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MOBILITY, DISABILITY, AND SOCIAL ENGAGEMENT IN OLDER ADULTS

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Abstract

Objective—To examine cross-sectional associations between mobility with or without disability and social engagement in a community-based sample of older adults

Methods—Social engagement of participants (n=676) was outside the home (participation in organizations and use of senior centers) and in home (talking by phone and use of internet). Logistic or proportional odds models evaluated the association between social engagement and position in the disablement process (no mobility limitations, mobility limitations/no disability, and mobility limitations/disability).

Results—Low mobility was associated with lower level of social engagement of all forms (OR=0.59, CI: 0.41–0.85 for organizations; OR=0.67, CI: 0.42–1.06 for senior center; OR=0.47, CI: 0.32–0.70 for phone; OR=0.38, CI: 0.23–0.65 for internet). For social engagement outside the home, odds of engagement were further reduced for individuals with disability.

Discussion—Low mobility is associated with low social engagement even in the absence of disability; associations with disability differed by type of social engagement.

Keywords

mobility; disability; social engagement; life space

Introduction

Older age may bring changes to functional ability and to social relationships. Social relationships are known to improve functional ability and well-being but limited functional ability may also impact one's ability to maintain social ties (Avlund, Lund, Holstein, & Due, 2004; Glass, Mendes de Leon, Marottoli, & Berkman, 1999; Levasseur, Desrosiers, & Noreau, 2004; Mendes de Leon, Glass, & Berkman, 2003). Social engagement, the real life activity that results from association with one's social ties, is important in reinforcing existing social relationships and provides a sense of value and identity (Berkman, Glass, Brissette, & Seeman, 2000). Active engagement with life, which includes social

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Disclosure Statement

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engagement, is recognized as an essential component of successful aging (Rowe & Kahn, 1997). However, opportunities for social engagement may decline with age, particularly as physical function declines (Avlund, Due, Holstein, Heikkinen, & Berg, 2002; Glass, Mendes de Leon, Seeman, & Berkman, 1997; Mollenkopf et al., 1997).

Mobility, Life-Space, and Disablement

Mobility is defined as the ability of an individual to purposively move about her environment. Mobility limitations are impairments in movement and affect between one third and one half of adults age 65 or older (Webber, Porter, & Menec, 2010). Mobility limitations affect an individual's health and well-being in multiple ways, including increasing the risk of disability (Webber et al., 2010). In older adults, development of disability, the inability to perform one's usual activities due to a physical or mental health problem, is typically a dynamic process that arises from multiple insults occurring over time (Verbrugge & Jette, 1994). The Disablement Process posits that functional limitations, restrictions in basic physical and mental actions such as mobility, precede disability (Verbrugge & Jette, 1994). However, not all functional limitations will result in disability and it is therefore important to distinguish the role each plays in the health of individuals. By assessing limitations and disability in conjunction, we can begin to understand how particular risk factors and health outcomes are associated with mobility limitations in the presence and absence of disability.

Many measures of mobility focus solely on an individual's ability to walk. However, this approach to measurement may not capture all aspects of mobility. Use of assistive devices, access to other resources and social needs may also impact mobility (Patla & Shumway-Cook, 1999; Webber et al., 2010). Performance-based measures of walking conducted in a clinic are important in that they provide an objective measure of mobility, but they may not capture challenges that may be faced in the real world, such as perception and avoidance of obstacles, performance of concurrent tasks such as conversing or carrying an object, negotiation of surfaces, and dealing with ambient conditions such as weather (Patla & Shumway-Cook, 1999). In addition, those who are physically capable of achieving high mobility may be limited in their actual mobility due to cognitive, financial, psychological or other limitations (Webber et al., 2010). To address these issues, the Life-Space Assessment (LSA) was developed to measure achieved mobility (Baker, Bodner, & Allman, 2003). Life-space represents the spatial area traveled by an individual as part of her daily routine and therefore represents what an individual has done rather than what they are capable of doing. In this way, it represents a combination of physical pathology, adaptations an individual makes to overcome presence of physical impairments, and an individual's desire or need to move about their environment (Peel et al., 2005).

