Self-reported and performance-based disability measures have a different impact on the degree of social integration among older Americans

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Objectives. To examine the differences of self-reported *versus* performance-based disability on social integration among older adults, as well as the direct and potential moderating role of the physical and social environment on these relationships.

Methods. Using data from the 2015 National Health and Aging Trends Study (n = 2,700), two indicators of disability (self-reported, performance-based), chronic health conditions, and home environment were examined as predictors of social integration using multinomial logistic regression.

Results. Compared to older adults with self-reported disabilities, older adults with performance-based disabilities were less likely to be nonintegrated. The presence of chronic conditions moderated these associations. Home environment had a direct effect on social integration, although it did not account for disability-related differences in outcomes.

Discussion. Careful selection of disability measures and the inclusion of physical and social environmental factors is important when investigating determinants of social integration among older adults.

Key words: self-reported disability, performance-based disability, social integration, chronic conditions, home environment

Social integration refers to the degree to which an individual is connected to others and to the community [1], including activities with friends, family, and/or other individuals such as supporting neighbors, joining in informal groups, using the phone, and visiting a church [2]. In the United States (U.S.), lack of social integration is a major concern for older adults [3]. Research suggests that approximately 28% of older adults report being lonely and 11 million older adults live alone [4], both of which contribute to high rates of morbidity and mortality [5,6]. Numerous studies have shown that social integration is associated with better cognitive function, less depression, higher self-rated health, and improved sense of belonging [7,8]. As such, the World Health Organization (WHO) recognizes social integration as a vital issue for aging (WHO, 2002). Understanding factors that promote social integration among older adults can help individuals achieve better outcomes and more successful aging.

The WHO disability model [9] define disability as the interplay between participation restriction, disruptions to the normal functioning of movement, and social relationships. Research has shown that, compared to the general population, older adults and those with disabilities are less likely to be socially integrated [10,11]. However, other studies have added complexity

to our understanding of the relationship between disability and social integration [8]. For example, numerous independent studies indicate that people with disabilities experience unique barriers that could reduce the opportunities to be socially integrated into daily life such as negative attitude toward disabilities [12], functional limitations [13], lack of transportation [14], unemployment [15], and lack of adequate social support systems and geographic barriers [16]. Additionally, the presence of chronic health conditions [17] and demographic characteristics such as gender [18], and race/ethnicity [19] influence social integration. These results suggest that older adults with disabilities, in particular those with chronic conditions, may be at greater risk for social isolation.

Studies have defined disability in a variety of ways. The majority of nationally representative surveys in the U.S. (e.g., Behavioral Risk Factor Surveillance System, American Community Survey) utilize the self-reported activities of daily living (ADL) [20] to indicate the presence of disability [21]. By this measure, findings between studies tend to be inconsistent. For example, some studies with older adults have found a strong connection between social integration and ADL function [22-25], while other studies show that ADL function and social integration are not always associated [26]. These inconsistencies may be attributable to the influence of the availability of social support. For example, married older men report better ADL function while unmarried older men report worse ADL function [27-29].

Clinical researchers often use objective, performance-based measures such as gait speed and standing balance to represent whether or not an individual has the capacity to perform certain necessary actions [30,31]. These objective measures reflect physical decline or functional limitation, in anticipation of future disability [32,33]. As with studies based upon self-reported disability measures, findings based upon performance-based disability measures also tend to be mixed. For example, in a longitudinal study, Buchman and colleagues [34] found that poor global motor function was associated with less social integration. In a separate study, however, they also found that social network size was not associated with either baseline motor function nor the rate of decline [35]. In a cross-sectional study, better gait speed was associated with having a social network and strong social ties [36]. However, unlike with some studies based upon self-reported disability measures [28], gender did not mediate these relationships [36], perhaps due to socio-economic factors [6]. den Ouden and colleagues [37] found that better ADL scores were longitudinally associated with leg extensor strength and handgrip strength only, after adjusting for covariates. In a separate study [38], this group also found that markers of subclinical vascular abnormalities indicated greater performance-based disability. However, markers of vascular abnormalities were not associated with self-reported disability longitudinally. Taken together, this body of research suggests that performance-based disability and self-reported disability, while related, may in fact be separate constructs.

