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Living Environment and Mobility of Older Adults

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Key Words
Physical functioning · Physical activity · Pedometer · Housing · Independence

Abstract
Background: Older adults often elect to move into smaller living environments. Smaller living space and the addition of services provided by a retirement community (RC) may make living easier for the individual, but it may also reduce the amount of daily physical activity and ultimately reduce functional ability. ***Objective:*** With home size as an independent variable, the primary purpose of this study was to evaluate daily physical activity and physical function of community dwellers (CD; n = 31) as compared to residents of an RC (n = 30). ***Methods:*** In this cross-sectional study design, assessments included: the Continuous Scale Physical Functional Performance – 10 test, with a possible range of 0–100, higher scores reflecting better function; Step Activity Monitor (StepWatch 3.1); a physical activity questionnaire, the area of the home (in square meters). Groups were compared by one-way ANOVA. A general linear regression model was used to predict the number of steps per day at home. The level of significance was $p < 0.05$. ***Results:*** Of the 61 volunteers (mean age: 79 ± 6.3 years; range: 65–94 years), the RC living space (68 ± 37.7 m^2) was 62% smaller than the CD living space (182.8 ± 77.9 m^2; $p = 0.001$). After correcting for age, the RC took fewer total steps per day excluding exercise ($p = 0.03$) and had lower function ($p = 0.005$) than the CD. ***Conclusion:*** On average, RC residents take 3,000 steps less per day and have approximately 60% of the living space of a CD. Home size and physical function were primary predictors of the number of steps taken at home, as found using a general linear regression analysis.

Introduction

Over 80% of older Americans wish to ‘age in place’, meaning the community in which they raised their children and had their careers [1]. However, aging in place may not be possible without help because older adults frequently experience a decline in their capacity for independence. Of those 50 years of age and older, 68% report having a condition that limits their mobility, and of those, more than half (56%) find it difficult to go out alone, for instance to visit the doctor or go grocery shopping. Grocery shopping and social engagement outside the home on average results in 115 driving trips being made per month [2]. However, those older adults with poor health or limitations to their physical activity (76%) are less likely to drive than those in good health (93%) [2, 3].

Transportation and functional limitation or poor health are possible reasons for older adults to move to a retirement community (RC). The fastest-growing housing

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market for older adults is continuing-care RC, a term describing senior housing communities that provide a wide range of care levels on the same campus [4]. After retirement, older adults may elect to move to a smaller living environment to reduce the burden of living in a larger home that is mismatched with regard to their waning functional ability. About 50% of older adults receive help with activities of daily living [1]. Even though daily life may be easier for the individual, the smaller living space and services provided by the RC may reduce the amount of physical activity needed to maintain an adequate level of function. RC residents have significantly lower function [5]. Those with lower function take significantly fewer steps per day [6]. Lower square footage in the continuing-care RC and increased assistance can both be characterized as factors that lessen the demands of the environment, which in turn can result in lower physical activity. The lower physical activity can then lead to lower physical function. Although older adults who move into an RC are likely older and less active, it is possible that their environment may contribute to lower mobility. The importance of regular physical activity for the maintenance of physical function is well documented; however, findings on the contribution of the home living environment to the overall daily physical activity have not been published. Expecting that the living space for residents in the community or community dwellers (CD) would be larger than that of RC residents let us ask the question what the relationship of home size to daily physical activity is.

The primary purpose of the study was to determine the association of home size with the daily level of physical activity in older adults. Daily physical activity, measured by number of steps per day, excluding intentional exercise, was hypothesized to be directly related to the size of the living space.