Disability is often operationalized as difficulties in self-care tasks (activities of daily living (ADLs)) or household tasks (instrumental activities of daily living (IADLs)). The LSA is associated with both ADLs and IADLs but mobility limitations as measured by the LSA are thought to precede difficulties in specific ADL or IADL tasks (Baker et al., 2003). Therefore, in a cross-section of an older population one would expect to find very few individuals without mobility restrictions but with disability; this group may represent individuals who are able to successfully overcome mobility limitations through social or financial resources or who have a non-mobility related disability. Among those with mobility restrictions, one would expect to find those whose limitations have progressed to disability and those who have limitations without disability. It is not yet clear how specific scores on the LSA relate to disability or what are appropriate cutoffs to indicate restricted life-space. Extremely low scores on the LSA may indicate that an individual is homebound, but the incorporation of frequency of travel and need for assistance into the composite LSA score can result in scores that indicate low mobility without disability. While the standard

measures of disability capture aspects of mobility (e.g. ability to get to places out of walking distance), the LSA measures achieved mobility as opposed to the capacity to perform that is assessed in disability questionnaires (Glass, 1998) {Glass, 1998 #34}. It is not yet clear how mobility limitations as measured by the LSA may impact the health and quality of life of older individuals, independent of disability.

Mobility, Disability, and Social Engagement

Mobility is central to fulfilling needs beyond basic survival, such as social engagement (Webber et al., 2010). For older adults, social activities are considered highly important and account for approximately 20% of trips outside the home (Mollenkopf et al., 1997). Withdrawal from social activities in this population is generally not voluntary but due to functional limitations (Mollenkopf et al., 1997). However, it is important to distinguish between activities that have little importance to an individual from those that provide enjoyment and a sense of meaning. A reduced involvement in the social environment may be welcomed, particularly as physical competence decreases and the demands of involvement are subsequently increased (Herzog, Ofstedal, & Wheeler, 2002). It has been shown that older adults with a disability have fewer social activities than those without a disability, but they also have a greater life satisfaction in association with those activities than those without disability (Jang, Mortimer, Haley, & Borenstein Graves, 2004). This may be due to a focus on a limited number of activities that confer psychological benefit to the individual, allowing the individual to reduce demands to match their capabilities without sacrificing the most meaningful activities.

We follow Berkman and colleagues (2000) in defining social engagement as participation in social activities which represents the enactment of social ties in real life activities and reinforces meaningful social roles. Increased social engagement in older adults is associated with greater quality of life (Levasseur et al., 2004), lower rates of depression (Glass, Mendes de Leon, Bassuk, & Berkman, 2006), improved cognition (Zunzunegui, Alvarado, Del Ser, & Otero, 2003), and lower mortality (Glass et al., 1999; Lennartsson & Silverstein, 2001; Unger, Johnson, & Marks, 1997). Previous research has indicated a role for social engagement in protecting against loss of functional ability and disability (Avlund et al., 2004; Buchman et al., 2009; James, Boyle, Buchman, & Bennett, 2011; Janke, Payne, & Van Puymbroeck, 2008; Mendes de Leon et al., 2003; Thomas, 2011a, 2011b; Unger et al., 1997). In addition, losses in physical functioning can reduce social engagement by reducing the opportunities for individuals to be socially engaged (Mollenkopf et al., 1997). Furthermore, disability in activities of daily living may affect an individual's ability to be socially engaged as these activities, such as bathing and grooming, are considered necessary prerequisites to interaction with others (Levasseur, Richard, Gauvin, & Raymond, 2010). The relation of physical function and disability with social engagement is likely cyclical as losses in social engagement may in turn accelerate functional decline and modify the functional consequences of disease (Mendes de Leon et al., 2003). Although social engagement has been assessed in relation to either functional limitations or disability, associations have not been assessed for the two simultaneously. Therefore, it is still unclear how social engagement is associated with mobility limitations both in the presence and absence of disability. As mobility limitations can interfere with one's ability to be socially engaged and social engagement is a risk factor for disability onset it is important to better understand these pathways as potential targets for interventions.

Technology such as telephones and the internet could provide opportunities for social engagement to those with limited mobility or disability as their use does not require an individual to leave their home. Internet usage has been shown to improve social capital, increase communication with friends and family, and enhance feelings of connectedness to the community and may be an increasingly important source of social engagement

(Hogeboom, McDermott, Perrin, Osman, & Bell-Ellison, 2010; Russell, Campbell, & Hughes, 2008; Sum, Matthews, Pourchase, & Hughes, 2009). It is unclear how technology-assisted engagement might differ from face-to-face engagement, though there is some suggestion that computer-mediated communication may not function as effectively as face-to-face communications in enhancing quality of life (Paul, Louis, Venhwei, Chengyu, & Tingjun, 2011) or buffering stressful life events (Lewandowski, Rosenberg, Jordan Parks, & Siegel, 2011). In contrast, online communities may provide opportunities to share in comfortably anonymous ways with people who share similar interests or life stressors (Savundranayagam & Ryan, 2008). Currently, little is known about how internet use relates to mobility and disability.