Environmental gerontology has argued that the physical environments in which older adults live influence well-being, self-reported and performance-based disability status, and social integration [39,40]. Older adults tend to spend much of their time at home [41]. When the home environment, including the physical layout and condition of the home, does not support their functional limitation, they experience a lower functional ability [42], which can impede social integration [40]. Given this, when older adults indicate having a disability, this may in part be attributable to inadequate interior conditions at home. Previous studies argue that the home environment, including clutter and disrepair, contribute to mobility difficulties [43] and reflect general social disadvantage [44]. Several independent studies also examine factors associated with disordered living conditions, social isolation [45] and high demand for housekeeping [44,45]. However, few studies to date have investigated the extent to which disability and conditions of the home environment, independently as well as in conjunction with one another, are essential to social integration.

The purpose of this study is to examine the differential impact of self-reported *versus* performance-based disability on social integration among older adults, as well as the direct and potential moderating role of the physical and social environment on these relationships. The identification of people with disabilities varies across federally and state-sponsored publically available data sets. Putnam et al. [20] have shown that, although most data sets had a measure of self-reported disability (the ADL limitation), several data sets used the presence of at least one specific diagnosis condition to represent the presence of disability (e.g., performance-based disability). These different disability measures have been utilized interchangeably in disability and health studies. However, few studies have examined the relative relationships of the two disability measures and home environment on social integration. Using a measure of self-reported and performance-based disability simultaneously in the same study allows us to contrast their unique impacts on social integration. This study is significant because findings could reinforce the importance of social integration for older adults with disabilities, regardless of how disability may be defined. Findings also provide critical information focused on the development of tailored interventions to promote social integration among older adults with both self-reported and performance-based disabilities, because the disability measures themselves may skew findings related to social integration.

Based upon the studies described before, we hypothesize that:

- H1. The degree of association between two different disability measures and social integration will be different;
- H2. Home interior conditions will explain some of the differences in social integration between those with self-reported *versus* performance-based disabilities.

METHODS

The Institutional Review Board of the first author's university approved this study (HUM00184720).

DATA AND SAMPLE

Data are drawn from the 2017 National Health and Aging Trends Study (NHITS) [46], a nationally representative sample of Medicare recipients aged 65 or older. The purpose of NHATS is to assess disability experiences, social circumstances, and general health and well-being in later life. The Institutional Review Board at Johns Hopkins University approved the NHATS. NHATS utilizes a stratified, three-stage sampling method and oversamples those who are aged 90 or older and those who were African American. Details of the sampling strategy and design are available elsewhere [47]. A total of 8,245 older adults participated in NHATS 2017 with a response rate of 71%.

MEASURES

For the current study, social integration was measured with five dichotomous (0/1) items reflecting social activities in the previous month: 1) visiting family and friends; 2) attending religious services; 3) participating in clubs, classes, or other organized activities; 4) going out for enjoyment, and; 5) doing volunteer work. We developed three classifications of social integration, consistent with previous studies [48,49]. Participants with a total score of zero were classified as *nonintegrated*, those with a total score of 1 were classified as *partially integrated*, and those with a total score of 2 or more were classified as *fully integrated*. We recognize that previous studies based upon the NHATS included both social integration and social network size to represent social isolation [49,50]. We treated them separately and included social integration only in this analysis because social network and social integration may impact differently upon people with disabilities due to their unique physical and social barriers [51].

Disability was assessed with two measures: the 6-item Activities of Daily Living scale (ADL) [52] and the 3-item Short Physical Performance Battery (SPPB) [30]. Participant ADL limitations served as a measure of *self-reported disability* for the present study. The ADL measure included self-reported difficulty with six activities in the previous month: 1) eating; 2) dressing; 3) toileting; 4) bathing/washing; 5) moving inside by oneself, and; 6) effort required to go outside by oneself. For each item, participants indicated "no difficulty," "a little", "some", or "a lot". Similar to a previous study using ADL limitations as an indicator of disability [53], those with at least a little difficulty on any item were classified as having a self-reported disability and those with no difficulty on any item were classified as not having a self-reported disability.

The SPPB is a clinician-rated assessment of lower extremity functioning in older adults and served as a measure of *performance-based disability* for the present study. It includes gait speed, standing balance, and time to stand up from a chair. NHATS performed the standardized scoring procedure, which is explained in more detail elsewhere [54]. SPPB total scores may range from 0 to 12. Based on previous research [30,55], participants with a score of 8 or greater were classified as having a performance-based disability and those with a score of 7 or lower were classified as not having a performance-based disability. Lastly, we developed a single dichotomous variable, with discreet categories, for which those with self-reported disabilities but without performance-based disabilities were classified as *0* and those with performance-based disabilities but without self-reported disabilities were classified as *1*.

