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Research Article

Functional Limitations, Social Integration, and Daily Activities in Late Life

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Abstract

Objectives: Disability in late life has been associated with increases in receiving care and loss of autonomy. The Disablement Process Model suggests that physical impairments lead to functional limitations that contribute to disabilities in managing household, job, or other demands. Yet, we know surprisingly little about how functional limitations are related to activities throughout the day among community-dwelling adults or the possible moderating role of social integration on these associations.

Methods: Community-dwelling adults ($N = 313$) aged 65 and older completed a baseline interview assessing their functional limitations, social ties, and background characteristics. Over 5–6 days, they answered questions about daily activities and encounters with social partners every 3 h on handheld Android devices.

Results: Multilevel logistic models revealed that functional limitations are associated with an increased likelihood of activities associated with poor health (e.g., TV watching, medical appointments) and reduced likelihood of social activities, or physical activities, chores, or leaving the home. Most moderation analyses were not significant; family and friends did not mitigate associations between functional limitations and daily activities, with the exception of medical appointments. Individuals with functional limitations were more likely to attend medical appointments when with their social partners than when alone.

Discussion: This study provided a modest indication that functional limitations in community-dwelling older adults are associated with patterns of activity that may lead to further limitations, disability, or loss of autonomy. Findings warrant longitudinal follow-up to establish subsequent patterns of decline or stability.

Keywords: Disability, Disablement process model, Ecological momentary assessments, Functional impairments

Disabilities increase with age and impede older adults' engagement in activities of daily life ([Centers for Disease Control and Prevention, 2020](#)). Indeed, older adults with more severe disabilities often receive increases in family care or reside in assisted living or skilled nursing fac-

ilities. The Disablement Process Model has been widely applied to describe the associations between impairments and disability in activities of daily living in late life. Functional limitations are a key component of this process. This model proposes that functional limitations

contribute to the accrual of problems that may undermine independence and autonomy (Fauth et al., 2007). The Centers for Disease Control and Prevention (2020) refers to these problems as *activity limitations*, but we use the term *functional limitations* consistent with the research model. These limitations stem from pain, decrements in strength, loss of agility, and other acute and chronic physical problems (Griffith et al., 2017; Verbrugge & Jette, 1994). Yet, to the best of our knowledge, researchers have not considered associations between functional limitations and activities throughout the day in independent community-dwelling older adults.

Older adults engage in an array of activities including self-care, socializing, and leisure. Individuals with functional limitations may spend more time in activities related to health (e.g., self-care, doctors' appointments), whereas their counterparts who do not experience such limitations may do more discretionary activities such as socializing, leisure, and physical exercise. Studies have linked withdrawal from activities to disability (Janke et al., 2008), but such studies have relied on self-report of activities looking back over long periods of time, rather than assessments of daily activities soon after they occur.

Moreover, little is known about social factors that may mitigate deleterious consequences of disability in daily life (Bierman & Statland, 2010). Social integration is the overall tendency to engage with a variety of close and more distant social partners (also called "weak ties" in the literature). Research examining social integration theory has found that engagement with a constellation of social partners (e.g., spouse/partner, children, friends, acquaintances, and neighbors) is beneficial for physical health and longevity (Cohen & Lemay, 2007; Stephens et al., 2014; Thomas, 2011, 2012). Research has also shown that social integration decreases the risk of disability over time (James et al., 2011; Thomas, 2011). Of interest in this study is whether the manifestation of social integration via daily encounters with social partners may foster a wider array of activities (Fingerman et al., 2019), especially when individuals have functional limitations.

Thus, we examined how functional limitations were associated with activities throughout the day in a community-dwelling sample of older adults experiencing a range of functional limitations (including no limitations/physically able). We also considered the potential role of encounters with social partners in mitigating the effects of such limitations on activity throughout the day.

Functional Limitations and Daily Activities

Physical impairments are common in the United States, with more than 40% of noninstitutionalized adults aged 65 and older reporting some form of functional limitation or disability (Centers for Disease Control and Prevention, 2020; Okoro et al., 2018). The most

common functional limitations include difficulties with mobility (e.g., walking, climbing stairs), which may impede or slow down other activities (Okoro et al., 2018). Functional limitations (i.e., mobility limitations) have been associated with less engagement outside the home (Carmona-Torres et al., 2019; Rosso et al., 2014). Compared to those with fewer or no functional limitations, older adults with a greater number of functional limitations may be homebound throughout much of the day and need to spend more time on self-maintenance and relatively sedentary activities and medical appointments (Shandra, 2019).

