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Life-Space Mobility of Older Adults Living in the Community – A Cross-Sectional Study

Arne Buss, BA, MScN[1], Karin Wolf-Ostermann, PhD[2], Steve Strupeit, PhD[3,*]

[1]*Research Associate, Department 11, Applied Social Sciences, University of Applied Sciences Munich, Am Stadtpark 20, 81243 München, Germany*

[2]*Professor, Department 7: Health Care Research, Institute for Public Health and Nursing Research (IPP), University of Bremen, Grazer Strasse 4, 28334 Bremen, Germany*

[3]*Professor, Department 11, Applied Social Sciences, University of Applied Sciences Munich, Am Stadtpark 20, 81243 München, Germany*

Corresponding Author:** ***Steve Strupeit, *Professor, Department 11, Applied Social Sciences, University of Applied Sciences Munich, Am Stadtpark 20, 81243 München, Germany.* ***Email:*** *strupeit @hm.edu*

Abstract

Introduction: *The aim of this study was to examine the life space accessed by older adults living in the community and to determine the relationships between life space and age, gender, functional status, cognitive status, and care dependency level.*

Materials and Methods: *This study was a single-site study with a cross-sectional design. The primary outcome was life space assessed with the Life-Space Assessment (LSA).*

Results and Discussion: *The mean LSA Score composite score was 48.73, indicating restricted lifespace. In particular, fewer participants traveled to areas outside of their town. Correlations were found between restricted life space and older age (p = 0.001) and between restricted life space and care dependency (p = 0.004).*

Conclusions: *Health care professionals can use knowledge about life space mobility outcomes to target useful interventions. Further studies are needed that examine life space mobility in older adults.*

Keywords: *Life space; Mobility; Older adults; Community; Nursing*

Abbreviations: *LSA- Life-Space Assessment, ADL- Activities of Daily Living, IADL- Instrumental Activities of Daily Living, MMSE- Mini-Mental State Examination, CDS- Care Dependency Scale, BI- Barthel Index*

1. INTRODUCTION

It is particularly important to maintain and facilitate mobility among the older population because they are at high risk for mobility impairment and, therefore, for becoming dependent on care. Assessments of older adults' life space may improve the effectiveness of interventions and enhance our understanding of the concept and course of mobility in this population. Assessment outcomes can encourage health care professionals to plan interventions to improve mobility, identify barriers to mobility (1), and determine the need for services (2). However, health care professionals typically use assessments that measure the results of mobility loss rather than mobility itself (3). As Rush and Ouellet (4) previously noted, in the nursing literature, mobility is primarily related to impaired physical mobility or to immobility and, thus, is measured as functional mobility, impaired mobility, or immobility in nursing practice. Two of the most common mobility assessments are the activities of daily living (ADL) and the instrumental activities of daily living (IADL). However, these instruments may provide a limited assessment of mobility given that they focus on functional impairment and "describe what people are able to do at a given point in time, rather than what people actually do in their daily lives" (1). Life-space assessment, by contrast, reflects a broader concept of mobility. Mobility, in terms of life space, refers "to the area through which the subject moved" (2). The

first life-space assessment instrument was introduced by May et al. (2). In a diary study, community-dwelling older adults were asked to identify which area life spaces they had visited in the past month. The authors found that life space was closely correlated with gait speed and sway path. A more recent life-space assessment instrument, the life-space assessment (LSA), was developed for the University of Alabama at Birmingham (UAB) Study (3). In most studies measuring older people's life space using the LSA, the participants' mean LSA composite scores were approximately half of the maximum score of 120 (1, 3, 5, 6),although one study (7)found a lower composite score (41.7). Factors associated with a restricted life space include female gender (1, 7, 8), old age (1, 7, 9), poor scores on the ADL scale (1, 7, 9, 10), less physical activity, depression (1, 7, 8), and cognitive decline (1, 5).We posit that in addition to these factors, individuals' care dependency levels, based on German statutory care insurance, and their utilization of care (professional or lay) could be associated with the restriction of their life space. If a person receives nursing care from professional nurses or informal caregivers, he or she likely experiences restrictions in his or her ability to move around.

To our knowledge, no findings on lifespace in a German older population have been published to date. The aim of this study was to examine older people's life space and the potential relationships between life space and age, gender, functional status, cognitive status, and care dependency.

2. Materials and Methods

2.1. Design and Sample

This study was a single-site study with a cross-sectional design; data were collected at only one point (admission to the geriatric clinic) for each patient. Participants were recruited from a geriatric clinic in Hamburg, Germany. The recruitment phase lasted six months, and all patients who met the inclusion criteria were deemed to be eligible to participate in the study. Therefore, we used a convenience sample. We did not perform an a priori sample size calculation.

