Physical Disability, Social Interaction, and Mental Health:
A Longitudinal Structural Equation Model Analysis

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SYNOPSIS

This study examines whether social interactions, an objective assessment of social context, mediates the association between physical disability status and global mental health over time. This study uses the three longitudinal waves of the National Social Life, Health and Aging Project (NSHAP) data. NSHAP data consists of interviews with adults 57 to 85 years old who currently live in their own homes (Analytic N = 3005). Researchers collected Wave 1 data in 2005-2006, Wave 2 in 2010-2011, and Wave 3 in 2015-2016.

I employed structural equation modeling (SEM) to examine disability status as it relates to social interactions and mental health as latent constructs, holding the effect of demographic characteristics constant. Findings suggest that the frequency of social interactions partially mediates how older adults with physical disabilities experience poorer mental health.

Longitudinal SEM results reveal that those with physical disabilities experience lower levels of future social interactions and poorer mental health outcomes. Future social interactions partially mediate the effect of physical disabilities on future poor mental health. Findings overall suggest that efforts to identify the determinants and mechanisms of poor mental health outcomes among the elderly benefit from consideration of how the impact of how physical disabilities are related to social interactions. *This analysis establishes the relationship between physical disability, social interactions levels, and mental health outcomes.*

Additionally, cross-sectional SEM models show that for each wave of data, people with physical disabilities report poorer mental health compared to people without physical disabilities.

People with disabilities also have lower amounts of social interactions. Low levels of social interactions are associated with poor mental health.

These longitudinal and cross-sectional findings align with the Stress Process Theory where stressors, in this case, a physical disability, are associated with poor mental health. These findings also support Stress Process Theory that if people have social interactions the effect of the stressor, physical disability, will have less of an effect on mental health. Additionally, these findings support the biopsychosocial framework of disability as each of the paths between physical disability (biological), mental health (psychological), and social interaction (social) are all substantive and statistically significant.

The findings from this study also have relevance for practitioners and policymakers working with older adults who have physical disabilities. For practitioners, if a patient currently has a physical disability, they also will likely experience social and emotional ramifications. Therefore, it is important for social workers and mental health professionals to consider social interactions and mental health considerations among people with disabilities. Considering social and emotional, not just physical, dimensions of disability will help practitioners to develop intervention strategies to seek out and maintain social interactions as well as to monitor the mental health of older adults with physical disabilities. Additionally, policymakers should be cognizant of the importance of social interactions for older adults with physical disabilities. For example, designing community spaces, handling weather emergencies, and implementing transportation plans should include designs that facilitate inclusion of people with walkers, wheel-chairs, scooters, canes, and other assistive devices. Knowing the relationship between physical disability, social interactions, and mental health should increase the importance of

allocations of public service money and effort into programs that foster social interactions among older adults such as community centers with programs focused on the social life of older adults.

INTRODUCTION

I examined the relationship between physical disability, social interactions, and mental health through four interrelated research questions. (1) What is the relationship between physical disability and mental health? (2) How are physical disability and social interactions levels related? (3) Is the relationship between social interactions and mental health significant? (4) Does physical disability have a relationship with future social interactions and mental health?

Researchers have examined questions 1, 2, and 3 are examined in isolation in previous research. This study pulls together these ideas tested individually in prior research to examine the relationship that exists between physical disability, social interactions, and mental health grounded in a biopsychosocial framework (Schneidert 2003) and Stress Process Theory (Pearlin, Schieman, and Meersman 2005). The biopsychosocial framework contains a biological, a psychological, and social understanding of disability. This model includes each component of this relationship with the biological as physical disability status, the psychological through mental health measures of depression, stress, anxiety, and loneliness, and the social through the frequency of social interactions. The Stress Process Theory shaped the model with social interactions as the buffer between physical disability, the stressor, and mental health.

DATA AND METHODS

National Social Life, Health, and Aging Project

Data used for this analysis comes from the National, Social, Health, and Aging Project (NSHAP) Waves 1, 2, and 3 data. The National Social Life, Health, and Aging Project is a nationally-representative panel (N=3005) of community-dwelling persons ages 57 to 85 (born

between 1920 and 1948 at Wave 1) in the contiguous United States (Waite et al. 2014). For NSHAP operationalization of community-dwelling means, participants are non-institutionalized and thus must live in their own homes rather than in an assisted facility such as a nursing home or hospice center. NSHAP collected data on a variety of domains related to health and social relations during in-home interviews that lasted on average for two hours that began with a short self-administered questionnaire and asked to complete a leave behind survey. Interview questions included a range of topics but largely focus on respondent's physical health, mental health, social networks, sexuality, and demographic information. NSHAP uses panel data (Waite 2017). Panel data exists by re-interviewing the same participants over time (Hecker and Gibbons 2006) and explained in greater detail in a subsequent section titled Longitudinal Panel Data.

Wave-Specific NSHAP Panel Data

Interviews of participants first occur for Wave 1 in 2005-2006, re-interviewed for Wave 2 in 2010-2011, and re-interviewed again for Wave 3 in 2015-2016. 3005 participants were included in Wave 1. For Wave 1, the weighted response rate was 75.5%. Males, oldest old adults (76-85), African-Americans, and Latinos were oversampled. 3,377 participants were in the Wave 2 sample. To be included in Wave 2, participants had to be included in the sampling frame for Wave 1 or were currently married to or a cohabitating romantic partner of a respondent. The weighted response rate for Wave 2 was 74%. 4,777 participants are included in Wave 3. Wave 3 re-interviewed participants from Wave 2 as well as added a new cohort of adults born between 1948-1965 along with their spouses or cohabitating romantic partner. Of the 4,777 participants in Wave 3, 49.6% (n=2,368) were added with the new cohort. The release of some information about Wave 3, including response rates is not complete as researchers at NSHAP are completing

quality control checks as well as data coding/cleaning. NSHAP nor this analysis uses weighted data (Waite 2017).

The current study examines the relationship between disability, social interactions, and mental health over time. Participants who were not present for two waves of data had no longitudinal data and thus were not relevant for this project. NSHAP followed 3005 participants consistently over the three waves. However, exclusion of participants who were not present at Waves 2 and 3 from this analysis generated a final sample size of 2,491 participants.[1]

Longitudinal NSHAP Panel Data

The use of longitudinal panel data is key "for establishing temporal order, measuring change, and making stronger causal interpretations" (Menard 1: 2002). This prospective panel design allows for researchers to examine how relationships between variables unfold over time (Wall and Williams 1970).

Longitudinal panel data has notable advantages when compared to cross-sectional data with more statistical power, each person serves as their own control, and researchers can tease out individual change over time (Hedecker and Gibbons 2006). Relationships between variables are significant with smaller sample sizes because longitudinal panel data has more statistical power. Each person serves as their own control for studies that examine social behavior in an experimental design. Lastly, re-surveyed participants allow researchers are able to examine not only change that occurs over time within groups but also change that occurs over time for individuals (Hedecker and Gibbons 2006, Menard 2002).

[1] If a respondent only missed one wave (i.e. they were in Wave 1 and 3 or in Wave 1 and 2) were not dropped as longitudinal analysis could be completed.

While longitudinal panel data provides a unique opportunity for examining change over time it is not without limitations (Menard 2002). Longitudinal panel data requires an extended period of time, has attrition (Hedecker and Gibbons 2006), and retesting effects can be an issue with longitudinal data (Menard 2002; Selig and Little 2012). Panel models are especially useful for looking at relationships between similar variables over time (Selig and Little 2012), in this case, disability, social interactions, and mental health. Longitudinal panel data is collected over several time points with the same sample. Because of the time between waves of data collection, longitudinal panel data takes a longer amount of time to collect than cross-sectional data. Attrition is when participants drop out of a study between data collection waves (Hedecker and Gibbons 2006). Attrition occurs because participants choose to no longer participate in a study, researchers are not able to contact them, and similar situations. Data collection that study population is older adults, such as NSHAP, also has attrition due to death of participants[2]. Priming effects are a greater concern in longitudinal data than cross-sectional data. Priming occurs when participants' answers are biased due to a stimulus. The previous waves of data collection can cause a priming effect for participants as they are asked the same questions across different waves of data (Menard 2002).

The ability to analyze the same variables over time for the same person was the deciding factor to use the NSHAP longitudinal panel data for this study. An examination of changes in physical disability, social interactions, and mental health over time allowed for analysis not only of the relationships at a single time point but also the delayed effects of physical disability on social interactions and mental health between time points. Additionally, the large sample size

[2] Between Wave 1 and Wave 2 430 respondents died. NSHAP researchers have not released this data for deaths between Waves 2 and 3.

and the variety of measures on key dependent and independent variables is a notable strength of NSHAP. Specifically, physical disability measures through Activities of Daily Living, social interactions frequency, as well as tested mental health measures make NSHAP uniquely suited for this study. Measures of relevance for the proposed project, as depicted in Figure 3:1, are as follows.

