A Person-Centered Analysis of Motivation for Physical Activity and Perceived Neighborhood Environment in Residents of Assisted Living Facilities

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Abstract

This study sought to identify profiles of individual, social, and perceived neighborhood environmental correlates of physical activity (PA) and to explore differences between the identified profiles in PA. Residents of assisted living facilities (*N* = 87, *M* age = 77.57 years) were recruited for the cross-sectional study. Participants reported their perceived support from important others for PA, basic psychological need satisfaction and motivation for PA, and perceived neighborhood environment around the assisted living facilities. Engagement in light PA and moderate-to-vigorous PA (MVPA) was measured by accelerometers over one week. We identified three profiles using latent profile analysis: 'low self-determined and minimally supported', 'moderately self-determined and supported', and 'highly self-determined and supported'. Results showed participants in the highly self-determined and supported profile engaged in higher levels of light PA and MVPA than participants from other profiles. Findings showed perceptions of the neighborhood environment should be taken into account with motivation regarding PA.

Keywords. self-determination theory, latent profile analysis, older adults, physical activity, perceived neighborhood environment.

Background

Physical activity (PA) can offer many psychological and physical health benefits in older adults. Several studies have documented that regular moderate-to-vigorous PA (MVPA; e.g., jogging) improves balance, reduces falls, lowers the risk of heart disease, stroke, osteoporosis, type 2 diabetes, and cancers in older adults (Government of Canada, 2011). Engagement in light intensity PA (e.g., slow walking) has also been reported to be associated with several beneficial health outcomes. For example, light PA has been shown to be associated with self-reported physical health, well-being (Buman et al., 2010), and plasma glucose control (Healy et al., 2007). This is particularly encouraging given that engagement in light PA may be perceived by older adults as more achievable than participation in MVPA. Indeed, light PA is characteristic of most of activities of daily living undertaken by this population (Ainsworth et al., 2000). As such, while it is important to understand correlates of MVPA participation in older adults, it is also necessary to examine key correlates of participation in light PA in this population. Hence, this study sought to identify profiles of interpersonal, intrapersonal, and environmental correlates of PA, and examine differences amongst these profiles in terms of light and MVPA.

Most previous studies examining the determinants of PA in older adults have focused on community settings (Thøgersen-Ntoumani, Cumming, Ntoumanis, & Nikitaras, 2012). However, an increasing number of older adults live in assisted living facilities (ALFs; Park-Lee et al., 2011), as they require some level of assistance with daily living. ALFs are designed to keep residents independent (Carder, 2002). PA can play a key role in helping these individuals improve or retain health, independence and well-being (Friedmann et al., 2015) and can prevent or delay residents' moving into nursing/care homes (Watson, Garrett, Sloane, Gruber-Baldini, & Zimmerman, 2003). However, a large proportion of residents in ALFs are physically inactive (Mihalko, 2006). While considerable research has been

conducted on older adults in free-living settings (Hausdorff, Rios, & Edelberg, 2001), research to understand PA behavior of older people in ALFs is rather scarce.

Motivation for PA

Self-Determination Theory (SDT; Ryan & Deci, 2000) is a theoretical framework that is increasingly employed to study motivation for PA engagement and well-being. SDT identifies three basic psychological needs: autonomy, competence, and relatedness, and postulates that the satisfaction of these needs is essential for optimal functioning and well-being. When such needs are satisfied, high quality of motivation towards PA ensues (Deci & Ryan, 2000).

According to SDT, there are three broad types of motivation, intrinsic, extrinsic and amotivation (Deci & Ryan, 2000). Intrinsic motivation is present when individuals feel an inherent enjoyment from participating in an activity. In contrast, when behaviors are extrinsically motivated, the behavior is engaged in for a separable outcome. There are four types of extrinsic motivation, namely integrated, identified, introjected and external regulations, which range in the degree to which they reflect internalized behavior. *Integrated regulation* is the most optimal type of extrinsic motivation whereby people engage in the behavior because it aligns with their values or identity. *Identified regulation* is evident when the individual engages in the behavior because (s)he values its outcomes (e.g., improved health). Thus, integrated and identified regulations represent high quality motivation because they are self-determined. When people have high levels of *introjected regulation*, they engage in the behavior due to internal pressure, such as feelings of guilt. When people have high levels of *external regulation*, they are motivated by pressure by others or because they want to gain others' approval. Introjected and external regulation represent low quality of motivation, because they are low in self-determination. There is also amotivation, which refers to lack of motivation, or an unwillingness to engage in the target behavior (Ryan &

Deci, 2000). Research evidence indicates that high quality types of motivation are positively related to greater participation in PA and exercise across all ages (Teixeira, Carraça, Markland, Silva, & Ryan, 2012).

