

Stress Proliferation and Disability over the Life Course

by

Jessica Sayles West

Department of Sociology
Duke University

Date: _____

Approved:

Scott M. Lynch, Dissertation Advisor

Jen'nan G. Read

Tyson H. Brown

Matthew E. Dupre

Dissertation submitted in partial fulfillment of
the requirements for the degree of Doctor
of Philosophy in the Department of
Sociology in the Graduate School
of Duke University

2021

ABSTRACT

Stress Proliferation and Disability over the Life Course

by

Jessica Sayles West

Department of Sociology
Duke University

Date: _____

Approved:

Scott M. Lynch, Dissertation Advisor

Jen'nan G. Read

Tyson H. Brown

Matthew E. Dupre

An abstract of a dissertation submitted in partial
fulfillment of the requirements for the degree
of Doctor of Philosophy in the Department of
Sociology in the Graduate School of
Duke University

2021

Copyright by
Jessica Sayles West
2021

Abstract

For decades, life course and stress process scholars have documented that negative, stressful experiences have consequences for health across the life course. However, less attention has been paid to hearing impairment, a highly prevalent functional limitation that has significant implications for the quality of life of older adults. Hearing impairment is common at older ages (reported by 27.3% of those aged 65-74 and 45.1% of those aged 75 and older) and has negative consequences for the quality of life not only of the focal individual but also for those close to them (CDC 2017, Ciorba et al. 2012, Dalton et al. 2003, Wallhagen et al. 2004). The aim of this dissertation is to apply a life course and stress process framework to the experience of hearing impairment via two studies that each use nationally representative, longitudinal data from the Health and Retirement Study (HRS). My findings contribute to our understanding of marriage, family, gender, and health by moving beyond the traditional approach that focuses on individuals with disabilities to explore the impacts of disability on spouses.

In Chapter 2, I build on the stress process framework by conceptualizing hearing impairment as a chronic stressor that impacts mental health and examining the role of social support in this relationship. Using fixed-effects regression models applied to three waves of HRS data (2006, 2010, 2014), I found that worse self-rated hearing is associated with a significant increase in depressive symptoms, and that social support interacted with hearing impairment: low levels of social support were associated with more depressive symptoms but only among people with poor self-rated hearing. Moreover,

high levels of social support reduced depressive symptoms for those with poor hearing. These findings suggest that hearing impairment is a chronic stressor in individuals' lives, and that responses to this stressor vary by the availability of social resources.

Chapter 3 examines stress proliferation among married couples. While decades of research show the health benefits of marriage, stress proliferation suggests that chronic stressors such as disability may undermine social relations, thus limiting their role as a coping resource. For this study, I matched couples by household identification number over ten waves of the HRS (1998-2016). Fixed-effects regression models revealed that wives' hearing impairment is associated with an increase in husbands' depressive symptoms, but that husbands' hearing impairment is *not* associated with wives' depressive symptoms. This could be because women in heterosexual marriages have traditionally been expected to monitor their husbands' health, but not vice versa. Since men are less used to serving as caregivers, they may find their wives' hearing impairment distressing. Also, wives usually find social support outside of the marriage, while husbands traditionally rely on their wives for companionship. This would provide wives, but not husbands, with external resources to cope with their spouses' hearing impairment. These findings reveal that the stress of hearing impairment does spill over from one spouse to another, depending on gender.

Overall, this dissertation demonstrates that hearing impairment is a chronic stressor that has major implications for individuals' mental health. Moreover, the mental health consequences of hearing impairment are not only limited to individuals but can

also spill over to impact spouses. Further research is needed to extend our understanding of how disability, in general, and hearing impairment, specifically, shapes health across the life course for individuals and those close to them.

Dedication

To my family – for loving and supporting me through it all.

Contents

Abstract	iv
Dedication	vii
Contents	viii
List of Tables	xi
List of Figures	xii
Acknowledgements.....	xiii
1. Introduction.....	1
2. Hearing Impairment, Social Support, and Depressive Symptoms Among U.S. Adults: A Test of the Stress Process Paradigm.....	6
2.1 Background	9
2.1.1 Stress, Social Support, and Health	9
2.1.2 Evidence on Hearing Impairment and Mental Health.....	12
2.1.3 Current Study	15
2.2 Methods	15
2.2.1 Sample	15
2.2.2 Depressive Symptoms	17
2.2.3 Hearing Impairment	17
2.2.4 Social Support	17
2.2.5 Control Variables	18
2.2.6 Analysis.....	19
2.3 Results	20

2.3.1 Describing the Sample.....	20
2.3.2 Results from Fixed Effects Models.....	22
2.4 Discussion	26
2.5 Conclusion.....	30
3. Hearing Impairment and Mental Health Among Married Couples	32
3.1 Background	33
3.1.1 Stress Proliferation and Linked Lives	33
3.1.2 Gender and Health Contingencies Within Marriage	35
3.1.3 Hearing Impairment Within Marriage.....	37
3.1.4 Current Study	39
3.2 Methods	39
3.2.1 Sample	39
3.2.2 Depressive Symptoms	40
3.2.3 Hearing	41
3.2.4 Control Variables	41
3.2.5 Analysis.....	42
3.3 Results	43
3.4 Supplementary Analyses	50
3.5 Discussion	50
3.5.1 Limitations.....	54
3.6 Conclusion.....	55
4. Conclusion	57