Mobility as measured by the LSA is associated with demographic, economic and disease measures, but associations with social activities have not been reported (Allman, Baker, Maisiak, Sims, & Roseman, 2004; Baker et al., 2003; Crowe et al., 2008; Peel et al., 2005; Xue, Fried, Glass, Laffan, & Chaves, 2008). These analyses aim to determine the association of mobility with social engagement and evaluate how these associations differ in the presence or absence of associated disability. Associations with social engagement that requires leaving the house (participation in organizations and use of senior centers) and that can be conducted in the home (talking to friends and relatives by phone and use of the internet) will be compared. We hypothesize that reduced social engagement is associated with mobility limitations among older adults, that this association is stronger for those with a disability, and that this association will be stronger for activities that require leaving the house.

Methods

This is a cross-sectional analysis of associations of life-space and functional disability with social engagement. By separately analyzing those who have mobility limitations, operationalized as restricted life-space, with and without disability we hope to clarify how various stages of the disablement process are related to social engagement.

Study Sample

The Public Health Management Corporation (PHMC) has conducted the population-based Household Health Survey (HHS) biennially in Philadelphia and surrounding counties since 1994. Recruitment is carried out by random digit dial for non-institutionalized individuals stratified on 54 service areas in order to maintain geographic representativeness. Those aged 60 years and older are oversampled. The adult with the last birthday in each household was selected for the interview. The overall response rate for the survey was 24.5% (American Association for Public Opinion Research's (AAPOR) Response Rate 3 (RR3) method) (AAPOR, 2011). A substudy to evaluate mobility that included a modified version of the Life-Space Assessment (LSA) was included in the 2010 survey for 702 individuals aged 65 and older living in the city of Philadelphia. Participation in the mobility study was 74.1%. The focus of the current analysis is the participants in the sub-study with a complete LSA (n=676).

All participants gave consent for inclusion at administration of the survey. This sub-study was approved by Drexel University's Institutional Review Board.

Mobility Measure

The LSA assesses the extent of movement of the respondent in the past months. Five levels of movement are assessed: (1) the home, (2) areas immediately outside the home such as yards or driveways, (3) the neighborhood, (4) the town or city beyond their neighborhood,

and (5) beyond their town. For each level of achieved mobility, the respondent is then asked how frequently they traveled to that area and whether they needed assistance from another person or from equipment (Peel et al., 2005). The LSA was modified for the current study by eliminating level 2 as described above as this level lacks relevance to many urban residents. Scores for distance travelled, frequency traveled and need for assistance were totaled to create an overall score; this scoring method was the most highly correlated with physical performance and other measures in testing by the LSA developers (Baker et al., 2003) and was used in the current analyses. Total scores range from 0 – 104, with higher scores indicating greater mobility. The validity and reliability have been established in a population of older adults (Baker et al., 2003; Peel et al., 2005). Internal consistency of the modified LSA was good in this sample ($\alpha=0.77$).

Low versus high mobility was determined by being above or below the median for the composite LSA score. The median for this sample is 52 and is similar to the cut point for low mobility of 56 proposed for the full LSA (range 0–120) by Shimada and colleagues (Shimada et al., 2010).

Disability Measures

Disability was assessed through administration of a 6 item activities of daily living (ADL; eating, dressing, grooming, walking, transference, and bathing) and a 6 item instrumental activities of daily living (IADL; using the telephone, getting to places outside of walking distance, shopping, preparing meals, taking medicine, and managing money) questionnaire (Lawton & Brody, 1969). Respondents were asked if they could perform each task independently, needed help, or could not do the task at all. Disability was defined as dependence or inability to perform one or more tasks.

Social Engagement

Social engagement included participation in activities that would reinforce social ties and social roles (Berkman et al, 2000).

The total number of social organizations in which an individual participated was reported. This was recoded as none, one, or two or more. Participants were asked whether or not they had heard of senior center activity programs. Those who responded yes to this question were then asked if they used these programs. Those who had not heard of these programs were assumed to not use them.

