Published in final edited form as:
Soc Indic Res. 2007 January ; 80(2): 379–392.

The Effect of Depressive Symptoms on the Association Between Functional Status and Social Participation

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Abstract

Objectives—The aim of the current study was to examine the interactive effects of depressive symptoms and lower extremity functioning on social participation for a group of moderately to severely disabled older women.

Methods—The study used a cross-sectional community based sample, enrolled in the Women's Health and Aging Study I, randomly selected from the Centers for Medicare & Medicaid Services enrollment files for women living in the Baltimore, Maryland area. The participants were women aged 65 or older who completed the in-person interview (n = 999).

Results— After adjusting for demographics and risk factors, each unit increase in the Short Physical Performance Battery (SPPB) score was associated with a 0.31 point increase in satisfaction with social participation for the non-depressed group, and 2.04 points for the depressed group.

Discussion—Depressive symptoms and lower extremity functioning interact to affect satisfaction with social participation. Among women with high depressive symptoms the gradient of association with social participation increased sharply with better lower extremity function compared with non-depressed women, where the gradient of association was moderate. The findings suggest the potential value of programs that focus on improving lower extremity function among older high risk groups.

Introduction

One of the hallmarks of good quality of life is social participation. Defined by the International Classification of Functioning, Disability and Health (ICF), social participation is an involvement in life situations, where "involvement may mean being included or engaged in an area of life, being accepted, or having access to needed resources" (WHO, 2001). The Institute of Medicine further characterizes social participation through a person-centric approach, suggesting that only the individual can place value or importance upon his or her participation in various life situations.

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The final, definitive version of this article has been published in the Journal, *Social Indicators Research*, January 2007, Volume 80, Issue 2, pages 379-392.

The original publication is available at http://www.springerlink.com

Over the past several decades, research has documented associations between social participation and health and well-being (Glass & Maddox, 1992;House, Landis, & Umberson, 1988;Unger, McAvay, Bruce, Berkman, & Seeman, 1999). In a review of 81 studies, social participation was found to have beneficial effects on the cardiovascular, endocrine, and immune systems (Uchino, Cacioppo, & Kiecolt-Glaser, 1996). Population-based studies have also reported that social participation is associated with better physiologic profiles, including lower heart rate and systolic blood pressure (Linden, Chambers, Maurice, & Lenz, 1993;Unden, Orth-Gomer, & Elofsson, 1991), lower serum cholesterol, and lower uric acid (Thomas, Goodwin, & Goodwin, 1985). The association between social participation and morbidity and mortality is especially evident among older persons, one of the fastest growing segments of the population (House et al., 1988;Seeman, 2000). Yet researchers have limited knowledge of factors that increase (or decrease) an older person's social participation.

Identifying factors associated with social participation would be an important first step, where such information could be used to identify potential targets for intervention. Lower extremity functioning, an important component in the evaluation of the older person, may provide useful information about social participation. Measures of lower extremity functioning that include tests of walking, balance, and chair stands objectively assess the ability of the individual to perform an action or activity. Poor lower body functioning has been linked with increased risk for mortality, nursing home admission and healthcare utilization (Guralnik et al., 1994;Ostir, Markides, Black, & Goodwin, 1998;Ostir, Volpato, Fried, Chaves, & Guralnik, 2002;Penninx et al., 2000). The measure also has been associated with physiologic changes that include low hemoglobin and albumin levels, frailty, and physical inactivity (Ferrucci et al., 2000;Fried et al., 2001)}.

Research further indicates a link between lower extremity functioning and depression. Results from the Medical Outcomes study found that the physical functioning of depressed individuals was comparable with, or worse than individuals with major chronic medical conditions (Wells et al., 1989). Other cross-sectional and longitudinal studies also show increases in depressive symptoms among older persons with poor physical functioning (Covinsky, Fortinsky, Palmer, Kresevic, & Landefeld, 1997;Kempen, Sullivan, van Sonderen, & Ormel, 1999). The implication is that depression interferes with normal functioning by increasing perception of physical symptoms such as pain or fatigue, as well as producing a loss of interest or pleasure in daily activities (Penninx, Leveille, Ferrucci, van Eijk, & Guralnik, 1999). However, the depression – physical functioning link is complex and most likely reflects a bidirectional association and likely involves both biological and psychological mechanisms. For example, depression can cause a change in hormone levels of immune function and increase the risk for disease and in turn disability (Miller, Spencer, McEwen, & Stein, 1993). On the other hand, decline in physical functioning has been shown to increase the risk of depression (Ormel et al., 1993;Turner & Noh, 1988).