Subjects and Methods

Subjects and Design

A cross-sectional study design was used to assess group differences in physical activity and physical function in older adults aged 65 years or older from single-family dwellings or apartments (CD) or residents from a local RC. CD residents were recruited from a life-long learning university organization (Learning in Retirement) with over 300 members, while RC residents were recruited from the Iris Place Retirement Community in Athens, Ga., USA. At the time of recruitment, the Iris Place Retirement Community had 156 residents, 123 in the main building (RC-MB) and 33 in detached apartments (RC-DA). The main building residents were offered 3 meals a day, while the residents of the detached apartments were offered 1 meal a day; both received light housekeeping (e.g. weekly change of linens, light vacuuming). Each participant signed an informed consent approved by the University of Georgia institutional review board. Inclusion criteria were age (≥65 years), being ambulatory, having little or no cognitive impairment (Telephone Interview for Cognitive Status score of ≥25 out of a total of 30), and stable health conditions (controlled heart disease, blood pressure, cholesterol and glucose) [7]. The Telephone Interview for Cognitive Status test, used for cognitive screening, was standardized and validated for use with English-speaking adults aged 60–98 years. The Telephone Interview for Cognitive Status test range of scores is 0–30, with established cutoff scores for demented (<25) and nondemented patients (≥25) [7]. Upon establishing eligibility, subjects were invited to continue with the study. Tests and questionnaires measuring physical function, physical activity and overall health were administered during 1 laboratory visit.

Physical Activity

Physical activity was measured both by self-report and with an objective measure of steps. Self-reported physical activity was measured using the Community Healthy Activities Model Program for Seniors questionnaire. The questionnaire includes a range of activities (light, moderate and vigorous) as well as energy expenditure for each activity based on the self-reported frequency (number of times/week) and duration of participation in a given activity [8]. The energy expenditure is reported in kilocalories per day [8].

Objective physical activity was measured with the StepWatch 3.1 step activity monitor pedometer. The step activity monitor is an ankle-worn dual-axis pedometer used to measure horizontal and vertical acceleration to detect steps. The step activity monitor measured within 1% of the actual steps taken at various walking speeds in a study by Karabulut et al. [9]; step activity monitor accuracy was verified by a manual count of 50 steps upon assignment of the step activity monitor to a participant. The information gathered by the step activity monitor was read and recorded directly in a computer. Excluding bathing time, the participants wore the step activity monitor for 48 h.

During a 48-hour period, physical activity was recorded in a log to identify and categorize clusters of steps on the step activity monitor into the following categories: inside the home; on grounds of home; outside the home, and during exercise; the categories excluding exercise were summed. Detailed instructions were provided along with the activity log to ensure correct reporting. The data from the step activity monitor were combined with the information from the activity log in order to obtain the type (gardening, exercise, shopping, etc.), duration (30-min increments) and location of the activities. Intensity measures of physical activity were not available.

Physical Function

Physical function was measured by using both a self-report and a performance-based measure. Self-reported physical function was measured as a part of the Medical Outcomes Study Short Form Health Survey (SF-36). The SF-36 is a multipurpose, short-form health survey that summarizes physical and mental aspects of health status [10, 11]. The SF-36 is a reliable and valid questionnaire that assesses physical functioning, physical role functioning, bodily pain, general health perceptions, vitality, social role functioning, emotional role functioning and mental health.

The physical functioning domain uses a 3-level response – limited a lot, limited a little, or not limited at all – to evaluate physical limitations [11]. Responses range from 0 to 100, with 100 reflecting better health status. A score lower than 65 on the SF-36 physical functioning scale has been associated with a lower probability of physical independence [12]. The SF-36 physical functioning questionnaire was administered prior to the Continuous Scale Physical Functional Performance – 10 (CS-PFP10) test to ensure that the participant did not gain insight into their ability when responding to questions on the SF-36.