Frequency of telephone conversations with friends or family was recorded as several times per day, once a day, a few times per week, or once a week or less frequently. Frequency of internet usage was recorded and coded as any use or no use. Reason for use of the internet was not recorded but prior research has shown that among older users the internet is largely used for email and other social purposes (Russell et al., 2008; Zickuhr, 2010).

Covariates

Several covariates were considered that may have independently affected mobility/disability and social engagement. These included demographic and socioeconomic characteristics, health conditions, and psychosocial measures. Demographics including age, gender, race, ethnicity, education, difficulty with housing costs, home ownership, marital status, and living arrangement were recorded. Income was recorded and coded as being above or below 200% of the federal poverty level.

Health conditions, including presence of diabetes, high blood pressure or asthma and occurrence of falls in the previous year, were recorded. Use of specific assistive devices –

grab bars, bath seat, raised toilet seat, portable commode, cane, walker, railings, wheelchair, and hearing aid – was scored as total number of devices used. Use of formal in home care was also assessed. Self-reported height and weight were recorded and body mass index (BMI) was calculated as $((\text{weight in pounds}/2.205)/(\text{total height in inches}^2) * 0.00064516)$ and categorized according to the standard cutoffs for underweight (<18.5), normal weight (18.5–24.9), overweight (25.0–29.9), and obese (≥ 30.0) (WHO, 1995).

Depressive symptoms were assessed using the short form Center for Epidemiologic Studies Depression Scale (CESD-10) and were dichotomized into low and high symptom levels using a cutoff of four or more symptoms (Andresen, Malmgren, Carter, & Patrick, 1994). Current levels of general stress were self-reported on a rating scale of 1 (lowest) to 10 (highest). This was recoded into three categories: low stress (1–3), medium stress (4–7), or high stress (8–10).

Travel Measure

The LSA was validated here by comparison with a measure of usual travel. Participants were asked “What is the ZIP code of the place where you spend most of your time when you are not at home?” ($n=475$). If a ZIP code was provided, this was compared to their home ZIP code by visual inspection of a zip code map for southeastern Pennsylvania. Participants were coded as: 1) regularly traveled in their home zip code only, 2) regularly traveled to an adjacent zip code, or 3) regularly travelled two or more zip codes away. Participants could also indicate that they did not regularly leave their home.

Statistical Analyses

Confirmatory factor analysis (CFA) was used to verify that the four LSA components measure a single factor (Crowley & Fan, 1997). Because no one fit statistic is accepted as the method to confirm this, multiple fit statistics were used: Goodness of Fit Index (GFI), Adjusted GFI that adjusts for degrees of freedom in the model, Normed fit index, and chi-square which is sensitive to sample size (Sun, 2005). Results were compared to a null model in which each item is considered as its own factor.

The LSA score and ADL/IADL disabilities were used to characterize study participants as having 1) high mobility with no disability, 2) high mobility with disability, 3) low mobility with no disability, or 4) low mobility with disability.

Comparisons of this sample to the Philadelphia population were done using 2010 US Census data. Univariate associations of life-space and disability status with demographic, health and socioeconomic variables were determined by ANOVA for normally distributed continuous variables and chi-square for categorical ones. Comparisons of LSA scores by disability status used Wilcoxon signed rank test due to skewed distributions of the LSA among subgroups. Appropriate regression models were developed to assess associations between life-space and disability status and each form of social engagement after adjustment for demographic, socioeconomic, and health variables. For all analyses, the high life-space, not disabled group was the referent. Due to the relatively small size of some of the sub-groups, a parsimonious adjusted model was developed using backward selection based on statistical significance ($p < 0.1$) of the covariate. All eliminated covariates were reintroduced individually into the model and those that changed the primary effect estimate by 10% or more were retained in the final model (Weng, Hsueh, Messam, & Hertz-Picciotto, 2009). Age and sex were included in all models.

