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Gender differences in the impact of perceived social support on the relation between disability and depressive symptoms

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Gender Differences in the Impact of Perceived Social Support on the Relation Between
Disability and Depressive Symptoms

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Thesis submitted to the Eberly College of Arts and Sciences
at the West Virginia University
in Partial Fulfillment of the Requirements for the degree of

Master of Science
In
Psychology

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Abstract

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Merideth Smith

Older adults with functional disabilities are at an increased risk for experiencing depressive symptoms. Studies using cross-sectional analyses have reported that social support mediates the relation between depressive symptoms and functional disability in older adults. Nonetheless, few studies have investigated this model over time. Additionally, the role of gender in this mediation relation has not been explored. This study used latent growth curve modeling to investigate the potential mediating role of perceived social support within the relationship between disability and depression and whether gender moderates that relation. Twins ($n = 656$) and co-twins ($n = 678$) from the Swedish Adoption/Twin Study of Aging were analyzed separately to cross-validate the results through a nonindependent replication. Four waves of mailed questionnaires were examined, spanning sixteen years. The overall analysis yielded a poor model fit. Mediation and moderation analyses could not be performed due to inadequate model fit. Poor model fit was also evident in sample two. Post-hoc analyses in sample two, in which observations from the last time of measurement were excluded, suggest that perceived social support may have a direct effect on depressive symptoms rather than playing a mediating role, but replication of these results is needed.

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Gender Differences in the Impact of Perceived Social Support on the Relation Between Disability and Depression.

Individuals who experience limitations in their ability to perform everyday activities and tasks, that is, individuals with disability, are at an increased risk for experiencing depressive symptoms (Bruce, 1999). In turn, the presence of depressive symptoms can result in steeper declines in disability and can have a detrimental impact on overall health and quality of life (Beekman, Deeg, Braam, Smit, & Van Tilburg, 1997; Oldehinkel, Van den Berg, Bouhuys, & Ormel, 2003). Older adults are vulnerable to both increasing levels of disability and elevated levels of depressive symptoms (Djernes, 2006).

Social support is a potential intervening factor within the experience of disability that could ameliorate the negative impact of disability and the presence of depressive symptoms (Cohen & Wills, 1985). Perceived social support, or a person's perception of the availability and quality of support, is an important component in understanding the increased levels of depressive symptoms in older adults with disability (Taylor & Lynch, 2004).

Gender is another potential intervening factor in understanding the interactions between disability, social support, and depression. It is unclear whether perceived social support influences depressive symptoms differently for men and for women with disability (Hann *et al.*, 2002; Penning & Strain, 1994). Insight into the experiences of men and women in later life with disability and a better understanding of the role social support plays in the development of depression in the context of disability can help lead to the development of more effective interventions.

Disability

Verbrugge and Jette (1994) and the World Health Organization's International Classification of Functioning, Disability, and Health (ICF) define disability as a decreased ability to engage in the basic activities of daily living (ADLs) due to a health condition (Bornman, 2004; Verbrugge & Jette, 1994). A health condition such as stroke, diabetes, injury, or muscle loss results in impairment in the body's physiological systems or structures. Impairments include difficulties in the body's ability to produce insulin and a loss of muscle strength in the body's extremities. These physical impairments can interact with the individual's environment and personal characteristics resulting in disability. For example, impairments like loss of grip strength can lead to a loss of mobility or ability to perform fine motor movements (Femia, Zarit, & Johansson, 2001; LeBrasseur, Sayers, Ouellette, & Fielding, 2006). According to Verbrugge et. al (1994) and the World Health Organization, disability is the result of impairments, such as loss of grip strength, interrupting the individual's ability to perform activities like cooking or using the toilet. The ability to eat, dress oneself, or use the toilet are examples of basic activities of personal care and living also known as physical activities of daily living (PADLs). The ability to cook, manage finances, shop, and negotiate transportation are examples of activities needed to maintain independence in the community, or instrumental activities of daily living (IADLs) (Katz, 1983).

The disability process can have significant influence on a person's living arrangements, health, and mental well-being (Lenze *et al.*, 2001). Approximately 87% of individuals with a disability have a secondary condition that results in increased distress and possible further disability (Kinne, Patrick, & Doyle, 2004; Nosek *et al.*, 2006).

These secondary conditions include chronic pain, fatigue, vulnerability to falling, sleep problems, and memory problems. Individuals reporting disability symptoms also report lower levels of quality of life, life satisfaction, and well-being (Penning & Strain, 1994; Verbrugge & Jette, 1994). Disability has been linked to higher levels of depressive symptoms (Bruce, 1999).

Depressive Symptoms

Older adults are particularly vulnerable to depressive symptoms. Djernes (2006) reviewed the literature on the prevalence of depression in older adults published between 1993 to 2004 and reported that diagnosed depression rates in older adults ranged from 1-4% in the community, whereas reports of depressive symptoms ranged from 7.2 to 15% (Djernes, 2006). Rates are especially high in the oldest old. In adults who are 84 years and older, the prevalence rates of clinically significant depressive symptoms ranged from 43% to 56% , as measured by scores of nine or higher on an eleven item Center For Epidemiology Studies-Depression measure (Zarit, Femia, Gatz, & Johansson, 1999) (Radloff, 1977).

Beekman, Geerlings, Deeg, Smit, Schoevers, de Beurs, Braam, Penninx, and Van Tilburg (2002) investigated the prevalence and course of three categories of depressive disorders, major depressive disorder, dysthymic disorder, and sub-threshold depression in older adults with symptoms of depression. Major depressive disorder (MDD) is a diagnosis of significantly impairing depressive symptoms, including either a loss of pleasure or sadness, for a period of two or more weeks. This study used the CES-D and Diagnostic Interview Schedule to identify cases of MDD. Dysthymic disorder is characterized by the presence of fewer depressive symptoms compared to the number of

depressive symptoms experienced during MDD, that have persisted over a period of two or more years. Sub-threshold depression was characterized by significantly impairing depressive symptoms, as measured by CES-D scores of 16 or greater, but not meeting criteria for a mood disorder using the Diagnostic Interview Schedule. In this six-year study of community dwelling older adults experiencing depressive symptoms in Amsterdam, 8% of the older adults at baseline met criteria for a major depressive disorder diagnosis (Beekman *et al.*, 2002). At baseline, 9% of the older adults met criteria for a diagnosis of dysthymia. Thirty-five percent of the individuals meeting criteria for MDD, experienced chronic depressive symptoms, whereas 52% of individuals who met criteria for dysthymia experienced chronic depressive symptoms over the six-year period. Within the sample of individuals identified as experiencing depressive symptoms, 75% of the older adults reported sub-threshold depression and 25% of those individuals experienced chronic symptoms of depression. Additionally, 27% of individuals reporting sub-threshold depression at baseline met criteria for a depression diagnosis sometime during the six-year period. As these statistics show, the experience of clinically significant depressive symptoms for older adults can be a chronic stressor for a significant portion of this population and increases the risk for developing a diagnosis of depression. Due to the significant portion of the older adult population with elevated depressive symptoms and the chronic nature of these symptoms, it is important to understand the potential risk factors and influences that contribute to these symptoms, such as declining health and disability.

Depressive Symptoms and Disability

The connection between poor physical health, disability and depression has received widespread attention in the fields of geropsychology and health psychology (Lenze et al., 2001). Older adults who experience limitations in ADLs are at a significantly increased risk for experiencing clinically significant depressive symptoms (Djernes, 2006). Of 614 older adults hospitalized due to medical illness, 34% reported experiencing mild depressive symptoms over a period of 12 months (de Jonge *et al.*, 2006). The level of disability is a stronger predictor of increased depressive symptoms than the original illness for adults over the age of 50 (Zeiss, Lewinsohn, Rohde, & Seeley, 1996). In older adults with disabilities, 32% exhibited clinically significant depressive symptoms at baseline and 34% of these adults exhibited clinically significant depressive symptoms three years later (Turner & Noh, 1988). In a one-year longitudinal study, Yang and George (2005) assessed changes in disability of older adults 65 years or older and the effect of these changes on depressive symptoms. Individuals who reported onset of disability at the one year follow up also reported higher levels of depressive symptoms at follow-up. Those who reported more severe symptoms of disability reported the greatest increase in depressive symptoms at follow-up. Thus, the presence and onset of disability is associated with present symptoms of depression as well as future changes in depressive symptoms.

