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Research Article

Physical Functioning Among Older Adults New to Long-Term Services and Supports

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Abstract

Background and Objectives: To identify determinants of self-reported physical functioning (PF) among older adults new to long-term services and supports (LTSS).

Research Design and Method: Using the International Classification of Function, Disability, and Health (ICF) framework, we conducted a secondary analysis of self-reported data on symptoms, basic/instrumental activities of daily living, quality of life, assistive devices, physical therapy needs, prior healthcare utilization, health status, and demographics from 470 older adults new to LTSS (Home/Community-Based n = 156; Assisted Living n = 156; Nursing Home n = 158). Multiple linear regression was used to identify associations between ICF constructs and self-reported PF (SF-12 Physical Composite Summary score [SF12PCS], lower scores indicate worse PF).

Results: LTSS recipients were mostly female (71%) and over age 80 (Mean: 80.9 years, *SD*: 8.7). LTSS recipients' mean SF12PCS score was 37.3 (*SD* 11.0), indicating overall low self-reported PF. LTSS recipients living in their homes (b = –3.35, p = .003) or assisted living facilities (b = –2.93, p = .012) had significantly lower mean scores compared to recipients in nursing homes. Higher SF12PCS scores were associated with fewer activities of daily living deficits (p < .001), and better quality of life (p < .001). Lower scores were associated with more symptoms (p < .001), poorer nutrition (p = .013), ambulation aid use (p < .001), and physical therapy (p < .026).

Discussion and Implications: Diverse health, activity, and environmental factors may facilitate early identification of new LTSS recipients most in need of interventions to optimize self-reported PF. Several health conditions may be targets for such interventions. Additional research is needed to evaluate and compare PF trajectories among older adults receiving LTSS in diverse settings.

Keywords: Function/mobility, Nursing home, Assisted living, Home and community-based services

Poor physical functioning (PF) is associated with negative patient-centered outcomes, including higher risk of 30-day hospital readmission (Greysen, Stijacic Cenzer, Auerbach, & Covinsky, 2015), increased morbidity and mortality (Matzen, Jepsen, Ryg, & Masud, 2012; Ostir et al., 2013), and long-term disability (Fried, Bandeen-Roche, Chaves, & Johnson, 2000; Zisberg et al., 2011). Older adults with chronic illness are at high risk for progressive decline and subsequent

disability (Cesari et al., 2006). Worsening PF affects chronically ill older adults' health and independence, and may impact how they perceive their overall health and symptom management (Zubritsky et al., 2013). Thus, PF is one of most important factors for quality of life among older adults (Fried, McGraw, Agostini, & Tinetti, 2008; Zubritsky et al., 2013).

Long-term services and supports (LTSS) encompasses diverse programs, such as institutional care, adult daycare programs, home health aides, transportation, personal care, and care coordination, to assist individuals with chronic health conditions or impairments in basic and instrumental activities of daily living (ADL) (Wysocki et al., 2015). LTSS interventions focus on the diverse clinical needs of chronically ill older adults by addressing symptom management and behavioral issues with the goal of improving overall quality of life (Zubritsky et al., 2013). LTSS are delivered across a spectrum of care settings, including nursing homes (NH), assisted living facilities (ALF), and via home and community based services (HCBSs) in older adults' homes. To best target effective LTSS interventions and efficiently allocate limited resources focused on optimizing PF and preventing disability in this population, we must first identify characteristics of older adults new to LTSS reporting poor PF, as these individuals may be at high risk for subsequent decline.

Unfortunately, little research has examined and compared PF among older adults new to LTSS (Wysocki et al., 2015). Past studies have primarily focused on outcomes and trajectories related to ADL disability (Marek et al., 2005; Pruchno & Rose, 2000; Sloane et al., 2005) and health care utilization (Chen & Berkowitz, 2012; Sands et al., 2012) among older adults across diverse LTSS settings. A recent review comparing LTSS in HCBS and NH settings suggests past studies lacked an examination of baseline PF among cohorts, and inconsistently distinguished older adults who may be new to LTSS from current or long-term users (Wysocki et al., 2015). PF is associated with quality of life over time among LTSS recipients (Naylor et al., 2016). Understanding PF at the time they enter a new phase in their trajectory could direct early interventions to optimize PF in this vulnerable population.