Logistic regression was used for engagement variables with dichotomous outcomes (use of senior centers and use of internet) to estimate odds ratios. The logistic odds ratio provides the ratio of the odds of participating in a particular activity compared to the odds of not

participating in that activity (Vittinghoff, Glidden, Shiboski, & McCulloch, 2005). Proportional odds models were tested for variables with multilevel ordinal outcomes (social organizations and phone conversations). The proportional odds ratio provides the cumulative probability that an outcome is greater than or equal to each ordinal category (McCullagh, 1980). The proportional odds assumption was met for the adjusted model of participation in social organizations (chi-square=19.2, $p=0.12$). This assumption was not met for the adjusted model of talking on the phone (chi-square=40.3, $p=0.01$). Therefore, a partial proportional odds model was used which allows each covariate to be specified as either proportional or non-proportional (Koch, Amara, & Singer, 1985). In this model, life-space and disability status met the proportionality assumption (chi-square=5.1, $p=0.28$) and a proportional odds ratio was calculated for the primary effect estimate with appropriate adjustment of the non-proportional covariates.

Results

Complete LSA data were available for 676 of the 702 adults aged 65 years and older who participated in the mobility study. Those who had a complete LSA did not differ in age, racial distribution, poverty status, home ownership, or whether they lived alone compared to the Philadelphia population over 65 years of age ($p > 0.01$). This sample was more likely to be female ($p < 0.0001$), less likely to be married ($p = 0.002$), and were better educated ($p < 0.0001$) than the older Philadelphia population.

Validation of Life-Space Assessment

The LSA is a relatively new measure of mobility and we used a modified version in this research; therefore, validation analyses were performed. The full range of possible LSA scores (0–104) was observed in this population. LSA scores were normally distributed with a median of 52, mean of 49.6, and a standard deviation of 24.8.

Confirmatory factor analysis (CFA) was performed on the modified LSA under the hypothesis that the scale represents a single latent mobility factor. Fit of the model was satisfactory by multiple fit indices that included adjustment for sample size: Goodness of fit index (GFI) = 0.99, Adjusted GFI = 0.976, Normed fit index (NFI)=0.992. The chi-square model fit test unadjusted for sample size indicated inadequate model fit ($p=0.04$) but this was likely due to the large sample size (Crowley & Fan, 1997). The fitted model (chi square=6.5) did perform substantially better than the null model (chi square=765.4, $p < 0.0001$).

LSA scores were consistent with data collected on participant's reported location of time spent outside the home. Those who reported not leaving their homes had a mean LSA of 38.4 (SD=24.7). This was statistically significantly lower ($p < 0.0001$) than those who left their homes regularly and spent their time in their home zip code (mean LSA=51.5; SD=24.7), an adjacent zip code (mean LSA=54.1; SD=19.7), or a non-adjacent zip code (mean LSA=61.9; SD=22.0).

Mobility and Disability

Mobility and disability overlapped in this population, but were not measuring identical constructs. While there was a broad range of LSA scores for those with no disability (range: 0–104; median=58.0), scores were more concentrated at the low end for those with a disability (range: 0–94; median=23.0). Presence of ADL/IADL disability and LSA score were strongly associated. Of those above the sample median of 52.0 on the LSA, 318 (93.5%) had no disability. Of the 362 individuals with low LSA scores (<52.0), 216 (59.7%) had no disability and 146 (40.3%) had a disability. The 22 individuals who had a disability

with high LSA score were excluded from further analyses as this group was small and it is unclear if they represent a specific population or are misclassified. The majority of this group (n=16, 72.7%) had a single IADL dependency and therefore represents a minimally disabled group. In addition, individuals in this group were more likely to be obese than individuals in the other groups (40.9% vs 28.4%) and being in this group may reflect difficulties due to body size as opposed to those from functional limitations. Finally, individuals with high mobility and a disability were less likely to be in poverty and more likely to use a car than individuals in other groups (data not shown). This may indicate that these individuals had the financial means to overcome mobility limitations despite the presence of a disability.

ADL dependencies were less common in those with low mobility and a disability than were IADL dependencies with 79 (54.2%) having one or more ADL dependency and 131 (89.7%) having at least one IADL dependency. Those who had IADL dependencies were more likely to have multiple dependencies whereas a single ADL dependency was more common.

Characteristics of the sample by mobility and disability status are shown in Table 1. Participants with low mobility without disability were older, more likely to be female, more likely to be non-white, and were more likely to have chronic conditions than were those with high mobility. They were also more likely to have lower socio-economic status and to have depression or high levels of stress (Table 1). Individuals with disability were older, more likely to be female, non-white and in poverty, and were more likely to have chronic conditions than those who had no disability (Table 1). Those with a disability were also much more likely to use mobility aids and in-home care than were individuals without a disability.