Prior research on activities has generally utilized one-time, retrospective reports for longer periods of time (Griffith et al., 2017; James et al., 2011) or reports of activities the previous day (Carr et al., 2019). The present study has the advantage of using Ecological Momentary Assessments (EMAs). With EMAs, participants respond to questions at intervals throughout the day, typically every few hours. EMAs obtain more immediate information about what the person is doing, documents co-occurrence of events throughout the day (e.g., encounters with social partners and activity), and is less subject to recall bias.

Previous studies have considered several categories of daily activities that include cognitive, physical, and social elements: self-care (e.g., bathing), chores (e.g., grocery shopping), home-based hobbies and activities (e.g., puzzles, computer use), television viewing, medical appointments, and social activities (e.g., volunteering, visiting, religious activities; Chen et al., 2019; Horgas et al., 1998). We anticipated that functional limitations would be associated with increased activities involving self-care, health, or being sedentary (e.g., television, medical appointments; Mares & Woodward, 2006) and with *less* engagement in activities that may involve expenditures of energy or leaving home (chores and social activities; Qiu et al., 2010; Van Hees et al., 2020). We also considered sleeping during the day (aka napping); a study of adults aged 18–64 revealed that individuals with physical impairments were at greater risk of shorter or longer sleep patterns than optimal (Shandra et al., 2014). Of course, being asleep precludes simultaneously engaging in other activities.

We further grouped these activities under the umbrella classifications of obligatory versus discretionary leisure activities. Considering broader rubrics may provide insight into the ways in which functional limitations contribute to discretionary activities. Older adults who remain in the community must manage obligatory tasks of daily life, alone or facilitated by social partners. Indeed, the Disablement Process Model differentiates functional limitations (e.g., difficulties with mobility) from disability (difficulties in daily activities; Fauth et al., 2007). That is, individuals with functional limitations may still complete activities necessary to maintain independent daily life, but may lack the stamina or physical capacity to perform an array of discretionary leisure and social activities.

Functional Limitations, Social Integration, and Activities

The literature is mixed with regard to the role of social partners in facilitating activities as individuals accrue functional limitations or disability. Research has shown people with disabilities are less likely to be involved in social activities such as volunteering (Shandra, 2017). A large Canadian study found that middle-aged and older adults experiencing a range of functional limitations and disability curtailed their social activity (Griffith et al., 2017). However, a study in the Netherlands revealed that older adults with what they deemed mild disabilities remained involved with neighbors, informal groups, and volunteer work (Van Hees et al., 2020).

We also considered the potential moderating effects of encounters with social partners throughout the day. Social integration (e.g., visiting friends or relatives, group meetings, volunteer work) is associated with a diminished likelihood of developing disability over time among community-dwelling older adults (James et al., 2011). Likewise, research reveals that encounters with a wide array of social partners were associated concurrently with a greater diversity of activities, being more physically active, and less sedentary throughout the day (Fingerman et al., 2019). In combination, these findings suggest that encounters with social partners throughout the day may facilitate nonobligatory leisure activities among older adults who have functional limitations.

Likewise, older adults spend time alone throughout the day (Birditt et al., 2019); being alone is associated with distinct daily activities (Lam & Garcia-Roman, 2019) that may or may not exacerbate associations between functional limitations and curtailed activity. That is, older adults who have functional limitations and who are alone may report engaging in more self-care and chores because there is no one to facilitate these tasks and functional limitations prolong the time needed to complete them. Likewise, older adults who have functional limitations may be less likely to leave the home or engage in leisure activities than older adults with fewer or no functional limitations, this may especially be the case when older adults are alone versus when they have encounters with social partners.

Other Factors Associated With Functional Limitations and Daily Activities

We considered other factors associated with key variables in this study. We drew upon findings of associations with disability, which were more common in the literature than functional limitations. For example, lower education (Okoro et al., 2018), being from underrepresented ethnic and racial groups (Warner & Brown, 2011), and being female (Okoro et al., 2018) are at greater risk of disability. Studies also suggest that gender is associated with the effects of social integration in the context of disability (Carr et al., 2017, 2019). Age is associated with smaller social

networks (Fingerman et al., 2003; Lang, 2001; Rook & Charles, 2017). Marital status or the presence of grown children also may explain time spent alone versus with others. Furthermore, disability has been associated with an increased risk of depression in late life (Greenglass et al., 2006); depressive symptoms also may affect daily activities. Finally, we adjusted for the time of day. Prior studies suggest older adults engage in the greatest activity from midday into early evening (Fingerman et al., 2019; Tucker et al., 2012).