Intervening Factors

The investigation of the pathway from disability to depression would be incomplete without an examination of possible intervening factors. The pathway between disability and depressive symptoms can involve interactions with environmental,

social, and personal characteristics, which can result in different trajectories of disability and depressive symptoms (Femia et al., 2001; Verbrugge & Jette, 1994). Disability status might be influenced by factors within the individual's environment, such as access to medical and rehabilitation care, friends, care-givers and poverty, or disability status might be influenced by individual level factors, such as gender or a history of depressive symptoms (Verbrugge & Jette, 1994). These environmental and individual level factors have potential to be effective target areas for intervention to prevent the onset or increase in disability and subsequent depressive symptoms. In particular, social support has been found to play a substantial role in influencing the pathway from disability to depressive symptoms (Chwalisz, Vaux, Frank, & Elliott, 2000).

Social Support

Social support is a construct comprised of many facets that could have different influences on the relation between disability and depression in older adults (Vaux, 1988a). One facet is the structural component of social support. This includes characteristics such as size of network (i.e. the number of individuals), the physical proximity to the members of the network, and the frequency of contact with network members (Berkman, Glass, Brissette, & Seeman, 2000). The structural components of social support can have a positive impact on the presence of depressive symptoms. In adult women with cancer, larger social networks were associated with fewer depressive symptoms (Hann et al., 2002).

Another important facet of social support is the specific function that the received support serves (Oxman & Berkman, 1990). Functions can include emotional, instrumental, or informational (Cohen, 1988; Oxman & Berkman, 1990). For patients

recovering from a stroke, emotional support was significantly correlated with increased functioning at a six-month follow up whereas instrumental support was found to be associated with increased functioning when provided in moderate amounts (Glass & Maddox, 1992). Nonetheless, other studies have found that the amount or type of support received is not related to decreases in depressive symptoms (Taylor & Lynch, 2004; Yang, 2006).

Perceived social support is the third component; it is the appraisal of the availability and adequacy of support (Oxman & Berkman, 1990). Perceived social support takes into account whether the support the individual receives meets the needs created by the functional limitations and whether that support is available when needed (Cohen & Wills, 1985). In adult patients with cardiac disease, perceived social support was significantly associated with depressive symptoms at baseline and one month later (Barefoot *et al.*, 2000). In studies comparing received support and perceived social support, the perception of support quality was a significant influence on the pathway between disability and depressive symptoms, whereas received support did not significantly influence the disability and depressive symptom pathway (Jang, Haley, Small, & Mortimer, 2002; Taylor & Lynch, 2004). The perception of the quality and availability of social support is an influential factor that affects the association between disability and depressive symptoms.

Main, buffering, and mediating effects

There are several theories that seek to explain how social support could influence depressive symptoms in the context of disability (Chwalisz *et al.*, 2000; Cohen, 1988; Vaux, 1988b). The most prominent theories include the main effect model, the stress-

buffering model, and the indirect-mediator model (Cohen & Wills, 1985; Pearlin, Menaghan, Lieberman, & Mullan, 1981). The main effects model emphasizes the potential benefits that an individual derives from social support regardless of distress (Krause, Giles, Coupland, & Wiemann, 1990). The stress-buffering model of social support asserts that the support received from others acts as a protective factor for the individual with disability by decreasing the distress experienced (Cohen & Wills, 1985). In this model, individuals who experience higher levels of disability benefit more from the positive effects of social support than individuals who are not experiencing high levels of disability. In an indirect-mediator effect of social support on depressive symptoms, changes in social support explain the relation between depressive symptoms and disability. As disability increases, individuals increasingly perceive their available social support to be inadequate. As the perception of the quality of support decreases, depressive symptoms increase (Vaux, 1988b).

There is evidence to suggest that social support may influence depressive symptoms through the main effects model. In a longitudinal investigation of in-patients diagnosed with a depressive disorder, ages 35 and older, both perceived social support and larger social support networks were associated with decreased depressive symptoms at a six month and thirty-two month follow up (George, Blazer, Hughes, & Fowler, 1989). Turner and Noh (1988) reported that the perceived quality of available support was predictive of depressive symptoms at baseline and four years after baseline measurement for adults over the age of 18. At time of measurement, perception of emotional support and the perceived stability of friendships was associated with depressive symptoms in older adults with vision impairment (Horowitz, Reinhardt, Boerner, & Travis, 2003). In a

two-year follow up, only the perceived stability of the friendship measured at baseline was significantly associated with depressive symptoms.

The literature investigating the stress-buffering model has produced inconsistent results (Cohen, 1988; Vaux, 1988b). In community residing older adults, there was a significant interaction between the quality of social support and disability in the prediction of depressive symptoms (Wallsten, Tweed, Blazer, & George, 1999). Individuals with disabilities who reported more positive views of their social support had fewer depressive symptoms. In contrast, in a six-year longitudinal study using older adults in the community, the perceived quality of support did not moderate the relation between disability and depressive symptoms (Yang, 2006). Barefoot et. al. (2000), did not report a significant interaction between perceived social support and functional status in the predication of depressive symptoms one month after the initial measurement. The investigations of the buffering role of social support have not produced consistent results, and this mixed evidence suggests that it has a limited ability to explain the impact of social support on the relation between disability and depressive symptoms.

The indirect-mediator model has received less attention in the literature than the stress-buffering model (Vaux, 1988b). In order to establish perceived social support as a mediator of the relation between disability and depressive symptoms, significant relations between the three variables need to be established. The literature suggests that perceived social support is related to decreased depressive symptoms (Jang et al., 2002). There is robust evidence that establishes the association between disability and depressive symptoms (Bruce, 1999). Finally, there is evidence that received social support increases when disability increases; however, when disability symptoms increase the

perception of the quality of the support decreases (Taylor & Lynch, 2004). These findings indicate that the received support is not meeting the needs of the individual and there is a negative association between disability and perceived social support. Yang (2006), found support for the indirect mediating role of social support over a two-year period in community dwelling older adults. The perceived quality of social support partially mediated the association between disability and depressive symptoms at baseline and at follow up. In a cross-sectional analysis of older adults, the perceived quality of instrumental support partially mediated the relation between disability and depressive symptoms, whereas an individual's sense of belonging and perceived quality of emotional support were not significant mediators (Newsom & Schulz, 1996). Taylor and Lynch (2004) investigated the meditational relation between social support and the pathway between disability, measured using items assessing ADLs and IADLs, and depressive symptoms, measured using the CES-D, using latent growth models. Trajectories of disability and depressive symptoms were established using data from adults 65 years or older that was collected over a ten-year period with four measurement periods. Perceived social support was measured using two items that assessed whether the participant could count on at least some family/friends for support and whether the participant had some family/friends with whom they could discuss problems. The baseline measurement of disability had a significant negative impact on the baseline measurement of perceived social support and the changes in disability had a negative impact on the changes in perceived social support. The baseline measurement and changes over time in perceived social support had significant negative associations with baseline depressive symptoms and changes in depressive symptoms. The pathway

between baseline disability and baseline depressive symptoms remained significant when baseline perceived social support was included in the model, though the inclusion of perceived social support did decrease the association between baseline disability and depressive symptoms, indicating a partial mediation. Nonetheless, the changes in perceived social support did fully mediate the relation between changes in disability and changes in depressive symptoms.

Several conclusions can be drawn from this research on the role of social support in the pathway between disability and depressive symptoms. Although the many components of social support may have a role in influencing the relation of disability with depressive symptoms, perceived social support will be the focus of this thesis due to its potential to serve as a mediator (Jang et al., 2002; Taylor & Lynch, 2004). Further, the indirect-meditating model of social support has been supported by significant results in both cross-sectional and longitudinal studies (Newsom & Schulz, 1996; Taylor & Lynch, 2004; Yang, 2006). Nonetheless, this research has not investigated the potential gender differences in the indirect-mediating influence of perceived social support on the relation between disability and depressive symptoms.

Gender

Gender is a potentially important factor in the relation between the disablement process and depression. There is well documented evidence that there are gender differences in prevalence of disability (Leveille, Penninx, Melzer, Izmirlian, & Guralnik, 2000). There is mixed evidence, however, regarding the extent to which gender differences in the number of depressive symptoms found earlier in the lifespan are also found in late life (Jorm, 1987). Furthermore, there have been few investigations of

gender differences in the associations between disability and depressive symptoms, and particularly in the way these associations may change over time.