Support from important others

Significant others (e.g., health-care providers, family members) can help satisfy the three basic psychological needs, and in turn, promote higher quality motivation via the level of autonomy support they provide to the individual. A meta-analysis documented empirical support for the sequence involving autonomy support (despite the use of the term 'autonomy support', the construct taps the support of all three needs), psychological need satisfaction, self-determined motivation, and health outcomes (Ng et al., 2012). However, while SDT addresses the roles of individual and social-contextual factors (Edmunds, Ntoumanis, & Duda, 2007), it does not explain how human behaviors and experiences can be partly guided by the neighborhood environment.

The role of the neighborhood environment

Older adults are more likely than younger individuals to be influenced by the neighborhood environments (Rasinaho, Hirvensalo, Leinonen, Lintunen, & Rantanen, 2007) because mobility and independence can be greatly limited by a poorly designed community (although it should be noted that such findings are dependent on social economic status and the type of environmental factors; Arango, Páez, Reis, Brownson, & Parra, 2013). For example, older adults are more physically active when their neighborhood environments have a number of walking paths and good street connectivity (Hall & McAuley, 2010). A review indicated neighborhood environment (i.e., high crime) as a barrier to PA in older adults (Schutzer & Graves, 2004). Sallis, Owen, and Fisher (2008) acknowledged that an important weakness of the literature on such environmental influences on PA was the lack of consideration of the social-psychological processes underpinning PA behaviors. Indeed,

Merom et al. (2009) found that motivational aids (e.g., teaching self-regulation strategies, such as goal setting, self-monitoring and recording of steps in a self-help walking program) could overcome the negative effects of low neighborhood aesthetic appeal (i.e., a neighborhood environment factor). To this end, Zhang and Solmon (2013) proposed a model integrating the neighborhood environment with SDT-based variables to better explain PA behaviors, although to our knowledge, this model has remained untested. Thus, assessing aspects of the neighborhood environment and interpersonal/situational factors proposed by SDT (autonomy support by others, motivation for PA, psychological need satisfaction via PA), may enhance our understanding of the correlates of PA behaviors in older adults. By and large, previous research has been conducted using variable-based approaches (e.g., regression analysis). In this study, we advocate the merits of a person-centered approach with latent profile analysis (LPA).

Person-centered approach

Variable-centered approaches (e.g., multiple regression, SEM) operate under the assumption that all participants are drawn from a single population and that an average set of parameters can be estimated for this population (Morin et al., 2016). The main interest in variable-centered approaches is to investigate associations among variables (Bergman & Andersson, 2010). A person-centered approach, such as that employed with LPA, aims to identify clusters of observations that are similar based on their values on cluster indicators (Pastor, Barron, Miller, & Davis, 2007). Individuals within the same LPA group have a homogeneous profile, whereas individuals across different LPA groups have heterogeneous profiles. As such, using a person-centered approach can reveal unobserved subpopulations characterized by different response patterns on cluster indicators. Previous findings on the relation between neighborhood environment and PA in older adults tend to be inconsistent and dependent on the types of measures utilized (Barnett, Barnett, Nathan, Van Cauwenberg, & Cerin, 2017).

Thus, person-centered approaches may be useful to provide a different perspective on the relation between the neighborhood environment and PA in older adults.

In light of the above, the aim of the current study was to identify distinct profiles of people representing individual (motivation and psychological need satisfaction), social (autonomy support from significant others), and perceived neighborhood environmental (neighborhood) correlates of PA, and to examine differences between these profiles in terms of objective levels of light PA and MVPA. Unfortunately, few studies have objectively measured PA among residents in ALFs (Lobo, Santos, Carvalho, & Mota, 2008; Haselwandter & Corcoran, 2015). We hypothesize that individuals who were most supported by significant others, had higher levels of self-determined motivation and need satisfaction via PA, and who also perceived the environments to be more facilitative of PA, would report the highest levels of both light PA and MVPA.

Methods

Participants

In total, 139 older adults were recruited from 13 ALFs in the West Midlands, England. All ALFs were located in residential areas in urban settings. Within these settings, residents were free to come and go, and participate in outdoor activities as well as other activities of daily living. The capacity of those ALFs ranged from 28 to 327 residents. Some ALFs had nurses (6 ALFs), gym instructors (6 ALFs), and social activity organisers (10 ALFs). Of the 139 older adults recruited for this study, 39 participants did not want to wear an accelerometer. Moreover, 13 participants were excluded either because they provided no questionnaire data (n = 2); incomplete accelerometer data (no weekend day, n = 9; less than 3 valid days, n = 2). Therefore, the final pool of participants consisted of 87 residents (58 females, mean age 77.57 years, SD = 8.11; range = 65-99 years). Researchers contacted either the facility manager or the wellbeing manager of each center, who confirmed that the center was an ALF.

