



## Research Paper

## Changes in perceived social support predict changes in depressive symptoms in adults with physical disability



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## ABSTRACT

**Background:** Perceived social support has been found to be associated with depression, subjective well-being and psychological health in cross-sectional studies in people with physical disabilities. No longitudinal studies have been conducted to examine these associations over time using a comprehensive measure of social support.

**Objective/hypothesis:** We hypothesized that: (1) the amount of perceived social support would be similar across individuals with different diagnoses often associated with disability (i.e., multiple sclerosis [MS], spinal cord injury [SCI], muscular dystrophy [MD]) but (2) lower among men, relative to women, and (3) changes over time in perceived social support would be negatively associated with changes in depressive symptoms across diagnostic groups.

**Methods:** A survey-based six-year longitudinal study. Depressive symptoms were measured with the PROMIS Depression scale. General (Total Scale), Friend, Family and Significant Other social support were measured with the Multi-dimensional Scale of Perceived Social Support (MSPSS).

**Results:** The findings indicated no significant differences in any of the perceived social support scales as a function of diagnosis or sex. However, over the course of six years, those reporting increases in social support reported decreases in depressive symptoms, while those reporting decreases in social support reported increases in depressive symptoms.

**Conclusions:** Changes in perceived social support are inversely related with the changes in depressive symptoms in adults with MS, SCI, and MD. Social support would be a reasonable treatment target in interventions seeking to improve psychological wellbeing in individuals with conditions that are often associated with disabilities.

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Findings from cross-sectional studies show that perceived social support is associated with depression and subjective well-being in people with physical disabilities.<sup>1,2</sup> A recent systematic review, found that the strongest associations take place specifically between social support and depression.<sup>3</sup> Focus groups with people aging with a physical disability have also highlighted the importance of maintaining social connectedness for successful aging.<sup>4</sup> Together, these findings suggest that social support may be important for maintaining good mental health in people living with

long-term, physical impairments and associated disability. However, relatively few studies have examined social support using longitudinal designs in this area. This limits the conclusions with respect to the possible causal impact of social support on mental health outcomes.

Among the few longitudinal investigations, to the best of our knowledge none have included comprehensive measures that assess the multiple domains of social support. Further, few studies have evaluated the role of social support in individuals with diagnoses often associated with physical disability, such as MS, SCI and MD. One of the few longitudinal studies in this area explored the role of perceived friend support (only) on the prediction of depression in older individuals with visual impairments.<sup>5</sup> While

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these investigators found that perceived support from friends was a significant factor in predicting change in depressive symptoms over time, the role of the support from family members or significant others was not examined.

Research also suggests that certain demographic variables, such as being male or being older, may be associated with lower levels of perceived social support.<sup>1</sup> However, with the exception of one study,<sup>1</sup> this preliminary finding has not yet been replicated in individuals with disability associated with long-term medical conditions.

The aim of the present study was therefore to replicate and extend, using a longitudinal design, earlier findings regarding the associations between social support and depressive symptoms in adults with one of three long-term medical diagnoses often associated with disability.<sup>1</sup> Based on the findings from previous research, we hypothesized that: (1) the amount of perceived social support would be similar across individuals with different diagnoses (i.e., MS, SCI, MD) but (2) lower among men, relative to women. Finally, we hypothesized that (3) changes over time in perceived social support would be negatively associated with changes in depressive symptoms across diagnostic groups.

## Methods

### Procedures

The data for the current analyses came from an ongoing longitudinal survey study of individuals aging with a physical disability.<sup>1</sup> Although some of the data from this survey have been presented in previous publications, none of those addressed the questions that are the focus of the current analyses. Participants with SCI and MS were primarily recruited from a database of individuals who had participated in previous survey studies and had agreed to be contacted again for research participation. This database is maintained by the University of Washington. Participants with MD were primarily recruited by sending invitation letters to individuals with a confirmed MD diagnosis via the University of Rochester Muscular Dystrophy Research Registry.