FIGURE 3:1 ABOUT HERE

Disability: Participants were asked to assess the degree of difficulty (no difficulty = 0 to unable to do = 3) they had with six Activities of Daily Living (ADL) expected to last at least three months: walking across a room, dressing, eating, bathing or showering, getting in and out of bed, and using the toilet[3]. An in-person interviewer asked these questions. The interviewer reads the following statement to each participant "we are interested in what activities are easy or difficult for you. Please look at the answer categories on the hand AA card and tell me how much difficulty you have with each difficulty. Exclude any difficulties that you expect to last less than three months." The hand card listed the options of 0= "no difficulty", 1= "some difficulty", 2= "much difficulty" and 3= "unable to do". Following the prompt and being given the hand card participants were read the following ADL measures (1) Walking across a room?, (2) Dressing, including putting on shoes and socks?, (3) Bathing or showering?, (4) Eating, such as cutting up your food?, (5) Getting in or out of bed?, and (6) Using the toilet, including getting up and down?. The interviewer recorded responses for each question.

[3] Other measures of health within NSHAP include self-rated health, information on medications, and biomarker data. I use ADL measures as they are a measure of disability across diagnosis and used within the medical community for practitioners as measures of physical disability (Spector et al 1987). Since one of the broader impacts of this paper is to help practitioners working with older adults with disabilities these measures are used in the study.

Prior analyses with these data, given that participants were community-dwelling at first interview, suggests that dichotomizing each indicator to reflect any difficulty is appropriate[4] (Warner and Kelley-Moore 2012; Warner and Adams 2016). I measured physical disability as a dichotomous variable for this study.[5] If participants identified that, they had difficulty completing any Activity of Daily Living (ADL) measure, I coded as having a physical disability (Spector et al. 1987). I used participants who did not have a physical disability as the reference group, or 0, for the physical disability measure.

Social Interactions: Participants were asked three separate social interactions questions about how often in the past 12 months they (a) did "volunteer work for religious, charitable, political, health-related, or other organizations"; (b) attended "meetings of any organized group"; and (c) got "together socially with friends or relatives". Responses for items ranged from 0= "never", 1= "less than once a year", 2= "About once or twice a year", 3= "Several times a year", 4= "About once a month", 5= "Every week", to 6= "Several times a week." [6]

These social interactions measures were selected to examine social interactions that unfold both within an organization[7], volunteering and attending meetings of an organized group,

[4] I collapsed measured of having a disability or not having a disability due to the small number of respondents who experience each disability.

[5] I also completed the analysis examining the change in disability over time. Change in disability between Waves 1 and 2 only predicted significantly predicted higher levels of depression at Wave 2 suggesting that having a disability, rather than change in disability status is a stronger predictor of social interactions and mental health.

[6] Analysis was also completed looking at the number of alters given for network data. I used frequency of social interactions to measure social interactions. Analysis of ego networks would measure the number of people a respondent was actively engaging with rather than the frequency interactions was occurring.

[7] I correlate volunteering and attending group events errors within each wave. As both of these measures exist within formal groups the correlation falls under the meaningfulness rule. SEM

as well outside of an organization, such as getting together socially with friends or relatives. I used three indicators of social interactions to generate a latent variable of social interactions. A higher score for the latent variable indicates higher frequency of social interactions. Social interactions measures were included in a leave behind survey. The response rate for the leave behind survey was 84% for Wave 1 and 87% for Wave 2. NSHAP researchers have not yet released response rates for Wave 3 (National Social Life, Health, and Aging Project 2018). Social interactions indicators are through total disaggregation, which is the use of individual variables rather than summated scales. The use of total disaggregation allows for an examination of how each individual measure directly relates to the latent variable (Williams, Vangenberg, and Edwards 2009).

Mental Health: NSHAP included four validated mental health scales, including for the Center for Epidemiological Studies Depression scale [CESD] (Radloff 1977), UCLA Short Loneliness scale (Hughes et al. 2004), the Hospital Anxiety Scale [HADS] (Bjelland et al. 2002), and the Perceived Stress Scale [PSS] (Sheldon, Kamarck and Mermelstein 1983)[8]. Health research widely uses each of the aforementioned scales in health research across disciplines and tested for people with disabilities. Higher scores on each of these scales indicate poorer mental health.

The Center for Epidemiological Studies Depression scale [CESD] short form is a widely used and validated scale measuring depression (Eaton et al.2004). CESD has been tested to be

experts outline that the meaningfulness rule is when errors are correlated due to their logical relationship to each other (Kenny 2011).

[8] There are two additional questions directly relating to overall mental health (1) self-rated mental health and a (2) happiness question. This study only uses the validated mental health scales that are for specific mental health outcomes to examine distinct psychological experiences.

reliable and valid for people with different types of disability including spinal cord injuries (Miller, Anton, and Townson 2008), stroke (Weimar et al.2002), and arthritis (Vali and Walkup 1998). The UCLA Loneliness Scale is valid and reliable short scale to measure loneliness (Russell, Peplau, and Curtona 1980). The UCLA Loneliness Scale has been used in studies examining mental health outcomes of people with disabilities (Alpass and Neville 2003; Duvdevany and Efrat 2004). The Hospital Anxiety and Depression Scale is a reliable instrument to assess levels of anxiety (Allen and Oshagan 1995). Researchers have validated the HADS Scale in medical settings, such as hospitals and at primary care facilities, as well as in the community (Snaith 2003). Studies examining various types of disabilities such as Parkinson's (Muslimović et al.2008), multiple sclerosis (Janssens et al.2003), and arthritis (Dickens et al.2002) have all used the HADS Scale. The Perceived Stress scale is the most commonly used psychological measure of stress (Cohen, Kamarck, and Mermelstein 1994). Additionally, PSS is widely used in research as the measure for stress in studies about people with disabilities (Bédard et al. 2009; Deldago 2007; McAuley et al.2006).

I used these four scales to generate a latent variable of mental health. A higher score for the latent variable indicates poorer mental health. I asked questions for the CESD (depression) scale, HADS (anxiety) scale, and PSS (stress) scale l during the in-person interview. I told participants "Now let's talk about thoughts and feelings you may have had during this past week. I will read a series of statements. Tell me how often during this past week you felt like this; rarely or none of the time, some of the time, occasionally, or most of the time? Don't take too long over your replies; your immediate reaction to each item will probably be more accurate than a long thought out response." I gave participants hand card FF with the following response options (1) rarely or none of the time, (2) some of the time, (3) occasionally, and (4) most of the

time. Statements for the CESD (depression) scale included (1) I did not feel like eating; my appetite was poor, (2) I felt depressed, (3) I felt that everything I did was an effort, (4) My sleep was restless, (5) I was happy, (6) I felt lonely, (7) People were unfriendly, (8) I enjoyed life, (9) I felt sad, (10) I felt that people disliked me, and (11) I could not get "going". I re-coded statements (5) I was happy and (8) I enjoyed life so that higher scores indicated higher levels of depression. I then added each respondent's answers for statements related to the CESD together. A higher score is associated with higher levels of depression.

Questions for the PSS (stress) scale included (1) I was unable to control important things in my life, (2) I felt confident about my ability to handle personal problems, (3) I felt that things are going my way, and (4) I felt difficulties were piling up so high that I could not overcome them. Statement (3) I felt that things are going my way was reverse coded so that higher scores indicated a higher level of stress. After recoding, all stress indicators were added together to construct the PSS scale with lower scores indicating a lower level of stress.

Questions for the HADS (anxiety) scale included (1) I felt tense or "wound up", (2) I got a frightened feeling as if something awful was about to happen, (3) Worrying thoughts went through my mind, (4) I could sit at ease and feel relaxed, (5) I got a frightened feeling like butterflies in my stomach, (6) I felt restless as if I had to be on the move, and (7) I had a sudden feeling of panic. For the HADS measures, I reverse coded (4) I could sit at ease and feel relaxed so higher scores would reflect higher anxiety. I added all eight indicators together for the HADS (anxiety) scale.

Questions for the UCLA (loneliness) scale were included in a leave behind questionnaire. These are the only mental health questions that that I did not ask during the in-person interview. Questions for the UCLA (loneliness) scale included (1) How often did you feel that you lack

companionship?, (2) How often do you feel left out?, and (3) How often do you feel isolated from others?. Response options for each of these questions ranged from 1= "Never", 2 = "Hardly even", 3 = "Some of the time", to 4= "Often". I added together question responses for respondent loneliness so that higher scores would indicate a respondent is lonelier.