The presence of chronic conditions was assessed according to whether participants had been diagnosed by a doctor with any of six conditions: 1) a heart attack or myocardial infarction; 2) heart disease including angina or congestive heart failure; 3) diabetes; 4) lung disease such as emphysema, asthmas, or chronic bronchitis; 5) stroke, or; 6) cancer. We coded the responses as *Yes (1)* if a respondent reported at least one chronic condition, or *No (0)* if a respondent reported no chronic conditions.

The presence of disrepair inside participants' homes was measured through direct observations by NHATS interviewers about the presence of flooring disrepair (no/yes), broken furniture (no/yes), and trip hazards (no/yes). Affirmation of at least one indicator was coded as presence. Clutter inside the home also was assessed by interviewer observation and was classified into no clutter or clutter.

Age was obtained at the time of the interview and only available categorically. For this study, age was dichotomized as 65-74 years old *versus* greater than 75 years old. Gender was categorized into *male* or *female*. Race/ethnicity was dichotomized into two groups: *White, not Hispanic* or *other*. Education was originally assessed in NHATS by nine categorical responses ranging from

Table I. Participants' characteristics.

Disability type	Performance-based	Self-reported	P-value**
Variable			
Total raw sample	1885	815	
Social integration			< .000
0= severe	2%	10%	
1= partial	6%	27%	
2= full	92%	63%	
Disability			< .052
1. SPPB limitation	100%	0	
0. ADL limitation	0	100%	
Chronic conditions			
Means (S.D.)*	2.29 (1.34)	3.27 (1.53)	< .000
1= present	51%	68%	< .000
0= not present	49%	32%	
Disrepair			< .002
1= present	5%	10%	
0= not present	95%	90%	
Clutter			< .006
1= present	16%	32%	
0= not present	84%	68%	
Age			< 0.81
0= 65-74	90%	90%	
1= 75-79	10%	10%	
Education			< .004
0= <= High school or GED	27%	49%	
1= > High school	63%	51%	
Gender			<.062
0= male	44%	46%	
1= female	56%	54%	
Race			<.000
1= Caucasian	79%	62%	
0= African American/Hispanic /Others	21%	38%	

* indicates the standard deviation; ** indicates statistically significance of the chi square test at < .05.

"no schooling completed" to "master's professional, or doctoral". We dichotomized this variable into "less than or equal to high school graduate" *versus* "greater than high school".

Data analysis

Frequencies, means, and standard deviations were calculated as appropriate for demographic variables, disability, and other independent variables. Items were coded so that higher scores indicated the presence of a condition. Multinomial logistic regression analyses with interaction effects were performed using the Mplus 8.2 [56], NOMINAL option to examine the relationships of the binary independent variables with three levels of the social integration dependent variable. The analyses used a maximum likelihood robust method with the fully socially integrated group as the reference group. This yielded comparisons of a nonintegrated group with a fully integrated group and of a partially integrated group with a fully integrated group. For the interaction terms, Mplus produced single estimates for the model parameters instead of class-specific estimates (e.g., the use of 1.00 as the reference value) in the multinomial logistic regression [56]. We utilized a 95% confidence interval to identify significant predictors.

RESULTS

We included older adults with self-reported disabilities only and those with a performance-based disability only in this current study to meet the study objectives.

Respondents with missing data on the required variables (i.e., who did not indicate responses) were excluded from this study. Thus, we analyzed 2,700 out of 8,245 participants from the 2017 NHATS dataset. Descriptive analyses showed that participants with both self-reported and performance-based disabilities who were excluded from this study were more likely to be old, Caucasian, and have an associate degree or higher. Those without either disability who were excluded from this study were more likely to be young, have disrepair but no clutter inside the home, and be socially integrated.

As summarized in Table I, the characteristics of the participants showed that older adults with performance-based disabilities were more likely to be educated, Caucasian, and less likely to be non-integrated, have at least one chronic condition, and have disrepair or clutter inside the home.