Theoretical Framework

The World Health Organization's International Classification of Functioning, Disability, and Health (ICF) (Figure 1) is a useful framework of determinants of PF (World Health Organization, 2002). The ICF represents individuals' PF on a continuum from injury/weaknesses in *body function and structure* (e.g., knee arthritis), to subsequent impairment in distinct *activities* (e.g., climbing stairs), and ultimately to disability, or impaired *participation* in activities in a social context (e.g., climbing stairs to do laundry) (World Health Organization, 2002). *Health conditions*, such as more chronic conditions (Cesari et al., 2006), poor nutritional status (Singh et al., 2014), and greater reported symptoms (Whitson et al., 2009) can hasten progression from limitations in distinct activities to limitations in participation. Contextual characteristics, categorized as *environmental and personal factors*, also impact PF. For example, older adults residing in an aging-in-place model may have better functional outcomes than older adults in institutional settings (Marek et al., 2005). Among *personal factors*, older age, female gender (Dunlop, Hughes, & Manheim, 1997; Millan-Calenti et al., 2010), and African American race or Hispanic ethnicity (Shih,

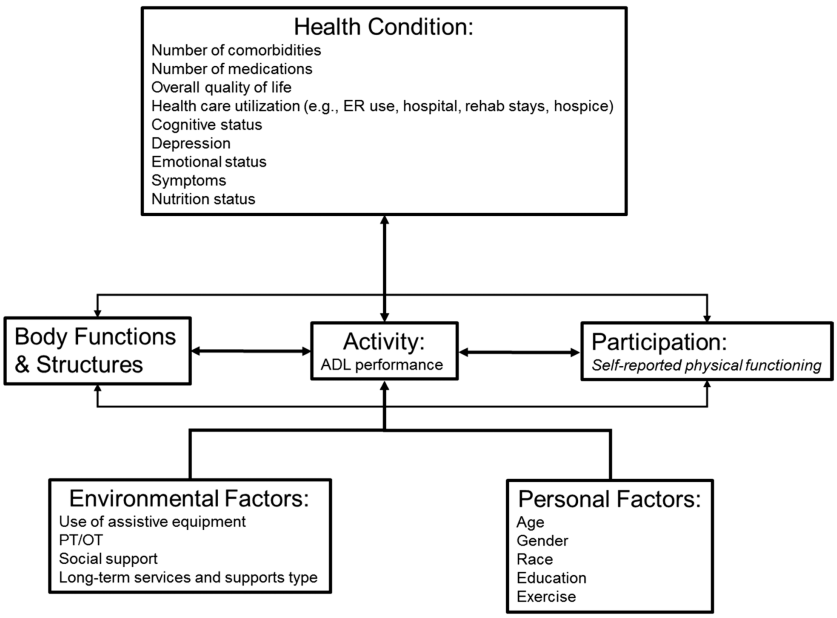

Figure 1. The World Health Organization's International Classification of Functioning, Disability and Health (ICF) Conceptual Framework Applied to Long-term Services and Supports with specific variables listed by ICF factor.

Song, Chang, & Dunlop, 2005), have been associated with poor PF outcomes. Conversely, physical activity has been linked to better PF outcomes (Chou, Hwang, & Wu, 2012).

The purpose of this study was to identify factors from four ICF constructs—health conditions, activity limitations, environmental, and personal factors—associated with self-reported PF among older adults new to LTSS. We hypothesized that (a) indicators of worsening health conditions, such as more chronic conditions, poorer nutritional status, depressive symptoms, and poor quality of life; (b) activity limitation related to ADL performance; (c) environmental factors, such as residing in settings offering higher levels of care (e.g., NH or ALF), use of assistive devices, and limited social support; and (d) personal factors such as older age, female gender, and limited reported exercise behavior, were associated with poorer self-reported PF. Early identification of characteristics of older adults new to LTSS with different baseline PF could lead to efficient allocation of resources, and targeted interventions to mitigate PF decline and disability for those individuals most at-risk.