In summary, we asked how functional limitations are associated with daily activity. Notably, associations between functional limitations and activities are likely bidirectional in contributing to disability over time: Lack of stimulating activities or physical activity may lead to disability (Dunlop et al., 2015).

Method

The Daily Experiences and Well-being Study, conducted in 2016, involved adults older than the age of 65 residing in the greater Austin Metropolitan Statistical Area, Texas ($N = 333$). Criteria for the study required that participants were community-dwelling, retired (i.e., working for pay 20 or fewer hours a week), and not a recipient of family care for activities of daily living, thus precluding individuals who had disabilities in activities of daily living. The sample provided an opportunity to examine functional limitations in this context.

Recruitment occurred via listed landline samples with matching addresses (in 2016, the vast majority of older adults still used landlines; Kennedy et al., 2016). Oversampling in high-density minority neighborhoods resulted in a sample with 32% of participants identifying as ethnic or racial minority (e.g., 16% African American, 16% Latino). The population in Austin aged 65 and older is more highly educated than the U.S. population (U.S. Census Bureau, 2017), but 15% of the sample had a high school education or less.

Participants completed a 2-h in-person interview assessing functional disability, social integration, and background characteristics (including health). Participants then completed a 5- to 6-day period in which they provided EMAs every 3 h. The study supplied Android devices and training. This study included participants who completed the Ecological Momentary Surveys ($N = 313$). Nonparticipation in the EMA primarily reflected technical difficulties and device failures.

Measures

Baseline interview

Self-reported functional limitations.—Participants completed a subscale of the 36-item disability scale in the

Medical Outcomes Study (MOS-36; Hays et al., 1993; Ware & Sherbourne, 1992). The subscale is called “physical functioning,” but the items correspond to the functional limitations construct in the Disablement Process Model and to measures that assess functional limitations (Fauth et al., 2007; Verbrugge & Jette, 1994). Participants initially rated how much pain or physical health interfered with normal activities during the past 4 weeks 1 (*not at all*) to 5 (*extremely*); follow-up questions addressed the extent to which limitations occurred in 10 physical activities (e.g., bending, climbing one flight of stairs, walking one block, lifting or carrying groceries) coded 1 (*not limited at all*), 2 (*limits a little*), 3 (*limits a lot*). The MOS scoring system treats the functional limitation ratings on a 100-point scale, and we used 0 (*not limited at all*), 50 (*limits a little*), and 100 (*limits a lot*), such that higher scores indicate greater functional limitations. We used the mean of the items, $\alpha = 0.94$.

Cohen social network index.—Participants completed an assessment of their general social integration. Using an adaptation of Cohen et al. (1997) widely used measure, participants indicated contact at least every 2 weeks 1 (*yes*) and 0 (*no*) with social partners in 13 different roles (e.g., spouse, children, extended relative, friend, coworkers, church/temple member, covolunteer, neighbor). We asked about grandchildren and siblings not included in the original measure.

Control variables from the baseline interview.—Participants provided their age, gender 1 (*male*), 0 (*female*), marital status coded as 1 (*married, remarried/cohabitating*) and 0 (*divorced, widowed, single, other unmarried*), education level coded as 1 (*high school or less education*), 2 (*some college/vocation or trade school*), 3 (*college graduate*), and racial and ethnic identities, with Hispanic and African American older adults coded as 1 (*minority*) versus 0 (*non-Hispanic White*). Participants self-rated their physical health from 1 (*poor*) to 5 (*excellent*). Because the correlation between self-rated health and disability score was high, $r = 0.60, p < .001$, we did not include health in the models.

Participants also completed an 11-item version of the Center for Epidemiological Studies—Depression scale, a measure of depressive symptomatology that serves as an indicator of mental health (Kohout et al., 1993; Radloff, 1977). Participants rated frequency of experiencing symptoms (e.g., sleep was restless, lonely, people disliked me) in the past week, using a scale from 1 (*rarely or none of the time*) to 4 (*most or all of the time*), $\alpha = 0.79$.