One of these managers gave permission to recruit participants for the study. Subsequently, residents were approached by researchers to participate in the study through monthly resident meetings or mornings coffee gatherings. Inclusion criteria were: having lived in ALFs for at least 4 months, ability to speak English, consent to the study, and to walk without assistance or walk using either a cane or walker.

Procedures

Ethical approval for this study was awarded by the Ethical Review Committee of a UK university. Participants were first informed of the purpose and procedures of the study, questions were answered, and then participants gave written informed consent. The participants were given a questionnaire pack to complete by the second visit, which took place one week later. Participants took approximately 20 minutes to complete the questionnaire pack. They were also requested to wear an accelerometer for 7 days to measure habitual PA engagement, and were supplied with a daily diary in which they were asked to report periods of non-wear (i.e., the time when they removed the accelerometer each day). During the second testing visit, the participants returned the questionnaires and accelerometers.

Measures

Autonomy support. Autonomy support from important others was measured using Williams et al.'s (2006) scale. Participants were first asked to identify the person they viewed to be most influential with regard to their PA behavior (e.g., friend, family member). Subsequently, they were asked to answer questions related to the support they perceived from this important other. The scale consists of 6 items (e.g., 'My important other encourages me to ask questions about my physical activity to improve my health'; ω= .96), each of which were rated on a 7-point scale (*1 = strongly disagree; 7 = strongly agree*). A high coefficient

alpha (α = 0.91) has been reported in a previous exercise study in adults (Ng, Ntoumanis, & Thøgersen-Ntoumani, 2014).

Basic psychological need satisfaction. Psychological need satisfaction was measured using the Psychological Need Satisfaction in Exercise Scale (PNSE; Wilson, Rogers, Rodgers, & Wild, 2006)(Wilson et al., 2006). In all 18 items, the word 'exercise' was replaced with 'physical activity'. The scale contains three subscales; autonomy (6 items; e.g., 'I feel free to be physically active in my own way'; ω= 0.85), relatedness (6 items; e.g., 'I feel attached to those who participate in physical activities with me because they accept me for who I am'; ω= 0.95), competence (6 items; e.g., 'I feel that I am able to participate in physical activities that are personally challenging'; ω= 0.96). Items were answered on a 6-point scale ranging from (1) *false* to (6) *true.* High coefficient alphas have been reported (autonomy α = 0.95, relatedness α = 0.96, competence α = 0.95) in previous research with older adults (Peddle, Plotnikoff, Wild, Au, & Courneya, 2008). For the purposes of LPA, an average overall psychological need satisfaction score across all scale items was computed. Higher scores indicate greater basic psychological need satisfaction.

Behavioral regulations. The Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2; Markland & Tobin, 2004) was used to measure intrinsic (4 items, e.g., 'I engage in physical activity because it's fun'; ω= 0.90), identified (4 items, e.g., 'I value the benefits of physical activity'; ω= 0.82), introjected (3 items, e.g., 'I feel guilty when I don't engage in physical activity'; ω= 0.77), and external regulation (4 items, e.g., 'I engage in physical activity because other people say I should'; ω= 0.73), as well as amotivation (4 items, e.g., 'I don't see why I should have to be physically active'; ω= 0.78). The scale was adapted to refer to 'physical activity' rather than 'exercise'. All 19 items were scored on a scale ranging from (1) *Not at all true* to (5) *Very true*. Previous research on older adults has reported coefficient alphas ranging from 0.64 (introjected regulation) to 0.93 (amotivation; Russell & Bray, 2009).

For the purposes of the LPA, the scales were combined into a relative autonomy index (RAI) by weighting and summing each scales with higher scores reflecting higher quality of motivation.