References.....	59
Biography.....	72

List of Tables

Table 1. Sample Characteristics by Interview Wave: HRS, 2006, 2010, and 2014 (n=6,075).	21
Table 2. Fixed Effects Regression Coefficients for Depressive Symptoms: HRS, 2006, 2010, and 2014.....	23
Table 3. Sample Characteristics for Wives and Husbands: HRS, 1998-2016 (n=5,485 Couples, 10,970 Individuals).	44
Table 4. Fixed Effects Regression Coefficients for Husbands' Depressive Symptoms: HRS, 1998-2016.....	46
Table 5. Fixed Effects Regression Coefficients for Wives' Depressive Symptoms: HRS, 1998-2016.....	47

List of Figures

Figure 1. The Stress Process Framework with Health and Retirement Study Variables.....	12
Figure 2. Hearing Ability, Social Support, and Depressive Symptoms: HRS, 2006, 2010, and 2016.....	26

Acknowledgements

I am incredibly grateful to my dissertation co-chairs, Scott Lynch and Jen'nan Read, for their training, guidance, and encouragement throughout my time at Duke. I am honored to have been your student and to have had the opportunity to work with both of you. Mentors like you two define the graduate school experience. Tyson Brown – your class introduced me to the stress process model and thus shaped the course of my dissertation. Matthew Dupre – your insight has been indispensable to my scholarship and your unwavering support of my focus on hearing impairment has encouraged me along the way. Thank you to my colleagues in the Medical Sociology graduate student group and Demography of Health and Aging for providing feedback, support through setbacks, and celebration in times of success. Thank you as well to the Duke Sociology Department and the Duke University Population Research Institute (DUPRI) for providing me with the resources and opportunities that made this research possible. And to Jessica Ellington – for always knowing the answer or how to find it.

1. Introduction

For decades, life course and stress process scholars have documented that negative, stressful experiences have consequences for health across the life course (Elder 1998, Pearlin 2010). Within the stress process framework, disability can be classified as a chronic strain, or ongoing, long-term difficulty that requires long-lasting management of social and instrumental activities and that can negatively affect well-being (Pearlin 1989, Pearlin 1999). Moreover, chronic strains can be sources of stress proliferation, which explains how stressors associated with one situation can lead to the emergence and accumulation of stressors in other life domains (Pearlin 1989, Pearlin, Aneshensel and LeBlanc 1997). Indeed, research using broad definitions of physical disability has shown that having a physical disability is associated with psychological distress (e.g., anger, depression, anxiety) (Alang, McAlpine and Henning-Smith 2014, Brown and Turner 2012, Muramatsu, Yin and Hedeker 2010) as well as engagement in poor health behaviors (e.g., smoking, lack of physical activity) (Clarke and Latham 2014, Krahn, Walker and Correa-De-Araujo 2015).

Much of the sociological and demographic research on disability has focused on difficulty or inability to perform “activities of daily living” (ADLs) (e.g., tasks that are essential for independent living) and “instrumental activities of daily living” (IADLs) (e.g., tasks that facilitate independent living but are not crucial for such) (Katz et al. 1963, Nagi 1991). An important, but understudied, disability affecting population health is hearing impairment. Hearing impairment is common at older ages (reported by 27.3% of

those aged 65-74 and 45.1% of those aged 75 and older) and has negative consequences for quality of life not only of individuals but also for those close to them (CDC 2017, Ciorba et al. 2012, Dalton et al. 2003, Wallhagen et al. 2004). The aim of this dissertation is to apply a life course and stress process framework to the experience of hearing impairment via two studies that each use nationally representative, longitudinal data from the Health and Retirement Study (HRS). My findings will contribute to our understanding of marriage, family, gender, and health by moving beyond the traditional approach that focuses on individuals with disabilities to explore the health impacts of disability on family members.

Chapter 2 builds on the stress process framework by conceptualizing hearing impairment as a chronic stressor that impacts mental health and examining the role of social support in this relationship (West 2017). Using fixed-effects regression models applied to three waves of HRS data (2006, 2010, 2014) (n=6,075), I found that worse self-rated hearing was associated with a significant increase in depressive symptoms. Social support appeared particularly important for people with hearing impairment: among older adults with poor self-rated hearing, high levels of social support lowered their depressive symptoms while low levels of social support resulted in higher levels of depressive symptoms. Results from this study reveal that hearing impairment is a chronic stressor that has negative consequences for mental health, suggesting the importance of ensuring that older adults with hearing impairment have access to sufficient social support.