Two perspectives have been proposed to explain the experience of disability and depression in men and women. The convergence hypothesis states there should be a decrease in the differences in depressive symptoms between men and women with age due to changing social roles and older adults' tendency to move towards androgyny (Carmel & Bernstein, 2003). Further, the health of women and men should begin to be more similar, with a decrease in stress, the strain on health will also decrease. The divergence hypothesis states that due to the cumulative effect of limited access to resources, and increased health and mental-health problems, women have a faster deterioration of both physical and mental health, thus one would expect the disablement process to be quicker and more distressing for women (Cairney & Wade, 2002; Carmel & Bernstein, 2003; Nolen-Hoeksema, Mazure, & Keita, 2006). The evidence for both perspectives when looking at disability, depressive symptoms, and social support, is inconsistent; research needs to examine the gender differences in each construct as well as the relations between the constructs.

Gender and Disability

Approximately 40% of women over the age of 65 report having at least one functional limitation. Women at this age are more likely than men to experience co-morbid debilitating conditions, such as musculoskeletal conditions (Nosek & Hughes, 2003; Wray & Blaum, 2001). Throughout the aging process, women have higher prevalence rates of disability than men. The gender difference in levels of disability appears to remain constant from middle age to the oldest-old (Carmel & Bernstein, 2003;

Wray & Blaum, 2001). Leveille, Penninx, Melzer, Izmirlian, and Guralnik (2000) reported that in community dwelling older adults, women had higher rates of disability in all age groups when compared to men. At age 85, the difference between the rates of disability in women and men was more distinct, with 65% of the women reporting disability and 43% of men reporting disability. Women who did not report any disability symptoms at baseline had a higher risk of becoming disabled seven years later when compared to men who did not report any disability symptoms at baseline. Additionally, men had a higher rate of recovery from disability when compared to women. Taken together, these studies suggest that women appear to have a higher rate of disability when compared to men, and this gap may widen in very old age.

Gender and Depressive Symptoms

There is consistent literature that suggests that young adult and middle-aged women experience more depressive symptoms than do young adult and middle-aged men (Piccinelli & Wilkinson, 2000). Nonetheless, the source of this difference is still debated. Theories have proposed that this difference in depressive symptoms can be attributed to biological factors, such as hormonal changes, social influences, such as designated sex roles, greater level of stressful events, or limited access to resources (Nolen-Hoeksema et al., 2006). Research examining whether these gender differences are found in older adults has produced less consistent results (Jorm, 1987). According to the convergence hypothesis, the amount of distress and depressive symptoms men and women experience should begin to look similar as both genders move towards more similar social roles (Carmel & Bernstein, 2003). An epidemiological study of German older adults over the age of 85 did not reveal any gender differences in depression (Meller, Fichter, &

Schröppel, 1997). Carmel and Bernstein (2003) found a similar result, in which women and men 85 years or older reported no difference in distressed mood. Nonetheless, other studies have found that women still have a higher risk of depressive symptoms even in the oldest-old (Sonnenberg, Beekman, Deeg, & van Tilburg, 2000). Currently, the issue remains unresolved.

Gender, Disability, and Depressive Symptoms

The effect of gender on the pathway between functional impairment and depressive symptoms has received little attention. Adult women with a disability typically report lower quality of life than men reporting a disability (Orfila *et al.*, 2006). Sonnenberg *et al.* (2000) reported women had higher rates of functional impairment and depressive symptoms compared to men. Risk factors, such as functional impairment, partially explained the gender differences in depressive symptoms. Nevertheless, the inclusion of risk factors did not completely explain why older women reported more depressive symptoms when compared to men. In patients aged 25 years or older with rheumatoid arthritis, gender did not interact with baseline disability to predict depressive symptoms at a one-year follow-up (Hommel, Wagner, Chaney, & Mullins, 1998). Other studies addressing the relation between pain, disability, and depression have also found a lack of a gender effect (Geerlings, Twisk, Beekman, Deeg, & van Tilburg, 2002). It is notable, however, that most studies investigating the disablement process and negative outcomes fail to test for gender differences in outcomes.

Gender and Social Support

When looking at gender, disability, and possible negative outcomes it is critical to understand the associations between gender and social support. In a study using middle

aged and older adults with depressive disorders, perception of inadequate social support was more predictive of higher depressive symptoms at a thirty-two month follow up for men than for women (George et al., 1989). Other studies have demonstrated that social support is important for both women and men (Antonucci & Akiyama, 1987; Patrick, Cottrell, & Barnes, 2001). Nonetheless, the source of support appears to have a differential impact for men and women. In older adults living in a rural setting, the perception of received emotional support was the same across the genders and emotional support from family members was related to reports of decreased negative affect in men and women (Patrick et al., 2001). In older adult men, however, the perception of emotional support from family was significantly related to positive affect, whereas the perception of emotional support from friends was significantly related to positive affect in women. Whereas support is important for both men and women, women's social networks appear to be more complex with the need for support from both family and friends, whereas men seem to gain the most benefit from the support from family members.

The gender differences in social support's impact on the relation between disability status and depressive symptoms have received little attention. Penning and Strain (1994) demonstrated gender differences in the use of support for older adults reporting limitations in activities of daily living and general well-being. More men reported not receiving any help either from another person or from a technical aid or device and significantly more women reported receiving assistance from others. In men, the interaction of receiving support from others and having higher levels of disability was related to lower reports of well-being. These factors were not significant predictors of

lower self-reported well-being in women. Investigations of gender differences in the role of social support on the relation between disability and depressive symptoms have not produced consistent results. Within a sample of cancer patients, higher levels of perceived social support was significantly related to lower reports of depressive symptoms in both men and women (Hann et al., 2002). Nonetheless, a larger network size was significantly associated with fewer depressive symptoms in women but not in men. Barefoot et al (2000) found a lack of gender differences in perceived social support's association with depressive symptoms at one-month follow up in patients with cardiac disease.

The literature reviewed above supports several conclusions. There is evidence that the experience of disability and the experience of depressive symptoms over time is not the same for women and men (Carmel & Bernstein, 2003; Sonnenberg et al., 2000). Further, there is evidence that there are gender differences in the impact of social support on depressive symptoms (George et al., 1989; Patrick et al., 2001). Nonetheless, the potential gender differences within the associations between social support, disability and depressive symptoms have received little attention and the results have been inconsistent (Barefoot et al., 2000; Hann et al., 2002; Penninx, Leveille, Ferrucci, van Eijk, & Guralnik, 1999).

Statement of the Problem

Disability affects a significant proportion of the elderly population (Ervin, 2006; Lenze et al., 2001). Individuals who become disabled may develop more depressive symptoms (Femia et al., 2001) and may experience changes in social support (Reinhardt, Boerner, & Benn, 2003). Generally, the literature supports the notion that positive social

support will have a beneficial influence in the individuals' life. Several theories suggest possible mechanisms for social support's role in the relation between the disablement process and depressive symptoms (Cohen, 1988). The indirect-mediator model has produced consistent evidence from cross-sectional studies, suggesting that social support may be a mediator in the association between disability and depression (Pearlin et al., 1981; Thoits, 1995). As an individual goes through the disablement process and develops specific needs or disengages from social networks, the perception of the social support will alter, which in turn will influence the levels of depressive symptoms

The research investigating the disablement process and the impact of social support has been limited in several respects. Social support is often tested as a static point in time. Social support is not a stable variable, but rather fluctuates as a function of changing needs, decreased ability to interact with the social networks, and the network's ability to be available and provide support to the individual (Lin & Ensel, 1984; Martire, Schulz, Mittelmark, & Newsom, 1999; Williamson, 1998). Despite the research supporting the dynamic nature of disability, depression, and social support (Maddox & Clark, 1992; Martire et al., 1999; Taylor & Lynch, 2004) many studies investigating the disablement process and social support utilize a cross-sectional design (Barefoot et al., 2000; Hann et al., 2002; Newsom & Schulz, 1996). Few studies have investigated this model over time (Taylor & Lynch, 2004). Although significant results have emerged with these cross-sectional studies, the complexity of social support over time may exert different effects and may have different trajectories when interacting with different factors such as gender.