Study inclusion criteria were: (1) being able to read and write English, (2) being at least 18 years old, and (3) having a self-reported diagnosis of “physician confirmed” MS, SCI, and MD. A survey, consent form and return envelope were sent to participants who were eligible and expressed an interest in participating. Reminder letters were sent to potential participants who did not return the survey within one month. If after six weeks the packet was not received, a reminder call was made. Once the surveys were received, research staff confirmed that the signed consent form was included in the package and reviewed it for missing data. Missing data were collected over the phone and all participants were sent \$25 for their time and effort. All recruitment and data collection procedures were approved by the University of Washington Human Subjects institutional review board.

Since July 2009, participants in the longitudinal study have completed surveys approximately every 12–15 months; the surveys are labelled in the order they are administered (T1, T2, etc.). The data used in this study were collected during the first administration (T1; July 2009–March 2010) and during the sixth administration (T6; October 2015–June 2016), which were spaced six years and 3 months apart. However, for clarity in the present analysis, we will refer to the first survey as T1 and the second survey (administered six years later) as T2.

During the first time point (T1), a total of 1562 surveys were mailed to participants, of which 1431 were returned, and from which 15 were excluded because: a signed consent form was not included with the survey ( $n = 7$ ), the participant did not have a

disability that met inclusion criteria ( $n = 3$ ), the survey was returned too late ( $n = 2$ ), the participant declined to participate ( $n = 2$ ), or the survey was a duplicate ( $n = 1$ ). The measures included in this analysis were randomly administered to approximately half of this sample at T1 ( $n = 703$ ), and a total of 475 of these participants completed the same measures at T2, resulting in a final sample size of 475 for these analyses.

### Measures

#### Demographic variables

Information about age, sex, ethnicity (i.e., African–American, Asian, Caucasian, Hispanic, Native American, Pacific Islander, Other), diagnosis, household income (i.e., less than \$25,000, \$25,000 - \$40,000, \$41,000 - \$55,000, \$56,000 - \$70,000, \$71,000 - \$85,000, \$86,000 - \$100,000, greater than \$100,000), marital status (i.e., Married, Living with significant other, Separated, Never married, Divorced, Widowed) and education (i.e., 9th grade or less, Grades 10–11, High school graduate or GED, Vocational or technical school, Some college, College graduate, Graduate school or professional school) was obtained using a demographics questionnaire with multiple response option questions.

#### Depressive symptoms

The severity of depressive symptoms was assessed using the Patient-Reported Outcomes Measurement Information System (PROMIS<sup>®</sup>) 8-item Depression short form at T1, and the PROMIS<sup>®</sup> Profile 29 short form at T2. These two measures are directly comparable - all PROMIS measures are scored on a T-score metric ( $M = 50$ ,  $SD = 10$ ), which allows for comparison to national norms and for standardization across different versions of the same measure. T-scores were used as outcomes for the analyses. The PROMIS scales have been successfully used in individuals with chronic medical conditions.<sup>6–8</sup> The reliability of the scale for this sample was high (Cronbach's Alphas = 0.95 for T1 and 0.93 for T2).

#### Social support

The Multi-dimensional Scale of Perceived Social Support (MSPSS)<sup>9</sup> was used to measure social support. The scale provides a global score of perceived social support and three subscale scores: significant other, family member and friend support. It has shown to have good psychometric properties.<sup>10</sup> The reliability of the total scale and subscales scores of the MSPSS for this sample were high (Cronbach's Alphas ranged 0.94 to 0.95 for all scale scores). Change in perceived social support over time was calculated by subtracting the scales scores at T1 from the scale scores at T2; thus, a positive change score indicates an increase in perceived social support and a negative score indicates a decrease in perceived social support.

#### Data analysis plan

We first computed means and standard deviations (continuous variables) and frequencies and percentages (categorical variables) to describe the sample. We then performed a series of four two-way ANCOVAs (one for each social support scale score) to test for the possible differences in social support at the T2 time point as a function of diagnosis (hypothesis 1) and sex (hypothesis 2) using income and age as covariates. In addition, to test hypothesis 1 (i.e., that the three diagnostic groups are equivalent on their perceived social support at T2) we performed a series of 12 two one-sided tests (TOST)<sup>11</sup> comparing the groups in pairs in the total MSPSS scales and the three subscales (i.e., MS vs MD, MS vs SCI and MD vs SCI per each of the four scales). In this test, a lower and upper bound are established. As the MSPSS scale does not have a minimally

clinically relevant difference established, we chose a 0.4 (Cohen *d*) effect size as the boundaries, which is the smallest effect we could detect with the sample size of the smallest group ( $N = 107$ ) with a power of 0.9. We first computed Levene's statistic for the homogeneity of variances and determined that they were all equal. In the TOST analysis, the null hypothesis is that the two groups are different, so a significant result ( $P < 0.05$ ) would indicate that the observed effects fall inside the equivalence bounds and that therefore the groups can be considered equivalent.