Mobility, Disability, and Social Engagement

In univariate analyses, all forms of social engagement were associated with mobility and disability status except use of senior centers (Table 2). As expected, social engagement was highest among those with high mobility. Adjusted analyses show that mobility and disability status were associated with all forms of social engagement whether occurring inside or outside the home (Table 3). The odds of engaging in social activities outside the home (participating in more social organizations and using senior centers) were lower for those with low mobility compared to those with high mobility. Participation was lowest for those with disability (Table 3). There appears to be a greater decline in odds of using senior centers for those with disability than there is for participating in social organizations (reduction in OR of 46.3% for senior centers and of 28.8% for social organizations compared to those with low mobility and no disability). However, as indicated by the wide confidence intervals, these estimates are somewhat imprecise. The observed trend of reduced engagement in those with disability compared to those low mobility without was marginally significant ($p=0.08$ for both).

Results of adjusted analyses for social engagement in the home were somewhat different. Low mobility was associated with lower odds of talking more frequently to friends or relatives by phone compared to those with high mobility (Table 3). Individuals with low mobility were about half as likely to frequently communicate by phone as were those with high mobility. In contrast, the odds were only reduced by 28% in those with disability and this association did not reach significance. Low mobility was also associated with lower odds of using the internet; however, there was no difference between those with or without a disability (Table 3). Both groups with low mobility were approximately 60% less likely to use the internet than were those with high mobility, even after adjustment for socioeconomic characteristics.

Discussion

In cross-sectional analysis of older adults, we found that lower life-space mobility and disability were each associated with lower levels of social engagement, indicating that mobility limitations even in the absence of disability are associated with reduced social engagement. These associations were observed for social engagement occurring both inside and outside the home, though patterns by mobility and disability status differed somewhat for each activity. For activities outside the home, our hypothesis that associations with social engagement would be stronger for those with a disability as opposed to those with only a mobility limitation when compared to those with high mobility was confirmed. However, for activities within the home, a similar pattern was not observed. The data also did not confirm our hypothesis that associations would be stronger for activities occurring outside the home compared to those in the home. The associations observed for participating in social organizations and for use of senior centers were in the expected direction; lower mobility was associated with lower levels of engagement outside the home and presence of disability may have strengthened this association. Although senior center use was only 21% in our sample, this is comparable to estimates of 15% from national data (Ralston, 1991). Poor mobility appeared to decrease the opportunities for an individual to participate in community social activities. Disability limits an individual's autonomy, making engagement in social activities outside the home more difficult. Additionally, increased social engagement reinforces existing social relationships, can increase access to resources, and promotes resilience which may all protect against further mobility declines and disability onset (Berkman et al., 2000; Lamond et al., 2008; Mendes de Leon et al., 2003; Unger et al., 1997).

Talking on the phone with friends differed by disability status but not in the expected direction. Among those with low mobility, those with disability were not less likely to talk with friends while those without disability had a lower likelihood of talking with friends compared to those without mobility limitations or disability. Disability may actually strengthen existing social relations as the disabled individual experiences increased need for help with daily activities (Avlund et al., 2002; Janke et al., 2008). The phone may have been used to strengthen and maintain these relations among those with a disability.

Internet use did not differ by disability status among those with low mobility. No previous studies have assessed associations of internet use as a form of social engagement with physical function or disability in older adults. Internet use in this age group has been reported to improve social capital, increase communication with friends and family, and enhance feelings of connectedness to the community (Hogeboom et al., 2010; Russell et al., 2008; Sum et al., 2009). We were not able to determine for what purpose the internet was used or whether individuals used computers in their homes, but email and other social uses are prominent among internet users in this age group (Russell et al., 2008; Zickuhr, 2010). Some senior centers, libraries and other community centers provide internet access and this may therefore represent social engagement outside the home. However, the strong univariate association between internet use and socioeconomic indicators may indicate that this was in-home use.

The mechanisms explaining the association between limited mobility and lower frequency of social engagement within the home are unclear. Our hypothesis is that limited mobility decreases one's ability to be socially engaged; however, the cross-sectional nature of these analyses do not allow for directionality of the association to be established. Previous longitudinal research has shown that participation in social activities may protect against functional declines and disability (Avlund et al., 2004; Buchman et al., 2009; James et al., 2011; Janke et al., 2008; Mendes de Leon et al., 2003; Thomas, 2011a; Unger et al., 1997).