Performance-based physical functioning was evaluated using the CS-PFP10 test. The shortened version of the CS-PFP test [5] is a reliable and valid measure of physical functioning that preserves the important information provided by the CS-PFP [13]. The CS-PFP10 is comprised of 10 household tasks performed sequentially where time, distance and weight are used to evaluate functional ability. The CS-PFP10 is a reflection of a person's functional capacity as each task is performed at maximal effort within the person's judgment of comfort and safety. Tasks that are quantified using both weight and time include: (1) carrying a pot of weight from one counter to another, and (2) carrying groceries approximately 52 m including a 4-step platform. Tasks that are quantified by time alone include: (1) transferring laundry; (2) donning and removing a jacket; (3) sweeping kitten litter into a dustpan; (4) climbing stairs; (5) sitting down and getting up from the floor, and (6) picking up 4 scarves from the floor. Tasks that are quantified by distance include: (1) a 6-min walk, and (2) a maximal reach using an adjustable shelf. A detailed description of the tasks and test setup is available at http://www.coe.uga.edu/cs-pfp/overview.html. The test is administered in a standardized environment with a set dialogue. The raw scores for each task are adjusted to a scale of 0–100, where 0 is the poorest performance. The formula used to correct each task is: [(observed score – lower limit)/(upper limit – lower limit)] × 100 [14]. The CS-PFP total score is the average corrected score of all the tasks, while the domain scores are the average of the corrected scores for the tasks assigned to the specific domain [13]. The domain scores include upper body strength (UBS), upper body flexibility (UBF), lower body strength (LBS), balance and coordination (BALC) and endurance (END). A CS-PFP10 total score below 57 (95% CI: 48–59) indicates a lower probability of living independently, or preclinical disability [12]. Previous work has shown the CS-PFP10 total scores are highly correlated when the same protocol is administered in 2 different settings (r = 0.95) [13].

Area of Living Space Used

Home area measurements were taken using a Bushnell Sonic Rule (Bushnell Corporation, Overland Park, Kans., USA) or from architectural blueprints. The Bushnell Sonic Rule can measure from 0.6 to 15 m, has an accuracy of ±0.5% and uses a red laser diode of 650 nm to measure. Each participant indicated the area of his or her home that was used at least twice a week as a living space. The overall living space was the sum of the area of the rooms the participant identified as currently being used.

Linear measurements in the RC were of the distance from the apartment to the dining room, laundry facilities and mailbox. In the single-family dwellings, the distance from the home to the mailbox was measured. A Measure Master measuring wheel by Rolatape (Spokane, Wash., USA) was used for the linear measurements. The measuring wheel can measure to the nearest 0.01 m.

Statistical Analysis

The independent variable for the ANOVA was the type of living arrangement (CD or RC). The dependent variables included (a) the number of steps per day excluding intentional exercise, and (b) physical functioning (CS-PFP10 total). The Pearson correlation was used to analyze associations. Where a significant correlation was found, a covariate was used to evaluate the significant differences between groups, analyzed by ANCOVA. A secondary analysis by ANOVA with a Duncan post hoc analysis was performed to determine group differences among RC-MB residents, RC-DA residents and CD. A generalized linear regression was used to predict the number of steps. Variables included in the generalized linear regression model were significantly correlated ($p < 0.05$) by type of living arrangement. Age, CS-PFP10 total score, home area (in square meters), SF-36 vitality, SF-36 general health and SF-36 mental health were entered stepwise into a general linear regression model.

A power analysis based on the CS-PFP10 total mean and variance from older adults in similar living arrangements (14) indicated that 25 participants per group were needed to assure a 90% power for detecting a difference ($\alpha = 0.05$) [15].

Results

Sixty-three older men and women volunteered for the study, of which 2 did not meet the inclusion criteria. Of the final sample, 31 participants were CD and 30 participants were residents of an RC. Of the RC residents, 11 lived in a 2-bedroom apartment detached from the main building (RC-DA), and 19 lived in the main building (RC-MB), either in a 1-bedroom or studio apartment. The sample characteristics by residential context are listed in table 1. The RC residents (mean age: 82.67 years; range: 70–93 years) were significantly older than the CD (mean age: 76.26 years; range: 65–94 years), but the 2 groups had a similar ratio of females to males (CD: 19 females to 12 males; RC residents: 18 females to 12 males). More participants in the CD group were married (61.0% compared to 26.6%), while the RC group had more widows or widowers (70.0% compared to 22.0%). The sample was relatively affluent, with over 70% indicating their income was more than USD 30,000/year. The participants were also well educated, with 93.5% of the CD group and 86.7% of the RC group having some college degree. Only 3.0% of the entire group reported less than a high-school education.