We planned to perform a regression analysis to test hypothesis 3 (i.e., that T1 to T2 changes in perceived social support would be associated with T1 to T2 changes in depressive symptomatology), if the study variables met the assumptions for regression analyses. Prior to performing the regression analysis, we tested the assumptions of the model by examining the skewness and kurtosis of the distributions of the continuous predictor variables and the criterion variable, and planned to compute the Durbin-Watson statistic, tolerance and the variance inflation factors (VIF)<sup>12</sup> to test for multicollinearity among the predictors. We found marked kurtosis in the social support change scores (between 3.5 and 3.8), with a large majority of the sample showing little change in perceived social support over time (e.g., 78% of the sample reported changes that were within  $\pm 1$  SD of the T1 total MSPSS score). Although these data did not meet the criterion (of normality), skewness was adequate; below 0.5 for all variables, tolerance and VIF were around 1 in all the regressions (they indicate a collinearity issue if they are lower than 0.1 and higher than 10, respectively), and the Durbin-Watson statistics were around 2 (being considered problematic if it is below 1 or above 3), so even if the data was not normally distributed, these statistics indicate that multicollinearity would not be a problem. Additionally, we selected participants who evidenced marked change in perceived social support (i.e., they either increased or decreased by 1 SD unit or more from T1 to T2 in the Total Scale [ $n = 105$ ]) with a goal of using this subsample to test the univariate association between change in perceived social support (as a dichotomous variable, i.e., substantial increase versus substantial decrease) and change in depressive symptomatology using a series of four independent sample *t*-tests, one for each social support subscale and the total scale. Cohen's *ds* were calculated for each *t*-test, being classified as small (0.20), medium (0.50) or large (0.80). Again, before performing the *t*-tests with the subsamples, we evaluated the skewness and kurtosis of the dependent variable (change in depressive symptomatology) in the subsamples, in order to ensure that it met the assumptions<sup>12</sup> for the planned analyses; the variables met these criteria. All the analyses were conducted using SPSS version 21 for Windows. The TOST was conducted using an Excel Macro.<sup>11</sup>

## Results

### Sample composition

Four hundred and seventy-five individuals (42% MS; 35% SCI; and 23% MD) provided data for both T1 and T2 assessments. The mean age of the study participants was 51.8 years ( $SD = 11.2$  years) at baseline and 62% were women. The sample was highly educated (81% had at least some college education), two thirds (66%) were married, and most participants reported their race as White (93%). No significant differences at baseline were found between the sample that provided T1 data only and the sample that provided both T1 and T2 data on any demographic variable. See [Tables 1 and 2](#) for additional information. A correlation matrix between the study variables is also presented for descriptive purposes. See [Table 3](#).

### Social support across diagnoses and sex

As expected, the ANCOVA findings using data from all of the study participants indicated no significant differences in any of the perceived social support scales as a function of diagnosis (hypothesis 1). Additionally, all the TOSTs were significant (Cohen's *ds* ranging from  $-0.1$  to  $0.1$ ,  $P_s < 0.03$ ), indicating that all of the diagnosis groups are equivalent with respect to the social support scales. However, inconsistent with study hypothesis 2, no significant differences were found in perceived social support measured at T2 between men and women. The ANCOVA results of social support at T2 as a function of diagnosis and sex when controlling for income, and age, are presented in [Table 4](#).

### Changes in depressive symptomatology as a function of changes in perceived social support

The results of the linear regression predicting change in depressive symptoms from T1 to T2 are presented in [Table 5](#). The Total MSPSS scale score explained 7% of the variance of the change on depressive symptoms ( $\beta = -0.26$ ,  $p < 0.001$ ), the Significant Other subscale explained 6% ( $\beta = -0.24$ ,  $p < 0.001$ ), the Family Member subscale explained 4% ( $\beta = -0.21$ ,  $p < 0.001$ ) and the Friend subscale explained 4% of the variance ( $\beta = -0.20$ ,  $p < 0.001$ ).