Design and Methods

Design and Sample

A secondary analysis was conducted using cross-sectional data from a parent study examining health-related quality of life among 470 older adults new to LTSS (HCBS, n = 156; ALF, n = 156; NH, n = 158) (Naylor et al., 2016; Zubritsky et al., 2013). In the parent study, older adults were recruited to participate from a total of 11 LTSS organizations (59 unique locations) located on the east coast of the United States. Eligibility criteria for the parent study included: age 60 years or older; never having received LTSS before and be within 60 days of start of LTSS; English or Spanish speaking; and Mini Mental State Examination (MMSE) score of > 11 (Folstein, Folstein, & Fanjiang, 2001; Folstein, Folstein, & McHugh, 1975). Most HCBS recipients were enrolled from Programs of All-Inclusive Care for the Elderly or similar programs which attempt to support NH-eligible individuals in their own homes to avoid NH placement. Older adults were ineligible to participate if, during screening, they had an impaired sense of reality (e.g., diagnosis of paranoia), or were considered terminally ill (e.g., prognosis of < 6 months to live in medical record, hospice enrollee). More in-depth recruitment details are presented elsewhere (Naylor et al., 2016).

Human Subjects

The parent study was reviewed and approved by three Institutional Review Boards associated with participating sites in this study: the University of Pennsylvania, the Philadelphia Veterans Medical Center and the Visiting Nurse Service of New York.

Measures

Multiple standardized instruments and investigator-developed items were used to collect baseline data from older adults new to LTSS. For the analyses presented here, the variables were selected from the parent study dataset using ICF constructs (Figure 1).

Outcome Variable

Self-reported PF, is conceptually defined as older adults' perceived functional limitations and physical health. Self-reported PF was operationalized using the Medical Outcomes Survey Short Form Physical Composite Score [SF12PCS]. The SF-12 provides a global measure of eight domains of health and function evaluating not just PF, but also role limitations (physical and emotional), social functioning, bodily pain, mental health, general health, and vitality (Ware, Kolinski, Turner-Bowker, & Gandeck, 2002; Ware, Kosinski, & Keller, 1996). The SF12PCS is a weighted summary score (0–100, population mean = 50, SD = 10) of the eight domains of health and function representing an individual's self-reported, overall perceived PF and physical health, where better PF is indicated by higher scores (Ware et al., 2002). Test–retest reliability of the SF12PCS is 0.89 (Ware et al., 1996). Relative validity estimates for the SF12PCS are 0.43 to 0.93 (median = 0.67) for SF12 PCS versus SF36. (Ware et al., 1996; Ware et al., 2002). The SF12PCS has been used to describe self-reported PF in adults with diverse chronic conditions (Jakobsson, Westergren, Lindskov, & Hagell, 2012; Preede et al., 2015; Resnick & Nahm, 2001; Soley-Bori et al., 2015).

Health Conditions

Health Conditions included in the analyses were: clinical characteristics of LTSS recipients such as number of chronic conditions; number of medications; health care utilization/resource use in the 3 months prior to start of LTSS; nutritional status (e.g., albumin level, nutritional assessment); and total number of bothersome symptoms. In addition, standardized assessment of emotional and cognitive status were included.

Emotional status. Both a measure for depression, the Geriatric Depression Scale-Short Form (GDS-SF), and a measure of overall emotional well-being, SF-12 Mental Composite Score (SF12MCS), were included as measures of emotional status. The GDS-SF is a 15-item scale assessing the presence of depressive symptoms (Marc, Raue, & Bruce, 2008; Yesavage, Brink, Rose, & Adey, 1983). The GDS-SF has been used with both institutionalized older adults and those with dementia, and is reliable and valid (Burke, Nitcher, Roccaforte, & Wengel, 1992; Conradsson et al., 2013; Yesavage et al., 1982). A score of 5 or greater on the GDS-SF indicates depressive symptoms (Marc et al., 2008). The SF12MCS is a weighted summary score (0–100, population mean = 50, SD = 10) of the eight domains (noted above) representing an individual's self-reported, overall mental health, where better mental health is indicated by higher scores (Ware et al., 2002). Test–retest reliability of the SF12MCS is 0.76 (Ware et al., 1996). Relative

validity estimates for the SF12MCS are from 0.60 to 1.07 (median = 0.97) for SF12 MCS versus SF36 (Ware et al., 1996; Ware et al., 2002).