Differences in Area of Living Space Used by CD and RC Residents

The results of the home area measurements are shown in table 1. As expected, the living space for the RC group was significantly smaller than that of the CD group (p =

Table 1. Sample characteristics by residential context

	CD (n = 31)	RC (n = 30)	RC-DA (n = 11)	RC-MB (n = 19)
Age, years	76.3 ± 7.6	82.7 ± 5.5[c]	81.2 ± 5.7	83.5 ± 5.4
Age range, years	65–94	70–93	77–85	80–86
Race, % Caucasian	100	100	100	100
Sex, % female	61.3	60.0	55	63
Marital status[a], %				
Married	61.3	26.7	73	0
Widow/widower	22.6	70.0	27	96
Income[b], %				
>USD 50,000	64.5	23.3	27.0	22.2
USD 30,001–50,000	12.9	46.7	27.0	50.0
≤USD 30,000	16.1	13.3	18.0	22.0
Education, %				
College graduate or higher	80.7	50.0	63.7	42
Housing				
Area, m^2	178.97 ± 77.9	68.7 ± 36.7[c]	110.13 ± 24.8	44.75 ± 13.3[d]
Linear, m	32.84 ± 72.0	154.34 ± 140.6[c]	183.0 ± 222	137.0 ± 60

Values for age and housing denote means ± SD. [a] Difference from 100% = divorced. [b] Difference from 100% = unknown or refused to report. [c] Significant differences between CD and RC groups (p < 0.05). [d] Significant differences between RC-DA and RC-MB groups (p < 0.05).

Table 2. Steps per day by the step activity monitor

	Inside home	On grounds	Inside and on grounds	Outside home	Exercise steps	Total excluding exercise	Total
CD (n = 31), steps/day	4,993 (2,216)	601 (1,004)	5,594 (2,629)	2,540 (1,550)	1,624 (2,084)	8,134 (3,147)	9,758 (3,968)
RC (n = 30), steps/day	3,033 (1,476)	1,235 (859)	4,269 (1,462)	1,519 (1,518)	996 (1,165)	5,787 (2,147)	6,783 (2,813)
Uncorrected[a]	0.001	0.010	0.019	0.012	0.154	0.001	0.001
Corrected[b]	0.001	0.034	0.051	0.259	0.462	0.030	0.037

Values denote means with SD in parentheses unless otherwise specified.
[a] Significance from one-way ANOVA. [b] Significance ANCOVA p values after covarying for age.

0.001). However, the RC group had significantly more linear space than the CD group (p = 0.001). The linear space values were not related to the number of steps per day on the grounds of home (r = 0.12). Since these values were not related, only area was used in the analysis. In the secondary analysis, RC-MB residents had significantly less living space than RC-DA residents (p = 0.001).

Differences in Physical Activity between CD and RC Residents

By both self-report and objective measures of physical activity, the RC group was significantly less physically active (table 2; fig. 1). The values for total energy expenditure due to physical activity (in kilocalories per week), as estimated by the physical activity questionnaire, were significantly lower in the RC group (mean: 2,953 ± 2,046 kcal/week) than in the CD group (mean: 5,118 ± 3,780 kcal/week; p = 0.006). The values reported for energy expenditure at moderate intensity were also significantly lower in the RC group (mean: 1,437 ± 1,353 kcal/week) than in the CD group (mean: 2,650 ± 2,974 kcal/week; p = 0.012). The physical activity questionnaire kilocalorie-per-week values for energy expended at moderate intensity were correlated with exercise steps (r = 0.37; p = 0.003). When physical activity was measured by the step activity monitor, the RC residents took fewer steps in all