There is little research assessing the association in the opposite direction, but evidence suggests that physical limitations can reduce social engagement, particularly among men (Thomas, 2011a). The presence of a strong relation between mobility/disability status and social engagement that did not require leaving the home may indicate that social engagement is affecting mobility or that the relation is reciprocal. Smaller social networks would decrease the opportunities for social engagement and may have a negative impact on mobility (Mollenkopf et al., 1997). In addition, loneliness can lead to decreases in mobility and increased disability (Perissinotto, Stijacic Cenzer, & Covinsky, 2012). The use of the life-space assessment to capture actual, rather than potential, mobility of an individual may reflect a decreased need or desire of individuals to be mobile when opportunities for social engagement are lacking. It is likely that there is a reciprocal relation between physical function and social engagement though further longitudinal studies are needed to ascertain the exact nature of this relation (Avlund et al., 2002; Mendes de Leon et al., 2003).

Previous studies that have assessed gender-specific associations of social engagement or social relations with measures of function have found that effect modification by gender is present (Avlund et al., 2002; Avlund et al., 2004; James et al., 2011; Unger et al., 1997). The current study included too few men to adequately assess effect modification. Results excluding men were no different from those including both genders that are presented here. Future research should evaluate how these associations may differ by gender.

This study had several limitations, most notably the cross-sectional design and inability to establish directionality of associations. We were also unable to distinguish between social engagement and one's social network. Engagement requires the existence of a social network and social networks are known to confer health benefits (Berkman et al., 2000; Herzog et al., 2002). If these relations are due to reduced social networks in addition to mobility limitations, then interventions need to consider enhancing social opportunities as well as providing transportation options. In addition, we did not have information on specific impairments that may have reduced mobility in this sample. Therefore, we could not determine if associations were due to underlying impairments or to mobility limitations. For example, poor vision could independently reduce mobility and decrease use of the internet. We also did not have information on cognitive status which could impact mobility, disability, and social engagement. Finally, we did not have information on day-to-day usage of and access to transportation options, although this study was done in an urban area with extensive transportation options that are provided free to those aged 65 years and older through state lottery proceeds.

This was the first study to assess life-space in relation to social engagement. The life-space assessment has an advantage over other measures of physical function and mobility in that it measures the actual movements of an individual over time rather than the physical ability to complete such movements. Therefore, it represents factors beyond physical impairments that may impact mobility. We show here that the LSA is a valid measure of achieved mobility in older urban residents and that it is well suited to studying mobility at various stages of the disablement process. Assessments of life-space should be considered in large health surveys of older adults to assess limitations in individuals achieved mobility.

The current analyses assessed multiple stages of the disablement process in relation to social engagement. It appears from these results that changes in social engagement may occur at various points on the pathway and can appear before disability onset. Prospective studies are needed to determine directionality of these associations in order to inform intervention strategies. Future studies could also be designed to determine whether promotion of social engagement may help prevent progression from mobility limitations to disability. Modern technologies such as the telephone and internet could provide opportunities for social

engagement to individuals with mobility impairments. Further studies are needed to determine the role that technology can play in maintaining social activities among older adults with limited mobility and whether technology-assisted engagement is comparable to face-to-face engagement. Social engagement is important in maintaining and reinforcing social ties that promote health and well-being (Berkman et al., 2000; Rowe & Kahn, 1997). Finding ways to maintain important and meaningful social engagement and social ties as functional limitations and disability occur not only is important in maintaining quality of life for older individuals but may be a means to prevent further declines in mobility and development of disability.

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Table 1

Selected characteristics of adults aged 65 years and older by mobility/disability status. Participants (n=680) were from a population-based survey of Philadelphia residents in 2010.