The impact of gender on disability, negative outcomes, such as depressive symptoms, and the role of social support has not received the attention that is needed. Gender does impact the experience of disability (Leveille et al., 2000) and depression (Piccinelli & Wilkinson, 2000), as well as perception of social support (Flaherty & Richman, 1989; Patrick et al., 2001). Despite these results, research on gender differences in the influence of social support on the association between disability and depressive symptoms has produced inconsistent results (Barefoot et al., 2000; Penning & Strain, 1994). Further, the analysis of gender effects has not been investigated in the indirect-mediating model of social support, nor has the gender effect been applied to a model over time.

The purpose of this study is to expand Taylor and Lynch's (2004) study examining the influence changes in perceived social support have on the relation between trajectories of disability and trajectories of depression, by testing the model in a large, population-based, longitudinal sample, and, further, assessing whether the model is differentially valid for men and women. This study addresses two questions:

Question 1. Do the changes in perceived social support mediate the relation between the changes of disability and changes of depressive symptoms?

Hypothesis 1: It is hypothesized that the changes in perceived social support will partially mediate the relation between changes of disability and depressive symptoms.

Question 2: Does gender moderate the mediation model, will the model fit differently for men and women.

Hypothesis 2: It is hypothesized that gender will moderate the model. Due to the lack of previous research to inform a hypothesis regarding the direction of the moderation effect, no direction of moderation by gender was specified.

Method

Participants and Procedures

The sample was comprised of participants from the Swedish Adoption/Twin Study of Aging (SATSA) who were 65 years or older in 1987. The SATSA database is a subsample of the Swedish Twin Registry (Lichtenstein *et al.*, 2002). The SATSA sample included all same sex twins in Sweden born between 1886 through 1958 who were raised apart since early childhood and a sample of same-sex twins who were reared together, and matched on age, sex and county of birth (Cederlöf & Lorch, 1978; Pedersen, McClearn, Plomin, & Nesselroade, 1991). Twins raised together and twins raised apart were included in this sample. The twins were analyzed separately in order to ensure independence of observations. The twins within a pair were randomly assigned to sample one ($n = 656$, including 235 males and 421 females) or sample two ($n = 678$, including 248 males and 430 females). Analyses were performed with sample one. The analyses were repeated in sample two as a non-independent replication. There was no statistically significant difference in age, ADL level, perceived social support, depressive symptoms, or gender between sample one and sample two. This study used the questionnaires collected in 1987, 1990, 1993, and 2003 from participants 65 years or older in 1987. The mean age of sample one in 1987 was 74.05($SD = 6.52$), the mean age in 1990 was 76.36 ($SD = 6.02$), the mean age in 1993 was 78.36 ($SD = 5.37$), and the mean age in 2003 was 85.79 ($SD = 4.00$) (See Table one for description of participants in sample one).

As would be anticipated due to the longitudinal nature of this study and the age of the sample, there was significant attrition. Among the participants who were 65 years or older in 1987, 130 participants died before 1990, 190 participants died before 1993, and 440 participants died before 2003. Of the participants who responded to the questionnaire in 1987 ($n = 393$), 88% responded to the CES-D, 90.3% responded to the ADLs, and 88.3% responded to the total perceived social support. Of the participants who responded to the questionnaire in 1990 ($n = 324$), 87.7% responded to the CES-D, 94.1% responded to the ADLs, and 88.9% responded to the total perceived social support. Of the participants who responded to the questionnaire in 1993 ($n = 270$), 89.6% responded to the CES-D, 94.4% responded to the ADLs, and 91.1% responded to the total perceived social support. Of the participants who responded to the questionnaire in 2003 ($n = 85$), 90.2% responded to the CES-D, 89% responded to the ADLs, and 85.4% responded to the total perceived social support. Among participants who responded to all questionnaires ($n = 74$), 94.6% responded to the 1987 CES-D, 94.6% responded to the 1990 CES-D, 95.9% responded to the 1993 CES-D, and 91.9% responded to the 2003 CES-D.

Sample one participants who were alive in 1987 and who did not respond to the CES-D at wave one were more likely to be older, $t(654) = 4.189, p < .001, d = .33$, and experiencing more functional limitations, $t(353) = -3.586, p < .001, d = .38$. Sample one participants who were alive in 1987 and who did not respond to the CES-D during wave two were more likely to be older, $t(557) = 6.104, p < .001, d = .52$, experienced more functional limitations in 1987, $t(353) = -5.154, p < .001, d = .55$, experiencing more current functional limitations, $t(303) = -1.996, p = .047, d = .23$, and better social support

in 1987 $t(345) = 2.254, p = .025$. Sample one participants who were alive in 1987 and who did not respond to the CES-D during wave three, were more likely to be older, $t(464) = 5.402, p < .001, d = .50$, more functional impairment in 1987, $t(353) = -5.619, p < .001, d = .60$ more functional impairment in 1990, $t(303) = -6.537, p < .001, d = .75$, more depressive symptoms in 1987, $t(344) = 2.336, p = .02, d = .25$, and more depressive symptoms in 1990, $t(282) = 3.547, p < .001, d = .42$. Sample one participants who were alive in 1987 and who did not respond to the CES-D during wave four were more likely to be older, $t(212) = 2.419, p = .016, d = .33$, have more functional limitations in 1987, $t(353) = -4.356, p < .001$, in 1990, $t(303) = -3.404, p < .001, d = .46$, and in 1993, $t(253) = -3.768, p = .006, d = .47$.

Measures

Perceived social support. Perceived social support was measured using a modified version of the Interview Schedule for Social Interaction (ISSI) (Henderson, Duncan-Jones, Byrne, & Scott, 1980). The original form of the ISSI contained 52 questions assessing availability of attachment, the perceived adequacy of attachment, the availability of social integration and the adequacy of the integration. The modified version contains twelve questions assessing the availability of attachment and the perceived adequacy of the supports available (Bergeman, Neiderhiser, Pedersen, & Plomin, 2001). Participants were asked twelve Likert-type items regarding the structural qualities of their social networks (example: “How many individuals do you meet or talk to on the phone in an ordinary week?” and “How many individuals in your neighborhood do you know so well that you can ask them for things?”). For each structural question, there was a corresponding question that assessed satisfaction: “Do you think that is

enough or would you like more or less of such people around you?” Response choices ranged from 1 = Would like fewer, 2 = Satisfied, 3 = Would like more. Individuals who responded they desired either fewer people or more people were coded 0 = not satisfied with the number of people in the social network. Individuals who responded they were satisfied were coded 1 = satisfied with the number of people in the social network.

These coded twelve corresponding items were summed to form the total perceived social support scale. If the participant answered ten of the twelve items, the total satisfaction score was imputed using the average of all items (The number of imputed scores in 1987: $n = 120$; 1990: $n = 68$; 1993: $n = 137$; 2003: $n = 26$). Higher scores indicated more satisfaction with the number of people in the social network. Only the satisfaction scale was used in the analyses. The perceived social support scale has good internal consistency in all measurement periods (sample one, 1987: $\alpha = .84$, 1990: $\alpha = .84$, 1993: $\alpha = .87$, 2003: $\alpha = .84$).

Disability. Disability was assessed using twenty self-report items pertaining to activities of daily living (ADL) including physical activities of daily living and instrumental activities of daily living. The physical activities of daily living (PADL) questions asked the participants to rate their ability to perform eleven basic self-care activities: eating, dressing one’s self, taking care of appearance, walking, getting in and out of bed, taking a bath/shower, getting in and out of a bathtub, standing up from an ordinary chair without the use of arms, bending down to pick up object from the floor, and walking up and down the stairs. The PADL item “Do you have difficulties making it to the bathroom on time?” was not included in the analyses due to a nonstandardized response choices. Instrumental activities of daily living (IADL) questions asked the

participants to rate their ability to perform nine instrumental activities: using the telephone, going places that cannot be reached by foot, shopping for groceries/clothes, preparing meals, doing housework, taking medicine, handling money, doing laundry, and doing maintenance around the house. Responses range from 3 = yes, able to perform without help, 2 = can perform with help, and 1 = cannot perform at all. If the participant answered ten out of eleven PADL items, the total PADL score was imputed using the average of all PADL items (1987: $n = 67$; 1990: $n = 45$; 1993: $n = 36$; 2003: $n = 32$). If the participant answered eight out of the nine IADL items, the total IADL score was imputed using the average of all IADL items (1987: $n = 112$; 1990: $n = 70$; 1993: $n = 34$; 2003: $n = 15$). The sum of both the PADL and IADL scales was used to calculate an overall ADL score. Higher scores indicated better ability to perform the activities of daily living. The total ADL score has good internal consistency in all measurement periods (sample one, 1987: $\alpha = .90$, 1990: $\alpha = .89$, 1993: $\alpha = .95$, 2003: $\alpha = .96$).