Cognitive status. The 11-item MMSE measures several aspects of cognition including orientation, recall, memory, attention, and calculation ability (Crum, Anthony, Bassett, & Folstein, 1993; Folstein et al., 2001, 1975). Higher MMSE scores indicate fewer cognitive deficits (range: 0–30).

Quality of life. A single item was used to elicit overall quality of life ("How would you rate your overall quality of life at the present time?"). The item was rated on a 5-point Likert scale: poor, fair, good, very good, and excellent (Yohannes, Dodd, Morris, & Webb, 2011; Zimmerman et al., 2006).

Resource use in prior 3 months. The use of various services in the 3 months prior to the start of the LTSS—such as emergency department visits, hospitalizations, short term rehabilitation stays—were collected from respondents and medical record review. Data were used as individual count variables in modeling.

Activity Limitation

Basic activities of daily living (BADL) were assessed using the Katz Basic Activities of Daily Living (BADL) tool (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963). This six-item scale provides a self-reported assessment of activities such as bathing, dressing, toileting, transferring, continence, and feeding. High scores indicate fewer deficits in BADLs. Past research using this measure in clinical settings, such as hospitals, home care, and assisted living, has demonstrated it can accurately classify BADL deficits in 96% of individuals (Katz et al., 1963). In the parent study, for enrollees with scores on the MMSE of < 24 a caregiver (e.g., home health aide, family caregiver, certified nurse assistant) who assisted the older adult with day-to-day activities provided answers for the BADLs scale.

Environmental Factors

Environmental factors included in the modeling were: LTSS type (NH, ALF, HCBS), use of physical therapy [no, needs but not receiving, yes receiving] and/or occupational therapy [yes/no], use of assistive devices that facilitate interaction with the environment (e.g., ambulatory assistive devices [yes/no], use of sensory assistive devices such as glasses or hearing aids [yes/no]) and social support using the Medical Outcomes Survey-Social Support [MOS-SS] survey (Sherbourne & Stewart, 1991). The four subscales of the MOS-SS included in this analysis were: affection, emotional/informational, tangible, and positive social interaction. Items are summed for each subscale, then the score is divided by the total number of items. Higher scores indicate greater feelings of the various types of social support (Gómez-Campelo et al., 2014; Sherbourne & Stewart, 1991).

Personal Factors

Personal factors included in the modeling were individual LTSS recipients' sociodemographic characteristics (e.g., race, gender, age, education) and health behaviors (e.g., "Do you regularly participate in any exercise, stretching, walking, tennis, biking, or swimming?" [yes/no]).

Statistical Analyses

Linear regression modeling was used to examine factors associated with self-reported PF among older adults new to LTSS. Seventeen participants were missing response items required to generate the SF12PCS subscale; therefore, our sample included 453 of the 470 LTSS (96.4%). Overall there was minimal missingness among the variables. Multiple imputation by fully conditional specification and with an assumed arbitrary missing pattern (number of imputations: five) was conducted and compared for sensitivity purposes. This sensitivity analysis revealed only small differences in terms of coefficient magnitude; thus, the complete data for the entire sample are presented. Based on bivariate regression modeling, an initial multivariable regression model was built using the bivariate modeling covariates that were statistically significant at the $p \leq .20$ level (Maldonado & Greenland, 1993; Vittinghoff, 2005). Using a stepwise deletion process, covariates were sequentially removed from the initial multivariable regression model until the final multivariable model included only covariates with significance at the $p \leq .05$ level. Race and ethnicity were not included in the modeling due to confounding with LTSS type (HCBS, ALF, and NH). All analyses were performed using SAS 9.4 (SAS Institute, Inc., Cary, NC).

Results

Table 1 depicts sample characteristics. Sample mean SF12PCS score was 37.27 (*SD* 10.95), indicating low self-reported PF among LTSS recipients in this study. Mean age of the sample was 80.88 (*SD* 8.71), and 71% were female. Most LTSS recipients were white (51%). LTSS recipients had an average of 8.63 (*SD* 4.42) comorbidities, and took an average of 11 medications (*SD* 4.76). Mean MMSE score was 24 (*SD* 3.94). Mean Katz BADL scores were 5.00 (*SD* 1.37) for ALF, 4.47 (*SD* 1.68) for HCBS, and 3.38 (*SD* 2.15) for NH. Most LTSS recipients reported using an aid for ambulation (79%), using vision or hearing aids (69%), and experiencing pain (56%). Sixty-three percent of recipients were receiving physical therapy and 33% were receiving occupational therapy. Thirty percent of LTSS recipients rated their quality of life as very good or excellent; whereas 68% rated their quality of life as good,