The means and standard deviations of change in depressive symptoms from T1 to T2 for the groups reporting large increases and large decreases in social support (controlling for marital status) are presented in [Table 6](#). The *t*-tests show that there were significant differences in change in depressive symptoms for these two groups. In every case, those who reported increases in social support reported decreases in depressive symptoms while those who reported decreases in social support reported increases in depressive symptoms. The between-group effect sizes were large.

## Discussion

These findings replicate earlier results from cross-sectional designs, which described important associations between social support and depression in individuals with disability. Specifically, we found that perceived social support assessed at one point in time was similar across different diagnoses. However, inconsistent with previous research, we did not find significant differences between men and women in their perceived social support at the second assessment point. The most important new finding was that changes in perceived social support over the course of six years were inversely associated with changes in depressive symptoms and that these changes explained a statistically significant percentage of the variance of depressive symptoms. These findings have a number of important implications for understanding the role of social support on the psychological wellbeing of people living with long-term, physical disabilities.

The finding that perceived social support did not differ as function of medical diagnosis is consistent with data from other studies,<sup>1</sup> and provides additional support for the idea that perceived social support may not be influenced by one's medical condition, or even overall disability level. That is, perceived social support may be similarly important (and potentially available) to all individuals. To the extent that social support plays an important role in psychological function, and the findings from the current study indicate that it does, the factors that influence the amount of social support extend beyond one's medical or health status.

The lack of differences in perceived social support between men and women was not expected, especially given that this same sample reported differences six years earlier. It is possible that this represents a function of aging, such that with increasing age, sex-

**Table 1**  
Description of the study participants that participated at Time 1 (T1) only (N = 703) and at both T1 and Time 2 (T2; N = 475).

Variable	T1 Sample		T1 + T2 Sample		Differences T-test or Chi-Square (df)
	Percent or Mean (SD)	N	Percent or Mean (SD)	N	
Age, years	52.4 (12.2)	703	51.8 (11.2)	475	1.42 (1176) NS
Sex					1.28 (1) NS
Men	41%	291	38%	181	
Women	59%	412	62%	294	
Diagnosis					0.80 (2) NS
Multiple sclerosis	41%	286	42%	201	
Spinal cord injury	35%	243	35%	167	
Muscular dystrophy	25%	174	23%	107	
Highest level of education					1.45 (1) NS
Primary school	3%	18	2%	9	
High or tech school	19%	134	17%	80	
Some college	26%	184	25%	117	
College graduate	30%	212	33%	156	
Some grad. school	22%	155	24%	113	
Ethnicity+^					0.59 (1) NS
Black/African American	3%	23	3%	15	
Asian	1%	4	0%	2	
White/Caucasian	93%	647	93%	441	
Hispanic/Chicano	1%	8	1%	6	
Native Am./Alaska Native	0%	3	1%	3	
Pacific Islander	0%	1	0%	1	
Other	2%	13	1%	1	
Annual household income+^					2.15 (1) NS
<\$25,000	24%	160	22%	100	
\$25,000-\$55,000	29%	196	28%	122	
\$56,000-\$85,000	20%	144	21%	97	
>\$86,000	27%	180	30%	137	
Marital status					0.24 (1) NS
Married/Living with SO	64%	452	66%	312	
Separated/Divorced	19%	132	19%	90	
Never married	13%	92	13%	61	
Widowed	4%	26	3%	12	
PROMIS depression	52.86 (9.08) 703	52.02 (8.95) 475	51.54 (11.76) NS		
MSPSS Scale					
Total Social Support	5.43 (1.33)	700	5.44 (1.32) 472	-0.18 (1170) NS	
Significant Othe	5.71 (1.61) 700	5.72 (1.61)	472	-0.13 (1170) NS	
Family Member		5.46 (1.60)	700	5.45 (1.59) 472	-0.08 (1170) NS
Friend		5.12 (1.55) 700	5.15 (1.53) 472	-0.41 (1170) NS	

+ T1 Sample: Ethnicity information was missing for 4 participants; marital status was missing for 1 participant household income was missing for 33 participants.