Depressive symptoms. Depressive symptoms were measured using the Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977). The scale contains twenty Likert-scale items that ask participants to rate the frequency of symptom occurrence during the past week (for example: “During the past week, I was bothered by things that usually don’t bother me”). Responses range from 0 = rarely or none of the time to 3 = all or most of the time. Four items were reversed scored. In an investigation using an early wave of the data used in the present study, the items factored into four subscales: depressed mood, psychomotor retardation, lack of well-being, and interpersonal difficulties (Gatz, Johansson, Pedersen, & Berg, 1993), similar to factors described in other studies using the CES-D (Hertzog, Van Alstine, Usala, & Hultsch,

1990). The total CES-D score is a sum of the four subscale scores. If the participant answered eighteen out of the twenty CES-D items, the total CES-D score was imputed using the average of all CES-D items (1987: $n = 56$; 1990: $n = 29$; 1993: $n = 32$; 2003: $n = 25$). High scores indicate higher levels of depressive symptoms. The total CESD score had good internal consistency in all measurement periods (sample one, 1987: $\alpha = .87$, 1990: $\alpha = .86$, 1993: $\alpha = .86$, 2003: $\alpha = .82$).

Analyses

Latent growth curve modeling (LGM) was used to address the above questions (Duncan, Duncan, & Strycker, 2006). LGM is a variant of structural equation modeling that estimates the mean structure of latent variables. Specifically, LGM allows for investigation into the individual differences in change over time, as well as the changes in the group mean over time. Analyses were conducted using SAS 9.1 and Amos 16.0 statistical software.

This study used a sample comprised of twins, however, the twins were used as individuals and twin analyses were not conducted. Two methods were used to adjust for the non-independence of observations as a result of including pairs of twins. The first method used a model with a shared slope and shared intercept between twins within the twin pair on each of the three variables, depressive symptoms, disability, and perceived social support (Olsen & Kenny, 2006). An admissible solution was not found using this model. The second approach involved using two separate datasets created by randomly selecting a twin from each twin pair. Analyses were performed with sample one and repeated in sample two as a non-independent replication. It is the results of this second approach that are presented in the current report.

The first hypothesis was that the changes in perceived social support would partially mediate the relation between the changes in disability and changes in depressive symptoms. The hypothesis was tested using a model that contained one slope and intercept for each factor (*see Figure 1.*). Age was covaried to control for its influence on perceived social support, disability level, and depressive symptoms. The slope of change for this model was estimated as linear. Linearity was assumed due to previous research, which has found similar results (Taylor & Lynch, 2004). The factor loadings for the observed variables correspond with the number of years passed from the first time period, which was fixed at zero (Factor loadings: 0, 3, 6, 16). The mean and disturbances for the slopes and intercepts of the latent variables and the covariances were not constrained and were freely estimated.

In order to test the planned mediation model, the distribution of products method was to be used (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). The unstandardized coefficients for the pathways from disability to perceived social support and from perceived social support to depressive symptoms were converted into z-scores by dividing each pathway coefficient by the respective standard error (See Figure 2). The product of the z-scores was compared to a critical value in a distribution table (MacKinnon et al., 2002). If the product of the z-scores was above the critical value for a small mediated effect in continuous variables at 95%, then the mediated effect would be significant. The use of the distribution of products method of mediation analysis was chosen because it has more accurate type 1 error rates compared to other methods of calculating mediation effects and significant power in order to detect small effect sizes in sample sizes ranging from 50 to 1,000 (MacKinnon et al., 2002).

The second hypothesis was that gender would moderate the social support mediation model. In order to test this hypothesis a multigroup model method was used to test for differences in model fit across men and women. The hypothesized mediation model was simultaneously tested with men and women each as a separate group. Using the sample one database, the first model freely estimated the means, disturbances, error variances, and regression pathways and did not constrain any pathways to be the same across gender. The second test ran the same model with the means, disturbances, and error variances allowed to be freely estimated but the regression pathways between the variables were constrained to be equal across men and women. The multigroup model analyses were replicated with the sample two database. Significant loss of model fit with the restricted model was taken as an indication of gender differences in this model.

Model fit was evaluated using root mean square error of approximation (RMSEA), and the Comparative Fit Index (CFI) (Kline, 2005). For the RMSEA, values from .00 to .08 were considered an indication of good model fit. The RMSEA is a measure of how closely the data fits the model, a score close to zero indicates a close approximant fit of the data. For the CFI, values greater than .9 were considered good model fit. The CFI compares the improvement in fit of the specified model to the independence model where all covariances are assumed equal. The chi-square test was used a supplementary measure of fit. The chi-square test is a measure of how well the data fit the model; a significant chi-square indicates the data do not adequately fit the model. In large samples, the chi-square can be inflated, so the chi-square used alone is not always a sign of poor model fit.

Post-hoc modification to model specification was carried out in order to provide suggestions in model specification for future research. Exploratory modification indices were obtained by rerunning the original model using a dataset with no missing data. Suggested modifications that were theoretically sound and resulted in an admissible solution were used.

Results

Mediation Analyses

Table 1 provides descriptive information about sample one participant characteristics. There were 64.2% females and 35.8% males, and the average age in 1987 was 74.05 (SD = 6.56). Variable correlations are presented in Table 2. Only the CES-D measure in 1993 was significantly correlated with the measure of ADLs in 2003, $r = -.198, p < .05$. No other measure of CES-D was related to ADLs in 2003. No measure of perceived social support was related to CES-D in 2003. CES-D measures in 1987, 1990, and 1993 and the perceived social support in 1987, 1990, 1993, and 2003 were moderately correlated. Finally, only the measure of ADLs in 1987 was related to perceived support in 1987, $r = .111, p < .05$.

In order to test the first hypothesis that the changes in perceived social support would partially mediate the relation between the changes in disability and changes in depressive symptoms, the means, disturbances, error variances, and regression pathways were freely estimated using only the data from sample one (See Table 3). The model fit indices suggest that the model did not adequately fit the data ($\chi^2 = 272.792, df = 72, p < .001, CFI = .786$, and $RMSEA = .065$). When the results were replicated using sample

two, the model fit was also inadequate ($\chi^2 = 254.546$, $df = 72$, $p < .001$, CFI = .818, and RMSEA = .061).

To isolate the source of the problem, model fit for each component of the original model was estimated. To assess model fit in the disability measure, only the disability measurements from 1987, 1990, 1993, and 2003 were included in the model. The slopes were constrained to be linear and the factor loadings for the observed variables correspond with the number of years passed from the first time period. The disability intercept and disability slope were covaried. The model fit indices suggest this model did not adequately fit sample one ($\chi^2 = 148.050$, $df = 8$, $p < .001$, CFI = .442, and RMSEA = .183) or sample two ($\chi^2 = 148.050$, $df = 8$, $p < .001$, CFI = .563, and RMSEA = .161). A similar model was used to assess model fit in the perceived social support measure with only the perceived social support measurements from 1987, 1990, 1993 and 2003 included in the model. The model fit indices suggest this model adequately fit sample one ($\chi^2 = 3.113$, $df = 8$, $p = .927$, CFI = 1 and RMSEA = .000) and sample two ($\chi^2 = 25.729$, $df = 8$, $p = .338$, CFI = .902, and RMSEA = .057). Finally, the same procedure was used to assess model fit in the CES-D measuring using only the CES-D measure from 1987, 1990, 1993, and 2003. The model fit indices suggest this model adequately fit sample one ($\chi^2 = 7.216$, $df = 8$, $p = .513$, CFI = 1 and RMSEA = .000) and sample two ($\chi^2 = 15.333$, $df = 8$, $p = .053$, CFI = .978, and RMSEA = .037). Taken together, these analyses suggest that poor model fit in the original model was due to lack of fit in the specification of the disability measurement model.