The mental health indicators are partially disaggregated for the SEM. Partial disaggregation is the use of scales as indicators for latent variables rather than individual variables (Williams, Vangenberg, and Edwards 2009). Even though this type of disaggregation does not allow for analysis of each individual variable, this study the uses well-established scale measures of mental health because of their wide use and high quality throughout the social sciences.

Control Variables: The full model includes control variables for sex, age, education, race, and marital status. Sex is measured as a dichotomous variable with female as 1 and male as 0. Sex was included as a control variable because patterns of social interactions are different for men and women (Walen and Lachman 2000). To adjust for age, I included age at Wave 1. To make the constant more meaningful I centered age by subtracting the lowest age (57) from each respondent's age. Thus the constant indicates the average value of the dependent variable (e.g. social interaction or poor mental health) for those at age 57. Because I subtracted a constant, the coefficients still indicate the increase or decrease in the dependent variables for a one-year increase in age. Increases in age are associated with changes in social interactions amounts and mental health (Musick and Wilson 2003), therefore age is an important control variable. Education is a good indicator of social class for older adults (Grundy and Holt 2001) and has a strong association with health (Mirowsky and Ross 2003). I control for level of education with an indicator variable for having more than high school education (=1) compared to high school

education or less (=0). For this analysis division of education into more than high school education and high school education or less to examine the effect of higher education. Race is included in the model as a dichotomous variable with minority racial identity as 0 and white as 1. Research has found that older people who are racial minorities have a smaller number of connections within their social network but a higher frequency of social interactions (Ajrouch, Antonucci, and Janevic 2001). Thus, a control for race was included as there is evidence supporting that social interactions unfold differently between whites and racial minorities. Lastly, marital status is included as a dichotomous variable with 0 being not currently married (widowed, divorced, etc.) and 1 as currently married. Marital status was included because the social connections that a person's spouse has often has a carryover effect into their own life and people who are not married have higher social interactions levels with others (Utz et al. 2002).

Analytical Approach

Structural Equation Modeling. While multiple regression or Ordinary Least Squares (OLS) is often used to examine relationships between multiple factors with a mental health outcome, that approach limits how we can assess the way particular variables influence outcomes of interest. Specifically, OLS regression assumes a linear relationship and largely minimizes the indirect pathways between non-physical factors as they relate to health measures (Raina et al. 2004). Due to these limitations, I employ Structural Equation Modeling (SEM) for this analysis. SEM allows measures not only the relationship between variables but also indirect and direct pathways, allows for variables to be grouped into a latent construct, as well as test advanced empirical hypothesis through goodness of fit statistics (Anderson and Gerbing 1988). Additionally, SEM "allows researchers to simultaneously implement two key aspects of the research process, linking latent variables associated with concepts of theory to indicators used to

represent these concepts and estimating relationships among latent variables as proposed by theory" (Williams, Vangenberg, and Edwards 588: 2009). This study uses Structural Equation Modeling to test the relationships, both direct and indirect, of mediating effects of social interactions levels between an individual's physical disability status and their mental health shown in Figure 3:2 below.

FIGURE 3:2 ABOUT HERE

Structural equation models should be theoretically driven and based on previous research (Bollen 1989, Overton 1998; Williams, Vandenberg, and Edwards 2009). This SEM analysis examines the relationship between physical disability, social interactions, and mental health. Structural equation models are uniquely suited to test the direct and indirect relationships between physical disability, social interactions, and mental health, through latent variables of social interactions and mental health, outlined in the theory and literature review sections above. This allows modeling to be less circumscribed to linear relationships, such as with regression modeling.

I tested measurement and structural models within the SEM analysis. Measurement models are the statistical testing of how well indicators load onto latent variables (Bollen 1989). I addressed measurement models in this study with two general equations. $Y = L_Y\eta + \varepsilon$ is the measurement model for endogenous latent variables, social interactions and mental health, in this study with Y is the vector of these dependent variable measurements collected from NSHAP Waves 1, 2, and 3, L_Y contains the loading scores on η, and ε is a measure of error within the model. Specifically, I used two measurement models for each latent variable. I measured disability status, the exogenous variable, as a dummy variable. If participants identified having difficulty with any activity of daily living (walking across a room, dressing self, bathing self,

getting in and out of bed, using the toilet, or eating) they were coded as having a disability. I measured social interactions, an endogenous variables $Y_{Social\ Interaction} = L_{Social\ Interaction}\eta + \varepsilon$. I measured mental health, an endogenous variable, as $Y_{Mental\ Health} = L_{Mental\ Health}\eta + \varepsilon$. For each wave of data these procedures were followed thus there is one exogenous variables (disability status at Wave 1) and 8 endogenous latent variables (disability at Wave 2 and 3, social interactions at Wave 1, 2, and 3, as well as mental health at Wave 1, 2, and 3).

Structural models encompass the causal relationship hypothesized between the endogenous and exogenous variables (Lai 2010). The structural equation model within this analysis follows a traditional model of $\eta = B_\eta + \Gamma\xi + \zeta$. B is the matrix of the effects of the regression coefficients of endogenous variables on other endogenous variables. For this study, social interactions on mental health Γ is the matrix from effects of the regression coefficients from the exogenous variable on endogenous variables, functional limitations on social interactions and mental health respectively. Lastly, ζ is the vector of residuals from the SEM. Bentler Comparative Fit Index (CFI) (Bentler 1990), Steigler-Lind Root Mean Square Error of Approximation (RMSEA) (Steiger 1990), and Tucker Lewis Index (TLI) (Tucker and Lewis 1973) were used as measurements for fit of the model as they are the industry standard for sample sizes above 400 (Kenny 2012; Kline 2016). RMSEA values less than 0.05, ideally closer to 0 (Browne and Cudeck 1993), CFI values greater than 0.90, and TLI values greater than 0.90 (Hu and Bettler 1998) indicate a good model fit.[9]

[9] There is ongoing debate if reporting CFI and TLI values is redundant as they are closely related. Additionally, there is debate as to what the cut off values should be for CFI and TLI as over 0.80 up to over 0.95 (Fan and Sivo 2005; Hu and Bentler 1999). Each model in this study having good model fit with a CFI and TLI of 0.80 or higher.

Time-Invariant Variables and Time-Variant. The control variables within this analysis are either time-invariant or time-variant. Time-invariant variables are factors measured within longitudinal data that will not change over time. Time-variant variables are factors that may, but do not necessarily, change over time. Time-Invariant variables within this study are age at Wave 1, race at Wave 1, education at Wave 1, and sex at Wave 1. The model uses the value that participants report at Wave 1. For older adults, marital status changes over time largely due to divorce, marriage, and widowhood (Huntley-Hall 2017; Smith, Zick, and Duncan 1991). Marital status relates to social interactions levels as well as mental health (Cornwell, Laumann, and Schumm 2008; Ferraro 1984). Thus, the only control variable that is time-variant is marital status.

Maximum Likelihood. Maximum likelihood is a common tool used for estimation and fitting method for structural equation modeling (Kline 2016). Maximum likelihood provides estimations that maximize the likelihood that the data were from the population (Bollen 1989; Kline 2016). Maximum likelihood has three notable properties; the properties are asymptotic, the maximum likelihood estimator is consistent, and they are not biased across variables used for estimation (Bollen 1989). Since the properties are asymptotic, they work especially well with larger sample sizes, such as with this study. As maximum likelihood is the default estimation and test for local fit[10] (Kline 2016), I used maximum likelihood for this analysis.

Correlated Errors. Correlated errors should only be included within structural equation models when they are logically driven rather than to increase model fit (Kline 2016). By correlating the errors associated with each of the variables the model adjusts for the overlap that

[10] Other options for model fit are unweighted least squares and generalized least squares.

may exist for these indicators (Kline 2016). For social interactions, of the three variables used for analysis[11] two, volunteering and attending group events, exist within formal group settings. I correlated these variables' errors to note that volunteering and attending group events very well may occur within the same setting. The correlated errors are included for volunteering and attending group events at Wave 1, Wave 2, and Wave 3. Similarly, of the mental health measures[12], depression, anxiety, and stress are interrelated as many people who experience depression have anxiety and high levels of stress (Cohen et al.1983). Thus correlation of errors is included for depression and anxiety, depression and stress, as well as anxiety with stress. The correlated errors are included for depression, anxiety, and stress at Wave 1, Wave 2, and Wave 3.

Correlations of errors are included when researchers use the same indicators across multiple data collection points (Kline 2016). When researchers correlate the errors it allows maximum likelihood to adjust for the relationship that exists between the same measures over time. As this model uses the same measures across each wave, such as the three social interactions measures of frequency volunteering, attending group events, and time spent with friends and family, the errors for identical variables the researcher should controlled these across waves. Thus, I correlated the errors for variables[13] measured across Waves 1, 2, and 3.