Chapter 3 extends the previous study by exploring how the stress associated with hearing impairment can spill over from the focal individual to impact close significant others (West 2020). While decades of research show the health benefits of marriage, stress proliferation suggests that chronic stressors such as disability may undermine social relations, thus limiting their role as a coping resource. For this study, I matched 5,485 couples (10,970 individuals) by household identification number over ten waves of the HRS (1998-2016). Fixed-effects regression models revealed that wives' hearing impairment was associated with an increase in husbands' depressive symptoms, but that husbands' hearing impairment was not associated with wives' depressive symptoms. Past research shows that within heterosexual marriages, women are more attuned to and responsive to their spouse's health, and also more likely than men to monitor and regulate their spouse's health behaviors to promote the health of their spouse. Since men are less accustomed to serving as caregivers, they might find their wives' hearing impairment distressing. Moreover, marital role expectations vary by gender, which often leads to women acting as their husbands' exclusive confidant, source of support, or caregiver. In contrast, women often find social ties and coping resources outside of the marriage. This would provide wives, but not husbands, with external resources to cope with their spouses' hearing impairment. Altogether, results from this study reveal that the stress associated with hearing impairment can spill over from one spouse to another, depending on gender, suggesting a need for increased vigilance regarding hearing impairment among both older adults and their spouses.

As I have described elsewhere (West and Lynch 2020), it is important to note that disability studies scholars have long stressed the impact that language can have on how people with disabilities are viewed (e.g., Linton 1998). Many terms have been used to refer to people with hearing impairments, including (but not limited to) Deaf, deaf, hard of hearing, hearing impaired, and having hearing loss (Brueggemann 2009). Given the weighted nature of language around disability, I drew on the disablement process (Nagi 1965, Nagi 1979, Nagi 1991, Verbrugge and Jette 1994), which describes the pathway linking pathology, impairment, functional limitations, and disability. Verbrugge and Jette (1994) considered hearing to be among the fundamental physical actions that are required to connect an individual to the social and physical environment, and therefore classified difficulty hearing as a *functional limitation*. Accordingly, I might have used the terms “people with hearing limitations” and “hearing limited;” however, these terms are not commonly used. Moreover, hearing “loss” assumes that all individuals can “lose” their hearing, which does not include those who are d/Deaf from birth and therefore never had any audiometric hearing to “lose.” Thus, I use the term “hearing impairment” throughout this dissertation.¹

Taken together, this dissertation indicates that hearing impairment has major implications for individuals’ mental health. Moreover, the findings illustrate that the impacts of hearing impairment are not limited to the individual, but rather spill over to

¹ A version of this paragraph was published in 2020 in a paper called “Demographic and Socioeconomic Disparities in Life Expectancy with Hearing Impairment in the United States” in *The Journals of Gerontology: Series B* under a license from Oxford Academic.

impact spouses. Further research is needed to extend our understanding of how hearing impairment shapes health across the life course for individuals and those close to them.

2. Hearing Impairment, Social Support, and Depressive Symptoms Among U.S. Adults: A Test of the Stress Process Paradigm¹

Over two decades ago, Verbrugge and Jette (1994) posited that both physical and mental well-being are involved in health decline as individuals age. Since then, research has increasingly noted the importance of jointly assessing mental health and physical health because examining them separately creates an artificial boundary between the two (Kelley-Moore and Ferraro 2005, Pearlin, Avison and Fazio 2007, Read, Porter and Gorman 2016). Numerous studies have shown that having a physical health condition (e.g., cancer, heart disease, or arthritis) can lead to poorer mental health outcomes (e.g., depression) (Polsky et al. 2005) because it is challenging to individuals' sense of identity and is therefore psychologically stressful (Charmaz 1983).

A growing, but understudied, physical ailment affecting population health is hearing impairment. It is the third most common chronic condition in older individuals behind hypertension and arthritis (Lin et al. 2011b) and is predicted to have a prevalence rate twice that of diabetes by 2025, in part due to an aging population (Cederroth, Canlon and Langguth 2013). Recent research projects that 15% of adults aged 20 or older will have a hearing impairment in 2020, with that number climbing to 23% in 2060 (Goman, Reed and Lin 2017). Moreover, individuals aged 70 or older are expected to be

¹ This chapter was published in 2017 in *Social Science & Medicine*, 192(Supplement C):94-101 under a license from Elsevier.

disproportionately affected, which is concerning given that this is a vulnerable population whose size will continue to increase as baby boomers age (Goman, Reed and Lin 2017).

To date, studies assessing the relationship between hearing impairment and mental health are limited, and those that exist yield mixed results. A comprehensive review of existing research found that most longitudinal studies were based in an international context (e.g., Australia, The Netherlands, Japan, and England) and the two based in the U.S. used the Alameda County Study (Strawbridge et al. 2000, Wallhagen et al. 2001). Of the longitudinal studies, some find that hearing loss results in higher levels of depressive symptoms (Kiely, Anstey and Luszcz 2013, Saito et al. 2010, Strawbridge et al. 2000, Wallhagen et al. 2001), while others find little or no association between the two (Chou 2008, Pronk et al. 2011, Pronk et al. 2014, Stam et al. 2016). Cross-sectional studies generally find a significant association between hearing impairment and more depressive symptoms (Capella-McDonnall 2005, Kramer et al. 2002), while some report that the association depends on factors such as age, with younger people experiencing more depressive symptoms than older people (Nachtegaal et al. 2009, Tambs 2004).