Gender

The second hypothesis was that gender would moderate the social support mediation model. The multigroup model was run separately for sample one and for sample two. The model using sample one data resulted in a negative perceived social support slope error variance and a negative depressive symptom slope error variance for males. To resolve this issue the error variance for perceived social support slope was constrained to be the same across females and males, and the error variance for depressive symptom slope was constrained to be one for females and males. When gender was freely estimated in the model using sample one data, the model fit indices indicated the model did not adequately fit the data ($\chi^2 = 588.515$, $df = 147$, $p < .001$, CFI = .543, and RMSEA = .068) (See Table 4). When the model using sample one data was constrained so the regression pathways for men and women were restricted to be equal, the model fit was not significantly worse ($\chi^2 = 593.444$, $df = 153$, $p < .001$, CFI = .544, and RMSEA = .066) (See Table 5). There was no significant difference in the chi-square estimate of model fit from the unconstrained to the restricted model (Change $\chi^2 = 4.929$, $df = 6$, $p = .553$). Due to the lack of adequate model fit, conclusions regarding a gender moderator effect cannot be reached.

The analyses for the second hypothesis were repeated using sample two data. The model using sample two data resulted in a negative perceived social support slope error variance and a negative depressive symptom slope error variance for both females and males. To resolve this issue the error variance for perceived social support slope was constrained to be the same across females and males, and the error variance for depressive symptom slope was constrained to be one across both females and males.

When the regression pathways were estimated freely across men and women in the sample two model, the model fit indices indicated the model did not adequately fit the data ($\chi^2 = 496.977$, $df = 147$, $p < .001$, CFI = .677, and RMSEA = .059) (See Table 6). When the model using the sample two data was constrained so the regression pathways were restricted to be equal across men and women, the model fit was not significantly worse ($\chi^2 = 502.491$, $df = 153$, $p < .001$, CFI = .677, and RMSEA = .058) (See Table 7). There was no significant difference in the chi-square estimate of model fit from the unconstrained to restricted model (Change $\chi^2 = 5.514$, $df = 6$, $p = .480$). Due to the poor model fit, conclusions regarding a gender moderator effect cannot be reached.

Modification Indices

The model as specified resulted in a poor fit for the data. A new database was created by eliminating all participants who had any missing data ($n = 84$), the data were not separated by twins due to the small sample size. Due to the small sample size only exploratory post-hoc modification indices were obtained using the original model. Using the modification indices that were theoretically sound and that resulted in an admissible solution, the final modified model included a covariance between the error variance for disability level in 1987 and 1990 and a covariance between the error variance for disability level in 1987 and 1993. When this modified model was run with the original dataset, which included participants with missing data, the model with the covariances did not have significantly better model fit ($\chi^2 = 272.885$, $df = 70$, $p < .001$, CFI = .785, and RMSEA = .066). The modified model did not have a significantly different chi-square fit compared to a model that did not contain the modified covariances (Change $\chi^2 = .907$, $df = 2$, $p = .635$). In the model using sample two data, the model without the

modified covariances had significantly worse model fit compared to the model with the modified covariances, ($\chi^2 = 247.532$, $df = 70$, $p < .001$, CFI = .823, and RMSEA = .061; Change $\chi^2 = 7.014$, $df = 2$, $p < .05$).

When the modified model was applied to the model using sample one data with restricted regression pathways across men and women the model fit did not significantly improve ($\chi^2 = 590.979$, $df = 149$, $p < .001$, CFI = .543, and RMSEA = .065). There were no significant differences in chi-square model fit between the model with the addition of the covariances and model without the modified covariances (Change $\chi^2 = 2.465$, $df = 4$, $p = .651$). In the model using sample two data with restricted pathways across gender the model without the modified covariances had significantly worse model fit compared to the modified model, ($\chi^2 = 490.057$, $df = 149$, $p < .001$, CFI = .685, and RMSEA = .058; Change $\chi^2 = 12.433$, $df = 4$, $p < .05$).

Post Hoc Analyses

Further analyses were conducted in order to inform future researchers on how the model fit may be improved. There may have been errors in model fit due to the significant portion of missing data in 2003 ($n = 85$). Post hoc analyses were conducted to test whether the model fit would improve if the 2003 measurement point was removed from the model. The modified model resulted in three measurement periods (1987, 1990, 1993), with the slopes constrained to be linear and the factor loadings for the observed variables corresponding with the number of years passed from the first time period (0, 3, 6). When the modified model was run using sample one, a negative error variance for the depressive symptoms slope and a negative covariance between the depressive symptoms slope and depressive symptoms intercept. The negative error variance and negative

covariance resulted in an inadmissible solution. When the modified model was run using sample two, the model produced an admissible solution. The model fit indices suggest the model fit the sample two data ($\chi^2 = 98.027$, $df = 32$, $p < .001$, CFI = .931, and RMSEA = .054). Using the modified model with sample two, the change in ADLs was significantly related to the change in perceived social support ($B = .197$, $SE = .091$, $p < .05$). The change in perceived social support was significantly related to change in depressive symptoms ($B = -1.064$, $SE = .398$, $p < .01$). The level of ADLs was related to the level of depressive symptoms ($B = -.592$, $SE = .112$, $p < .001$). The level of perceived social support was also related to the level of depressive symptoms ($B = -2.042$, $SE = .314$, $p < .001$).

The next step was to determine whether perceived social support mediates the relation between ADLs and depressive symptoms over time using the modified model. The unstandardized coefficients from the pathway from ADLs slope to perceived social support slope and the pathway from perceived social support slope to depressive symptom slope were converted to z-scores for the analyses run with sample two data (Sample Two: $z_{\alpha}z_{\beta} = -2.75$). The critical value for a small mediator effect for a sample size over 500 was 18.168. No model revealed a significant mediator effect between changes in ADLs, changes in perceived social support, and changes in depressive symptoms.

The mediation analyses were repeated to investigate whether the level of perceived social support mediated the relation between the level of ADLs and level of depressive symptoms using the modified model. The unstandardized coefficients from the pathway from the level of ADLs to the level of perceived social support and the

pathway from the level of perceived social support and level of depressive symptom were converted to z-scores for the model using sample two data (Sample Two: $z_{\alpha}z_{\beta} = -5.78$). There was no significant mediator effect between the level of ADLs and perceived social support on depressive symptoms.

Further analyses were conducted to determine the model fit for each component of the original model when data from the 2003 measurement occasion were excluded. To assess model fit in the disability measure, only the disability measurements from 1987, 1990, and 1993 were included in the model. The slopes were constrained to be linear and the factor loadings for the observed variables corresponded with the number of years passed from the first time period. The disability intercept and disability slope were covaried. The model fit indices suggest this model did not adequately fit sample one ($\chi^2 = 106.310$, $df = 3$, $p < .001$, CFI = .659, and RMSEA = .229) or sample two ($\chi^2 = 59.827$, $df = 3$, $p < .001$, CFI = .821, and RMSEA = .167). Additionally, the disability model when run using the sample one database produced a matrix that was not positive definite, which prevented an admissible solution. A similar model was used to assess model fit in the perceived social support measure with only the perceived social support measurements from 1987, 1990, and 1993 included in the model. The model fit indices suggest this model adequately fit sample one ($\chi^2 = .114$, $df = 3$, $p = .990$, CFI = 1 and RMSEA = .000) and sample two ($\chi^2 = 3.370$, $df = 3$, $p = .338$, CFI = .998, and RMSEA = .013). Finally, the same procedure was used to assess model fit in the CES-D, using only the CES-D measure from 1987, 1990, and 1993. The model fit indices suggest this model adequately fit sample one ($\chi^2 = 3.064$, $df = 3$, $p = .382$, CFI = 1 and RMSEA = .006) and sample two ($\chi^2 = 4.205$, $df = 3$, $p = .240$, CFI = .996, and RMSEA = .024).

Discussion

A mediation analysis could not be completed due to poor model fit . The post-hoc analyses of the model without the 2003 measurement period suggest that the level of perceived social support may be significantly related to the level of depressive symptoms, and changes in perceived social support may be significantly related to the changes in depressive symptoms. These post-hoc results add support to the findings from previous literature that indicate social support may play a direct role in influencing the level of depressive symptoms and the changes in depressive symptoms (George et al., 1989; Horowitz et al., 2003; Turner & Noh, 1988). When the regression pathways between disability, perceived social support, and depressive symptoms were constrained to be the same across men and women, the model fit did not significantly become worse in either sample one or sample two. Nonetheless, the poor model fit suggests these results cannot be interpreted.