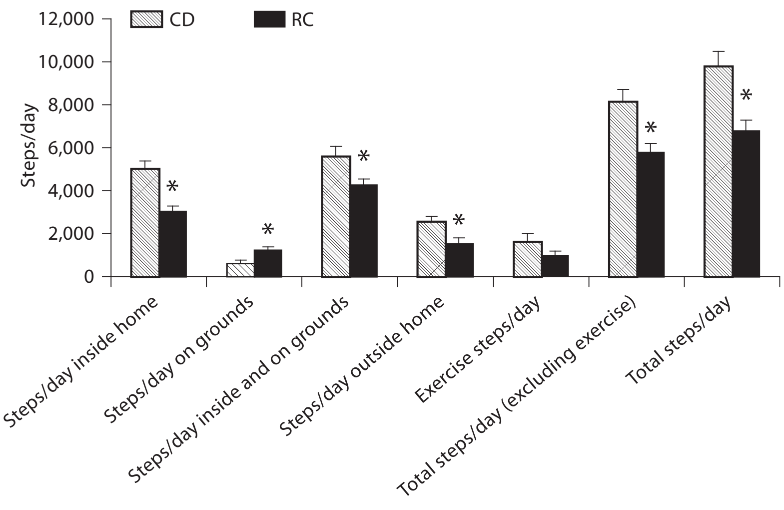

Fig. 1. Steps per day by the CD group and RC group. Bars and whiskers: means ± standard error of the measure. * Significant difference between groups, $p < 0.05$.

Table 3. Self-report function SF-36 domain scores

	PF	PR	BP	GH	VT	SF	ER	MH
CD (n = 31)	73.71 (23)	77.42 (21)	71.55 (19)	77.58 (14)	68.75 (10)	92.34 (16)	88.44 (19)	86.61 (10)
RC (n = 30)	64.17 (21)	65.83 (28)	73.50 (25)	64.53 (16)	58.54 (16)	87.92 (20)	83.61 (22)	80.50 (12)
p	0.098	0.069	0.734	0.001	0.005	0.337	0.369	0.029

Values denote mean scores for different groups and p values for level of significance from one-way ANOVA with SD in parentheses.
PF = Physical functioning; PR = physical role functioning; BP = bodily pain; GH = general health; VT = vitality; SF = social functioning; ER = emotional role functioning; MH = mental health.

categories, with the exception of steps per day on grounds of home (p = 0.01), where RC residents took more steps. No significant difference was found between the groups in the number of steps per day taken during exercise (p = 0.154). After correcting for age, the direction of significance remained the same, with the exception of steps per day taken outside of the home, which became nonsignificant. A significant relationship ($p < 0.001$) was present between living space and total number of steps per day (r = 0.531) and steps excluding exercise (r = 0.532).

In the secondary analysis of the RC residents, steps taken in the home and on grounds did not differ across the 3 groups (CD: 5,594 ± 2,629; RC-DA: 4,625 ± 1,213; RC-MB: 4,062 ± 1,582 steps) when comparing area. However, the number of steps per day, excluding exercise, was significantly higher for the CD (9,758 ± 3,968) than the RC-MB residents (6,090 ± 2,755; p = 002). For the RC-DA residents, the number of steps (7,981 ± 2,004) was not significantly different from those taken by either the CD or the RC-MB residents.