The purpose of this study, using data from a large cohort of community-living older women, was to provide evidence of the association among lower extremity functioning, depressive symptoms, and social participation. The specific aims were to (1) examine whether lower extremity functioning was associated with social participation; and (2) examine whether depressive symptoms modified this association. We hypothesized that better lower extremity functioning would be associated with increased satisfaction with social participation and that high depressive symptoms would reduce this conditional association.

Methods

Study Population

Data are from the Women's Health and Aging Study I (WHAS I) (Guralnik, Fried, Simonsick, Kasper, & Lafferty, 1995). The WHAS I is a community-based study of moderately to severely disabled women aged 65 or older sponsored by the Laboratory of Epidemiology, Demography, and Biometry of the National Institute on Aging and conducted by The Johns Hopkins Medical Institutions. A detailed description of the sampling methods has been published elsewhere (Kasper, Shapiro, Guralnik, Bandeen-Roche, & Fried, 1999). Subjects were drawn from an age-stratified random sample from the Centers for Medicare & Medicaid Services (CMS) enrollment file for women living in the Baltimore, Maryland area. Screening identified approximately the one-third most functionally disabled older women as defined by the following 4 domains: (1) mobility and exercise tolerance; (2) upper extremity function; (3) basic self-care tasks; and (4) higher functioning tasks. 1,002 (71%) of the 1,409 women who completed the in-person screening interview, reported difficulty in tasks in two or more of the four domains listed above and scored ≥ 18 on the Mini-Mental State Examination (MMSE) agreed to participate in the full baseline interview and examination. The present study includes women at the baseline assessment who had complete data on the primary variables of interest (n = 999).

Measures

Social Participation—The Social Participation Scale, a subscale of the Perceived Quality of Life Scale, measures an individual's satisfaction with their social participation (Patrick, Danis, Southerland, & Hong, 1988). For each item, individuals were asked to rate their level of satisfaction on a scale from 0 (extremely dissatisfied) to 10 (extremely satisfied). The three item scale included satisfaction with community or neighborhood participation (e.g., religious, political or other), satisfaction with getting outside of the house (e.g., go into town or using public transportation) and satisfaction with recreation or leisure activity. The three items showed high internal consistency (alpha = 0.73). In summing the three individual items an overall social participation variable was created for each person (range 0 – 30), where higher scores indicate higher satisfaction with social participation.

Geriatric Depression Scale—The Geriatric Depression Scale (GDS) is a measure of depressive symptomatology (Yesavage et al., 1982). The scale is reliable and valid for use in older populations, and is related minimally to somatic symptoms, making it preferable for use with chronically ill and disabled older persons. For the study's sample of normal and depressed older persons, Yesavage (1982) reported an alpha coefficient of 0.94 for the GDS. Scores have a potential range of 0–30, with higher scores indicating higher depressive symptoms. An established cut-point of >14 has been used to categorize older persons with high depressive symptoms (Norris, Gallagher, Wilson, & Winograd, 1987).

Short Physical Performance Battery—The Short Physical Performance Battery (SPPB) includes three objective tests of lower extremity function 1) a hierarchical test of standing balance; 2) a 4-meter walk; and 3) 5-repetitive chair stands. For each test a 5-level summary scale (0 – 4) was created. A zero score indicates 'unable to perform', while a 1 – 4 score represents approximate quartiles based on specific cut-points previously established (Guralnik et al., 2000;Ostir et al., 1998). Subjects in the 'unable to perform' category included: 1) those who tried but were unable; 2) the interviewer or subject felt it was unsafe; 3) the subject could not walk; or, 4) for other health reasons (e.g., too ill).

In summing the three individual categorical scores an overall SPPB score was created for each person (range 0 – 12), with higher scores indicating better lower extremity function. The SPPB has been shown to be reliable, valid and sensitive to change. Intraclass correlation coefficients ranged from 0.88 to 0.92 for measures made 1-week apart, with a 6-month average correlation coefficient of 0.78 (Ostir et al., 2002). The SPPB was used as a continuous and categorical variable based on established cut-points (0–3, 4–6, 7–9, 10–12).

