alive and full of vitality"). The scale has been used for older adults in a previous study [31] and found to demonstrate excellent internal reliability in the present study (α = .94).

Sociodemographic variables included age, marital status, education, income, number of diagnosed diseases, and ethnicity.

Statistical analysis

Data were examined and cleaned based on the procedures proposed by Tabachnick et al [32]. Descriptive statistics (means, standard deviations, and percentages) were calculated for all variables, including skewness for normality and Cronbach α for reliability. This study examined Mahal's distance and Cook's distance for outlier assumption. Multicollinearity of predictors including covariates was explored using variance inflation factor (VIF) statistics. VIF values were suitable for all variables (range = 1.10–1.56),

which are less than the value of multicollinearity (VIF values > 10) [33]. There were no particular outliers based on Mahal's distance (maximum distance = 21.76; critical value = 24.32) [34].

Pearson's correlation coefficients were estimated for independence of dependent variables. Independent *t* tests were used to explore whether there were any significant differences between groups of age and number of chronic diseases. Chi-square tests were used to test for significant differences in gender, marital status, education, annual income, and ethnicity. Hierarchical regressions were performed to examine housing type as a predictor of LPA, MVPA, and vitality. All statistical analyses were conducted using SPSS 23 (IBM Corp, Armonk, NY, USA). Significance was set at $p < .05$.

Ethical considerations

Ethical approval for this study was granted by the Ethical Review Committee of the University of Birmingham (Approval no. 13-0797). Written informed consent was obtained from all participants. Procedures were followed in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All documents were separated into different locked filing cabinets. Extracted data were anonymized using IDs instead of identifiable information.

Results

Table 1 shows the characteristics of participants from the two types of housing. The majority of participants were women (68.2%) and white British (88.5%). Chi-square tests and t tests revealed significant differences in age, marital status, education, annual income, ethnicity, and number of chronic diseases between participants from CLSs and ALFs. Participants living in CLSs were more likely to be younger, live with a spouse, have a higher education degree, have higher annual income, and have fewer chronic diseases than participants from ALFs.

PA levels and vitality scales of older adults living in CLSs and ALFs are shown in Table 2. Skewness scores of continuous variables were acceptable (range of skewness = −0.34 to 1.54; ±2.00) [35]. On average, the participants spent 31.6% of their waking time in LPA on a daily basis. Older adults in CLSs spent more time in LPA (36.31 vs. 28.11 min/day) and MVPA (4.89 vs. 1.37 min/day) than those in ALFs. A higher level of vitality was found in older adults from CLSs than in those from ALFs (4.89 vs. 4.23, respectively). Correlation coefficients (Pearson's r) ranged from .26 to .54 between dependent variables.

Tables 3, 4, and 5 show the results of a series of hierarchical regressions. After adjustment for age, marital status, education, numbers of diagnosed diseases, and ethnicity, type of housing was significantly associated with LPA (Table 3) and MVPA (Table 4). Age was a predictor for LPA (β = −.20) and MVPA (β = −.23), whereas number of diagnosed diseases (β = −.24) and ethnicity (β = −.18) were predictors of MVPA only. Although vitality was significantly higher in those living in CLSs, the association between vitality and the type of housing was no longer significant ($p = .27$) after controlling for the sociodemographic variables. Marital status (β = .25), education (β = .29), and number of diagnosed diseases (β = −.27) were significant predictors of vitality.

Discussion

The purpose of this study was to examine differences in PA levels and subjective vitality between older adults from two different types of housing (CLSs vs. ALFs). It also explored predictors of PA levels and vitality among individuals from CLSs and ALFs. In our study, older adults in ALFs spend a higher proportion of their waking time being physically active (1.4% in MVPA and 28.1% in LPA) than a similar sample of older adults living in ALFs in the US (2.0% in MVPA and 17.7% in LPA) [21]. It is worth noting that the

Table 1 *Sample Characteristics and the Association With the Two Housing Types (N = 148).*