Table 1. Long-Term Services and Supports Participant Demographics by International Classification of Functioning, Disability, and Health Factors

Variable	*n* (%)	Mean ± *SD*	Range
Personal factors			
Age (years)[a]		80.88 ± 8.71	60–98
Gender: Female	334 (71.06%)		
Race			
Non-white	228 (48.82%)		
White	239 (51.18%)		
Years of school completed[a]		11.89 ± 4.42	0–26
Participates in regular exercise	339 (72.59%)		
Environmental factors			
Long-term services and support type[a]			
ALF	156 (32.98%)		
HCBS	156 (33.19%)		
NH	158 (33.83%)		
Uses ambulation aid[a]	367 (78.59%)		
Uses glasses or hearing aid[a]	324 (69.38%)		
Reported need for equipment[a]	135 (29.84%)		
Total number of assistive devices[a]		2.56 ± 1.34	0–9
Reports need for physical therapy[a]			
No	204 (47.22%)		
Yes	94 (21.76%)		
Receiving	134 (31.02%)		
Social support			
Affection[a]		2.79 ± 1.18	0–4
Emotional/Informational[a]		2.72 ± 1.02	0–4
Positive social interaction[a]		2.46 ± 1.14	0–4
Tangible[a]		2.97 ± 0.95	0 – 4
Health condition factors			
Number of chronic conditions		8.63 ± 3.94	1–27
Total number of medications[a]		11.14 ± 4.76	1–31
Overall quality of life[a]		2.97 ± 1.07	1–5
Health care utilization past 3 months			
Short term rehab/nursing home stay	64 (14.07%)		
Emergency Department visit (not admitted)[a]	33 (7.19%)		
Hospitalization	99 (21.15%)		
Mini Mental State Examination[a]		23.96 ± 4.29	12–30
Geriatric Depression Scale[a]		4.55 ± 3.39	0–15
SF12 Mental Composite Score		49.01 ± 10.52	13.89–76.18
Total number of bothersome symptoms[a]		6.11 ± 3.23	0–13
Currently receiving physical therapy[a]	294 (63.36%)		
Currently receiving occupational therapy	151 (32.61%)		
Albumin g/dL		3.71 ± 0.86	1.6–8.8
Nutritional risk assessment[a]		6.52 ± 4.78	0–21
Activity			
Katz Basic Activities of Daily Living[a]		4.28 ± 1.88	0–6
Participation			
SF12 Physical Composite Score		37.27 ± 10.95	12.60 – 61.31

Notes: ALF = assisted living facility; HCBS = home and community based services; NH = nursing home.
[a]All items significant in bivariate analyses at the 0.20 level and used in model building.

fair, or poor. Seventy-three percent of recipients reported exercising regularly.

Table 1 highlights variables within the ICF categories that were significant in the bivariate analyses. Among health conditions, total number of medications, quality of life, recent emergency department visit (prior 3 months), cognitive status, depression status, total number of bothersome symptoms, receipt of physical therapy, self-reported

Table 2. Multivariable Linear Regression Model of Self-Reported Physical Functioning Among Older Adults New to Long-Term Services and Supports ($N = 470$)

Variable	*b*	*SE*	*p*
No ambulation aid use	3.50	1.00	< .001
LTSS Type (Nursing Home, *reference group)*			
Assisted Living Facility	−2.97	1.15	.010
Home and Community Based Services	−3.53	1.12	.002
Mini Mental State Examination	−0.55	0.10	< .001
Total number of symptoms	−1.05	0.16	< .001
Basic ADL	0.88	0.25	< .001
Nutrition Risk Assessment	−0.28	0.11	.014
Overall Quality of Life	1.68	0.40	< .001
No emergency room visits 3 months prior to LTSS	3.15	1.53	.004
Need for PT (receiving PT, *reference group)*			
No reported need for PT	2.70	1.07	.011
Reported need for PT	0.56	1.20	.639

Note: ADL = activities of daily living; *b* = unstandardized regression coefficient; *SE* = standard error for regression coefficient; LTSS = long-term services and supports; PT = physical therapy.

need for physical therapy, ability to perform ADLs, and nutritional risk assessment score were statistically significant at the 0.20 level in bivariate analyses.