Demographic, Mobility and Health Covariates—Demographic covariates included age (range 65 to 101), race (white and non-white), marital status (married and unmarried), and years of schooling (≥ high school vs. < high school). Health covariates included smoking status (current and never/former), cognitive status (MMSE score 18 – 30) (Folstein, Folstein, & McHugh, 1975), self-reported mobility and medical conditions. The self-reported mobility measure was created by asking individuals if they had difficulty (yes or no) walking ¼ mile, climbing stairs or walking across a room. When summed, the measure ranged from 0 – 3, with higher scores indicating more difficulty. Medical conditions including MI ($\underline{n}$ = 203), stroke ($\underline{n}$ = 143), diabetes ($\underline{n}$ = 187) and hip fracture ($\underline{n}$ = 75) were ascertained using standardized algorithms that utilized self-reported data, a nurse's examination, current use of medications, medical records, and a questionnaire completed by the subject's primary care physician (Guralnik et al., 1995). A summary medical conditions variable was created with a potential range of 0 – 4.

Statistical Analysis

We examined demographic, health-related and functional status variables using descriptive and univariate statistics. Statistical comparisons of baseline characteristics and social participation used χ^2 analysis. Analyses of an interaction effect by depressive symptoms and SPPB in their relation to social participation were performed using both χ^2 analysis and general linear regression, with and without adjustment for relevant risk factors. Risk factors included age, race, education, current smoking status, medical conditions, cognition, and self-reported mobility. For the general linear models, unstandardized parameter estimates were presented along with corresponding standard errors (SE), $\underline{p} < 0.05$ was considered significant. Model assumptions for the general linear regression models were tested and met. All analyses used SAS software, version 9.0 (SAS Institute, Inc. Cary, North Carolina).

Results

The mean age at baseline interview was 78.3 years (SD 8.05), 21.2% were married, 71.3% were white, and 35.5% had 12 or more years of schooling. Mean SPPB and geriatric depression scale scores were 5.9 (SD 3.3) and 8.0 (SD 5.6), respectively. The mean social participation score was 20.2 (SD 7.4; median 21.0, interquartile range = 15 – 26).

Table 1 shows associations for selected sample characteristics by social participation, categorized by approximate quartiles. Demographic characteristics (age, marital status, race, and years of schooling) were not associated with social participation. Current smokers were significantly more likely to report being dissatisfied with their social participation compared with former or non-smokers ($\underline{p}$ = .005). Number of medical conditions was associated with increased dissatisfaction ($\underline{p}$ = .0001), especially among those with 2 or more medical conditions. High depressive symptoms (GDS score > 14) was associated with increased dissatisfaction ($\underline{p}$ = .0001). A general association was observed between self-reported mobility and social participation ($\underline{p}$ = .0001), where difficulty in mobility was associated with less satisfaction with social participation.

Figure 1 shows a dose-response association between the SPPB and mean social participation scores ($p = .0001$). Women in the lowest SPPB category of 0–3 reported a mean social participation score of 17.4, whereas those who scored in the highest SPPB category (10–12) reported a mean participation score of 22.3. Similar trends were observed when the sample was stratified into three age categories including 65–74, 75–84, and ≥ 85 (data not shown).

We next tested for an interaction effect between the continuous SPPB and the continuous geriatric depression scale in their relationships with social participation ($p = .003$). Figure 2 shows the interaction between the continuous SPPB and the dichotomized geriatric depression scale (≤ 14 and > 14) on social participation. Non-depressed women reported higher mean social participation scores than depressed women across each of the 4 SPPB categories ($p = .002$), with the greatest difference found among those in the 0–3 category. Among the non-depressed, a general positive trend was observed between higher SPPB scores and greater satisfaction with social participation. Among the depressed, the trend was also positive, with a stronger gradient of association between higher SPPB scores and satisfaction with social participation.

Table 2 presents generalized regression analyses of the interaction between the continuous SPPB and the dichotomized geriatric depression scale (≤ 14 and > 14), with adjustment for demographic and health factors. In Model 1, with adjustment for age and continuous depression score, the results show for each unit increase in SPPB score the associated increase in satisfaction with social participation was 0.39 of a point for the non-depressed group (GDS ≤ 14), and 2.03 points for the depressed group (GDS > 14). In Model 2, results were similar after adjusting for age marital status, race, years of schooling, smoking status, medical conditions, cognition, self-reported mobility and continuous depression score. Each unit increase in SPPB score was associated with a 0.31 point increase in satisfaction with social participation for the non-depressed group, and 2.04 points for the depressed group.