RESULTS

[11] Social interactions variables are frequency of (1) volunteering, (2) attending group events, and (3) time spent with friends and family.

[12] Mental Health Measures are (1) Depression (CESD), (2) Loneliness (UCLA), (3) Stress (PSS), and (4) Anxiety (HADS)

[13] The same variables used across all three waves include the physical disability measure (disability as dichotomous variable), social interactions measures (frequency of volunteering, attending group events, and time spent with friends and family), mental health scales (CESD, HADS, PSS, UCLA), and marital status (married as a dichotomous variable).

Descriptive Statistics across Three Waves

Descriptive statistics of all study variables are contained in Table 3:1. For the 2,491 participants, 36% had at least one disability at Wave 1 which increased to 52% at Wave 2 and 69% at Wave 3. This pattern is common as people age they are more likely to develop physical limitations and thus are more likely to have a disability. Social Interactions is relatively consistent over three waves using indicators of volunteering[14] (2.14 at Wave 1, 2.15 at Wave 2, and 2.16 at Wave 3) and attending group events[15] (2.58 at Wave 1, 2.64 at Wave 2, and 2.66 at Wave 3). However, there are notable differences between waves when examining the time spent with friends and family[16] (4.32 at Wave 1, 4.27 at Wave 2, and 4.48 at Wave 3).

TABLE 3:1 ABOUT HERE

Loneliness changes over time, decreasing between each wave[17] (4.04 at Wave 1, 3.20 at Wave 2, and 2.98 at Wave 3). Anxiety changes over time, increasing between Waves 1 and 2 then decreasing between Waves 2 and 3[18] (10.57 at Wave 1, 11.66 at Wave 2, and 11.42 at Wave

[14] ANOVA Output for volunteering= F (2,7470) = 0.05, p=0.95

[15] ANOVA Output for attending group events= F (2,7470) = 0.90, p=0.94

[16] ANOVA output for time with friends and family = F (2,7470) = 17.02, p<0.001. Change between Waves 1 and 2 is not significant (p= 0.38) with a decrease of 0.05. Change between Waves 1 and 3 is significant (p <0.01) with an increase of 0.08. Change between Waves 2 and 3 is significant (p <0.01) with an increase of 0.12.

[17] ANOVA output for loneliness = F (2,7470) = 187.43, p<0.001. Change between Waves 1 and 2 is not significant (p=0.38) with a decrease of 0.05. Change between Waves 1 and 3 is significant (p<0.01) with an increase of 0.16. Change between Waves 2 and 3 is significant (p<0.01) with an increase of 0.12.

[18] ANOVA output for anxiety = F (2,7470) = 817.13, p<0.001. Change between Waves 1 and 2 is significant (p<0.001) with an increase of 1.09. Change between Waves 1 and 3 is significant (p<0.001) with an increase of 0.85. Change between Waves 2 to 3 is significant (p=.04) with a decrease of 0.24.

3). Depression decreases between Waves 1 and 2 but is stable between all other waves[19] (16.56 at Wave 1, 16.11 at Wave 2, and 16.25 at Wave 3). Stress changes over time with an increase between Waves 1 and 2 and a decrease between Waves 2 and 3[20] (5.79 at Wave 1, 7.17 at Wave 2, and 6.13 at Wave 3).

Half of the participants were female (51.6%). Their average age was 64.9 years old at Wave 1, ranging from 57 to 85 years old. Over two-thirds of participants (76.0%) were white. Half of the participants' highest degree of education was high school or less than high school and half of the participants' highest degree of education was some college or more. At Wave 1 60% of participants were married compared to 57% at Wave 2 and 56% at Wave 3. Overall, the averages for social interactions, mental health, age, education, and race remain relatively stable over time with some minor fluctuations in social interactions and mental health. Over time there is an increase in the percent of people with disabilities and a slight decrease in the percent of people who are married.

Disability, Social Interactions, and Mental Health over Time

This chapter examines the complex relationship between disability, mental health, and social interactions at a given time point, as well as the effect of disability over time on social interactions and mental health. For each wave, the relationship between disability and poor mental health was a positive moderate relationship for each wave at .46 (Wave 1), .44 (Wave 2),

[19] ANOVA output for depression = F (2,7470) = 132.11, p=0.01. Change between Waves 1 and 2 is significant (p=0.005) with a decrease of -0.45. Change between Waves 1 and 3 is not significant (p=0.08) with a decrease of 0.31. Change between Waves 2 and 3 is not significant (p=0.59) with an increase of 0.14.

[20] ANOVA output for stress = F (2,7470) = 1237.86, p<0.001. Change between Waves 1 and 2 is significant (p<0.001) with an increase of 1.21. Change between Waves 1 and 3 is significant (p<0.001) with an increase of 0.94. Change between Waves 2 and 3 is significant (p<0.001)

and .38 (Wave 3). Additionally, the relationship between disability and social interactions remained moderately negative for each wave with correlations of -.40 (Wave 1), -.31 (Wave 2), and -.47 (Wave 3). Social interactions have a weak negative relationship with poor mental health with -.10 at Wave 1, -.16 at Wave 2, and -.16 at Wave 3. These findings, shown in Figure 3:3 below, support the Stress Process Theory that people with disabilities have better mental health outcomes when they have social interaction to mediate the effects of disability on mental health.

FIGURE 3:3 ABOUT HERE

There is a negative relationship between social interactions and disability status over time (-.26 from Wave 1 to Wave 2 and -.48 from Wave 2 to Wave 3). This finding supports the notion that physical disability not only affects social current interactions but also in the future in a negative manner so people with disabilities not only have lower levels of social interactions currently but this carries over into their future levels of social interactions. There is also an association of disability status with poor mental health over time. The association is weak and positive between Wave 1 disability status and Wave 2 poor mental health (.27), and moderate and positive (.42) between and Wave 2 disability status and 3 poor mental health. Therefore, currently having a disability is not only associated with poor current mental health but also future poor mental health.

The three-wave structural equation models all produced goodness of fit statistics within the ranges considered acceptable that I described above (i.e. RMSEA of 0.04, CFI of 0.92, and TLI of 0.89). As seen in Table 3:2 below the results indicate that women, those who are older, and those who have higher levels of education have higher, and whites have lower, levels of social interactions compared to those in the reference groups. Women, however, do not have worse poor mental health than men. Those who are older, more educated, and white have lower

levels of poor mental health compared to those in the reference groups. Marital status in prior waves is not associated with social interactions, but within waves those who are married have lower poor mental health than those who are not married. Therefore, even though marital status is not associated with social interactions levels among older adults, it is associated with better mental health at each wave. All indicators for the measurement model of disability, social interactions, and mental health loaded significantly to their respective latent constructs.

TABLE 3:2 ABOUT HERE

Direct, Indirect, and Total Effects

Effects are a measurement of the influence of a variable, or set of variables, on an outcome (Bollen 1987). Examination of effects allows the researcher to tease out the effect variables within a structural equation model (Cohen et al.2003). Researchers report effects as direct effects, indirect effects, and total effects (Bollen 1987; Cohen et al.2003). Measurement of direct effects is the coefficient between two variables (Bollen 1987; Cohen et al.2003). Direct effects for this study are the coefficients from the relationship between physical disability and poor mental health. Indirect effects include all pathways to a single variable mediated or moderated by one or more variables (Bollen 1987; Cohen et al. 2003). Calculation of indirect effects for this study is by multiplying the unstandardized coefficients of physical disability status with social interactions and social interactions to poor mental health. Total effect is the measurement of both the direct and indirect effects within a model (Bollen 1987; Cohen et al.2003). Table 3:3 contains total effects calculations for the outcomes of social interaction and poor mental health using summation of the direct effect and indirect effect for each outcome.

TABLE 3:3 ABOUT HERE

For this longitudinal model, there are a total of 5 paths. Each wave has a path accounting for 3 of the paths. Across waves of data, there are two additional paths. Then from Wave 1 to Wave 2 accounts for a path. Lastly from Wave 2 to Wave 3 accounts for a path.

The direct path from disability status in Wave 1to poor mental health is 0.46. The indirect path from disability to social interactions to poor mental health is 0.04. The total association from disability status to poor mental health for Wave 1 is 0.50. Therefore, in Wave 1 a portion of the association from disability status to poor mental health is through social interactions. The direct path from disability status to poor mental health in Wave 2 is moderate and positive (0.44). The indirect path from disability to social interactions to poor mental health is 0.05. The total path for Wave 2 is 0.49. Thus there is a similar level of mediation through social interaction among older adults about five years after the first wave. The direct association from disability to poor mental health in Wave 3 is smaller than in the prior two waves, 0.38. The indirect path from disability to social interactions to poor mental health is larger in Wave 3, 0.08. The total path for Wave 3, however, is similar to the prior waves, 0.46. Thus more of the total effect from disability status to poor mental health is through social interactions in Wave 3 (.08) than in the prior waves. The associations are similar across waves (with the except of the indirect effect in wave 3), suggesting that disability status and level of social interactions are relevant for mental health from the mid-fifties to the late nineties.