Differences in Physical Function and Health Status between CD and RC Residents

The health status was not significantly different between RC residents and CD when evaluated using the SF-36, except for 3 domains (table 3). The 3 domains where the RC group score was significantly lower than the CD group score were: general health (p = 0.001), vitality (p = 0.005) and mental health (p = 0.029). In contrast, self-reported function was not significantly different between groups, while physical performance measured by the CS-PFP10 was significantly different in each domain and in

Table 4. Performance-based physical functioning by CS-PFP10 score

	UBS	UBF	LBS	BALC	END	CS-PFPTOT
CS-PFP10 score – CD (n = 31)	50.27 (22.43)	66.87 (16.92)	41.75 (18.33)	51.45 (17.03)	51.80 (17.15)	50.25 (17.20)
CS-PFP10 score – RC (n = 30)	28.11 (15.04)	51.20 (20.41)	23.01 (13.37)	30.93 (15.46)	31.253 (15.54)	30.21 (14.66)
Uncorrected[a]	0.001	0.002	0.001	0.001	0.001	0.001
Corrected[b]	0.021	0.127	0.013	0.004	0.005	0.005

Values denote mean scores for the different groups with SD in parentheses unless otherwise specified. CS-PFPTOT = Total CS-PFP10 score.
[a] Level of significance from one-way ANOVA. [b] ANCOVA p values after covarying for age.

the total score (table 4). The CS-PFP10 total score was correlated with the area of the home used (r = 0.54; p = 0.001) and total steps per day (r = 0.66; p = 0.001). The domain scores for UBS (p = 0.001), UBF (p = 0.002), LBS (p = 0.001), BALC (p = 0.001) and END (p = 0.001) were all significantly lower in the RC group. The CS-PFP10 total score was significantly correlated with age (r = –0.68). After correcting for age, the CS-PFP10 total score for the RC group was still significantly less than for the CD group (p = 0.005) (table 4).

Since the CS-PFP10 total score and number of steps per day were significantly lower in the RC group, the CS-PFP10 total score was used as a covariate to evaluate the impact of function on the number of steps taken per day. As illustrated in figure 1, fewer steps per day were taken by the RC group inside the home (p = 0.021); however, they took more steps per day on the grounds of the home (p = 0.011). Concerning all other categories, the groups were similar.

Using a regression analysis of the number of steps per day (excluding exercise steps), an R^2 of 0.432 was found where CS-PFP10 total score (β = 0.453) and area (β = 0.362) were both significant (p = 0.004); age (β = 0.076; p = 0.578), vitality (β = –0.008; p = 0.941), general health (β = 0.004; p = 0.976) and mental health (β = 0.010; p = 0.937) were not significant.

Discussion

The primary purpose of the study was to determine the association between the size of the home to a person's daily level of physical activity. This study found that physical activity is influenced predominately by function and the size of the home. Daily physical activity, measured by number of steps per day, excluding intentional exercise, was directly related to the size of the living space and was significantly higher in the CD than the RC residents.

As people experience a decline in their capabilities, to live independently they may elect to live in increasingly smaller space. In a stairstep fashion, the average size of the RC living space was approximately 60% of the size of the CD home. The RC-DA home size was 38% of the size of the CD home. The RC-MB home size was approximately 60% of the size of the RC-DA, which was smaller than the CD living space.

RC residents were once living as CD residents. The CD group showed a score range for functional ability (CS-PFP10 total score range: 43–56) that is commensurate with living independently [12], whereas the RC group did not (CS-PFP10 total score range: 24–35). Consistent with earlier findings [12], the CS-PFP10 total mean score for the CD group was within the threshold for independence of 47–58, while the RC mean score was below the threshold range for independence. Approximately two thirds (64%) of the CD were above the threshold of independence (57; 95% CI: 48–58), whereas only 13% of the RC residents exceeded the threshold. The RC residents had lower functioning and were living in a smaller space with less demands of physical activity. However, it may be worth noting that the lower body physical functioning in the CD group was below this threshold and may signal an impending loss of the ability to climb steps, carry groceries and transfer laundry. This may be an early marker for future loss of independence. CD residents should heed the 2008 US Surgeon General's Physical Activity Guidelines [16] that recommends strength training on a regular basis for older adults.