Discussion

Our study provides evidence that lower extremity functioning, measured by an objective physical performance battery, predicts satisfaction with social participation among a group of moderately to severely disabled older women. We found a positive and significant gradient of association between lower extremity functioning and satisfaction with social participation. We also found evidence of an interaction effect between lower extremity functioning and depressive symptoms in their relationship with social participation. As expected, non-depressed women were significantly more likely to report being satisfied with their social participation than those who reported high depressive symptoms, across all categories of the SPPB measure. However, as scores on the SPPB increased among women with high depressive symptoms the gradient of association with social participation increased sharply compared with non-depressed women, where the gradient of association was more moderate. Other significant predictors of social participation included smoking status and self-reported mobility. The results suggest that current smokers or those who report some level of difficulty in the three mobility items of walking a ¼ mile, stair climbing and walking across a room were less satisfied with their social participation than non-smokers or those reporting good mobility, respectively.

Given that measures of social participation are linked to better health, the question for researchers and clinicians is how to effectively intervene to improve social participation. The current analyses have identified two potentially modifiable risk factors – depressive symptoms and lower extremity functioning. Depression, which affect up to 20% of older persons living in the community, may be an effective target for intervention as evidence suggests that it is

inversely related to physical exercise (Miser, 2000), such as walking, and may be related to an inability or a perceived inability to adapt to social or environmental demands (Ryff & Singer, 1996). Similarly, because the SPPB provides a measure of risk for progression to various outcomes in older persons this measure may be ideal in targeting at risk populations for intervention (Guralnik, Leveille, Volpato, Marx, & Cohen-Mansfield, 2003).

To our knowledge, our findings regarding the observed interaction between depressive symptoms and SPPB on satisfaction with social participation are the first such data to be reported. Past reports suggest a complex association between depressive symptoms and functional limitations, whose effect on outcomes of interest may be mutually reinforcing (Ormel et al., 1993;Penninx et al., 1998;Von Korff, Ormel, Katon, & Lin, 1992). This mutually reinforcing relationship, where depression predicts poor physical function and poor physical function predicts depression causing a downward trend in the health of the older person, appears to hold cross-sectionally and longitudinally (Covinsky et al., 1997;Penninx et al., 1998) though the specific causal ordering between the two factors is often difficult to disentangle. In a cross-cultural study, for example, disability rates were 4–5 times higher among patients with depressive disorders compared with non-depressed patients after adjustment for chronic medical conditions and other relevant risk factors (Ormel et al., 1994). Similar to these results, we also found a linkage between depressive symptoms and poor lower extremity functioning; where the most dissatisfied with their social participation were those categorized with both high depressive symptoms and poor lower extremity functioning. However, our results also show that high levels of lower extremity functioning could be achieved by women classified with high depressive symptoms, and that this group of women could correspondingly report high levels of satisfaction with social participation. Moreover, increasing satisfaction with social participation, through better functioning among depressed individuals, may in turn produce a positive change in depressive status (Heidrich & Ryff, 1993), though longitudinal data would be needed to test this hypothesis.

To date, social integration or participation has been most often assessed by network size, or number of emotional or tangible supports. Findings typically show an inverse relationship between social participation and health status, though results are mixed on specific outcomes such as cardiovascular disease or disease severity (Seeman, 1996). Our method was to examine social participation using a person-centered approach, which places emphasis on the subjective views of the individual. The increasing shift toward a person-centered model appears justified as mounting epidemiological and clinical evidence indicates good agreement between these measures and health. Also, because satisfaction with social participation characterizes the subjective views of the individual, satisfaction measures may be important supplements to traditional physiological or biological measures of health outcome. Research examining patient views has found that they are among the best predictors of use of medical services and are strong predictors of function and mortality, even after clinical factors have been controlled. Also, individual perceptions regarding social isolation have been shown to be a stronger predictor of stress and health than objective measures (Seeman, Singer, Rowe, Horwitz, & McEwen, 1997;Uchino et al., 1996).

Our analysis has some limitations. First, findings were based on cross-sectional data analysis, thus, the causal ordering of the risk factors could not be determined. Ultimately, understanding the true impact of depressive symptoms and functional limitations on social participation will require longitudinal data. Second, we had no objective way to link satisfaction with social participation to the person's actual engagement in social activities. Individuals could indicate that they were "very satisfied" with social participation, without actually having engaged in any social activity. An important area of future research will be to assess the correspondence between a person's perception of their satisfaction with social participation and actual

engagement in social related activities. However, accumulating evidence indicates that subjective measures of health and quality of life including measures of satisfaction are valid and reliable, and are responsive to important clinical changes (Cleary et al., 1991;McDowell & Newell, 1996;Ostir, Smith, Smith, & Ottenbacher, 2005). The strengths of the study include its large sample and homogenous population.