Perceived neighborhood environment. Perception of the neighborhood environment was measured using the ALPHA (Assessing Levels of PHysical Activity) scale (Spittaels et al., 2009, 2010). The scale assesses the participants' perception of the suitability of their neighborhood environment for physical activity. The scale comprises 48 items, representing nine domains, including; types of residences (ω= .93), distance to local facilities, walking and cycling infrastructure (ω= .80), maintenance of walking (ω= .50) and cycling infrastructure, neighborhood safety (ω= .73), pleasant for walking (ω= .53) or cycling, walking (ω= .59) and cycling network, home environment, and workplace or study environment. For this study, questions about the home environment (6 items), work environment (10 items), and those related to cycling (6 items) were excluded, as they were not relevant to our sample. We also excluded two items (maintenance of infrastructure) with high rate of missing values. Thus, participants were asked to respond to 24 items. The ALPHA has previously demonstrated moderate to good test-retest reliability intraclass coefficients among adults (0.66 to 0.86 across all subscales) Spittaels et al.'s (2010)). For the purposes of the LPA, a total sum score across all questions was computed with higher scores indicating perceptions of a PA-friendly neighborhood environment (Duncan, Birch, Woodfield, & Al-Nakeeb, 2012).

Physical activity. Objective PA was measured using an accelerometer (model: GT3X+ and WGT3X-BT; ActiGraph, Pensacola, FL, USA) for 7 consecutive days. The models have been shown to have high intra-monitor reliability (Miller, 2015). The accelerometer was worn on the right hip during all waking hours. Participants were asked to record times they removed/replaced the accelerometer during the 7-day monitoring period in a PA diary log. The accelerometer measured PA in 60-second epochs. Non-wear time was defined as 90

minutes of consecutive zeros in the movement counts recorded by the accelerometer, allowing for 2 minutes of counts < 100 (Choi, Ward, Schnelle, & Buchowski, 2012). Accelerometer data were considered valid when participants had worn the accelerometer for ≥ 10 hours per day on ≥ 3 days (including at least one weekend day). A time filter was set to extract data representative of waking hours from the PA diary log (between 7 am and 10:30 pm). The mean accelerometer counts per minute (CPM) was used to classify the intensity of PA (light, moderate or vigorous) per minute. Cut-points developed by Troiano et al. (2008) were used to classify light PA [100-2019 cpm], moderate PA [2020-5998 cpm], and vigorous PA [≥ 5999 cpm]. Moderate and vigorous PA were combined to represent MVPA. These cut-points have been used in previous studies of older adults (Hagströmer, Troiano, Sjöström, & Berrigan, 2010). To adjust for inter-participant variability in accelerometer wear time, average daily time spent engaged in light PA and MVPA intensity were expressed as percentage of daily wear time for use in subsequent correlation and latent profile analyses (Booth et al., 2014).

Statistical Analysis

Descriptive statistics were calculated using IBM SPSS version 22. Subsequently, bivariate correlations and LPA were conducted with Mplus version 7.31. For the LPA, the Full Information Robust Maximum Likelihood (FIML) estimator was used (Enders & Bandalos, 2001), which provides standard errors and a chi-square test statistic that are robust to non-normality (Muthén & Muthén, 1998-2017). This estimator also handles missing data and yields unbiased estimates when data are missing at random. In this study, models with 1 to 4 classes were examined and compared using statistical criteria. A number of statistical criteria were used to assess model fit. The Akaike information criterion (AIC; Akaike, 1987), the Bayesian information criterion (BIC; Nylund et al., 2007), and the sample-size adjusted BIC (SSA-BIC; Yang, 2006) are relative measures of fit where a lower value indicates a better fit.

We also used entropy (ranges between 0 and 1), and the bootstrapped likelihood ratio test (BLRT) as criteria when choosing the final model (Nylund et al., 2007; Peel & MacLahlan, 2000). Higher entropy indicates better precision in the latent class categorization. The BLRT was used to compare the *k*-1 with the *k*-Class Model and a statistically significant BLRT in favor of the *k*-Class Model indicates a better model fit. Finally, we considered the proportion of cases within each class, as smaller numbers can result in low power and precision (Berlin, Williams, & Parra, 2014). In Step 2, the BCH method was applied to examine the association between the latent classes and light PA and MVPA (Asparouhov & Muthén, 2014).

Results

Descriptive statistics and correlations

Descriptive statistics are displayed in Table 1. Participants were mainly married/co-habitating (40.2%) or widowed (46.0%). Approximately, one third of participants (29.9%) had finished secondary school and 58.6% reported that their annual income was less £20,000 per annum when they had a job. Major current diseases reported were cardiovascular diseases (35.5%) and musculoskeletal disorders (30.3%). As seen in Table 2 the percentage of time spent daily in light PA was substantially higher (27.73%, 201 min) than time spent in MVPA (1.35%, 9.76 min). Of the proposed PA correlates, basic psychological need satisfaction for PA correlated most strongly with daily light PA and MVPA.