Five- to six-day intensive data collection

Daily activities.—At each 3-h assessment, participants reported whether they had engaged in 11 activities grouped into six categories based on the literature: (a) self-care (e.g., bathing, dressing), (b) at-home hobbies and activities (e.g., puzzles, computer use), (c) television viewing, (d) medical

appointments, (e) chores (chores, shopping), and (f) social activities (e.g., visiting with someone, volunteering, religious activities). At each 3-h assessment, activities were coded as 1 (*engaged in at least one activity within that category*) or 0 (*did not engage in an activity in that category*). Participants also indicated whether they had left home and whether they had slept in the prior 3 h. All assessments involved 1 (*yes*) and 0 (*no*) responses.

We grouped these activities as obligatory (self-care, chores, medical appointments) and discretionary (hobbies, television, and social activities). We did not include leaving home and napping in these classifications because it is not clear whether individuals have discretion in these activities.

Encounters with social partners.—At each EMA, we asked about encounters with different social partners during the prior 3 h. We used the 10 closest relationships listed in the baseline interview as well as engagement with up to six other social partners who might be considered non-intimate (weak) ties (e.g., neighbor, coworker, acquaintance, stranger) in the EMAs. We summed encounters with different types of social partners to generate this index.

Time of day.—The EMAs were time-stamped. Our prior research has found that older adults engage in the most activity between noon and 07:00 p.m., and the least activity prior to noon. We controlled for these periods: morning, midday to early evening, and evening to bedtime.

Analytic Strategy

We examined bivariate correlations to ascertain whether to categorize the activities as obligatory or leisure activities, but associations with functional limitations were not consistent within these categories. For example, functional limitations were positively associated with doctors' appointments ($r = 0.27, p < .001$) and negatively associated with chores ($r = 0.16, p = .005$). Thus, we estimated the models for six categories of activities: self-care, chores (household chores and shopping), watching television, at-home hobbies (puzzles and computer use), social (volunteering work, visiting with someone and religious involvement), and medical appointment. We also considered leaving the home and napping.

To test hypotheses that functional limitations are associated with daily activities, we estimated three-level logistic models with SAS PROC GLIMMIX. All models adjusted for gender, age, education, minority status, marital status, having any children, depression, and time period of assessment.

Prior to estimating the models, we examined the distribution of the independent variable, functional limitations. More than 1/3 of the sample ($n = 120$) indicated that they had no functional limitations. Theoretically and empirically, researchers have treated the MOS-36 scale as a continuous

variable (Hays et al., 1993). Thus, to deal with this skew, we estimated the models in two manners. First, we examined the sample of participants who had at least one functional limitation; this sample of 193 participants had a more even distribution. These analyses provided a more conservative test of the role of variability among those who had functional limitations. The 193 participants completed 3,785 assessments ($M = 20$ assessments) compared to 2,477 for the 120 other participants ($M = 21$ assessments).

We also reran all models with the full 313 participants including the individuals who reported no functional limitations, though we anticipated that participants who had no functional limitations ($n = 120$) might drive these results.

Finally, we asked whether social partners mitigated associations between functional limitations and daily activities. We estimated these moderation models using the 193 participants who had at least one functional limitation and repeated with the entire sample of 313.

We considered moderation at the 3-h assessment level as (a) the total number of types of social partners encountered during the prior 3 h and (b) no social encounters/being alone during the prior 3 h (Birditt et al., 2019). Given the nested structure of the data, we mean-centered the number of social encounters within participants prior to calculating the interaction terms.

Then, we looked at potential moderating effects of overall social integration using the Cohen Index score for social integration; it is possible that contact with social partners for a 2-week period accounts for daily activities, even when few social partners were encountered during the 3-h periods in which these activities co-occurred. This moderation term pertained to the participant level (i.e., Cohen Index, functional limitations), and we used the sample grand mean in centering the variable.

Results

Descriptive Statistics

Participants ($N = 313$) completed 6,262 assessments during waking hours across the 5–6 days of intensive data collection. We used the ratio of assessments in which each participant engaged in each activity compared to the total number of assessments (accounting for unequal numbers of assessment completions across participants). Older adults may manage multiple activities during any 3-h period (Fingerman et al., 2019); thus, the sum of numbers given in Table 1 may exceed 1.00. At-home hobbies (e.g., crossword puzzles) were the most frequent activity, followed by television viewing and chores (e.g., shopping, errands). Participants reported self-care and social activities in a quarter to a third of assessments. Medical appointments (2%) were the least frequent activity. Participants reported having left home during a substantial proportion of measurement occasions. In addition, participants reported that they were asleep (i.e., napping) at 17% of assessments.