At least three factors may be contributing to these mixed results. First, the use of different depression indices could produce conflicting findings because the measures included in the Diagnostic and Statistical Manual of Mental Disorders scale differ from those in the Center for Epidemiologic Studies Depression Scale. Studies using the former scale find a significant association between hearing loss and depression (Strawbridge et al. 2000, Wallhagen et al. 2001), while those using the latter are more mixed (Chou 2008, Kiely, Anstey and Luszcz 2013, Pronk et al. 2011, Pronk et al. 2014). Second, there are

varying follow-up times in longitudinal studies that could affect the ability to find significant results because the impact of hearing loss on depression may be immediate or may take time to emerge (e.g. Kiely, Anstey and Luszcz 2013, Pronk et al. 2011, Saito et al. 2010). Third, some studies have small sample sizes (Pronk et al. 2011, Stam et al. 2016) that could result in non-significant findings, particularly when multiple covariates are included in the analyses.

In addition to these mixed findings, extant literature has yet to consider the role of social support in conditioning the relationship between hearing impairment and depressive symptoms. The stress process paradigm posits that social support can alter the relationship between a stressor and depressive symptoms by preventing an individual from perceiving a potential stressor as stressful or by reducing the severity of a reaction to an actual stressor (Cohen and Wills 1985). Physical health problems are highly stressful for individuals and there is considerable evidence that social support is an important resource that helps them cope more effectively by encouraging engagement in positive health behaviors and reducing reactions to stress (Hollingshaus and Utz 2013, Milner et al. 2016, Stanton, Revenson and Tennen 2007, Waverijn, Heijmans and Groenewegen 2017). Hearing impairment is a physical disability that impacts functioning across all domains of daily life (Dalton et al. 2003), yet few studies have treated hearing impairment as a stressor in the stress process model formulation. Thus, the extent to which hearing impairment interacts with other factors, such as social support, to affect mental health remains unexplored (Stam et al. 2016).

The current study contributes to this literature and a growing body of work on the physical-mental health connection in several ways. First, it conceptualizes hearing impairment as a physical health stressor and examines its relationship to depressive symptoms. Second, it builds on the stress process paradigm to explore two ways in which social support could influence the association between hearing impairment and depressive symptoms: by buffering or mediating the original relationship or by interacting with hearing impairment to influence depression at different levels of social support (e.g., low and high levels). Third, it employs longitudinal data from three waves of the Health and Retirement Study (HRS) (2006, 2010, and 2014) to overcome some of the obstacles that have contributed to mixed findings in previous studies. The HRS is nationally representative, spans nine years, and contains large samples that provide sufficient power to apply the stress process paradigm to hearing impairment.

2.1 Background

2.1.1 Stress, Social Support, and Health

Stress process researchers distinguish between two types of stressors. First, life events are discrete changes in individuals' lives that have negative health consequences. Oft-cited examples include accidents, loss of employment, or widowhood. Second, chronic strains are ongoing, long-term difficulties that negatively affect well-being, such as living in poverty or having a chronic illness (Pearlin 1989). Both types of stressors can be sources of stress proliferation, a perspective within the stress process paradigm positing that stressors associated with one situation (e.g., chronic illness) may lead to the

emergence and accumulation of stressors in other life domains (e.g., financial strain due to the inability to find work) (Pearlin 1989, Pearlin, Aneshensel and LeBlanc 1997).

Physical illness has been classified as a chronic strain because it requires the long-lasting management of social and instrumental activities (Pearlin 1999). Being diagnosed with a physical illness often necessitates adjustments that occur over time and across emotional, behavioral, and other life domains (Stanton, Revenson and Tennen 2007). Charmaz (1983) describes physical illness as a form of suffering that can challenge an individual's identity and personal relationships and cause a loss of self-image, rendering it psychologically stressful. Other research supports this idea, finding that physical health conditions such as cancer, heart disease, and arthritis lead to an increase in depressive symptoms among adults (Polsky et al. 2005, Schnittker 2005). Research has also applied the stress process model to broad definitions of physical disability and finds that having a physical disability is associated with symptoms of psychological distress, including anger, depression, and anxiety (Alang, McAlpine and Henning-Smith 2014, Brown and Turner 2012, Muramatsu, Yin and Hedeker 2010).

Leading explanations for these relationships have focused on theories of stress and coping to understand how individuals adjust to physical illness and disability (Aneshensel 1992, Stanton, Revenson and Tennen 2007). One important theory of stress and coping is the stress-buffering model which is grounded in the stress process paradigm. This paradigm recognizes that the stressors that individuals experience and the resources available to them can alter the health consequences of stressors (Pearlin et al. 1981, Pearlin 1989, Turner 2013). Social support is one such resource and the stress-

buffering models specifies at least two ways that this alteration may occur. First, higher levels of social support can be protective by buffering (mediating) the effect of the stressor on mental health (Cohen and Wills 1985). In this scenario, individuals with high levels of social support may be protected against negative mental health outcomes when exposed to stress. For example, social support buffers the effects of stress for parents of pediatric cancer patients because it provides them with more coping options and helps them balance competing demands between work and caregiving (Gage-Bouchard 2017).