There are two paths that cross two time points: the relationship between physical disability at Wave 1 to social interactions and poor mental health at wave 2, and the relationship between physical disability at wave 2 to social interactions and poor mental health at Wave 3. Wave 1's direct path from physical disability to wave 2 poor mental health is 0.27. The indirect path from wave 1 disability to wave 2 social interactions to wave 2 poor mental health is 0.04.

The total path is 0.35. Wave 2's direct path from physical disability to wave 3 poor mental health is 0.42. The indirect path from wave 2 disability to wave 3 social interactions to wave 3 poor mental health is 0.08. The total path is 0.50. The paths between each wave of data are similar to each other, showing that the effects of the relationship between physical disability and poor mental health partially accounted for by an inclusion of social interactions over time.

Supplementary Analysis: Disability, Social Interactions, and Mental Health at One Time Point

I also analyze each wave of NSHAP separately to see if inclusion of multiple waves of data changes the patterns of relationships between physical disability status, social interaction, and poor mental health. Completing a supplementary analysis of each wave as a check of the full model. My findings for each wave matched closely with the three wave model.

For Wave 1, there is a good model fit with RMSEA (0.04), CFI (0.91), and TLI (0.89) all within acceptable parameters. As seen in Figure 3:4, all indicators for the measurement model of social interactions and mental health loaded significantly to their respective latent constructs. For Wave 1 (seen in Figure 3:4), there is a moderate positive (.43) relationship between disability status and poor mental health, a moderate negative (-.40) relationship between disability status and social interactions, and a weak negative (-.19) relationship between social interactions and poor mental health over time. To that end, older adults with disabilities have poorer mental health and lower social interactions, and those with higher social interactions have lower poor mental health. Social interactions partially mediate the relationship between disability status and poor mental health.

FIGURE 3:4 ABOUT HERE

As seen in Table 3:4, of the control variables sex, age, and education were significant in the relationship between disability status and social interactions. Women have higher levels of social

interactions compared to men. With each year of age, there is a small but significant increase in the frequency of social interactions. People with higher levels of education indicate higher levels of social interactions. Similar to Wave 1, older adults with physical disabilities have poorer mental health and lower social interactions, and those with higher social interactions have lower poor mental health. Women have higher levels of poor mental health than men. People with higher levels of education as well as people who are married have lower levels of poor mental health than those in the reference groups.

TABLE 3:4 ABOUT HERE

My analysis of Wave 2 has good model fit, the RMSEA (0.05), CFI (0.93), and TFI (0.88) which are all within acceptable parameters. As seen in Figure 3:5, all indicators for Wave 2's measurement model of social interactions and mental health loaded significantly to their respective latent constructs.

Also seen in Figure 3:5, Wave 2 data follows a similar pattern to Wave 1. There is a moderate positive relationship (.51) between disability and poor mental health, disability is moderately negatively (-.34) associated with social interactions, and social interactions is weakly negatively (-.28) associated with poor mental health. Therefore, compared to not having one, having at least one disability is associated with poorer mental health and lower levels of social interactions, and low levels of social interactions associated with higher poor mental health.

FIGURE 3:5 ABOUT HERE

As seen in Table 3:5, for the relationship between disability status and social interactions sex, education level, and race were significant. Women had higher levels of social interactions than men. Higher levels of social interactions were associated with higher levels of social interactions. People who identified as white had higher amounts of social interactions than

people who identified as racial minorities. For the relationship between disability status, social interactions, and mental health sex and marital status were significant. Women have higher levels of poor mental health and people who are married have lower levels of poor mental health.

TABLE 3:5 ABOUT HERE

Wave 3's model fit statistics, in Figure 3:6 below, were the strongest out of the three waves of data with an RMSEA of 0.03, CFI of 0.96, and TLI of 0.93. All indicators for the measurement model of social interactions and mental health loaded significantly to their respective latent constructs.

Wave 3, depicted in Figure 3:6, follows a similar pattern to Waves 1 and 2. Disability has a moderate positive (.41) with poor mental health. However, there is a strong negative (-.67) relationship between disability and social interactions, stronger than measured in the two previous waves. Additionally, the relationship between social interactions and poor mental health is also stronger as a moderate negative (-.37) relationship. To that end, the overall relationships are the same. The strengths of those relationships, however, are higher compared to the previous waves of analysis. Beyond stronger relationships between the variables, the model fit statistics are better for Wave 3.

FIGURE 3:6 ABOUT HERE

As seen in Table 3:6, control variables of sex and education were significant for the relationship between disability status and social interactions. Women reported having higher levels of social interactions than men. People with higher levels of education have higher frequency of social interactions. Upon examination of the relationship between disability status, social interactions, and mental health the control variables of sex, education, and marital status

were significant. Women have higher levels of poor mental health. People with higher levels of education and people who are married have lower levels of poor mental health.

TABLE 3:6 ABOUT HERE

Sensitivity Analysis

Social interactions and mental health are examined within this study as latent constructs. I completed a sensitivity analysis on the factor loading for social interactions and mental health. Confirmatory factor loading analysis show that the social interactions variables loaded onto a single factor with an eigenvalue of 2.38 and uniqueness of 0.20 for volunteering, 0.17 for attending group events, and 0.24 for time spent with friends and family. For mental health, one notable factor emerged with a weak second factor. The factor with an eigenvalue 1.47 and uniqueness of 0.68 for the UCLA loneliness scale, 0.54 for the HADS anxiety scale, 0.87 for the PSS stress scale, and 0.43 for the CESD depression scale.[21]

Completion of additional sensitivity analysis examined if each variable used to generate latent constructs. This analysis examined if each construct within a given factor gave a similar model output. To complete the sensitivity analysis, I replaced the latent constructs with each of their indicators and re-ran the structural equation model to see if the model found different results with a single indicator rather than the latent variable.

To that end, for social interactions the model was rerun using volunteering, attending group events, and time spent with friends and family individually. Each social interactions variable (volunteering, attending group events, and time spent with friends and family) generates a similar model to the latent construct of social interactions. Having a disability is associated

[21] Reported Eigenvalues and factor uniqueness values are for Wave 1. Factor analysis across waves followed the same pattern.

with lower levels of each social interactions variable and inferior mental health. Each mental health scale (UCLA loneliness scale, the HADS anxiety scale, the PSS stress scale, and the CESD depression scale) generates a similar model to the latent construct of mental health. Having a physical disability is associated with having higher levels of loneliness, anxiety, stress, and depression. The analysis also show that having more social interactions are associated with lower levels of loneliness, anxiety, stress, and depression. These findings all align with the findings using the comprehensive latent constructs of social interactions and poor mental health. To that end, the sensitivity analyses show that the main conclusions (i.e. the direction and strength of the associations) are robust to various measurement strategies and specifications.

DISCUSSION AND CONCLUSION

Social interactions partially mediate the negative association between functional limitations and mental health among older adults. There is a moderate negative association between functional limitations and mental health, a strong negative association between functional limitations and social interactions, and a weak positive association between social interactions and mental health.

The findings lend support to the call to consider how functional limitations unfold in a social context and that context is necessary for understanding the psychosocial consequences of disablement (Warner and Kelley-Moore 2012). Importantly, when considered with prior research, the results indicate that objective and subjective measures of social connectedness operate differently (Cornwell and Waite 2009) as objective measures of social interactions mediate the lower psychosocial mental health of persons with functional impairments but their subjective appraisals of how well that interaction meets their needs may moderate these deleterious effects.

Limitations. Limitations of this study are rooted in the data and assumptions within the model. NSHAP, while nationally representative and well respected, only includes adults who are community dwelling. Older adults with high levels of disability are largely institutionalized within nursing homes, skilled care facilities, and hospices. Older adults within institutions will have different levels of social interactions and mental health and thus this study is not generalizable to all older adults. Assumptions within the model are within the latent constructs of physical disability, social interactions, and mental health. Activity of Daily Living measures are widely used and verified as measures of physical disability, thus they are of less concern as a study limitation. Social interactions were generated under the assumption that people's social involvement with friends, family, and community organizations is a strong conceptualization of social interactions. It is likely that there are some individuals within this age group who solely interact with one group (i.e. just friends, just family, just church) and have very high and satisfying levels of social interactions. Lastly, mental health is generally not used as a holistic measure in most studies; therefore, results should be interpreted with minor caution.