As the number and proportion of older persons living in the community increases over the coming decades, the emphasis on understanding factors linked with good social participation will also likely increase. Because both emotional and functional components are important for good social functioning, research designed to determine the efficacy of social participation intervention programs will need to jointly consider these two factors. Findings may prove beneficial to improving quality of life in older persons.

Acknowledgements

Sources of Support: This research was supported by funding from the American Heart Association, grant # 027045N, National Institutes of Health, Department of Health & Human Service, Independent Scientist Award (K02-AG019736 & K01-HD046682), and National Institute on Aging Award (R03-AG023888).

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Table 1

Demographic and health characteristics by social participation score: Women's Health and Aging Study I (n = 999).

		Social Participation Score				
Baseline Characteristics	**n**	**0 – 15 (%)**	**16 – 21 (%)**	**22 – 26 (%)**	**27 – 30 (%)**	**p-value**
Age	387	(24.8)	(26.9)	(26.6)	(21.7)	.97
65 – 74	311	(26.1)	(22.8)	(26.7)	(24.4)	
75 – 84	301	(28.9)	(22.6)	(22.9)	(25.6)	
≥ 85						
Race	712	(27.4)	(23.3)	(26.7)	(22.6)	.37
White	287	(24.0)	(26.8)	(22.7)	(26.5)	
Non-White						
Marital Status	212	(24.1)	(23.1)	(34.4)	(18.4)	.92
Married	287	(27.1)	(24.7)	(23.1)	(25.2)	
Unmarried						
Education	645	(24.1)	(24.3)	(30.8)	(21.2)	.54
< High School	354	(27.1)	(24.3)	(22.6)	(25.1)	
≥ High School						
Smoking Status	468	(28.9)	(26.5)	(24.6)	(20.1)	.005
Current	531	(24.3)	(22.4)	(26.4)	(26.9)	
Former/Non						
Medical Condition[a]	540	(22.8)	(22.8)	(28.9)	(25.6)	.0001
0	330	(25.8)	(28.5)	(22.1)	(23.6)	
1	129	(43.4)	(20.2)	(20.2)	(16.3)	
> 2						
Depressive symptoms	146	(19.8)	(25.6)	(27.4)	(27.2)	.0001
≤ 14	853	(65.1)	(17.1)	(14.4)	(3.4)	
> 14						
Mobility[b]	175	(16.6)	(17.7)	(32.6)	(33.1)	.0001
0	307	(19.5)	(20.2)	(33.9)	(26.4)	
1	311	(25.7)	(32.5)	(21.2)	(20.6)	
2	206	(46.1)	(23.8)	(13.6)	(16.5)	
3						

[a] Medical conditions included: MI, stroke, diabetes and hip fracture

[b] Mobility tasks included: walking a ¼ mile, climbing stairs and walking across a room

Table 2

General Linear Models assessing the interaction between a short physical performance battery and depressive symptoms on social participation (n = 999).

	Social Participation					
	b	Model 1[b] (SE)	p	b	Model 2[b] (SE)	p
SPPB (0 – 12) [a]						
GDS ≤ 14	0.39	.07		0.31	.08	
GDS > 14	2.03	.54		2.04	.56	
Age (65 – 101)	0.08	.03	.003	0.04	.03	.15
White (vs. nonwhite)				0.15	.48	.76
High school (< High school)				−0.25	.43	.56
Married (vs. Unmarried)				0.63	.51	.21
Current smoker (vs. non or former smoker)				−1.07	.40	.008
Medical conditions (0 – 4)				−0.29	.27	.29
Cognition (18 – 30)				0.08	.07	.27
Mobility (0 – 3)				−0.56	.24	.02
GDS (continuous)	−0.68	.06	.0001	−0.34	.29	.25

[a] The interaction between the Short Physical Performance Battery (SPPB) and the Geriatric Depression Scale (GDS) was significant for Model 1 (p = .005) and Model 2 (p = .008).

[b] Note: The analysis for both GLM models shown above included the main effects for SPPB and GDS and their interaction term. Because the interaction term was significant this indicates that the association between SPPB and social participation depends on level of GDS (≤ 14 and > 14).