Functional Limitations and Daily Activities

We used three-level logistic models to test links between functional limitations and each of the dichotomously coded categories of daily activity, 1 (*did an activity in this category*) and 0 (*did not do an activity in this category*) in the prior 3 h. Given the skew in the distribution of functional limitations, we estimated models in two manners: (a) excluding those individuals who reported no functional limitations and only including the $n = 193$ who had at least one functional limitation, (b) including all individuals $N = 313$ in the sample. Note that significance in the tables is based on the t test for each variable (i.e., estimates/SE), but the odds ratios are based only on the estimates.

As can be seen in Table 2, among older adults who reported at least one functional limitation ($n = 193$), more functional limitations were associated with greater likelihood of TV watching (odds ratio [OR] = 1.01, $p = .003$) and medical appointments (OR = 1.02, $p = .001$). Functional limitations also were associated with lower likelihood of chores (OR = 0.99, $p = .005$), social activities (OR = 0.99, $p = .02$), and leaving the home (OR = 0.99, $p < .001$). Notably, the effect of functional limitations on social activities was small.

The models predicting self-care and at-home hobbies (e.g., puzzles, computer use) were not significant. Older adults with a greater degree of functional limitations were more likely to nap (OR = 1.01, $p = .01$; findings not shown here).

We repeated the analyses including the entire sample of 313 participants. The pattern of findings was similar, although the association with social activities was not significant (OR = 1.00, $p = .29$) and the association with self-care activities was significant (OR = 1.01, $p = .02$; Supplementary Table 1).

Encounters With Social Partners and Daily Activities

We asked whether encounters with friends, family, and acquaintances moderated associations between functional limitations and daily activities, by including an interaction term of functional limitations \times number of social encounters in the prior 3 h for the 193 participants who had at least one functional limitation. Significant functional limitations \times number of social encounters were observed on medical appointment ($B = 0.00$, $p = .04$) and sleep ($B = 0.00$, $p = .03$; see Table 3). Simple slope analyses revealed that functional limitation was associated with a greater likelihood of going to medical appointments, but this effect was only significant when individuals had more social encounters (OR = 1.02, $p < .001$) but not when they had fewer social encounters (OR = 1.01, $p = .33$) than their own average (Figure 1).

We also examined potential moderating effects of social integration from the Cohen measure using the sample

Table 1. Participants' Demographic Characteristics, Social Ties, and Daily Activities ($N = 313$)

	Participants		
	<i>M</i>	<i>SD</i>	Range
<i>Individual characteristics</i>			
Age	73.94	6.38	65–90
Functional limitation ^a	24.90	28.22	0–100
Depression ^b	16.46	4.70	11–33
<i>Cohen social network index</i> ^c	6.07	1.85	1–11
		<i>Proportion</i>	
Reporting no functional limitations		0.38	
Female		0.56	
High school or less		0.15	
Some college		0.28	
College or more		0.57	
Married		0.59	
Ethnic or racial minority ^d		0.31	
Had children		0.91	
		<i>Proportion of assessments (n = 6,262)</i>	
<i>Activities reported at each 3-h assessment</i>			
Self-care activities		0.27	
At-home hobbies and activities ^e		0.60	
Television viewing		0.55	
Medical appointment		0.02	
Chores ^f		0.50	
Social activities ^g		0.31	
Sleeping		0.17	
Leaving home		0.41	
<i>Social encounters in prior 3 h</i>			
Number of social ties ^h	2.79	0.41	0–16
<i>Time of assessment</i> ⁱ			
Morning		0.26	
Midday to early evening		0.50	
Evening		0.24	

Notes:

^aFunctional limitation was calculated by recoding and averaging 10 items, 0 represented no functional limitation and 100 represented high functional limitation.

^bDepression score was the sum of 11 items (e.g., poor appetite, felt depressed, restless sleep).

^cNumber of roles involving social contacts in the past 2 weeks.

^dHispanic or African American.

^eAt-home hobbies and activities included reading, puzzles, music, or electronic devices.

^fChores including housework and errands.

^gSocial activities included visiting with someone, volunteering, religious activities.

^hNumber of social ties (e.g., spouse, child, friend, acquaintances, service provider, stranger) encountered every 3 h.

ⁱMorning (06:00 a.m. to 12:00 p.m.), midday (01:00 p.m. to 07:00 p.m.), and evening (08:00 p.m. to 05:00 a.m.).

of participants who had at least one functional limitation. None of the interaction terms for overall social integration were significant for this subsample.