Variable	Total (n = 148)	CLS (n = 63)	ALF (n = 85)	*t* or F (*p*)
Age (yrs), mean (SD)	74.70 (8.28)	70.98 (6.92)	77.46 (8.17)	$t = 5.21$ (<.001***)
Women, n (%)	101 (68.2)	43 (68.3)	58 (68.2)	$x^2 = 0.00$ (.998)
Marital status				
Partner (yes), n (%)	76 (51.4)	41 (65.1)	35 (41.2)	$x^2 = 7.35$ (.004**)
Education, n (%)				
Secondary	43 (29.1)	17 (27.0)	26 (30.6)	$x^2 = 37.46$ (<.001***)
Higher/postgraduate	42 (28.4)	33 (52.4)	9 (10.6)	
Other	49 (33.1)	9 (14.3)	40 (47.1)	
Missing	14 (9.4)	4 (6.3)	10 (11.7)	
Annual income, n (%)				
Less than £20,000	72 (48.6)	22 (34.9)	50 (58.8)	$x^2 = 14.73$ (<.001***)
More than £20,000	63 (42.6)	41 (66.1)	22 (25.9)	
Missing	13 (0.8)	-	13 (15.3)	
Drink alcohol, n (%)				
No	48 (32.4)	16 (25.4)	32 (37.6)	$x^2 = 2.06$ (.107)
Currently	97 (65.5)	46 (73.0)	51 (60.0)	
Missing	3 (2.1)	1 (1.6)	2 (2.4)	
Smoke, n (%)				
No	140 (94.6)	60 (95.2)	80 (94.1)	$x^2 = 0.00$ (.664)
Currently	6 (4.1)	2 (3.2)	4 (4.7)	
Missing	2 (1.3)	1 (1.6)	1 (1.2)	
Ethnicity, n (%)				
White British	131 (88.5)	50 (79.4)	81 (95.3)	$x^2 = 7.53$ (.004**)
Non-white	17 (11.5)	13 (20.6)	4 (4.7)	
Number of diagnosed chronic diseases, mean (SD)	1.37 (1.08)	.84 (.77)	1.76 (1.11)	t = 5.99 (< .001***)

**$p < .01$.
***$p < .001$.
Individuals answering 'other' as their education level were excluded from the chi-square test.
Note. ALF = assisted-living facility; CLS = community-living setting; SD = standard deviation.

Table 2 *Characteristics of the Study Variables (N = 148).*

Variables	Skewness	Cronbach α	Mean (SD)	Range
1. Light PA	0.27	-	31.60 (11.08)	-
Community-living settings	-	-	36.31 (10.54)	-
Assisted-living facilities	-	-	28.11 (10.20)	-
2. MVPA	1.54	-	2.87 (2.10)	-
Community-living settings	-	-	4.89 (3.39)	-
Assisted-living facilities	-	-	1.37 (1.37)	-
3. Vitality	-0.34	.94	4.51 (1.43)	Scale = 1-7
Community-living settings	-	-	4.89 (1.38)	-
Assisted-living facilities	-	-	4.23 (1.40)	-

Note. Light PA = light physical activity; MVPA = moderate to vigorous physical activity; PA = physical activity; SD = standard deviation.

participants in the present study were younger on average (77.46 years of age) than participants in the previous study (83.4 years of age) [20]. Age was found to be a negative predictor of both LPA and MVPA in this study; therefore, it is likely that the discrepancies in PA levels between the present study and previous research are due to age.

Although it was not possible to directly compare the results owing to different accelerometer cutoff points used, the present study builds on previous research by directly comparing PA levels between older adults living in different types of housing. The findings from the present study indicate that differences in LPA and MVPA are more marked than differences in vitality levels between individuals living in CLSs and those living in ALFs. More specifically, time spent in MVPA was two times higher in community-living older adults than in their counterparts. Furthermore, LPA was only associated with age, but MVPA may be influenced by other sociodemographic factors such as education and ethnicity.