Profile analysis

The fit indices for the 3-Class Model had lower values for the AIC (839.78), BIC (903.89), and SSA-BIC (821.86), indicating a better model fit than the 1-Class (AIC = 961.01; BIC = 980.74; SSA-BIC = 955.50), 2-Class (AIC = 866.69; BIC = 908.61; SSA-BIC = 854.97) and 4-Class (AIC = 831.24; BIC = 917.55; SSA-BIC = 807.12) Model. Moreover, the higher entropy (1-Class Model = 1; 2-Class Model = 0.81; 3-Class Model = 0.84; 4-Class Model = 0.84) and significant BLRT (2-Class Model: $p < 0.001$; 3-Class Model: $p < 0.001$; 4-Class

Model: $p > .05$), as well as the reasonable proportion of participants in each class, supported the selection of the 3-Class Model as the final model. Class 1 was labeled 'low self-determined and minimally supported' (24%), and consisted of participants who perceived the neighborhood environment to be not conducive to PA, and who reported low levels of autonomy support from important others, psychological need satisfaction, and self-determined motivation. Class 2 was labeled 'moderately self-determined and supported' (53%), and contained individuals who reported moderate scores on all variables. Class 3 was labeled 'highly self-determined and supported' (23%) and was characterized by people reporting the environment as being highly facilitative of PA, and who reported high levels of autonomy support from important others, need satisfaction, and self-determined motivation.

Profile classification and PA

Chi-square tests revealed statistically significant differences in MVPA and light PA among the three latent classes (Table 4). Class 3 had higher MVPA and light PA than the other two classes. The mean percentage of daily MVPA in the Class 3 'highly self-determined and supported' class was approximately three times larger than in the 'low self-determined and minimally supported' class, and twice as large as in the 'moderately self-determined and supported' class. Based on Cohen's *d* effect size rule of thumb (small = 0.2, moderate = 0.5, large = 0.8; Cohen, 1988), large effect sizes were found between the 'highly self-determined and supported' class and the 'low self-determined and minimally supported' class in perceived neighborhood environment and autonomy support from important others. The effect sizes were moderate to large in terms of basic psychological need satisfaction and relative autonomy index across all classes. No statistically significant differences were found between the 'low self-determined and minimally supported' and the 'moderately self-determined and supported' classes in light PA and MVPA.

We also ran the LPA with the entire sample (*N* = 139) who had provided self-reported PA data, and examined differences between the classes on self-reported PA. The self-reported PA was assessed using the Physical Activity Scale for the Elderly (PASE; Washburn, Smith, Jette, & Janney, 1993), which provides a weighted and summated PASE score over the last seven days; higher scores of PASE represent higher levels of PA. The LPA showed that a 3-Class solution provided a good representation of the data and the three classes were very similar to the ones obtained in the main analysis in this paper with the objective PA data. The χ^2 difference test showed that the high (*M* = 129.75, *SE* = 18.72) and moderately (*M* = 95.59, *SE* = 7.52) self-determined and supported classes reported higher levels of PA compared to the low self-determined and low supported class (*M* = 65.93, *SE* = 6.46). Unlike the analysis with objectively-assessed PA, this analysis showed no differences in PA scores.

Discussion

The purpose of the current study was to identify typologies/profiles of older ALF residents based on their perceptions of autonomy support by important others to engage in PA, their psychological need satisfaction and self-determined motivation associated with PA engagement, and their perceptions of their neighborhood environment. Further, we examined whether individuals across these profiles differed in terms of their daily engagement in light PA and MVPA. Three distinct profiles/classes emerged from the LPA.

An important finding was the significant differences in levels of light PA engagement across the three classes. Specifically, more light PA was observed in participants in the 'highly self-determined and supported' group, relative to participants in 'low self-determined and minimally supported' and 'moderately self-determined and supported' profiles. Light PA (e.g., walking) is characteristic of most activities of daily living in older adults (Ainsworth et al., 2000), and accumulation of light PA is associated with several beneficial physical and psychological health outcomes (Buman et al., 2010). In future research, it should be

investigated which specific features of both perceptions of neighborhood environment and autonomy support of important others (i.e., family, ALF staff) predict differences in light PA. Interestingly, residents rated their family or staff of ALFs as their 'important others' who support their PA engagement. Therefore, it should be explored how interventions for PA can be effectively delivered via family members or staff of ALFs.