	High mobility, No disability	Low mobility, No disability	Low mobility, Disability	p- value
Total n (%)	318 (46.7)	216 (31.8)	146 (21.5)	
Age – mean (SD)	72.8 (6.0)	75.1 (6.8)	77.6 (7.8)	<0.001
	N (%)	N (%)	N (%)	
Female	218 (68.6)	153 (70.8)	118 (80.8)	0.02
Race				
<i>White</i>	192 (61.7)	95 (44.8)	61 (41.8)	<0.001
<i>Black</i>	102 (32.8)	106 (50.0)	74 (50.7)	
<i>Other</i>	17 (5.5)	11 (5.2)	11 (7.5)	
Lives Alone	151 (47.8)	130 (60.2)	82 (56.9)	0.01
Education				
< <i>HS</i>	33 (10.4)	56 (25.9)	39 (26.9)	<0.001
<i>HS graduate</i>	114 (36.1)	102 (47.2)	63 (43.5)	
> <i>HS</i>	169 (53.5)	58 (26.9)	43 (29.7)	
Below 200% Poverty	100 (31.5)	115 (53.2)	98 (67.1)	<0.001
Has Diabetes	70 (22.1)	55 (25.5)	61 (41.8)	<0.001
Has High Blood Pressure	205 (64.5)	133 (61.6)	111 (76.0)	0.01
Obesity Status				
<i>Normal/Underweight</i>	115 (36.4)	76 (35.4)	48 (33.3)	0.01
<i>Overweight</i>	123 (38.9)	82 (38.1)	39 (27.1)	
<i>Obese</i>	78 (24.7)	57 (26.5)	57 (39.6)	
Current Depression	25 (8.4)	38 (19.9)	33 (26.4)	<0.001
Level of Stress				
<i>Low</i>	152 (48.9)	102 (49.8)	58 (41.7)	0.08
<i>Medium</i>	120 (38.6)	68 (33.2)	50 (36.0)	
<i>High</i>	39 (12.5)	35 (17.1)	31 (22.3)	
Number of Aids Used				
0	160 (50.3)	85 (39.7)	13 (9.2)	<0.001
1	80 (25.2)	38 (17.8)	17 (12.0)	
2	41 (12.9)	36 (16.8)	24 (16.9)	
3+	37 (11.6)	55 (25.7)	88 (62.0)	
Uses In-Home Care	7 (2.2)	15 (7.0)	36 (24.7)	<0.001

Table 2

Distribution of mobility/disability status and social engagement among adults aged 65 years and older. Participants (n=680) were from a population-based survey of Philadelphia residents in 2010.

	Total	High mobility, No disability	Low mobility, No disability	Low mobility, Disability
	N (%)	N (%)	N (%)	N (%)
Total	680 (100)	318 (46.7)	216 (31.8)	146 (21.5)
Engagement Outside the Home				
Social Organizations				
<i>None</i>	335 (49.8)	133 (42.1)	115 (54.0)	87 (60.4)
<i>1</i>	190 (28.2)	93 (29.4)	64 (30.1)	33 (22.9)
<i>2+</i>	148 (22.0)	90 (28.5)	34 (15.9)	24 (16.7)
Uses Senior Center Activities	145 (21.3)	67 (21.1)	47 (21.8)	31 (21.2)
Engagement Inside the Home				
Talks to Friends/Relatives				
<i>Once/week or less</i>	66 (9.8)	18 (5.7)	34 (15.9)	14 (9.9)
<i>Few times/week</i>	165 (24.6)	75 (23.8)	60 (28.0)	30 (21.1)
<i>Once/day</i>	137 (20.4)	72 (22.9)	40 (18.7)	25 (17.6)
<i>Several times/day</i>	303 (45.2)	150 (47.6)	80 (37.4)	73 (51.4)
Uses Internet	233 (34.7)	169 (54.2)	44 (20.7)	20 (13.7)

Table 3

Adjusted associations of mobility/disability status with social engagement among adults aged 65 years and older. Participants (n=680) were from a population-based survey of Philadelphia residents in 2010.

	<u>Engagement Outside the Home</u>		<u>Engagement In the Home</u>	
	Participates in Social Org. ^a	Uses Senior Center Activities ^b	Talks to Friends or Relatives ^c	Uses Internet ^d
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
High mobility, No disability	1.0	1.0	1.0	1.0
Low mobility, No disability	0.59 (0.41, 0.85)	0.67 (0.42–1.06)	0.47 (0.32, 0.70)	0.38 (0.23–0.65)
Low mobility, Disability	0.42 (0.26, 0.67)	0.36 (0.19–0.68)	0.72 (0.44, 1.19)	0.39 (0.18–0.86)

^a adjusted for age, sex, race, living alone, education, high blood pressure, and number of aids used

^b adjusted for age, sex, race, living alone, high blood pressure, number of aids used, and use of formal in-home care

^c adjusted for age, sex, race, education, stress, use of formal in-home care, diabetes and depression

^d adjusted for age, sex, race, living alone, education, poverty, diabetes, obesity, number of aids used, formal in-home care, and depression