2.2. The Eligibility Criteria were as Follows

- an established diagnosis of functional mobility impairment of the musculoskeletal system or of stroke (ICD-10: S00-T98 [except T36-87], T89, T88, T90-T95, T98, M00-M99, I61, I63, or I66);
- age older than 60 years;
- the ability to communicate (motorically, cognitively, and psychologically);
- the ability to speak German
- residence in Greater Hamburg (home or nursing home); and
- the provision of written informed consent.

2.3. The Exclusion Criteria were as Follows

- a score of less than 25 points on the Mini-Mental State Examination (MMSE) and discharge within the first week of the study;
- a disease expected to lead to death during the study period. A physician was consulted to identify these individuals. This criterion typically affected patients receiving palliative care;
- spatial or temporal orientation deficits; and
- function-impairing cognitive impairments.

2.4. Ethics Approval and Consent to Participate

The study protocol was approved by the ethics commission of the Medical Association of Hamburg (PV2972). All participants provided informed consent to participate in the study.

2.5. Measures

Two study nurses collected data at the time of the participants' admission to the geriatric clinic (between May 2008 and August 2009). We chose this collection point because we wanted to assess the life space accessed by the participants in their everyday life prior to admission (the past four weeks). Data on the following outcomes were collected once for each participant. The study nurses who performed data collection held a bachelor's degree in nursing. Prior to the study, two researchers trained the study nurses on the data collection procedures and on use of the instruments.

2.6. Life-Space Assessment

The LSA was introduced by Baker, Bodner (3). This questionnaire assesses a person's life space and level of dependence when moving within a certain life space. Five different life-space levels are included in the questionnaire (see Table 2). Respondents are asked to state whether they have been to each life-space level during the past four weeks (Yes or No). Each "Yes" is given a point value, starting with 1 (life-space

level 1) and increasing by 1 point for each life-space level (2 for "Yes" in life-space level 2, 3 for "Yes" in life-space level 3, etc.). In addition, respondents are asked to state how often they visited each life-space level [less than 1 time per week (score = 1), 1-3 times per week (score = 2), 4-6 times per week (score = 3), or daily (score = 4)]. Independence level is assessed by querying whether the respondent needed aids, equipment, or help from another person to move within a life-space level [personal assistance (score = 1), equipment only (score = 1.5), or neither equipment nor personal assistance (score = 2)]. The overall score for each life-space level and the total score are calculated by summing the scores. The total score ranges from 0 ("totally bed-bound") to 120 ("traveling out of town every day without assistance"). The LSA is positively scored, with higher scores indicating a larger life space (1).

The patients' functional status was measured using the Barthel Index (BI), a standard geriatric instrument that assesses the fundamental functions of daily living. The BI consists of 10 items (nutrition/eating, transfer, washing, toilet, bathing, walking, stair climbing, dressing/undressing, bowel control, and urine control), with each item scored as 0, 5, 10, or 15. The BI is positively scored, and the overall score ranges from 0 (totally dependent) to 100 (independent) (11).

2.7. Cognitive Impairment

Cognitive impairment was measured using the MMSE, which is the most frequently used instrument for screening mental/memory disorders. The MMSE comprises 30 exercises, and a trained examiner scores each exercise with a value of 1 or 0. The overall score ranges from 0 to 30. The MMSE is positively scored; an overall score lower than 17 indicates severe memory impairment, and an overall score between 17 and 24 indicates slight impairment (12).

2.8. Care Dependency

Care dependency was measured by determining the participants' German care dependency levels. Level 1 indicates the lowest requirements, implying an average need for daily formal nursing care (basic care and household assistance) of more than 90 minutes, with more than 45 minutes involving basic care. Level 2 indicates moderate requirements, implying an average need for daily formal nursing care of more than 3 hours, with more than 2 hours devoted to basic care. Level 3 indicates the highest requirements, implying an average need for daily formal nursing care of more than 5 hours, with more than 4 hours involving basic care. Therefore, the care dependency levels can be regarded as being negatively scored. Additionally, participants were asked if they received any formal or informal care (Yes or No).