The extended period of time between measurement periods may also have limited the ability of the measure of disability to detect changes in functioning. The onset of a physical impairment may reduce an individual's ability to perform activities of daily living. With adaptation and rehabilitation, however, the ability to perform the activities of daily living may return. The small correlations between disability status in 2003 and variables measured in 1987, 1990, and 1993 suggest that measures of depressive symptoms, disability, and perceived social support taken between ten to sixteen years prior have little relation to the current disability status. The improvement in model fit with removal of the 2003 measurement when using sample two suggests that the extended period of time between the 1993 and 2003 measurement periods may have

contributed to the poor model fit. Additionally, the measurement of perceived social support was restricted to 0 (not satisfied) or 1 (satisfied) for each item, which limited the range of responses. There is also research that suggests other variables, such as socioeconomic status, or race, might moderate the overall mediation model (Schieman & Plickert, 2007). Further, there is evidence to suggest that only examining perceived social support, rather than factors such as support provided to others is a limited approach to understanding the relation between social support, disability, and depressive symptoms. Providing social support to others has been shown to be more predictive of mortality in older adults compared to measures of the amount of support received from others (Brown, Nesse, Vinokur, & Smith, 2003). Additionally, providing support may interact through other intrapersonal variables, like desire for personal control or self-esteem, to influence depressive symptoms in older adults (Krause & Shaw, 2000; Krause, Herzog, & Baker, 1992). The exclusion of a measure of support provided to other individuals may limit the findings of any significant mediational relation between disability level and depressive symptoms.

When the regression pathways were constrained to be equal across gender in both sample one and sample two, the model fit did not become significantly worse. Both twin mediation models had to be modified, however, in order to prevent negative covariance, which resulted in poor model fit. Specifically, the error variance for the perceived social support slope and the depressive symptoms slope were constrained to be the same across gender in the model using sample one data. The error variance for the depressive symptoms slope was constrained to be one across genders. This limits the interpretation of these results. It is unknown whether gender would moderate the relations between

disability status, perceived social support, and depressive symptoms in a model that was correctly specified.

The lack of better model fit with the data and the modification indices that improved model fit suggest there are other models that may better explain the relation between disability, perceived social support, and depressive symptoms in older adults. The clustering of significant modification indices around the disability measurements suggests changes in how disability is measured may result in improved model fit. Nonetheless, these modification indices did not result in improvement in model fit for either the mediation model or the moderation model. Additional model adjustments, which modified the model by removing the measurements taken during 2003, resulted in an inadmissible solution for sample one, but an improved model fit and admissible solution for sample two. This suggests the 2003 data may have contributed to the poor model fit due to the significant amount of attrition. Further, analyses of the components of the model using data from the 1987, 1990, and 1993 measurement periods also suggest areas in which future researchers can make improvements. Both the perceived social support and the depressive symptoms components had adequate model fit. The disability component, however, had poor model fit suggesting this component of the model needs further modification, such as changing the slope estimation.

Limitations

There were several limitations to this study. The significant amount of attrition and its relation to more disability, older age, and more depressive symptoms introduces a selection bias. Individuals who are responding from 1987 to 2003 are more likely to be younger, have less disability, and be less depressed. Participants who experienced more

limitations in the activities of daily living were more likely not to respond. The participants who do respond are less likely to experience the changes in disability status and might not have experienced subsequent changes in perceived social support.

As suggested by the poor model fit, the model as specified may be incorrect. The relation between disability, perceived social support, and depressive symptoms may not be a mediational relation as specified. The use of maximum likelihood estimation is sensitive to error and a mistake in model specification can result in errors in estimation. The direction of the regression pathways may also be incorrect. For the purpose of this study, it was assumed that disability symptoms were related to increases in depressive symptoms. There is evidence, however, that the pathway between disability and depressive symptoms is reciprocal and depressive symptoms have a negative impact on disability (Bruce, 2001). There has been some evidence to suggest that disability has a larger effect on depressive symptoms than depressive symptoms has on disability (Ormel, Rijdsdijk, Sullivan, van Sonderen, & Kempen, 2002). Similarly, depressive symptoms may adversely affect the perception of one's social support (Blazer, 1983). Additionally, the slope of disability status may better be represented in the model as a curvilinear slope rather than a linear slope. The lack of a significant impact of gender may be due to the atheoretical specification that resulted due to the negative error variance. Although the poor model fit suggests the specification of the model in this study was incorrect, these results suggest researchers should look for other possible explanations for the role of perceived social support on disability and depressive symptoms.

There were also limitations to the measurement of the variables. The measure of perceived social support was not broken down into specific types of social support, nor

was the source of that support broken down. It has been suggested that these specific components are important in investigating the role of social support in the disablement process (Vaux, 1988a). Additionally, each item assessing perceived social support was reduced to two response choices. This severely limited the amount of variability in participant scores, which may have resulted in a lack of significant results. Further, the measurement of ADLs did not take into account the possibility of rehabilitation and improvement in functioning during the periods between measurements. The poor model fit for the disability component of the model also suggests there may have been problems with the measurement of disability. Despite the limitations to the measurement of perceived social support and disability, the results from the post-hoc analyses using the model without the 2003 measurement suggest the changes in perceived support influences changes in depressive symptoms and the level of perceived social support influences the level of depressive symptoms. A measure of perceived support with more variation in response choice may better illuminate this relation.

This study has several strengths. The use of data collected over a period of sixteen years allows an investigation into the changes in disability, perceived social support, and depressive symptoms. This study was able to address whether changes in perception of social support influence the relation between disability and depressive symptoms over time. This question has received limited attention by Taylor and Lynch (2004). Additionally, this study used a measure of perceived social support that consisted of twelve questions that addressed whether the participant desired more or less support. The measure of social support addresses specifically whether the participant was satisfied with the amount of support received or if the participant desired change in

the amount of support. The two-item measure of perceived social support in Taylor and Lynch (2004) assessed whether the participant felt they could count on some individuals for support.

Conclusions and Future Directions

This study was unable to assess whether changes in perceived social support and the level of perceived social support would mediate the relation between disability status and depressive symptoms. Further, this study was unable to detect a significant gender moderation. Nonetheless, the removal of the 2003 measurement period in a model using sample two data resulted in good model fit. Changes in perceived social support did not mediate the relation between changes in disability and depressive symptoms in these post-hoc analyses. Nor did the level of perceived social support mediate the relation between the level of disability and the level of depressive symptoms. In contrast, the level of perceived social support and the changes in perceived social support both significantly influenced depressive symptoms. A better perception of one's support may be directly related to fewer depressive symptoms. Replication of these results is needed.

Future studies should consider addressing the mediational model using more specific measurements of social support that distinguish the type of support provided and the source of that support. Additionally, the measurement of social support should also be broadened to address other components like the support the older adult provides to others. Studies investigating disability over time also need to address the dynamic nature of functioning in older adults. Finally, as evident by this study it is important for future studies to address different models of disability, perceived social support, and depressive symptoms. Future models should consider investigating the role of changes in perceived

support directly influencing depressive symptoms, as well as investigating the role of depressive symptoms on disability and perceived social support.