We estimated the same moderation analyses with the entire sample ($N = 313$). There were no significant moderating effects of social encounters throughout the day. There was only one significant moderating effect of social integration from the Cohen measure for chores ($B = -0.00$, $p = .03$; [Supplementary Table 2](#)). Simple slope analysis showed that functional limitation was associated with reduced likelihood of doing chores, but this effect was only significant for those who had more social

integration ($OR = 0.99$, $p < .001$) but not significant for those who had less social integration ($OR = 1.00$, $p = .49$; [Supplementary Figure 1](#)). In other words, functional limitation matters to those who had more social integration in which it reduced the likelihood of doing chores (presumably because others perform these chores for them, perhaps over longer time periods rather than concurrently).

Finally, we included interaction terms for being alone at each assessment \times functional limitations. Interaction terms were not significant for either the sample of 193 older adults with a functional limitation or for the entire sample of 313 older adults.

Table 2. Multilevel Models for Functional Limitations Associated With Activities Throughout the Day Excluding Individuals With No Limitations

Parameter	Television viewing			Medical appointment			Chores			Social activities			Leaving home		
	B	SE	OR	B	SE	OR	B	SE	OR	B	SE	OR	B	SE	OR
Fixed effects															
Intercept	0.36	1.31	1.01	-1.98	1.78	1.02	-0.29	1.22	0.99	-0.94	1.14	0.99	0.86	0.86	0.99
Functional limitations ^a	0.01**	0.00	1.01	0.02**	0.01	1.02	-0.01**	0.00	0.99	-0.01*	0.00	0.99	-0.01***	0.00	0.99
<i>Participant covariates</i>															
Gender ^b	0.48*	0.22	1.61	-0.18	0.31	0.84	-0.61**	0.21	0.54	-0.41*	0.19	0.67	0.11	0.14	1.12
Age	-0.01	0.02	0.99	-0.03	0.02	0.97	0.00	0.02	1.00	0.01	0.01	1.01	-0.01	0.01	0.99
High school or less	(Ref.)			(Ref.)			(Ref.)			(Ref.)			(Ref.)		
Some college	-0.19	0.31	0.83	0.03	0.42	1.03	0.72*	0.30	2.06	-0.48	0.28	0.62	-0.14	0.21	0.87
College or more	-0.44	0.31	0.64	0.05	0.41	1.05	1.11***	0.29	3.02	-0.15	0.27	0.86	-0.01	0.20	0.99
Minority status ^c	0.49*	0.23	1.63	-0.15	0.32	0.86	0.17	0.22	1.19	-0.31	0.20	0.73	-0.18	0.15	0.84
Marital status ^d	-0.30	0.23	0.74	0.02	0.32	1.02	0.21	0.22	1.24	0.08	0.20	1.08	-0.05	0.15	0.95
Had children	-0.09	0.37	0.91	0.04	0.51	1.05	-0.11	0.34	0.89	-0.26	0.32	0.77	0.08	0.24	1.08
Depression ^e	-0.02	0.02	0.98	-0.01	0.03	0.99	0.00	0.02	1.00	0.01	0.02	1.01	0.01	0.01	1.01
Morning	(Ref.)			(Ref.)			(Ref.)			(Ref.)			(Ref.)		
Midday	0.48***	0.09	1.62	-0.32	0.22	0.73	0.11	0.09	1.12	0.13	0.10	1.14	0.33***	0.09	1.40
Evening	2.15***	0.13	8.56	-1.59***	0.40	0.20	-0.64***	0.11	0.53	-0.41***	0.12	0.67	-0.86***	0.11	0.42
Random effects															
Intercept VAR (Level 2: Day)	0.08***	0.07		1.05***	0.33		0.19***	0.07		0.24***	0.08		0.21***	0.07	
Intercept VAR (Level 3: Participant)	1.34***	0.20		0.59***	0.28		1.14***	0.17		0.90***	0.14		0.42***	0.08	
-2 (pseudo) log likelihood	3,209.94			1,155.00			16,405.26			16,641.71			16,116.52		

Notes: OR = odds ratio; VAR = variance. Participant $n = 193$. Assessments $n = 3,785$.

^aFunctional limitation was calculated by recoding and then averaging 10 items, 0 represented no functional limitation to 100 represented high functional limitation.