Second, the stress-buffering model posits that social support can be protective by interacting with (moderating) the stressor itself. In this scenario, social support has a stronger protective effect on depressive symptoms under conditions of high stress compared to conditions of low stress (Cohen and Wills 1985). For example, one study found higher levels of depression among students with low social support compared to those with high social support, but only under conditions of high stress not under conditions of low stress (Wang et al. 2014).

To date, few studies have conceptualized hearing impairment as a stressor linked to health outcomes. Put in terms of the stress process model, hearing impairment is a stressor that gives rise to the accumulation of additional stressors in the form of stigma, discrimination, social and emotional loneliness, and social withdrawal (Erler and Garstecki 2002, McGee 2015, Mick, Kawachi and Lin 2014, Pronk, Deeg and Kramer 2013). Under the stress-buffering model, social support could provide the coping resources necessary to mediate the association between hearing impairment and depressive symptoms. Additionally, if social support interacts with hearing impairment

(moderation), individuals with hearing impairment who have higher levels of social support will be protected against an increase in depressive symptoms. The current study fills this gap in the literature by applying the stress process model to the relationship between hearing impairment, social support, and depressive symptoms. Figure 1 provides a diagram of how hearing impairment fits into the stress process paradigm (adapted from Turner 2013).

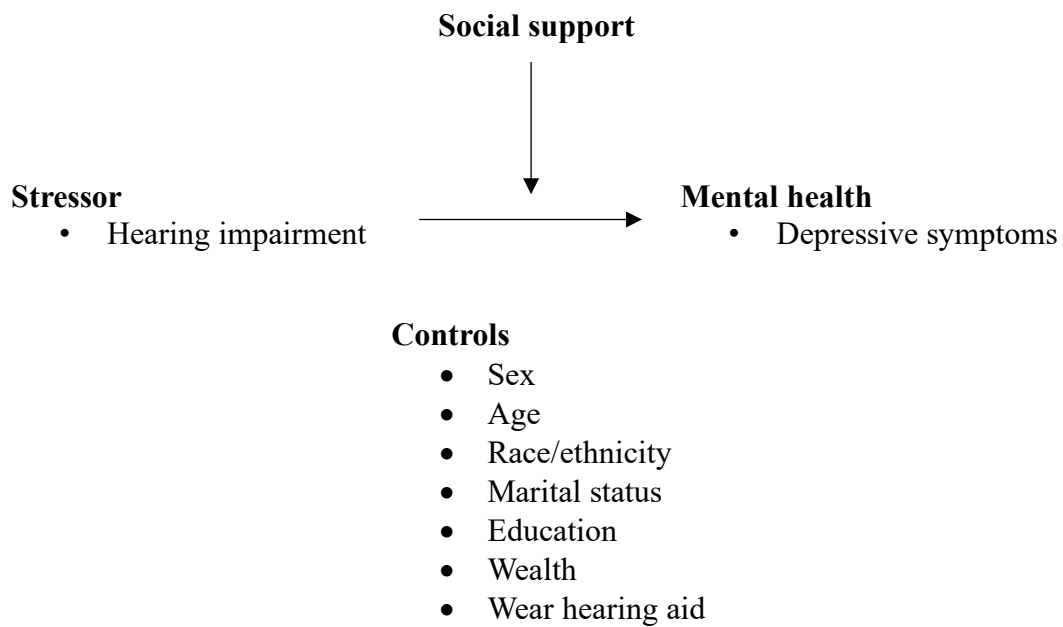


Figure 1. The Stress Process Framework with Health and Retirement Study Variables.

2.1.2 Evidence on Hearing Impairment and Mental Health

One way in which hearing impairment behaves as a stressor is through its effect on mental health outcomes. Depression is typically the most common outcome of

interest, usually measured by self-reported depressive symptoms using the Center for Epidemiologic Studies Depression Scale, and to a lesser extent with the Diagnostic and Statistical Manual of Mental Disorders to assess major or clinical depression (Kiely, Anstey and Luszcz 2013, Pronk et al. 2011, Pronk et al. 2014, Strawbridge et al. 2000, Wallhagen et al. 2001). Findings from these studies have been mixed.

In some cross-sectional studies, researchers find a significant association between hearing impairment and depressive symptoms (Capella-McDonnall 2005, Ishine, Okumiya and Matsubayashi 2007, Kramer et al. 2002). More recently, a nationally representative survey revealed that 11.4% of U.S. adults with a self-reported hearing loss reported moderate to severe depression, with an additional 19.1% reporting mild depressive symptoms (Li et al. 2014). However, other cross-sectional research reports that whether hearing impairment is associated with depression may depend on the ages of participants (younger age is associated with higher levels of depressive symptoms) (Nachtegaal et al. 2009, Tambs 2004) and how hearing impairment is measured (audiometrically measured hearing impairment is associated with depressive symptoms) (Lee et al. 2010).