The difference in functioning could be attributed to the health issues in the RC group. The residents of the RC had significantly lower self-report general health, vitality and mental health domain scores on the SF-36 health survey. The groups were not significantly different in self-reported physical functioning, physical role functioning or bodily pain (all domains of the physical component). The lack of reporting of a significant difference in physical functioning could be due to a different frame of reference in the place they live. Since the RC provides basic services, the physical ability of the residents is enough to meet the demands of the environment. The residents of the RC are not required to do all of the activities of daily living that a person in a single-family dwelling may need to do. Another reason for the lack of difference in the groups could be due to the self-selection of the participants. People who perceived that their functioning was lower may not have volunteered for this study because they were not comfortable with their level of functioning in their everyday environment.

Physical activity was significantly less in the participants from the RC residents as compared to the participants from the CD group, but this was not due to age or health status. Forty-three percent of the variance in steps inside and on the grounds of the home was explained by function and area. The primary influence on the number of steps per day taken by residents appeared to be the size of the living space used since a subsequent covariate analysis using the living space equated the two groups in number of steps per day. Steps attributed to exercise were not significantly different between the groups. This finding may signal that CD do not get sufficient exercise to maintain functional independence, warranting a longitudinal study of CD planning to move to an RC. In summary this analysis indicates that the number of home-related steps taken per day is influenced by both the actual size of the living space used and function once health and age factors are accounted for in statistical analysis.

RC-DA residents took more steps inside their home than RC-MB residents, but they did not have significantly more steps per day when they were calculated both inside and on the grounds of home, indicating more of the RC-MB residents' steps per day were taken on the grounds of the facility. Even though there was no significant difference present in the combined category of inside the home and on the grounds of home, RC-DA residents had significantly more steps per day excluding exercise than the RC-MB residents. Older adults may move to a living space that matches their functional ability as perceived changes in functional ability emerge. This requires a longitudinal study to tease out the causal impact of function on choice of living space or vice versa.

RC residents had significantly more steps per day on the grounds of home than the CD. Since essential services were provided in the RC, the RC residents were not required to leave the grounds as much as the CD. As the RC residents had lower physical functioning, the fewer steps may also reflect their lack of ability to go outside the home as much as CD residents do. This difference in the number of steps per day outside of the home that CD take is not offset by the higher number of steps per day the RC residents take on the grounds of home, thus the RC residents need to find a way to balance the steps per day that may be lost by not going outside of the grounds as frequently as they might if they were in a detached single-family dwelling or apartment. These data indicate that CD residents get more physical activity than RC residents, and that this is not due to exercise. Persons moving into an RC may be well advised to consider that the move will cost them 3,000 steps per day on average that would otherwise come from CD home and associated activities.

Self-reported physical activity was also lower in the residents of the RC in both total kilocalories per week expended and kilocalories per week expended at a moderate intensity. The kilocalories per week expended at a moderate intensity were also significantly correlated with the exercise steps per day. The RC residents perceived themselves as performing fewer activities at moderate intensity than the residents of the single-family dwellings, but the measurement of exercise steps per day was not significantly different between the groups.

This study helps clarify the contribution of the demands of the home to daily physical activity in older adults, but there are some limiting factors. The size of the home is only one measure of the demands of a home, such as caregiving responsibilities or other activities that do not require steps. Also, the sample did not include those with cognitive impairments or severe functional impairments. The sample was composed of volunteers, which limits generalizability. The sample was 100% Caucasian, and only 3.2% had less than high-school education. These data were collected in the spring and summer; seasonal variation also could have influenced the activity in the home.

A prospective study is needed to tease out the underlying determinants of why some older adults age in place as CD, while others move to an RC. Such a study can help to identify interventions to lessen the environmental demands, improve personal competence and strengthen social networking and caregiving, allowing older adults the highest quality of life by optimizing their environmental and functional status.