2.9. Statistical Analysis

Descriptive statistics were used to describe the test results from the LSA, BI, MMSE, and care dependency measurements. Correlations among metric/ordinal variables were examined using Pearson's and Spearman's correlations. Chi-square tests, t-tests and F-tests were used to analyze the data. We used a fixed-effects analysis of covariance (ANCOVA) model to analyze the effects on our main outcome parameter (LSA). We adjusted this model for the following confounding factors: gender, age, functional status (BI), care dependency level, and formal/informal care. We did not include MMSE as a confounding variable because of its high correlation with age, and the interactions between confounding variables were not modeled because of the small number of study participants. Statistical model assumptions regarding the normal distribution of variables and multi collinearity were examined, and then further analyses were conducted. Significance was set at $p < 0.05$. All stated p-values are nominal. All statistical analyses were conducted using IBM SPSS® Statistics for Windows, version 22.0 (IBM Corp., Armonk NY, USA).

3. Results and Discussion

3.1. Patient Characteristics

A total of 124 patients participated in the study; their baseline characteristics are shown in Table 1. The mean age of the participants was 83.52 (64-102) years, and male and female participants were evenly distributed; the mean BI score was 55.52 (5-90), and the mean MMSE score was 27.93 (25-30).Approximately two-thirds of the participants did not report a care dependency level or receive formal or informal care. Approximately one-third reported a care dependency level of 1, and the fewest participants (5.4%) had a level of 2. Of the participants, 39.3% and 30% received informal and formal care, respectively.

Table1. *Participants' Characteristics*

Age, mean (SD[1]) (Range)	83.52 (8.15) (64-102)
Gender, N[2] (%)	
Male	62 (50)
Female	62 (50)
BI[3], mean (SD) (Range)	55.52(17.95) (5-90)
MMSE[4], mean (SD)(Range)	27.93 (1.59) (25-30)
CDL[5], N (%)	
None	73 (65.8)
1	32 (28.8)
2	6 (5.4)
Informal care, N (%)	
Yes	46 (39.3)
No	71 (60.7)
Formal care, N (%)	
Yes	37 (30.8)
No	83 (69.2)
LSA[6], mean (SD) (Range)	48.73 (25.83) (0-120)

[1]Standard deviation, [2]Number, [3]Barthel Index, [4]Mini-Mental State Examination, [5]Care Dependency Level, [6]Life-Space Assessment

3.2. Life-Space Assessment

The composite LSA score for all participants was 48.73.The majority of participants stated that they had been to other rooms of their home aside from the room where they sleep (97.5%); had been to an area outside of their house, such as in their yard or driveway (93.3%); or had been to places in their neighborhood other than their yard or apartment building (88.3%) during the past four weeks. Approximately three-fourths of the participants (75.4%) reported that they had been to places outside of their neighborhood but within their town. Fewer than half of the participants (47.5%) stated that they had been to places outside of their town (see Table 2).The composite LSA score was significantly correlated with age (r = -0.305; p = 0.001), with older participants displaying a significantly lower LSA score (c.f. Table 3). The ANCOVA results ($p < 0.001$; $R^2 = 0.298$), controlling for the influence of gender, age, functional status (BI), care dependency level, and formal/informal care (no support, informal assistance, formal assistance, formal and informal assistance), showed a significant influence of care dependency level (p= 0.004). Participants with a lower care dependency level had lower composite LSA scores than those with the highest care dependency level in our study (level 2) (level 0: ß = -20.242; level1: ß = -33.343) (see Table 4).

Table2. *Life-Space Activities within the Last Month*

Life-Space Level	**Responses**	
During the past four weeks, have you been to…	**Yes N[1] (%)**	**No N (%)**
Life-Space Level 1… **Other rooms of your home besides the room where you sleep?**	117(97.5)	3 (2.5)
Life-Space Level 2… **An area outside of your home, in your own yard or driveway?**	112 (93.3)	8 (6.7)
Life-Space Level 3… **Places in your neighborhood other than your own yard or apartment building?**	106 (88.3)	14 (11.7)
Life-Space Level 4… **Places outside of your neighborhood but inside your town?**	89 (75.4)	29 24.6)
Life-Space Level 5… **Places outside of your town?**	57 (47.5)	63 (52.5)

[1]Number of participants

Table3. *Correlations among the Variables*

		BI[1]	MMSE[2]	LSA[3]
Age	**Pearson correlation**	-0.141	-0.282	-0.305
	Sig.[4] (2-sided)	0.117	0.006	0.001
	N[5]	124	95	111
BI	**Pearson correlation**		0.053	0.155
	Sig. (2-sided)		0.608	0.104
	N		95	111
MMSE	**Pearson correlation**			0.035
	Sig. (2-sided)			0.750
	N			86

[1]Barthel Index, [2]Mini-Mental State Examination, [3]Life-Space Assessment, [4]Statistical Significance, [5]Number