H1. Two disability measures and social integration

In the comparisons between the nonintegrated group and the fully integrated group (reference group) (Tab. II), all main independent variables except chronic conditions and disrepair significantly differed between the two groups. The relative odds ratio for performance-based disability (SPPB) was 0.03, indicating that, compared with those with self-reported disabilities (ADL), people with performance-based disabilities were less likely to be classified as nonintegrated. Additionally, the relative odds ratio for the two-way interaction between performance-based disability and chronic condition was

0.30, revealing that those with performance-based disabilities, as well as chronic conditions, were less likely to be classified as nonintegrated.

H2. Home interior conditions and social integration

The relative odds ratios for clutter were 0.31 (severe) and 0.01 (partial), respectively, indicating that, compared to those without clutter, people with clutter were less likely to be classified into the nonintegrated and the partially integrated groups. However, the relative odds ratios for the interaction between disability and clutter were not significant (Tab. III).

Because the relative odds ratios of the interactions between performance-based disability and chronic conditions and between performance-based disability and social network were contradictory, we examined the bivariate relationships of these variables using descriptive statistics. The results indicated that, although older adults in the non-integrated group were more likely to perceive difficulties in activities such as eating, dressing, toileting, bathing/washing, moving about independently inside the home, and having to make an effort to go outside ($p < .05$).

We also conducted a simple logistic regression analysis with a dichotomous outcome, comparing the nonintegrated group with the combined partially and fully integrated group. The interaction between having a disability and chronic conditions was similar to the multinomial logistic model comparing partially integrated to fully integrated. This result shows that the unique differences between two disability measures in the degree of

Table II. Parameter estimates, relative odds ratios, and 95% confidence intervals for the final multinomial logistic regression analysis; No integration *versus* full integration.

Predictor	No Integration *vs* Full Integration(reference)			
	Estimate (E.E.)	Odds ratio		95% CL
			Lower	Upper
Performance-based disability	**-3.56(0.96)**	**0.03**	**0.01**	**0.01, 0.17**
Chronic condition	-1.84(1.92)	0.16	0.03	1.92
Disrepair	5.39(3.39)	3.56	0.13	8.70
Clutter	**-5.88(2.71)**	**0.01**	**0.00**	**0.44**
Age	0.35(0.28)	1.41	0.73	2.77
Education	-0.64(0.28)	0.53	0.37	1.11
Gender	0.32(0.29)	1.38	0.77	2.39
Race	**-1.10(0.31)**	**0.33**	**0.21**	**0.68**
Interactions (1 x 1)				
Disability x chronic conditions	**1.18(0.76)**	**0.30**	**0.11**	**0.57**
Disability x disrepair	-0.84(1.24)	0.43	0.08	4.91
Disability x clutter	1.98(0.92)	7.26	0.95	9.42

Abbreviations. CL: confidence intervals; EE: the error of the estimate. The main analysis and the interaction analysis were conducted separately.

Table III. Parameter estimates, relative odds ratios, and 95% confidence intervals for the final multinomial logistic regression analysis; partial integration *versus* full integration.

Predictor	Partial integration *vs* Full integration (reference)			
	Estimate (E.E.)	Odds ratio	95% CL	
			Lower	Upper
Performance-based disability	**-1.56(0.41)**	**0.21**	**0.02**	**0.46**
Chronic conditions	0.83(1.03)	0.44	0.73	1.43
Disrepair	-0.49(1.86)	0.62	0.02	10.16
Clutter	**-2.04(1.19)**	**0.31**	**0.02**	**0.48**
Age	-0.06(0.17)	0.94	0.56	1.13
Education	**-0.73(0.16)**	**0.48**	**0.34**	**0.65**
Gender	0.01(0.17)	1.00	0.72	1.37
Race	**-0.60(0.17)**	**0.55**	**0.57**	**0.79**
Interactions (1 x 1)				
Disability x chronic conditions	0.37(0.35)	1.45	0.32	1.07
Disability x disrepair	0.38(0.63)	1.46	0.86	1.62
Disability x clutter	0.65(0.39)	1.92	0.11	1.41

Abbreviations. CL: confidence intervals; EE: the error of the estimate. The main analysis and the interaction analysis were conducted separately.

social integration could not be detected with a simple logistic regression analysis.

DISCUSSION

Identifying the association of self-reported versus performance-based disability, as well as environmental factors, on older adults' experiences of social integration has the potential to enhance our understanding of past and future research in this field. This enhanced understanding may allow us to more appropriately allocate resources and develop targeted programs to best meet the needs of older adults with disabilities in the community. In this study, we found that two different disability measures differently impacted social integration, with older adults with performance-based disabilities reporting better social integration compared to older adults with self-reported disabilities. This association was moderated by the presence of chronic conditions (in the model comparing nonintegrated to fully integrated). The home environment (disrepair, clutter) did not interact with disability to explain differences in social integration.