Studies using longitudinal data also yield mixed results. Three factors may be contributing to these mixed results. First, the use of different depression indices results in conflicting findings. Measuring depressive symptoms using the scale from the Diagnostic and Statistical Manual of Mental Disorders yields a significant association with hearing (Strawbridge et al. 2000, Wallhagen et al. 2001). Alternatively, using the Center for Epidemiologic Studies Depression Scale sometimes yields a significant association

(Kiely, Anstey and Luszcz 2013) but sometimes does not (Chou 2008, Pronk et al. 2011, Pronk et al. 2014).

Second, varying follow-up times may affect the ability to find significant findings. With short follow-up periods (between one and three years), studies predominantly find an association between hearing and depressive symptoms (Saito et al. 2010, Strawbridge et al. 2000, Wallhagen et al. 2001), but Chou (2008) reports no association. Studies with medium length follow-up periods (up to six years) tend not to find an association (Pronk et al. 2011, Pronk et al. 2014, Stam et al. 2016), but Gopinath et al. (2012) report a significant relationship. With the longest follow-up period of sixteen years, Kiely, Anstey, and Luszcz (2013) report a significant association between hearing and depressive symptoms.

Third, small sample sizes can contribute to non-significant findings, particularly when multiple covariates are included in the analyses. Studies with less than one thousand participants tend to find no association between hearing and depressive symptoms (Pronk et al. 2011, Stam et al. 2016), while studies with over two thousand participants tend to find an association (Gopinath et al. 2012, Strawbridge et al. 2000, Wallhagen et al. 2001). Finally, a comprehensive review of existing literature found that most of the longitudinal studies assessing the relationship between hearing impairment and depressive symptoms were based in an international context, namely Australia, the Netherlands, Japan, or England. The two studies that were based in the U.S. both used the Alameda County Study (Strawbridge et al. 2000, Wallhagen et al. 2001).

2.1.3 Current Study

The current study aims to contribute to existing research by addressing some of the limitations in previous studies on the relationship between hearing impairment and mental health. Drawing on the stress process framework, the analysis conceptualizes hearing impairment as a physical health stressor and examines its relationship to an important mental health outcome (depression). Then the analysis examines the extent to which social support effects this relationship, thereby answering a recent call for studies to include mediators and moderators, such as social support, in longitudinal analyses of the hearing impairment and mental health relationship (Stam et al. 2016). Specifically, a large, longitudinal sample is used to address the following questions: 1) to what extent does hearing impairment lead to increased levels of depressive symptoms?; 2) to what extent does social support mediate this relationship?; and 3) to what extent does social support interact with hearing impairment to influence its relationship to depressive symptoms?

2.2 Methods

2.2.1 Sample

This study uses data from the Health and Retirement Study (HRS) to address these questions. The HRS is a longitudinal, nationally representative survey of U.S. adults over the age of 50 and their spouses that has been conducted every two years since 1992. The original core sample design of the HRS is a multi-stage area probability sample of households. The HRS monitors changes in cognitive, physical, and functional health that are associated with aging. The core survey, which is asked of every participant

in each survey wave, includes questions about employment, retirement, income, wealth, family structure, health, and health care utilization.

The HRS supplements the core survey with separate modules. In 2006, the HRS included a module on life satisfaction and psychological well-being called the Leave-Behind Participant Life Style Questionnaire (Smith et al. 2013). Of the participants who completed a face-to-face core survey in 2006, a randomly selected half was given the leave-behind survey. In 2008, another randomly selected half was given the leave-behind survey. Participants were eligible for the leave-behind survey in every other wave, meaning that participants eligible in 2008 were eligible again in 2012, while participants eligible in 2006 were eligible again in 2010 and 2014.

The core HRS is comprised of 37,495 individuals. The analytic sample for this study is restricted to individuals who were assigned the leave-behind survey beginning in 2006 (n=18,469). For a longitudinal analysis, the sample is further restricted to individuals who completed the leave-behind survey in 2006, 2010, and 2014. In 2006, 8,565 people were eligible for the leave-behind survey (response rate of 88.15%), 7,684 in 2010 (response rate of 81.05%), and 6,296 in 2014 (response rate of 83.23%). Individuals who were not eligible for the leave-behind survey were removed (eligible n=8,565), as were individuals who did not return the survey, resulting in a sample of 6,311 participants. Finally, individuals were excluded if they were under the age of 50, had died, or failed to respond to the items comprising the outcome variable (depressive symptoms), resulting in a final sample of 6,075 individuals.

2.2.2 Depressive Symptoms

The main outcome variable is depressive symptomology based on a summed score of responses to eight questions that are a modification of the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff 1977). Items in the scale ask about feeling depressed, feeling that everything was an effort, having restless sleep, feeling lonely, feeling sad, not being able to get going, feeling happy, and enjoying life. Participants reported whether the eight statements were true much of the time during the past week (yes; no). Summed scores range from zero to eight, with higher scores indicating more depressive symptoms. The shortened CES-D scale shows good internal consistency (α range from 0.77-0.83) (Steffick 2000).