Perceptions of neighborhood environment were more positive in 'highly self-determined and supported' compared to 'moderately self-determined and supported' (d =.8) and so were the differences between the two classes in terms of MVPA (d =.8). This finding is important because although older adults are encouraged to engage in regular MVPA to reap health benefits (World Health Organization, 2011), adequate MVPA (150 mins a week of moderate PA or 75 minutes of vigorous PA) is a challenging aim for older adults to accomplish (Troiano et al., 2008). In this study, participants spent approximately 9.83 (1.36%) minutes per week in MVPA, which is far less than the recommended guidelines. Further research should examine which specific environmental features (e.g., types of residence, distance to local facilities) are more influential factors in determining MVPA.

Our findings are consistent with previous research demonstrating that when individuals feel that significant others offer them autonomy support for PA engagement, engage in PA for self-determined reasons and experience psychological need satisfaction from that engagement, they are more likely to be physically active (Rouse, Ntoumanis, Duda, Jolly, & Williams, 2011). Our findings are also in line with previous work showing that perceptions of a PA-conducive neighborhood environment were positively related to step counts in older women (Hall & McAuley, 2010) and self-reported PA in older adults (Chad & Reeder, 2005).

The identified classes may be useful when considering the development of interventions aimed at encouraging higher engagement in PA among older residents in ALFs.

Interestingly, the personal motivational variables (self-determined motivation and psychological need satisfaction) differentiated more strongly between the three classes than the contextual variables (perceptions of others' autonomy support and perceptions of neighborhood environment). It is possible to enhance personal motivation for PA [via SDT-based interventions; cf. Hancox et al., (2015)], which can increase need satisfaction and self-determined motivation towards PA. It is possible that motivational factors may override the impact of perceived environmental constraints (Merom et al., 2009). However, this hypothesis has not yet been tested with older adults. Results from studies testing this hypothesis could have implications for public health and planning policy.

Limitations, future research directions, and practical implications

One limitation of this study is that it analyzed overall scores for motivation and psychological need satisfaction and perceived neighborhood environment, as opposed to subscale scores. Thus, we did not demonstrate which individual motivational regulations, psychological need satisfaction, and aspects of the neighborhood environment were associated with the largest differences in PA. This was a pragmatic decision on the basis of the number of variables that were included in the profiles. While individual scores provide valuable sources of information, overall scores for these variables have been shown to predict PA and other related outcomes in older adults (Duncan et al., 2012; Russell & Bray, 2009). A further limitation of the study was that it did not obtain objective ratings of neighborhood environment. Perception of the neighborhood environment might vary depending on individuals' background (e.g., social economic status, health status; Arango et al., 2013; Moran, MacMillan, Smith-Merry, Kilbreath, & Merom, 2015). However, perceptions of neighborhood environment are important components and play a key role in examining determinants of PA promotion (Carnegie et al., 2002). Future research should incorporate both perceived and objectively-measured (i.e., geographic information systems; GIS) aspects

of the neighborhood environment. Another limitation of the study was its cross-sectional nature hence, we are unable to make causal inferences. It would be interesting to examine the stability/change of the identified classes over time, particularly after individuals engage in a PA randomized control trial. Moreover, our sample size (n = 87) is relatively small for LPA. Small sample sizes in latent profile analysis with a moderate number of classes can explain more variance compared to many classes derived from large sample size (Marsh, Lüdtke, Trautwein, & Morin, 2009). Future research with larger sample sizes should try to replicate the profiles and the associations found in the present study. However, supplementary analyses with a larger sample size for which we had self-reported PA data, showed very similar profiles. Furthermore, level of physical function might be important for activities of daily living in residents of ALFs (Park-Lee et al., 2011). Therefore, although the current study included participants who were able to walk independently, it is important for future research to measure physical function to better account for the independent effects of PA.

Notwithstanding these limitations, the study makes several unique contributions to current psychosocial research on PA in older adults. Specifically, it represents the first attempt to incorporate factors from both motivational and the perceived neighborhood environment literatures to predict objective levels of PA in older adults in ALFs. In doing so, it extends self-determination theory research in PA by considering aspects of the perceived neighborhood environment in conjunction with pertinent psychosocial motivational correlates of PA engagement. In this regard, it offers a complementary view of the theoretically integrated model of SDT and the neighborhood environment, proposed by Zhang and Solmon, (2013). The use of objective measures of PA addresses issues with over-reporting of PA and common method variance in previous studies that relied on self-reports. Further, the use of a person-centered analysis takes into account inter-individual differences and examines how intrapersonal, interpersonal, and contextual correlates of PA relate within people as opposed

to across people. Hence, this person-focused approach provides an alternative view to the traditional variable-centered approach utilized in the literature that examines correlates of PA in older adults. Lastly, this research investigates older adults in ALFs, an under-researched group of older adults. Findings from our study could be utilized to help these individuals remain independent and avoid or delay move to full care facilities.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest.