To our knowledge, this is the first study examining differences in older adults' level of subjective vitality between older adults living

Table 3 *Hierarchical Regression Models for Associations Between Housing Types and Light Physical Activity (N = 148).*

Variables	β	t (*p*)	β	t (*p*)
Housing types	.36***	4.22 (<.001)	.22*	2.11 (.037)
Age			−.20*	−2.05 (.043)
Marital status			.13	1.50 (.137)
Education			.06	0.66 (.508)
Income			−.03	−0.31 (.760)
Number of diseases			−.15	−1.58 (.118)
Ethnicity			−.07	−0.84 (.401)
R^2 and *p*-value of the model			R^2 change	
			.18***	*p* < .001

*$p < .05$.
***$p < .001$.

Table 4 *Hierarchical Regression Models for Associations Between Housing Types and Moderate to Vigorous Physical Activity (N = 148).*

Variables	β	t (*p*)	β	t (*p*)
Housing types	.55***	7.26 (<.001)	.35***	4.21 (<.001)
Age			−.23**	−2.97 (.004)
Marital status			.04	0.49 (.623)
Education			−.00	−0.03 (.973)
Income			.08	1.03 (.305)
Number of diseases			−.24**	−2.99 (.003)
Ethnicity			−.18*	−2.57 (.011)
R^2 and *p*-value of the model			R^2 change	
			.45***	*p* < .001

*$p < .05$.
**$p < .01$.
***$p < .001$.

Table 5 *Hierarchical Regression Models for Associations Between Housing Types and Vitality (N = 148).*

Variables	β	t (*p*)	β	t (*p*)
Housing types	.25**	2.86 (.005)	.11	1.11 (.268)
Age			−.05	−0.50 (.620)
Marital status			.25**	2.90 (.005)
Education			.29**	3.36 (.001)
Income			−.04	−0.50 (.619)
Number of diseases			−.27**	−2.85 (.005)
Ethnicity			.04	0.48 (.632)
R^2 and *p*-value of the model			R^2 change	
			.20***	*p* < .001

**$p < .01$.
***$p < .001$.

in CLSs and ALFs. The results revealed levels of vitality to be higher in participants in CLSs than in ALFs, but this relationship was no longer significant after adjusting for sociodemographic variables. Sociodemographic variables such as marital status, education level, and number of chronic diseases were found to be significantly associated with older adults' levels of vitality. A previous study found that vitality levels were higher in more active individuals [36]; however, the study failed to explore difference among housing types and to adjust for sociodemographic variables, such as education level, income, and so on. Our results suggest that vitality, which represents a mental aspect of health, might be more directly linked to an individual's background than to the type of housing. Thus, it is important to consider such sociodemographic factors when developing and delivering interventions to enhance both PA and levels of vitality in older adults irrespective of the type of housing they live in. For example, local governing bodies of CLSs could provide more people-centered community programs for those who live alone and have poor education backgrounds. In addition, staff in ALFs could provide activities to promote vitality through social interaction while involving older adults in PA programs. This is particularly important for individuals living in ALFs who are more likely to be widowed and are frailer than those living in CLSs [17,37]. These PA programs should focus on promoting LPA, which is more common in older adults and has been shown to benefit both physical and mental health and well-being [6]. For instance, activities could have frequent breaks or diverse time durations to facilitate engagement in PA for older adults who are frailer or suffer from chronic diseases.

The limitations of this study are as follows: the sample size which was relatively small and participants were mainly women and white British. As such, the results cannot be generalized beyond older adults in the present study. Further studies are needed to examine associations between PA and housing types in a more diverse sample. In addition, it was not possible to examine the casual relationships between PA, vitality, and types of housing owing to the cross-sectional nature of the study. Further research should focus on exploring different ways to increase PA, particularly LPA in individuals living in ALFs.

Conclusion

This study is the first to compare objectively measured PA between older adults from CLSs and those living in ALFs. Older adults in CLSs were found to engage in higher levels of LPA and MVPA than those from ALFs. These findings highlight the need for interventions aimed at increasing activity levels in older adults from ALFs. Levels of vitality were higher in participants in CLSs as opposed to those in ALFs; however, this relationship was no longer significant after adjusting for sociodemographic variables. Thus, it may be that sociodemographic factors (i.e., marital status,

education level, and number of chronic diseases) are more significant than housing type in predicting levels of vitality among older adults.

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Conflict of interest

The authors have no potential conflicts of interest.

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