Conclusions

In this study, those that lived in an RC were significantly less active (approx. 3,000 steps/day) than the single-family dwellers in both objective and self-rated activity measures. A person's level of functioning may influence the place they live in, or the place the person lives in may influence the level of functioning. At the same time, the size of a person's home can also impact the number of steps they take in a day. However, the difference was determined to be a result of physical activity other than exercise. CD took more steps inside and on the grounds of the home than RC residents. This difference in steps could be due to the smaller living space in the RC, less need to take steps due to the provision of essential services or because of lower physical functioning. On the other hand, CD experiencing functional limitations may also precipitate the move to an RC.

In summary, RC residents were older and less active, and had lower functioning than CD. However, after correcting for age, the lower activity was due in part to lower functioning and smaller living quarters. The RC residents may need to increase exercise to replace the activities that are lost by living in smaller quarters and receiving essential services. CD may need to focus on building LBS while still living independently.

References

1 American Association of Retired Persons: Beyond 50: a report to the nation on independent living and disability. Washington, AARP, 2003.
2 American Association of Retired Persons: Beyond 50: a report to the nation on livable communities – creating environments for successful aging. Washington, AARP, 2005.
3 Sims RV, Ahmed A, Sawyer PA, Allman P: Self-reported health and driving cessation in community-dwelling older drivers. J Gerontol A Biol Sci Med Sci 2007;62A:789–793.
4 Milne G: Continuing care retirement communities: an emerging – and ill-defined – model in senior housing. http://www.snapforseniors.com/Services/FreeContent/ContinuingCareRetirementCommunities.aspx (accessed February 27, 2010).
5 Cress ME, Buchner DM, Questad KA, Esselman PC, deLateur BJ, Schwartz RS: Continuous-scale physical functional performance in healthy older adults: a validation study. Arch Phys Med Rehabil 1996;77:1243–1250.
6 Petrella JK, Cress ME: Daily ambulation activity and task performance in community-dwelling older adults aged 63–71 years with preclinical disability. J Gerontol A Biol Sci Med Sci 2004;59:264–267.
7 Brandt J, Spencer M, Folstein MF: The telephone interview for cognitive status. Neuropsychiatry Neuropsychol Behav Neurol 1988;1:111–117.
8 Stewart AL, Mills KM, King AC, Haskell WL, Gillis D, Ritter PL: CHAMPS physical activity questionnaire for older adults: outcomes for interventions. Med Sci Sports Exerc 2001;33:1126–1141.
9 Karabulut M, Crouter SE, Bassett D Jr: Comparison of two waist-mounted and two ankle-mounted electronic pedometers. Eur J Appl Physiol 2005;95:335–343.
10 Ware J Jr, Bayliss MS, Rogers WH, Kosinski M, Tarlov AR: Differences in 4-year health outcomes for elderly and poor, chronically ill patients treated in HMO and fee-for-service systems: results from the Medical Outcomes Study. JAMA 1996;276:1039–1047.
11 Ware JE Jr, Sherbourne CD: The MOS 36-item short-form health survey (SF-36). 1. Conceptual framework and item selection. Med Care 1992;30:473–483.
12 Cress ME, Meyer M: Maximal voluntary and functional performance levels needed for independence in adults aged 65 to 97 years. Phys Ther 2003;83:37–48.
13 Cress ME, Petrella JK, Moore TL, Schenkman ML: Continuous-scale physical functional performance test: validity, reliability, and sensitivity of data for the short version. Phys Ther 2005;85:323–335.
14 Cress ME, Buchner DM, Questad KA, Esselman PC, deLateur BJ, Schwartz RS: Exercise: effects on physical functional performance in independent older adults. J Gerontol A Biol Sci Med Sci 1999;54:M242–M248.
15 Keppel G, Wickens TD: Effect size, power, and sample size; in Keppel G, Wickens TD (eds): Design and Analysis. A Researcher's Handbook, ed 4. New Jersey, Pearson Prentice Hall, 2004, pp 159–801.
16 Physical Activity Guidelines Advisory Committee: 2008 physical activity guidelines for Americans. ODPHP publication No. U0036. Washington, US Department of Health and Human Services, 2008.