Future Research Directions. Researchers beyond this dissertation needed to examine various measures of social interactions, subjective measures of social support, and barriers to social interactions. Analysis of objective measures of social interactions and subjective measures of social support will provide a more robust assessment of the social context in which older persons experience functional limitations. Research should unpack the barriers to social interactions for people with disabilities based on their physical and social environment. In conjunction with longitudinal data to examine the causal order of physical disability, social interactions, and mental health would allow researchers and medical practitioners to develop best

practices to prevent excess deterioration of social interactions and mental health for people with physical disabilities.

Figures and Tables:

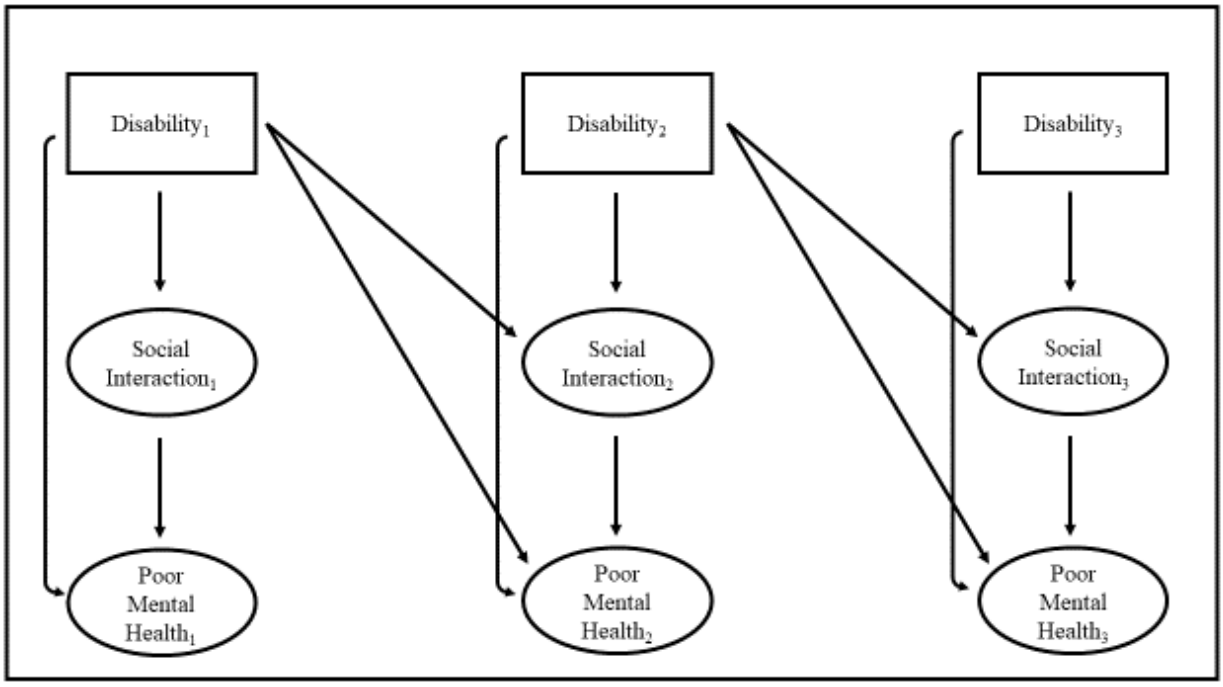

Figure 3:1. Longitudinal Structural Equation Model of Disability, Social Interactions, and Mental Health

Data: NSHAP Waves 1, 2, and 3

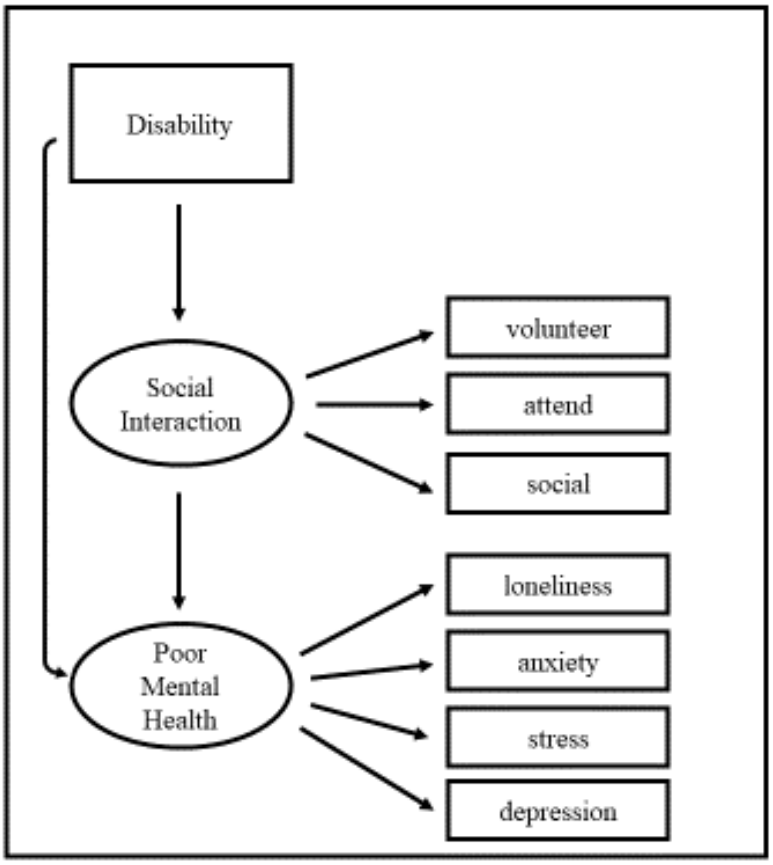

Figure 3:2. Structural Equation Model with Latent Variable Indicators for Disability and Social Interaction Predicting Poor Mental Health

Data: NSHAP Waves 1, 2, and 3

Table 3:1. Descriptive Statistics for the Variables Included in the Multivariate Analysis

	Wave 1			Wave 2			Wave 3		
	Mean	Std. Dev.	Range	Mean	Std. Dev.	Range	Mean	Std. Dev.	Range
Disability (Dummy)									
Has Disability	0.36		0-1	0.52		0-1	0.69		0-1
Social Interactions									
Volunteering	2.14	2.08	0-6	2.15	2.14	0-6	2.16	2.19	0-6
Attend Group Activities	2.58	2.15	0-6	2.64	2.18	0-6	2.66	2.24	0-6
Time with Friends & Family	4.32	1.30	0-6	4.27	1.37	0-6	4.48	1.31	0-6
Mental Health									
Loneliness (UCLA)	4.04	1.41	0-9	3.20	2.31	0-9	2.98	2.27	0-9
Anxiety (HADS)	10.57	3.46	7-28	11.66	3.67	6-27	11.42	3.42	6-25
Depression (CESD)	16.56	5.19	11-43	16.11	4.90	10-41	16.25	5.05	11-40
Stress (PSS)	5.79	2.28	4-16	7.17	2.67	2-16	6.73	2.52	2-16
Controls									
Age ^	69.30	7.85	57-85						
Degree (Education)^	2.49	1.07	1-4						
White (Race) ^	0.76		0-1						
Married	0.60		0-1	0.57		0-1	0.56		0-1

^ Included as time invariant variables using Wave 1 values.

Data: NSHAP

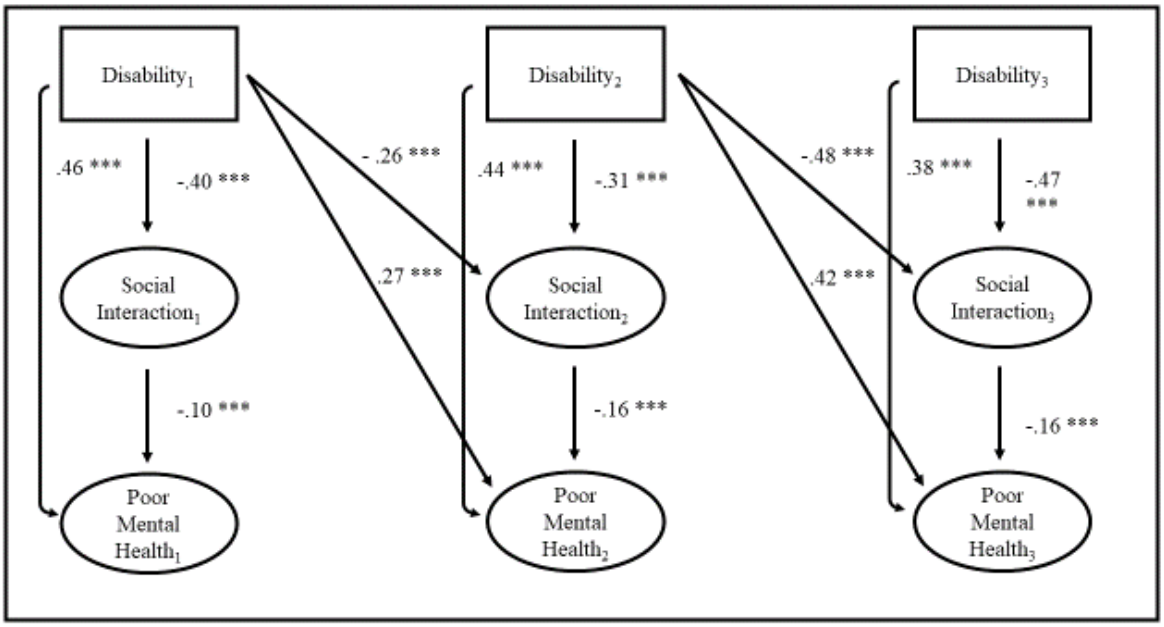

Figure 3:3. Structural Equation Model for Disability and Social Interaction Predicting Poor Mental Health Waves 1, 2, and 3