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Table 1.

Characteristics of Participants

Variables	Participant numbers	%
n	87	
Gender	58 (female)	66.7
Age (*M*, *SD*)	77.57	8.11
BMI (*M*, *SD*)	28.10	4.89
Marital		
Married/co habitating	35	40.2
Widowed	40	46.0
Single (never married)	2	2.3
Separate/divorced	10	11.5
Education (missing 12.6 %)		
Secondary	26	29.9
Higher	8	9.2
Post Graduate	1	1.1
Other	8	9.2
None of above	33	37.9
Annual income (missing 14.9 %)		
< £20,000	51	58.6
£20,000 – £35,000	19	21.8
£35,000 – £45,000	2	2.3
> 45,000	2	2.3
Race		

White British	82	94.3
Irish	2	2.3
Other white	1	1.1
Black Caribbean	1	1.1
Other Asian	1	1.1
Drink (missing 2.3 %)		
Currently	52	59.8
Previously	17	19.5
Never	16	18.4
Smoke (missing 1.1 %)		
Currently	4	4.6
Previously	44	50.6
Never	38	43.7
Disease indicators (missing 2.3 % in diabetes)		
Diabetes	10	6.6
CV	54	35.5
MS	46	30.3
Kid-liver	4	2.6
Lung	12	7.9
Cancer	8	1.3
Parkinson's disease	2	1.3
Other	16	10.5

Note. CV = Cardiovascular diseases, MS = Musculoskeletal disorders, Kid-liver = Kidney-Liver disease.

Table 2.

Estimated Sample Statistics and Bivariate Correlations

	M	*SD*	Skew	Kur	2.	3.	4.	5.	6.	7.
1. Wear time (min)	723.07	67.55	0.44	-0.83	-0.29**	-0.21	0.02	-0.05	-0.08	0.11
2. Light PA (min, %)	201, 27.73	10.36	-0.00	-0.12	-	0.56**	0.31**	0.31**	0.41**	0.24*
3. MVPA (min, %)	9.76, 1.36	1.36	1.51	3.66		-	0.22*	0.22*	0.41**	0.35**
4. Perceived neighborhood environment	2.97	0.49	-0.87	1.97			-	0.21	0.36**	0.31**
5. Autonomy support	5.40	1.63	-0.93	-0.02				-	0.53**	0.50**
6. Psychological needs satisfaction	4.53	1.07	-0.66	-0.19					-	0.75**
7. Self-Determination Index	9.45	6.93	-1.03	1.36						-

Note. *$p < .05$, **$p < .001$, Light PA = Light physical activity, MVPA = Moderate-to-vigorous physical activity.

Table 3.

Profile Characteristics

	Class 1: Low self-determined and minimally supported (*n* = 21, 24%)			Class 2: Moderately self-determined and supported (*n* = 46, 53%)			Class 3: Highly self-determined and supported (*n* = 20, 23%)					
	M	*SD*	*Range*	*M*	*SD*	*Range*	*M*	*SD*	*Range*	d_{2-1}	d_{3-1}	d_{3-2}
Perceived neighborhood environment (ALPHA; 1-5, 1-4, 0-1)	2.7	0.7	5.3	2.9	0.6	4.5	3.4	0.4	2.8	0.3	1.1	0.8
Autonomy support (1-7)	3.8	2.8	3.7	5.8	2.4	2.5	6.2	1.6	2.1	0.8	1.1	0.2
Psychological needs satisfaction (PNSE; 1-6)	3.1	1.4	2.1	4.7	1.6	2.2	5.6	0.3	0.9	1.1	2.4	0.6
Self-Determination Index (BREQ-2; 1-5)	0.8	10.5	3.6	10.1	8.9	2.0	16.5	4.1	0.7	1.0	2.0	0.8

Note. *d* = Cohen's *d* effect size statistic, ALPHA = Assessing Levels of PHysical Activity, Autonomy Support = Important Other Questionnaire, PNSE = Psychological Need Satisfaction in Exercise Scale.

Table 4.