The multivariable regression model, presented in Table 2, depicts the final set of statistically significant health conditions variables (at $p \leq .05$). In this sample of older adults new to LTSS, higher self-rated PF was associated with fewer bothersome symptoms ($p < .001$), and better nutrition ($p = .013$). Additionally, each unit increase in quality of life ratings was associated with an increase in SF12PCS scores by 1.68 points ($p < .001$). On average, SF12PCS scores were 3.41 points greater among participants who have not had a recent ER visit (prior 3 months) compared to those who have ($p = .026$). Under the construct of activity, fewer deficits in basic ADL ($p < .001$) was associated with higher SF12PCS scores.

Among environmental factors, LTSS type, use of ambulation assistive devices for ambulation, use of sensory assistive devices, reported need for assistive equipment, total number of assistive devices, and social support was statistically significant at the 0.20 level in bivariate analyses. In the final model, however, only no reported need for PT, use of ambulation assistive devices, and LTSS type were statistically significant. SF12PCS scores were 2.37 points higher among LTSS recipients with no reported need for physical therapy compared to recipients currently receiving physical therapy ($p = .026$). No significant difference in SF12PCS scores was seen between LTSS recipients who reported a need for physical therapy and recipients currently receiving physical therapy ($p = .740$). On average, SF12PCS scores were 3.40 points greater among LTSS recipients who reported no use of an ambulation aid compared to those who do use ambulation aids ($p = .001$). SF12PCS scores were 2.93 points lower among recipients in ALF ($p = .012$) and 3.35 points lower among recipients in HCBS ($p = .003$) compared to recipients in NH.

Among personal factors, only age and education were significant at the 0.20 level in the bivariate analyses. However, these variables were eliminated through backward selection and not retained in the final multivariate model.

Discussion

To date, little research exists describing determinants of PF among older adults new to LTSS (Wysocki et al., 2015). Our study findings add to the literature with the unique expansion of specifically examining ICF constructs—health conditions, activity, environmental factors, and personal factors—associated with self-reported PF among older adults at the start of receiving LTSS. Our hypothesis regarding the association of personal factors and self-reported PF was not supported. However, various health conditions, activity, and environmental factors were significantly associated with self-reported PF. These findings may be useful in early identification and intervention among older adults most at-risk for progressive functional decline and disability.

We found multiple health condition factors associated with self-reported PF in our sample of LTSS recipients. Some of these factors may be potential targets for interventions to optimize PF. For example, greater reporting of bothersome symptoms and poorer nutrition were associated with poorer PF. LTSS recipients may experience activity limitations due to symptoms such as shortness of breath, fatigue, and pain, contributing to lower perceived PF; thus, effective management of these types of symptoms could improve self-reported PF (Whitson et al., 2009). Additionally, LTSS recipients with poor nutrition may also experience muscle weakness and fatigue (Singh et al., 2014). Initial nutrition consultation and ongoing nutritional intervention are essential to mitigate the impact of nutritional deficits on PF among older adults new to LTSS.

Similar to past research examining the relationship between the activity construct ADL disability and self-reported PF, LTSS recipients in our sample who reported fewer ADL deficits also reported better PF (Hellstrom, Andersson, & Hallberg, 2004). Interventions to improve ADL performance could contribute to greater independence and better self-reported PF. Interventions involving caregiver training in function-focused strategies (Resnick, Galik, Gruber-Baldini, & Zimmerman, 2011) or addressing functional goals and home environment needs by interdisciplinary teams (Szanton, Leff, Wolff, Roberts, & Gitlin, 2016) have been associated with ADL performance improvements.

Regarding environmental factors, LTSS type was associated with self-reported PF in our sample. Older adults at the start of receiving LTSS who remained at home reported

poorer PF compared to older adults starting care in the NH and ALF setting, which contrasts with prior research suggesting that PF would be worse among LTSS recipients in institutional settings providing higher levels of care (Sloane et al., 2005). An explanation for this finding could be the availability of services to support PF among LTSS recipients. NH and ALF settings have more consistent access to staff to assist with activities compared to recipients living in a non-institutional setting. Most HCBS recipients in our sample were enrolled from programs which used NH entry criteria to determine eligibility, and likely needed levels of care similar to NHs LTSS recipients. Inconsistent activity assistance at home may result in activity limitations and perceptions of poor PF among HCBS recipients.