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Table 1. Descriptive Information of sample one*

	Frequency	Mean	Standard Deviation
Sex			
Female	64.2		
Male	35.8		
Rear			
Together	52.3		
Apart	47.7		
Age in 1987		74.05	6.52
Age in 1990		76.36	6.02
Age in 1993		78.36	5.37
Age in 2003		85.79	4.00
CESD 1987		13.52	8.69
CESD 1990		14.02	8.33
CESD 1993		13.83	8.35
CESD 2003		16.94	7.54
ADLs 1987		56.12	5.22
ADLs 1990		58.00	4.91
ADLs 1993		55.17	5.86
ADLs 2003		54.13	8.53
Social support 1987		10.82	2.24
Social Support 1990		10.90	2.19
Social Support 1993		10.93	2.26
Social Support 2003		10.69	2.45

*1987 $n = 393$, 1990 $n = 324$, 1993 $n = 270$, 2003 $n = 85$, sample sizes vary slightly by measure

Table 2. Sample One Variable Correlations

	Age	CESD 1987	CESD 1990	CESD 1993	CESD 2003	ADLs 1987	ADLs 1990	ADLs 1993	ADLs 2003	Social 1987	Social 1990	Social 1993	Social 2003
Age	1												
CESD 1987	.132* (346)	1											
CESD 1990	.052 (284)	.600** (249)	1										
CESD 1993	-.069 (242)	.543** (208)	.482** (209)	1									
CESD 2003	.020 (74)	.309** (65)	.271** (68)	.319** (70)	1								
ADLs 1987	-.463** (355)	-.243** (327)	-.215** (253)	-.094 (209)	-.003 (68)	1							
ADLs 1990	-.347** (305)	-.103 (260)	-.242* (279)	-.117 (216)	-.160 (70)	.677** (265)	1						
ADLs 1993	-.387** (255)	-.062** (212)	-.023 (212)	-.083** (237)	.143 (72)	.471** (217)	.570** (220)	1					
ADLs 2003	-.445** (73)	.102 (65)	-.027 (66)	-.198* (69)	-.100 (66)	.350** (66)	.168 (68)	.234 (70)	1				
Social support 1987	.044 (347)	-.345** (326)	-.267** (250)	-.228** (208)	-.118 (68)	.111* (329)	.035 (260)	.061 (214)	-.057 (65)	1			
Social Support 1990	-.079 (288)	-.244** (253)	-.203** (272)	-.235** (209)	.021 (65)	.066 (252)	.104 (278)	-.004 (213)	.021 (63)	.512** (254)	1		
Social Support 1993	-.009 (246)	-.284** (209)	-.253** (208)	-.328** (234)	-.191 (70)	.028 (211)	-.070 (218)	.043 (328)	.199 (68)	.523** (211)	.530** (212)	1	
Social Support 2003	-.014 (70)	-.312* (63)	-.259** (65)	-.389** (68)	-.042 (66)	.068 (65)	.050 (66)	.217 (69)	.026 (62)	.513** (66)	.402** (64)	.604** (69)	1

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

Table 3. Beta Coefficients for Mediation Model

Sample 1					
	Social Support Intercept	Social Support Slope	Depressive Symptoms Intercept	Depressive Symptoms Slope	Age
ADLs Intercept	.074** (.028)		-.477*** (.104)		-.410*** (.038)
Social Support Intercept			-1.664*** (.260)		.033 (.020)
ADLs Slope		.07* (.031)		-.332* (.145)	-.029*** (.007)
Social Support Slope				-.907 (1.297)	-.002 (.002)
Depressive Intercept					-.010 (.075)
Depressive Symptoms Slope					-.023* (.009)
Sample 2					
	Social Support Intercept	Social Support Slope	Depressive Symptoms Intercept	Depressive Symptoms Slope	Age
ADLs Intercept	.026 (.025)		-.529*** (.106)		-.334*** (.038)
Social Support Intercept			-2.103*** (.329)		-.024 (.018)
ADLs Slope		.053 (.044)		-.187 (.124)	-.023** (.007)
Social Support Slope				-1.124** (.375)	-.001 (.003)
Depressive Intercept					-.062 (.075)
Depressive Symptoms Slope					.002 (.010)

* $p < .05$, ** $p < .01$, *** $p < .001$ (Sample 1: $\chi^2 = 272.792$, $df = 72$, $p < .001$, CFI = .786, and RMSEA = .065; Sample 2: $\chi^2 = 254.546$, $df = 72$, $p < .001$, CFI = .818, and RMSEA = .061)

Table 4. Beta Coefficients for Model Using Sample One Data with Regression Pathways Freely Estimated Across Gender

Male					
	Social Support Intercept	Social Support Slope	Depressive Symptoms Intercept	Depressive Symptoms Slope	Age
ADLs Intercept	.127 (.065)		-.463 (.291)		-.293*** (.053)
Social Support Intercept			-1.538* (.688)		.055 (.029)
ADLs Slope		.162* (.066)		-.927 (.813)	-.010 (.010)
Social Support Slope				-1.751 (3.979)	.000 (.004)
Depressive Intercept					-.076 (.131)
Depressive Symptoms Slope					-.038 (.024)
Female					
	Social Support Intercept	Social Support Slope	Depressive Symptoms Intercept	Depressive Symptoms Slope	Age
ADLs Intercept	.067 (.034)		-.446*** (.126)		-.460*** (.052)
Social Support Intercept			-1.793*** (.356)		.030 (.028)
ADLs Slope		.011 (.031)		-.345* (.168)	-.040*** (.010)
Social Support Slope				-2.027 (3.453)	-.003 (.003)
Depressive Intercept					-.061 (.113)
Depressive Symptoms Slope					-.032 (.020)

* $p < .05$, ** $p < .01$, *** $p < .001$ ($\chi^2 = 588.515$, $df = 147$, $p < .001$, $CFI = .543$, and $RMSEA = .068$)

Table 5. Beta Coefficients for Model using Sample One Data with Regression Pathways Constrained to be the Same Across Gender

Gender Restricted						
	Social Support Intercept	Social Support Slope	Depressive Symptoms Intercept	Depressive Symptoms Slope	Age _{male}	Age _{female}
ADLs Intercept	.066* (.029)		-.455*** (.106)		-.293*** (.053)	-.460*** (.052)
Social Support Intercept			-1.649*** (.267)		-.039 (.023)	-.032 (.026)
ADLs Slope		.077** (.028)		-.391 (.203)	-.009 (.011)	-.040*** (.010)
Social Support Slope				-.659 (1.855)	-.002 (.004)	.002 (.003)
Depressive Intercept					.081 (.100)	-.064 (.108)
Depressive Symptoms Slope					-.035 (.022)	-.029 (.017)

* $p < .05$, ** $p < .01$, *** $p < .001$ ($\chi^2 = 593.44$, $df = 153$, $p < .001$, CFI = .544, and RMSEA = .066; $\Delta\chi^2 = 4.929$, $df = 6$, $p = .553$)

Table 6. Beta Coefficients for Model Using Sample Two Data with Regression Pathways Freely Estimated Across Gender

Male					
	Social Support Intercept	Social Support Slope	Depressive Symptoms Intercept	Depressive Symptoms Slope	Age
ADLs Intercept	-.048 (.038)		-.419* (.185)		-.254*** (.063)
Social Support Intercept			-2.208*** (.545)		-.062* (.028)
ADLs Slope		-.058 (.044)		-.086 (.261)	-.019 (.014)
Social Support Slope				-.695 (1.122)	.002 (.005)
Depressive Intercept					-.069 (.127)
Depressive Symptoms Slope					-.013 (.023)
Female					
	Social Support Intercept	Social Support Slope	Depressive Symptoms Intercept	Depressive Symptoms Slope	Age
ADLs Intercept	.059 (.032)		-.632*** (.134)		-.373*** (.050)
Social Support Intercept			-1.867*** (.431)		-.002 (.0242)
ADLs Slope		.100 (.059)		-.108 (.256)	-.027** (.009)
Social Support Slope				-1.097 (.877)	.000 (.004)
Depressive Intercept					-.199 (.103)
Depressive Symptoms Slope					-.010 (.017)

* $p < .05$, ** $p < .01$, *** $p < .001$ ($\chi^2 = 496.977$, $df = 147$, $p < .001$, CFI = .677, and RMSEA = .059).

Table 7. Beta Coefficients for Model Using Sample Two Data with Regression Pathways Constrained to be the Same Across Gender

Gender Restricted						
	Social Support Intercept	Social Support Slope	Depressive Symptoms Intercept	Depressive Symptoms Slope	Age _{male}	Age _{female}
ADLs Intercept	.012 (.025)		-.567*** (.106)		-.256*** (.063)	-.372*** (.050)
Social Support Intercept			-2.071*** (.319)		-.051 (.027)	-.031 (.022)
ADLs Slope		.063 (.035)		-.105 (.108)	-.018 (.014)	-.028** (.009)
Social Support Slope				-.874 (.679)	.002 (.005)	.000 (.004)
Depressive Intercept					.042 (.117)	-.176 (.100)
Depressive Symptoms Slope					-.032 (.023)	-.010 (.017)

* $p < .05$, ** $p < .01$, *** $p < .001$ ($\chi^2 = 502.491$, $df = 153$, $p < .001$, CFI = .677, and RMSEA = .058; Change $\chi^2 = 5.514$, $df = 6$, $p = .480$)

Figure 1. Final path model specification