Chi Square Difference Tests

	Light PA (%)					MVPA (%)				
	M	*SD*				*M*	*SD*			
Class 1	22.6	11.8				0.8	1.0			
Class 2	28.0	10.1				1.2	1.2			
Class 3	32.7	10.6				2.4	1.9			
Class comparisons	χ^2	*p*	$d_{2\text{-}1}$	$d_{3\text{-}1}$	$d_{3\text{-}2}$	χ^2	*p*	$d_{2\text{-}1}$	$d_{3\text{-}1}$	$d_{3\text{-}2}$
Overall test	8.4	0.015	0.5	0.9	0.5	10.6	0.005	0.4	1.0	0.8
1 vs. 2	2.9	0.088				1.8	0.182			
1 vs. 3	8.4	0.004				10.5	0.001			
2 vs. 3	2.7	0.100				6.0	0.014			

Note. *d* = Cohen's *d* effect size statistic, Class 1: Low self-determined and minimally supported (*n* = 21, 24%), Class 2: Moderately self-determined and supported (*n* = 46, 53%), Class 3: Highly self-determined and supported (*n* = 20, 23%).

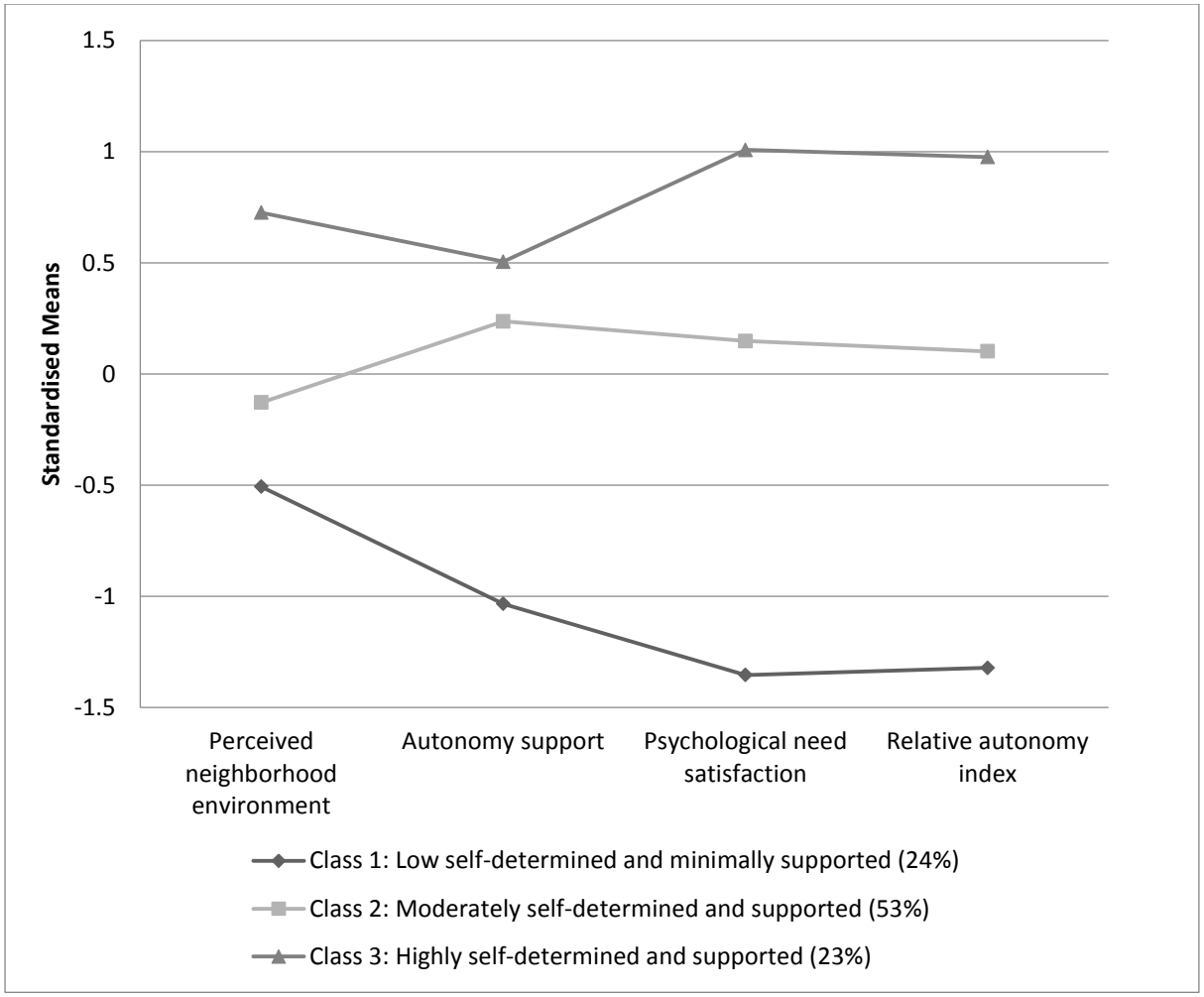

Figure 1. Profiles identified via Latent Profile Analyses