Our results generally confirm previous research showing that having a disability is associated with less social integration [8]. We expanded on this research by including both self-reported and performance-based disability measures in the same study to examine the relative impact of each. Consistent with our hypothesis, we found differences in the effect of the disability measures on social integration. In our study, older adults with performance-based disabilities were more likely than those with self-reported

disabilities to be socially integrated, providing support for previous research showing that certain components of the two disability types may be overlapping but that, overall, they are distinct from one another [57]. Additionally, compared to performance-based measures, self-reported ADL function may be related to psychosocial factors such as depressive symptoms [57], pain [58], and care dependence [59]. Older adults with self-reported disabilities could have more psychological and social challenges in their lives than those with performance-based disabilities only in this study.

It is also important to recognize that different disability measures are based upon samples of individuals experiencing different types of disabilities, which influence the study findings. This study purposefully restricted the analytic sample to those who reported either self-reported disability or performance-based disability. Those with self-reported disabilities but without performance-based disabilities could include frail older adults without any medical diagnoses who may not have adequate social support systems. Those with performance-based disabilities but without self-reported disabilities could include individuals with congenital disabilities. Although their unmet needs are highly prevalent [60,61], those with congenital disabilities may utilize their support systems to engage in ADLs. Further studies are needed to identify the characteristics of these disability groups in order to more fully interpret results. The current study provides further evidence for researchers and clinicians and underscores the importance of clearly defining different disability populations.

We considered the direct impact of the home environment on social integration, as well as the potential

moderating effect of these factors with disability on integration. Similar to previous studies [62], we found that physical barriers in the form of clutter in the home were associated with less social integration. This finding is consistent with the basic understanding put forth by environmental gerontology. Previous studies have shown that clutter links to cognitive and other physiological declines. For example, older adults with hoarding disorder have shown deficits in memory, attention, and executive functioning [63]. Other factors associated with less social integration include loneliness [64], depression and distress [65], lack of sleep and fatigue [66], and lack of social support [48]. Therefore, future research and intervention development projects should include the mental health status of participants and other similar considerations when working to promote social integration.

Our study found that older adults with performance-based disabilities and chronic health conditions are less likely to be nonintegrated, compared to older adults with performance-based disabilities and no chronic health conditions. Previous research suggests that having a chronic health condition increases one's utilization of social support (e.g., friends, family, caregivers), resulting in increased social integration [67] The impact of having a chronic condition on social integration for people with performance-based disabilities would be an essential topic to investigate in future studies.

LIMITATIONS

This study has several limitations. First, we used a cross-sectional design. Thus, our results cannot be interpreted as causal. Second, this study did not assess the same activities between self-reported disability and performance-based disability, nor did we have available in NHATS an objective, third-party measure of self-reported disability, both of which limit our ability to compare the predictive value of self-reported and performance-based disability [68]. Thirdly, we followed the previous studies to define self-reported disability and performance-based disability, another study used a different cut-off point [69]. Our findings cannot generalize other disability studies. Finally, although clutter and home arrangement have been linked to mental health conditions, our findings cannot generalized to these studies. NHATS includes limited psychosocial variables to assess stress, coping, and psychological function. It is crucial to consider these factors when examining social integration.

CONCLUSIONS

This study demonstrated that two different disability measures characterize older adults and suggest substantial differences in predicting social integration. This calls for recognizing the impact of the selection of disability measures on social integration and similar psychosocial outcomes in future studies. It also is vital to examine factors associated with these differences and to develop interventions covering the characteristics of self-reported disability, performance-based disability, and ADL support systems. People with self-reported disabilities may need support to expand social contacts and social engagement beyond their existing social network. By applying a more comprehensive approach to study disability and aging, environment, and social integration, it may be possible to identify additional moderating and mediating factors. This will provide clearer guidance for how to intervene to improve social integration in later life.

Conflict of interest statement
The authors declare no conflict of interest.

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Author contributions
The authors contribuited equally to the work.

Ethical consideration
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The research was conducted ethically, with all study procedures being performed in accordance with the requirements of the World Medical Association's Declaration of Helsinki.

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