Table4. *Group differences in LSA total scores*

Variables		N[1] (%)	*p*-value
Gender	Male	51.85 (26.49)	0.233
	Female	46.00 (24.74)	
Care dependency level	None	53.37 (22.88)	0.004
	1	31.45 (20.43)	
	2	65.42 (33.31)	
	3	---	
Formal care	Yes	39.99 (25.89)	0.671
	No	52.85 (25.33)	
Informal care	Yes	42.02 (24.90)	0.538
	No	52.92 (25.88)	

[1]Number

The aim of this study was to examine the life space of older people and the potential relationships between life space and age, gender, functional status, cognitive status, and care dependency. This study measures the life-space mobility of older adults in Germany. The participants' mean LSA composite score was 48.73. In most other studies assessing older people's LSA, the mean LSA composite score was higher (1, 3, 5, 6), ranging from 62.9 (3) to 69.8 (5). In one study (7), the mean LSA composite score was lower than that in the current study. However, these differences can be explained by differences in the participants' mean age across the studies. In the studies of Crowe, Andel (5), Ritchie, Locher (6), Peel, Sawyer Baker (1), and Baker, Bodner (3), the mean age was approximately 75 years. By contrast, in this study, the mean age was 83.52 years. In the study conducted byAl Snih, Peek (7), the participants' mean age was slightly higher (84.2 years). As a restricted life space has been found to be associated with older age (1, 7, 9), the lower LSA score in the present study is likely a result of the higher mean age of the participants. Moreover, in our study, the participants apparently represented a more vulnerable population than the community-dwelling older adults in other studies (1, 3, 5). However, we could not compare our results on health and functional outcomes with those of previous studies because different measures were used across studies. The findings on the five different levels of life space areas revealed that a majority of the study participants had visited places outside of their homes (i.e., their driveway) and places in their neighborhood. Two-thirds had visited places outside of their neighborhood but within their town. Less than half of the participants had traveled to places outside of their town. One interpretation of these findings is that there appears to be a need for interventions or services that help older adults reach these places. Based on the LSA, nurses can use their knowledge of such mobility restrictions to target useful interventions, because the LSA identifies the level at which assistance is needed. For instance, community-dwelling older adults may benefit from transport services, assistive devices (e.g., walking aids), or social support. However, such information was beyond the scope of this study. The use of single assessments measuring physical functioning may not be sufficient to gather such information. Statistical analysis revealed correlations between LSA composite scores and age and between LSA composite scores and care dependency: older participants had lower LSA scores than younger participants. These findings are in line with results from previous studies

(1,7, 9). Thus, these findings are expected and support the relationship between old age and life space restriction. Furthermore, in this study, care dependency was related to a restricted life space. Participants who had a care dependency level of 1 had lower LSA composite scores than participants with a care level of 2. These findings appear to be contradictory. One might expect that a higher care dependency level would be related to a more restricted life space. Previous studies (1,7, 9) found that limitations in ADL were related to a restricted life space, and because the rating of care dependency levels in Germany is based on ADL, we expected a similar relationship. However, our findings are contrary to this expectation. The low proportion of participants with a care dependency level of 2 (n = 6; 5.4%) may have influenced our results. Nevertheless, those individuals exhibited a higher LSA score than those with a care dependency level of 1. Thus, a higher care dependency level may not necessarily lead to a restriction in a person's life space. For example, if a care-dependent person is bound to a wheelchair, he or she may able to move around via car and, thus, reach places outside of the town or neighborhood. In contrast, participants in care level 1 could have been assessed for care level 1 earlier and could now need care level 2 without having yet applied for it. However, these results could have been influenced by the sample size. The proportion of patients with a care dependency level of 2 may have been higher in a larger sample. Moreover, the German care dependency levels used in this study have not been validated to measure care dependency. The relationship between care dependency and the use of life space must be further examined.

4. Limitations

Several limitations of the present study should be considered. All participants were recruited from a single hospital, and some patients were excluded because they did not meet the eligibility criteria. This methodology may have influenced the representativeness of the study's findings. Additionally, the participants may have traveled to the hospital, which could have affected their usual life space patterns. Moreover, the sample size in this study was smaller than that in other studies on this subject, potentially influencing the statistical analysis. Our study could have benefited from qualitatively asking the subjects to provide their rationale for either accessing or for refraining from accessing different life space levels. However, a qualitative approach was beyond the scope of this study.

5. Conclusions

Health care professionals can use this knowledge about life space levels to target interventions. Older adults need support to reach places outside of their neighborhood or town; the individual level of need for assistance should be determined using LSAs or other instruments. To our knowledge, this study presents the first results from Germany using the LSA. Future studies are needed using larger sample sizes, rigorous methods and comparable samples.

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