2.2.3 Hearing Impairment

Assessing hearing impairment in community-based settings is complicated, as it is most often diagnosed with the use of auditory tests. Such tests require expensive equipment, trained technicians, and strict controls on background noise (Bagai, Thavendiranathan and Detsky 2006). Instead, the core HRS survey asks every participant to report self-rated hearing (excellent, very good, good, fair, or poor) in each wave. If participants wear a hearing aid, they are asked to rate their hearing while wearing a hearing aid as usual. Prior research comparing self-reported hearing to objective measurements has found a high correlation between the two (Sindhusake et al. 2001).

2.2.4 Social Support

The social support scale assesses participants' perceptions of the social support available from their family, friends, spouse or partner, and children (Cohen 2004). The

scale is comprised of three questions asked about each of the four types of significant other for a total of twelve items (response scale from a lot, some, a little, to not at all). Specifically, participants are asked how often they can open up to each type of significant other (four items), how often they can rely on those significant others (four items), and how much those significant others understand the way the participants feel about things (four items) (α in all three waves is 0.77). Higher scores indicate higher levels of social support. The variable is included in statistical models in continuous form but presented in the descriptive table in three categories (low, medium, and high social support).

2.2.5 Control Variables

Prior research has identified several social status characteristics that are associated with mental health and stress exposure, and these are included in the analysis as controls (Aneshensel, Phelan and Bierman 2013, Lee and Bierman 2018). These include gender (male; female), age (continuous), race/ethnicity (non-Hispanic white; non-Hispanic black; non-Hispanic other race; Hispanic), marital status (married or partnered; separated, widowed, or divorced; never married), and two measures of socioeconomic status (SES). Educational attainment is coded as less than high school; high school or equivalent; some college; or college and above. Because income is a less useful measure of SES in late life due to exiting the labor force (Marmot 2015), wealth (logged continuous variable) measures total household assets while subtracting out debt (Bugliari et al. 2016). Finally, since hearing aid use can reduce the odds of depressive symptoms (Mener et al. 2013), the analysis includes a dichotomous measure in the models (1=use hearing aids).

2.2.6 Analysis

Table 1 presents descriptive statistics for the sample by interview wave. Table 2 uses fixed effects models to estimate the association between hearing impairment and depressive symptoms within individuals over time. A fixed effects model is a longitudinal model that treats unobserved, time-invariant variables that differ across individuals as a set of fixed parameters that can be swept out of the equation (Allison 2009). The model controls for variables that either cannot or have not been measured and allows those variables to have an association of any kind with the measured variables. Thus, the model captures only within-individual differences (i.e., change), which makes it less subject to unobserved confounding than other models while simultaneously reducing its efficiency. The main requirements of a fixed effects model are that the dependent variable is measured on at least two time points for every individual and that the predictor variables change in value across those time points for a large set of the sample (Allison 2009).

The basic fixed effects model can be expressed as follows:

$$y_{it} = \mu_i + \beta \text{hearing}_{it} + \gamma x_{it} + \alpha_t + \varepsilon_{it}$$

where y_{it} is the number of depressive symptoms for an individual i at time t , and x_{it} is the vector of control variables. The parameter β hearing represents the effect of the focal analysis measure (self-rated hearing), or the change in self-rated hearing from 2006-2014. The μ_i term accounts for both observed and unobserved stable traits between individuals while the α_t term accounts for year fixed effects, therefore capturing trends that are constant across individuals over time. For ease of interpretation, Figure 2 presents a

graph of the interaction between hearing impairment and social support. Missing values were imputed using multiple imputation with chained equations in Stata 14.2 (StataCorp 2015).

2.3 Results

2.3.1 Describing the Sample

Table 1 presents characteristics of the sample over the three waves of data. The mean level of depressive symptoms slightly decreases over time, from 1.34 in wave 1 to 1.29 in wave 2 to 1.24 in wave 3 (range from zero to eight). Over one fifth of the sample has fair to poor hearing in each wave (23.12%, 22.34%, and 21.32%). The mean level of social support is consistent across waves, decreasing slightly from 14.26 to 14.22 to 14.19 (range from zero to twenty-eight). Women are slightly better represented (59.14%, 59.49%, and 60.57%), which is consistent with literature that has found that women have lower levels of mortality at older ages than men (Deeg 2016). The sample is predominantly comprised of non-Hispanic whites (around 80% in each wave). This is not necessarily problematic for this study, as research reports that hearing loss prevalence varies across racial/ethnic groups, with whites experiencing a disproportionate burden of hearing loss (Agrawal, Platz and Niparko 2008). Further, although blacks are more likely to have their hearing tested and whites are more likely to wear hearing aids (Nieman et al. 2016), researchers suggest that this is not reflective of differential socioeconomic status, but rather to some protective effect of black race (Lin et al. 2011b).