Note: Controlled for sex, age, education, and race at Wave 1. Controlled for marital status at each wave. CFI= 0.0.92 TLI= 0.89 RMSEA = 0.04

Data: NSHAP Waves 1, 2, and 3

Table 3:2. Control Variable Significance For Three Wave Structural Equation Model of Physical Disability, Social Interactions, and Poor Mental Health

	Model 1 Dis -> SI		Model 2 Dis -> SI ->PMH	
Time Invariant				
Female (vs. Male) (Sex)	0.21	***	0.05	
Age	0.01	**	-0.01	**
H.S. + (vs. LT HS) (Education)	0.17	***	-0.70	***
White (vs. Non-white) (Race)	-0.04		-0.70	*
Time Variant				
Married at Wave 1 (vs. non-married) (Marital Status)	0.05		-0.32	***
Married at Wave 2 (vs. non-married) (Marital Status)	0.01		-0.44	***
Married at Wave 3 (vs. non-married) (Marital Status)	0.06		-0.42	***

For the Time Invariant Variables: Model 1 coefficients are for the associations of the control variable with Social Interaction (W1_SI) in the model with Wave 1 Disability (W1_Dis) as a predictor. Model 2 coefficients are for the associations of the control variables with Wave 1 Poor Mental Health (W1_PMH) in the model with Disability (W1_Dis) and Social Interaction (W1_SI) as predictors.

For the Time Variant Variables (Married): Model 1 coefficients are for the associations of the control variable with Social Interaction (SI) in the model with Disability (Dis) as a predictor. Each line relates to a specific wave of data. Model 2 coefficients are for the associations of the control variables with Poor Mental Health (PMH) in the model with Disability (Dis) and Social Interaction (SI) as predictors. Wave 1 is on the first line, Wave 2 on the second line, and Wave 3 on the third line.

Dis= Disability, SI= Social Interaction, PMH= Poor Mental Health
H.S.+ = High School or more of education
LT HS = Less than High School education

Data: NSHAP Waves 1, 2, and 3
* $p < .05$; ** $p < .01$; *** $p < .001$

Table 3:3. Direct, Indirect, and Total Effects from Physical Disability to Poor Mental Health through Social Interaction

	Direct Effect	Indirect Effect	Total Effect
Wave 1 ($Dis_1 \rightarrow SI_1 \rightarrow PMH_1$)	0.46	0.04	0.50
Wave 2 ($Dis_2 \rightarrow SI_2 \rightarrow PMH_2$)	0.44	0.05	0.49
Wave 3 ($Dis_3 \rightarrow SI_3 \rightarrow PMH_3$)	0.38	0.08	0.46
Wave 1 to Wave 2 ($Dis_1 \rightarrow SI_2 \rightarrow PMH_2$)	0.27	0.04	0.35
Wave 2 to Wave 3 ($Dis_2 \rightarrow SI_3 \rightarrow PMH_3$)	0.42	0.08	0.50

Dis_1= Physical Disability at Wave 1, SI_1= Social Interactions at Wave 1, PMH_1= Poor Mental Health at Wave 1

Dis_2= Physical Disability at Wave 2, SI_2= Social Interactions at Wave 2, PMH_2= Poor Mental Health at Wave 2

Dis_3= Physical Disability at Wave 3, SI_3= Social Interactions at Wave 3, PMH_3= Poor Mental Health at Wave 3

Data: NSHAP Waves 1, 2, and 3

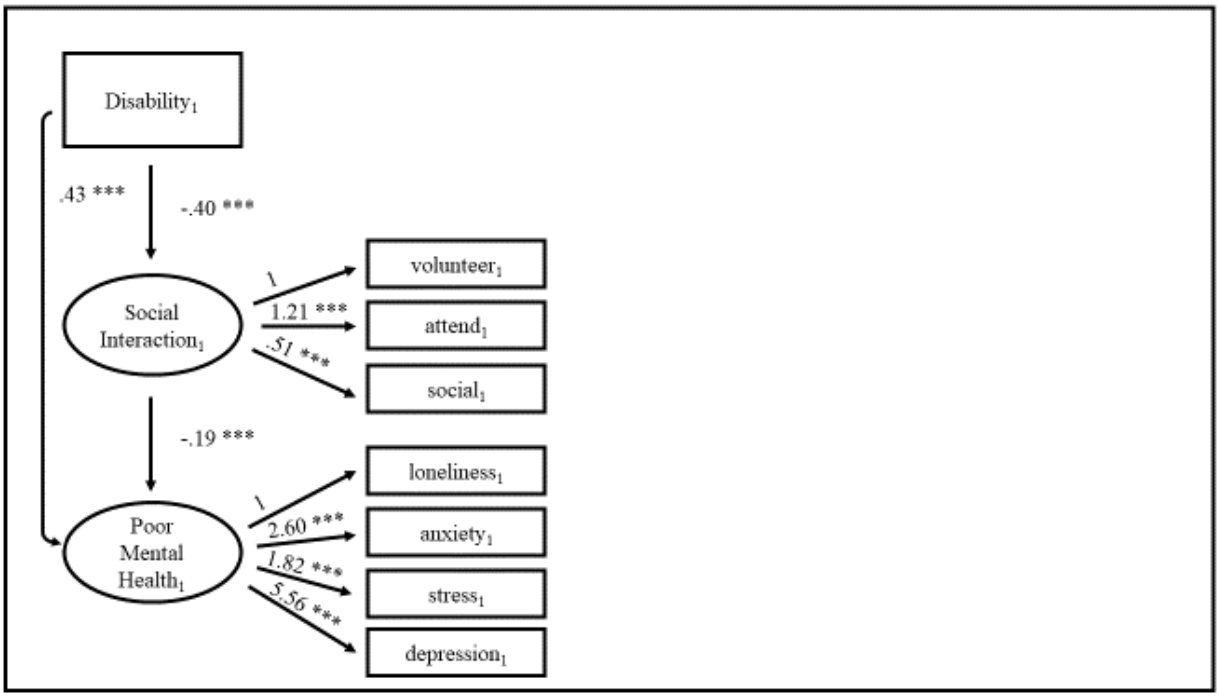

Figure 3:4. Structural Equation Model for Disability and Social Interaction Predicting Poor Mental Health Wave 1
Note: Controlled for sex, age, education, race, and marital status at Wave 1. CFI= 0.0.91 TLI= 0.89 RMSEA = 0.04

Data: NSHAP Waves 1, 2, and 3

Table 3:4. Control Variable Significance For Wave 1 Structural Equation Model of Physical Disability, Social Interactions, and Poor Mental Health

	Model 1 W1_Dis -> W1_SI		Model 2 W1_Dis -> W1_SI -> W1_PMH	
Female (vs. Male) (Sex)	0.43	***	0.14	***
Age	0.01	**	0.00	
H.S. + (vs. LT HS) (Education)	0.42	***	- 0.04	*
White (vs. Non-white) (Race)	0.13		- 0.03	
Married (vs. non-married) (Marital Status)	0.03		- 0.21	***

Model 1 coefficients are for the associations of the control variable with Wave 1 Social Interaction (W1_SI) in the model with Wave 1 Disability (W1_Dis) as a predictor.
Model 2 coefficients are for the associations of the control variables with Wave 1 Poor Mental Health (W1_PMH) in the model with Disability (W1_Dis) and Social Interaction (W1_SI) as predictors.