^ T1 + T2 Sample: Ethnicity information was missing for 2 participants; household income was missing for 19 participants.

NS= Non-Significant (P > 0.05).

Note: To compare groups on categorical variables, education level (some college or more education versus high school or less education), ethnicity (white versus non-white or other), income (\$55,000 annual income or less versus \$56,000 annual income or more), and marital status (married/living with SO versus not married or living with SO) were collapsed.

**Table 2**  
Means and SDs of PROMIS Depression and MSPSS at T1 by sex and diagnostic group (N = 475).

Group	Total Social Support	Significant Other Support	Family Support	Friend Support	Depression
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Sex					
Male	5.42 (1.28)	5.71 (1.57)	5.56 (1.50)	5.00 (1.58)	52.49 (8.64)
Female	5.45 (1.34)	5.72 (1.63)	5.38 (1.64)	5.25 (1.48)	51.75 (9.14)
Diagnosis					
MD	5.49 (1.19)	5.84 (1.41)	5.50 (1.48)	5.11 (1.52)	51.52 (8.12)
MS	5.47 (1.37)	5.76 (1.59)	5.41 (1.63)	5.23 (1.53)	51.05 (9.19)
SCI	5.38 (1.34)	5.59 (1.75)	5.47 (1.61)	5.09 (1.53)	53.54 (9.03)

based differences in perceived social support begin to lessen. For example, there is evidence that as women age, they tend to report having smaller networks and less frequent contact with them.<sup>13</sup> As discussed more later, to the extent that social support plays an important role in psychological health, and to the extent that social network size decreases as people age (perhaps in particular for women), it may be important to help individuals develop ways to maintain social support over time.

The most important and new finding from this study was that

those who lost social support over the study time period reported higher levels of depression than those who gained social support. This difference was substantial – nearly a full standard deviation on our depression outcome measure (the PROMIS Depression Scale). Although clinically meaningful difference values have not yet been established for the PROMIS Depression scales in individuals with MS, SCI, or MD,<sup>14</sup> for other samples living with a chronic condition (e.g., cancer patients) a difference of 3.0–4.5 points is considered meaningful.<sup>15</sup> The difference found here was nearly twice this,

**Table 3**  
Pearson correlation coefficients between study variables.

Variable	Age	Total Social Support	Significant Other	Family Member	Friend
Age	1.00	0.00	0.01	−0.06	0.06
Total Social Support	0.00	1.00	0.85*	0.84*	0.82*
Significant Other Support	0.01	0.85*	1.00	0.58*	0.55*
Family Member Support	−0.06	0.84*	0.58*	1.00	0.53*
Friend Support	0.06	0.82*	0.55*	0.53*	1.00
Depression	−0.03	−0.35*	−0.24*	−0.30*	−0.36*

\*P < 0.01.

**Table 4**  
ANCOVA results predicting perceived social support at T2, controlling for annual income and age (N = 475).

MSPSS Scale	Group F	p-value
Total Social Support		
Sex	0.35	0.556
Diagnosis group	0.46	0.632
Significant Other Support		
Sex	0.00	0.998
Diagnosis group	0.13	0.875
Family Member Support		
Sex	0.04	0.848
Diagnosis group	0.19	0.827
Friend Support		
Sex	1.56	0.212
Diagnosis group	1.68	0.188

MSPSS = Multidimensional Scale of Perceived Social Support.

indicating that changes in perceived social support plays a potentially very important role in the amount of depressive symptoms experienced in our sample.

However, to provide context to these findings about changing social support, it is also important to recognize that stability in social support over time was the normative pattern. Most participants (78%) did not report substantial changes in social support over the six-year period of this study. For those with adequate social support, this stability is encouraging – for those without support, it is problematic. This stability suggests that increases in

social support may not happen naturally, and that for this population, some intervention or strategy for increasing and maintaining social support may be required.