^b1 (Male), 0 (Female).

^cCoded as 1 (Hispanic or African American) and 0 (non-Hispanic White).

^dCoded as 1 (married/cohabitating) or 0 (not married).

^eDepression score was the sum of 11 items (e.g., poor appetite, felt depressed, restless).

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

Table 3. Multilevel Models for Moderating Effects of Functional Limitations × Number of Social Encounters Every 3 h on Activities Throughout the Day

Parameter	Medical appointment			Sleep		
	B	SE	OR	B	SE	OR
Fixed effects						
Intercept	-1.26	1.86		-2.26*	1.08	
Functional limitations ^a	0.01*	0.01	1.01	0.01**	0.00	1.01
Number of social encounters ^b	0.21***	0.05	1.23	-0.30***	0.03	0.74
Functional limitations ^a × Number of social encounters ^b	0.00*	0.00		0.00*	0.00	
<i>Participant covariates</i>						
Gender ^c	-0.15	0.31	0.86	0.25	0.18	1.28
Age	-0.03	0.02	0.97	0.02	0.01	1.02
High school or less	(Ref.)			(Ref.)		
Some college	0.05	0.44	1.05	-0.89***	0.25	0.41
College or more	0.08	0.42	1.08	-0.66**	0.24	0.52
Minority status ^d	-0.18	0.33	0.83	-0.02	0.19	0.98
Marital status ^e	-0.01	0.32	0.99	0.00	0.19	1.00
Had children	0.06	0.52	1.06	-0.44	0.29	0.65
Depression ^f	-0.00	0.03	1.00	0.02	0.02	1.02
Morning	(Ref.)			(Ref.)		
Midday	-0.45	0.23	0.64	-0.02	0.11	0.98
Evening	-1.51***	0.41	0.22	-0.50***	0.13	0.61
Random effects						
Intercept VAR (Level 2: Day)	1.07***	0.35		0.00	—	
Intercept VAR (Level 3: Participant)	0.64***	0.30		0.67***	0.12	
-2 (pseudo) log likelihood	22,879.48			18,000.98		

Notes: OR = odds ratio; VAR = variance. Participant $n = 193$. Assessments $n = 3,785$.

^aFunctional limitation was calculated by recoding and then averaging 10 items, 0 represented no functional limitation to 100 represented high functional limitation.

^bThe total number of social encounters during 3-h interval.

^c1 (Male), 0 (Female).

^dCoded as 1 (Hispanic or African American) and 0 (non-Hispanic White).

^eCoded as 1 (married/cohabitating) or 0 (not married).

^fDepression score was the sum of 11 items (e.g., poor appetite, felt depressed, restless).

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

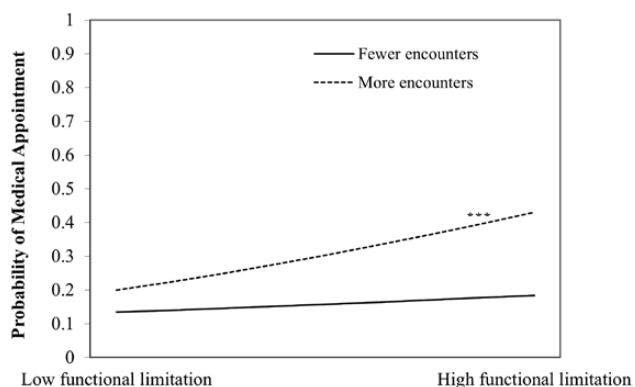


Figure 1. Interaction effect of functional limitation × number of social encounters every 3 h on older adults' likelihood of medical appointment ($n = 193$).

Discussion

This study contributes to the disability literature by documenting small associations between functional limitations and daily activities in a sample of older adults who

reside in the community (as opposed to assisted living or skilled nursing care facilities) and who did not require care for instrumental activities of daily living. We applied the Disablement Process Model to examine functional limitations that may be associated with difficulties optimizing the environment to maintain independence and autonomy and that contribute to the emergence of disability (Fauth, 2007; Verbrugge & Jette, 1994). The study illustrates how functional limitations in a community-living sample affect everyday activities. We do not wish to overstate the pathways in the Disablement Process Model in our cross-sectional study, but rather, to highlight concurrent associations between functional limitations and activity engagement which are at the heart of disability.