Dis= Disability, SI= Social Interaction, PMH= Poor Mental Health
H.S.+ = High School or more of education
LT HS = Less than High School education

Data: NSHAP Waves 1, 2, and 3
* p < .05; ** p < .01; *** p < .001

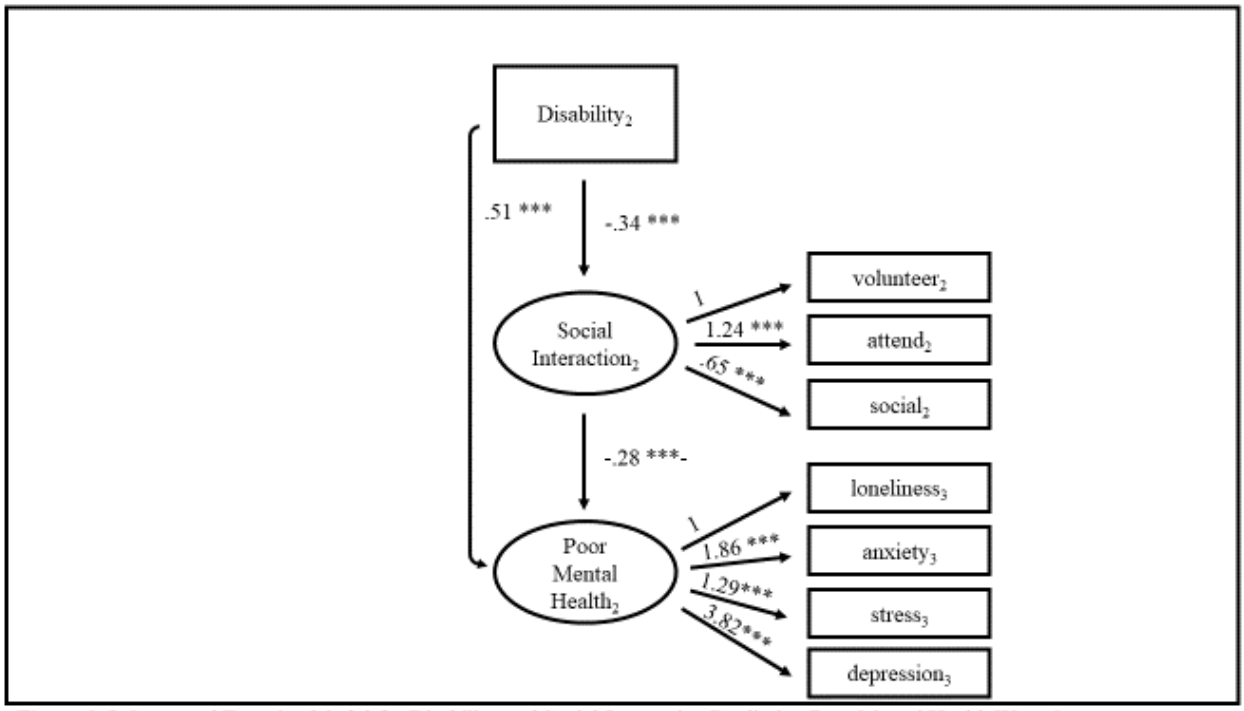

Figure 3:5. Structural Equation Model for Disability and Social Interaction Predicting Poor Mental Health Wave 2
Note: Controlled for sex, age, education, and race at Wave 1. Controlled for marital status at Wave 2. CFI= 0.0.93 TLI= 0.88 RMSEA = 0.05

Data: NSHAP Waves 1, 2, and 3

Table 3:5. Control Variable Significance For Wave 2 Structural Equation Model of Physical Disability, Social Interactions, and Poor Mental Health

	Model 1		Model 2	
	W2_Dis -> W2_SI		W2_Dis -> W2_SI -> W2_PMH	
Female (vs. Male) (Sex)	0.43	***	0.19	**
Age	0.01		0.00	
H.S. + (vs. LT HS) (Education)	0.44	***	-0.01	
White (vs. Non-white) (Race)	0.22	**	-0.02	
Married (vs. non-married) (Marital Status)	-0.08		-0.23	*

Model 1 coefficients are for the associations of the control variable with Wave 2 Social Interaction (W2_SI) in the model with Wave 2 Disability (W2_Dis) as a predictor.
Model 2 coefficients are for the associations of the control variables with Wave 2 Poor Mental Health (W2_PMH) in the model with Disability (W2_Dis) and Social Interaction (W2_SI) as predictors.

Dis= Disability, SI= Social Interaction, PMH= Poor Mental Health
H.S.+ = High School or more of education
LT HS = Less than High School education

Data: NSHAP Waves 1, 2, and 3
* p < .05; ** p < .01; *** p < .001

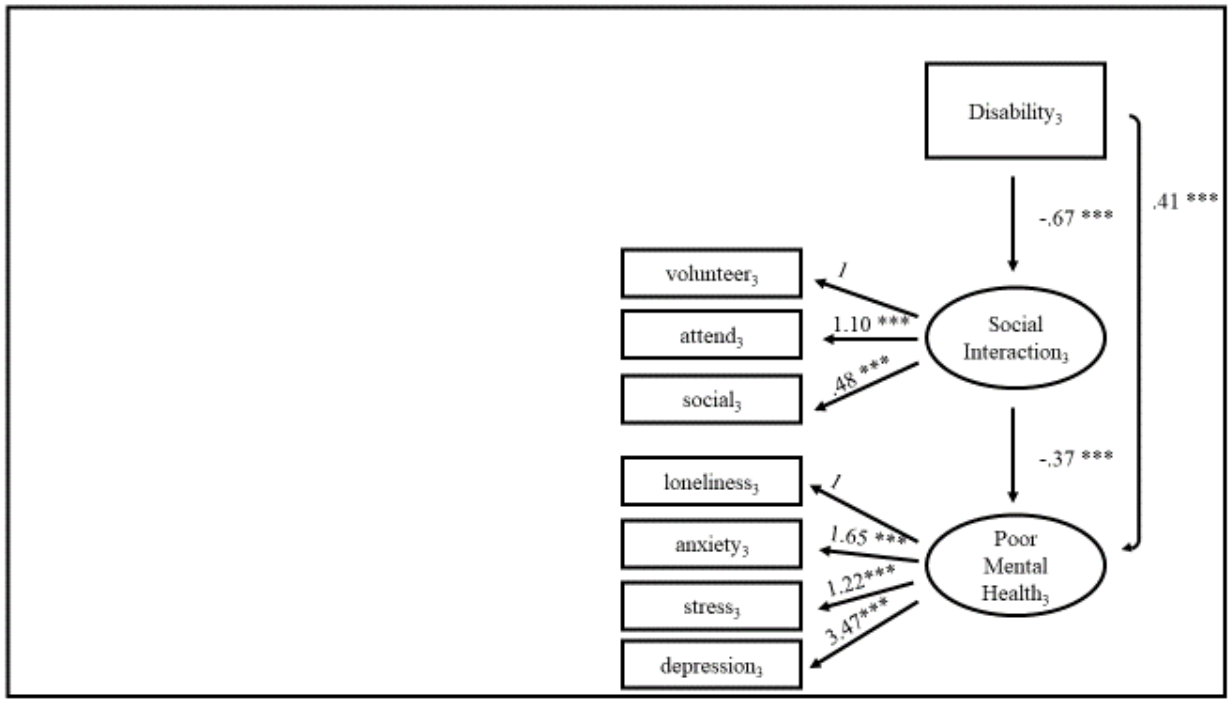

Figure 3:6. Structural Equation Model for Disability and Social Interaction Predicting Poor Mental Health Wave 3
Note: Controlled for sex, age, education, and race at Wave 1. Controlled for marital status at Wave 3. CFI= 0.0.96 TLI= 0.93 RMSEA = 0.03

Data: NSHAP Waves 1, 2, and 3

Table 3:6. Control Variable Significance For Wave 2 Structural Equation Model of Physical Disability, Social Interactions, and Poor Mental Health

	Model 1		Model 2	
	W3 Dis -> W3 SI		W3 Dis -> W3 SI -> W3 PMH	
Female (vs. Male) (Sex)	0.47	***	0.14	***
Age	0.00		0.00	
H.S. + (vs. LT HS) (Education)	0.44	***	-0.01	*
White (vs. Non-white) (Race)	0.15		-0.03	
Married (vs. non-married) (Marital Status)	0.04		-0.21	***

Model 1 coefficients are for the associations of the control variable with Wave 3 Social Interaction (W3_SI) in the model with Wave 3 Disability (W3_D) as a predictor.

Model 2 coefficients are for the associations of the control variables with Wave 3 Poor Mental Health (W3_PMH) in the model with Disability (W3_D) and Social Interaction (W3_SI) as predictors.

Dis= Disability, SI= Social Interaction, PMH= Poor Mental Health
H.S.+ = High School or more of education
LT HS = Less than High School education

Data: NSHAP waves 1, 2, and 3
* $p < .05$; ** $p < .01$; *** $p < .001$

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