An important next step may be to examine the role that interventions designed to improve or maintain social support have in the lives of individuals with conditions such as MS, SCI, MD, and identifying the most important elements in achieving the desired success. Research looking specifically into those diagnoses is scarce. However, a recent integrative review focusing on interventions to reduce social isolation and loneliness in older people which reported on the findings from 39 studies, showed that the common elements of successful interventions seem to be: adapting to the specific needs of the target population, involving users in the design of the intervention and implementing and actively engaging in activities.<sup>16</sup> Another recent systematic review examined the effectiveness of 22 online interventions on reducing social isolation in older people.<sup>17</sup> This work concluded that the evidence about the effectiveness of on-line interventions is still weak but positive in improving communication and decreasing loneliness. Using online resources can be a cost-effective and efficient way to improve access to social support treatments for adults with the rehabilitation diagnoses studied here, especially given the transportation barriers common to this population. The effects of these interventions in disabled populations remain to be tested.

The present study has a number of limitations that should be considered when interpreting the findings. First, most of the participants were Caucasian/White and reported a high level of

**Table 5**  
Linear regression predicting changes in depressive symptoms as a function of changes in perceived social support.

Variables	R <sup>2</sup>	Δ R <sup>2</sup>	F	F <sub>change</sub>	F <sub>change</sub> P-Value	β	β P-Value	CI 95%
Total Social Support	0.07	0.07	35.22	35.22	<0.001*	−0.26	<0.001*	(−2.49 to −1.25)
Significant Other	0.06	0.06	27.95	27.95	<0.001*	−0.24	<0.001*	(−1.81 to −0.83)
Family Member	0.04	0.04	20.64	20.64	<0.001*	−0.21	<0.001*	(−1.72 to −0.68)
Friend	0.04	0.04	20.02	20.02	<0.001*	−0.20	<0.001*	(−1.71 to −0.67)

\*p < 0.001.

**Table 6**  
Associations between change in perceived social support and change in depressive symptoms (N = 105).

MSPSS Scale	Mean change in depression (SD)	T-score	P	Cohen's d
Total Social Support		4.435	<0.001	0.87
Loss	3.43 (8.64)			
Gain	−4.70 (9.70)			
Significant Other		4.884	<0.001	0.94
Loss	3.69 (8.92)			
Gain	−4.62 (8.89)			
Family Member		3.662	<0.001	0.75
Loss	1.58 (8.60)			
Gain	−5.3 (9.76)			
Friend		3.356	<0.001	0.58
Loss	2.49 (8.11)			
Gain	−2.6 (8.78)			

MSPSS = Multi-dimensional Scale of Perceived Social Support.



education; it is not known if these findings would generalize to people of other racial backgrounds or with less formal education. Second, unfortunately, we did not assess the number of household members or household composition, which meant that we were unable to calculate net-equivalent household income. This methodological limitation can be addressed in further surveys. Finally, as mentioned previously, we found little change in perceived social support for a substantial proportion of the sample. Although this finding is important in and of itself, perhaps more variability in change in social support would emerge over a longer period of time (i.e., decades instead of years).

With the current trends of increasing life expectancy in individuals with MS,<sup>18</sup> SCI,<sup>19</sup> and MD,<sup>20</sup> research to understand the factors that contribute to positive function as people age is very important. A study testing the role of social support in cognitive-behavioral therapy for patients with mental health problems (posttraumatic stress disorder)<sup>21</sup> found that Significant Other's support positively mediated the effects of the treatment. Therefore, improving social support may also enhance the effects of other approaches used to improve psychological wellbeing. In this study, we found that changes in social support over time are linked to depressive symptoms, identifying social support as a potentially modifiable factor that could influence psychological function over time. While this finding is consistent with cross-sectional studies that have shown concurrent associations between social support and depression in older people living with a physical disability,<sup>22</sup> the replication of this finding in the context of a longitudinal study provides stronger support for this association. An important next step is to develop and evaluate the beneficial effects of interventions which could improve or maintain social networks and support in individuals with MS, SCI and MD.

## Conclusions

The primary conclusions of this longitudinal study are that (1) substantial changes in perceived social support over a six-year period is relatively rare but (2) when changes occur, they are inversely related with changes in depressive symptoms in a sample of adults living with MS, SCI, and MD. Social support may be a viable treatment target for ensuring psychological wellbeing in these populations.

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