Older adults with greater functional limitations spent more time going to medical appointments, viewing television, and doing chores. Medical appointments likely reflect underlying physical impairments requiring ongoing attention. Television viewing is a sedentary homebound form of entertainment that may be appealing in late life; on average, older adults spend six or seven waking hours

viewing television (Depp et al., 2010; Mares & Woodward, 2006). Sedentary activities may stem from functional limitations, but lack of exercise and being sedentary may also lead to a further decline in a cycle of behaviors and deleterious health consequences. Likewise, older adults who have greater functional limitations were less likely to engage in activities pertaining to chores (e.g., shopping; Carmona-Torres et al., 2019), perhaps reflecting decreased involvement in activities that require stamina.

Functional limitations also were associated with less likelihood of reporting social activities throughout the day. This association is perplexing because it was small and only evident among the subsample who had at least one functional limitation. Yet, this association is consistent with literature showing social integration is associated with disability both concurrently and over time (James et al., 2011; Shandra, 2017; Thomas, 2012). If findings in the current study replicate, social withdrawal may be a bellwether of future difficulties.

Perhaps not surprisingly, functional limitations were unrelated to the likelihood of engaging in at-home hobbies. Leisure activities that require lower levels of energy may be rewarding to older adults. Hobbies are usually cognitively stimulating and enjoyable (Wang et al., 2013).

We had initially considered the broader categories of obligatory and leisure activities, predicting that individuals with functional disabilities would marshal resources and energy to complete the obligatory activities to maintain autonomy. The patterns of associations did not fit this expectation, however. Individuals with functional limitations were less likely to engage in obligatory tasks that involved chores and home leaving and this lack of engagement may presage later disabilities involved in loss of autonomy. On the other hand, they may be optimizing their use of resources by engaging in more enjoyable activities.

Social Integration, Functional Limitations, and Daily Activities

Social integration on the whole (e.g., contact with different social partners for a 2-week period) did not play a key role in the findings. Likewise, encountering a greater number of social partners throughout the day did not condition associations between functional limitations and daily activities in a systematic way. The one finding regarding encounters with social partners and a greater likelihood of going to medical appointments hints at the role of social integration in facilitating health care. Older adults who have functional limitations and fewer social contacts may not go to doctors as often, at least in part because they may have no one to go with them. The finding underscores a potential vulnerability of people living in the community who have functional limitations but fewer social contacts.

Nevertheless, the scant findings also suggest different types of social partners may encourage or discourage different constellations of daily activities (Fingerman et al.,

2019). For example, individuals who have functional limitations may draw on their closest social partners to help with daily chores rather than their acquaintances. Qualities of these relationships also may make a difference in these patterns. A study of older adults who had severe impairments revealed that marital support buffered the effects of disability on negative emotions among women but intensified negative emotions among older men (Carr et al., 2017). That study did not consider daily activities, but suggests that relationship qualities contribute to the effects of social partners when older adults incur severe disability. Future research should consider the qualities of the relationships with social partners with regard to daily activities and also consider a wider spectrum of functional limitations and disability.

Surprisingly, being alone during the assessment periods did not moderate associations between functional limitations and daily activities. This lack of association may partially reflect a failure to assess the emotional valence of being alone. Some studies suggest that solitary activities are associated with higher levels of sadness and pain (Lam & Garcia-Roman, 2019), where other studies suggest that solitude can be beneficial at times (Birditt et al., 2019). As such, future studies should address the ways in which older adults interpret their solitude and how that might lead to activity choices, including leaving the home.

Limitations and Future Directions

This study of community-dwelling older adults examined how functional limitations are associated with the daily lives of autonomous older adults. The EMA approach provided advantages of assessing activities close to the time when they occur over multiple days (Moskowitz & Young, 2006), but did not assess how participants viewed these activities (e.g., enjoyable). It is possible that motivation plays a role in decisions about activities, and subjective interpretations of activity warrant consideration. Furthermore, we measured a curtailed range of activities. Future studies might use the Daily Reconstruction Method involving reports of every activity the previous 24 h (Depp et al., 2010; Horgas et al., 1998; Lam & Garcia-Roman, 2019).

Overall, this study examined functional limitations that do not prohibit people from living in the community and found that these limitations nonetheless show small associations with activities in their daily lives. Differences in activities may have long-term implications for the onset of disability, health, and well-being as people age.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

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This study was not formally preregistered, but the research design was generated in advance and reviewed by the National Institute on Aging prior to implementation. Data and additional documentation of sample and measures are available upon request to the corresponding author.

Conflict of Interest

None declared.

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