In this sample of older adults new to LTSS, 34% of those receiving HCBS reported a need for physical therapy, but were not receiving it. In contrast, only 17% of older adults in NH and 9% of older adults in ALF reported feeling that they needed physical therapy. LTSS recipients with unmet needs for physical therapy had SF12PCS scores that were not significantly different from those actually receiving physical therapy. This reported unmet need for physical therapy may impact self-reported PF among older adults receiving LTSS at home; however, we were unable to explore this further due to small sample size. Unmet needs related to PF and disability have been associated with multiple adverse consequences (Allen, Piette, & Mor, 2014), including risk for hospital readmission (Depalma et al., 2013) and emergency room visits (Hass, DePalma, Craig, Xu, & Sands, 2017). Clinicians and case managers should consider evaluating HCBS LTSS recipients for potential unmet physical therapy needs. As the population of older adults receiving HCBS services increases, accurate classification of at-risk individuals could lead to more efficient allocation of resources (Weaver & Roberto, 2015).

This study has some limitations. Although the study is a secondary data analysis, post-hoc analysis demonstrated 80% power to detect a 1% increment in variance explained ($p < .05$). The ICF describes multiple contributors to PF. We addressed most constructs, excluding specific body structures and function. The ability to determine associations between exercise type, frequency, intensity, and dose and self-reported PF was limited by our dataset which included a single yes/no item about "regular" exercise. Medical records were used for health care utilization data due to lack of access to more accurate claims data. Many individuals receiving LTSS have cognitive deficits which can potentially affect the reliability of self-reported data such as the SF12PCS. However, the final model controls for level of cognitive impairment. We are confident in our findings as other researchers have used validated measures of self-reported PF successfully among older adults with cognitive impairment (Liu, Galik, & Resnick, 2015; Resnick & Nahm, 2001). Additionally, while proxy BADL data are not optimal, the use of proxy data for the proportion of participants with cognitive deficits was to obtain an objective, and likely more accurate, assessment of BADL (Lum, Lin, & Kane, 2005).

Study participants were recruited from LTSS on the east coast, limiting generalizability of this study's findings to other geographic areas in the United States. Additional research is needed in a nationally-representative sample to determine if factors associated with PF are similar across geographically-diverse older adults. Differential entry requirements among recipients in ALF, NH, and HCBS settings could impact the characteristics of LTSS received, and may influence PF outcomes. This secondary analysis focused on a single data point, capturing a snapshot of participants' baseline PF and health status at the start of receiving LTSS. Examining PF trajectories with ongoing receipt of LTSS may provide additional insight into changes in PF and associated factors over time. Such longitudinal studies should include performance-based measures of PF that have been studied in diverse clinical settings, such as the Short Physical Performance Battery or gait speed, as these options may be more responsive to changes in PF over time (Guralnik et al., 2000).

Similar to other research examining self-reported PF among chronically ill individuals (Preede et al., 2015; Soley-Bori et al., 2015), we used the SF12PCS as our outcome measure. However, the SF-12 may have limitations for capturing PF among non-community-dwelling older adults (Jakobsson et al., 2012; Resnick & Nahm, 2001). Standard scoring methods may misclassify items on energy level and social activities and these factors' relationships to physical and mental health among non-community-dwelling older adults (Resnick & Nahm, 2001). No clear consensus exists for scoring methods for community versus non-community dwelling older adults, complicating comparisons of self-reported PF between these groups. Additional research is needed to identify appropriate SF-12 scoring methods when comparing community and non-community dwelling older adults.

Optimizing PF is an important target for clinicians working with older adults new to LTSS. We uncovered important health conditions and environmental factors associated with PF that could be used as potential targets for clinical intervention. Clinicians may use these findings to prepare family caregivers and staff to apply evidence-based interventions designed to address identified risk factors. Additionally, research is needed to examine decision-support or screening tools incorporating these factors to promote early identification and efficient allocation of health care resources aimed at optimizing PF in this at-risk population.

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Conflicts of Interest

None declared.

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