**Table 1. Sample Characteristics by Interview Wave: HRS, 2006, 2010, and 2014
(n=6,075).**

	Wave 1 n = 6,075	Wave 2 n = 5,041	Wave 3 n = 4,226
CES-D	1.34	1.29	1.24
Self-rated hearing			
Excellent	15.24%	15.49%	15.89%
Very good	25.83%	26.36%	27.16%
Good	35.80%	35.81%	35.63%
Fair	17.06%	16.47%	15.96%
Poor	6.06%	5.87%	5.36%
Social support (mean)	14.26	14.22	14.19
Low social support	5.70%	5.80%	5.95%
Medium social support	89.15%	89.21%	89.22%
High social support	5.14%	4.99%	4.83%
Wear hearing aid	13.33%	13.17%	12.05%
Marital status			
Married/partnered	64.65%	65.30%	65.98%
Divorced/widowed	32.51%	31.90%	31.19%
Never married	2.84%	2.80%	2.83%
Female	59.14%	59.49%	60.57%
Age	70.87	70.54	69.94
Race/ethnicity			
NH white	79.27%	79.52%	79.32%
NH black	12.01%	11.81%	11.80%
NH other	1.91%	1.97%	2.03%
Hispanic	6.81%	6.70%	6.84%
Education			
<high school	16.81%	15.59%	14.86%
High school/GED	37.94%	38.00%	37.81%
Some college	22.60%	23.06%	23.14%
College or more	22.65%	23.34%	24.20%
Wealth (median)	\$216,598	\$224,000	\$233,000

Note: NH = non-Hispanic.

2.3.2 Results from Fixed Effects Models

Table 2 presents the fixed effects regression coefficients identifying factors associated with depressive symptoms. Sex, race, and education are not included because they are time-invariant. Model 1 provides evidence regarding the first research question, whether hearing impairment leads to increased levels of depressive symptoms. In Model 1, having worse hearing is significantly associated with higher levels of depressive symptoms ($p=0.001$). Specifically, each one unit move from better to worse hearing (on a five-point scale from excellent to poor) is associated with a 0.063-point increase in the number of depressive symptoms.

Table 2. Fixed Effects Regression Coefficients for Depressive Symptoms: HRS, 2006, 2010, and 2014.

	Model 1 Coef (SE)	Model 2 Coef (SE)	Model 3 Coef (SE)	Model 4 Coef (SE)
Worse self-rated hearing	0.063 (0.018)**	0.054 (0.019)**	0.054 (0.018)**	0.282 (0.062)***
Controls				
Age		-0.001 (0.003)	-0.001 (0.003)	-0.001 (0.003)
Marital status [married]				
Divorced/widowed		0.545 (0.055)***	0.518 (0.056)***	0.515 (0.055)***
Never married		-0.013 (0.220)	-0.053 (0.221)	-0.063 (0.220)
Log of wealth		-0.001 (0.009)	-0.001 (0.009)	-0.001 (0.009)
Use hearing aids		0.111 (0.072)	0.111 (0.072)	0.117 (0.072)
Social support			0.014 (0.005)**	0.058 (0.012)***
Interaction				
Social support*hearing				-0.016 (0.004)***
Constant	1.17 (0.051)***	1.07 (0.256)***	0.901 (0.264)**	0.280 (0.310)

Note: Sex, race, and education not included because they are time invariant. HRS = Health and Retirement Study; Coef = coefficient; SE = standard error.

*p<0.05, **p<0.01, ***p<0.001

Models 2 and 3 provide evidence regarding the second research question, whether social support mediates the relationship between hearing impairment and depressive symptoms. Adding time-varying control variables (age, marital status, wealth, and hearing aid usage) in Model 2 slightly buffers the association between hearing impairment and depressive symptoms, but the relationship persists ($p=0.003$). Marital status is the only statistically significant control variable. Specifically, being separated, divorced, or widowed is associated with more depressive symptoms compared to people who are married ($p<0.001$).

The significant relationship between hearing impairment and depressive symptoms persists after adding social support in Model 3, and the coefficient remains the same as in Model 2 (0.054 ; $p=0.004$). Similar to the previous model, being separated, divorced, or widowed is associated with more depressive symptoms ($p<0.001$). Higher levels of social support are associated with more depressive symptoms ($p=0.009$). While this finding seems counterintuitive, as it might be expected that social support would *decrease* depressive symptoms, Model 4 clarifies the relationship between social support and depressive symptoms.

Model 4 includes control variables, social support, and an interaction term between social support and hearing impairment, as per the stress-buffering model, to address the final research question regarding the moderating role of social support. Having worse self-rated hearing ($p<0.001$), being separated, divorced, or widowed ($p<0.001$), and having higher levels of social support ($p<0.001$) are all associated with more depressive symptoms. However, Model 4 shows that social support interacts with

hearing impairment to influence levels of depressive symptoms ($p < 0.001$). The results indicate that having higher levels of social support and worse self-rated hearing results in lower levels of depressive symptoms. Thus, the presence of social support lessens the burden of hearing impairment, suggesting that it creates a multiplicative, rather than additive, effect on the relationship between hearing impairment and depressive symptoms.

Figure 2 provides a graphical representation of the interaction term. For individuals with the lowest level of social support, moving from excellent hearing to poor hearing results in a roughly one symptom increase in CES-D symptoms. In other words, low levels of social support increased depressive symptoms, but only among those with poor hearing. Among people with excellent self-rated hearing, low levels of social support did not increase depressive symptoms. For people with high levels of social support, moving from excellent to poor hearing results in a reduction in the number of CES-D symptoms. Thus, high levels of social support are protective for people with worse self-rated hearing.

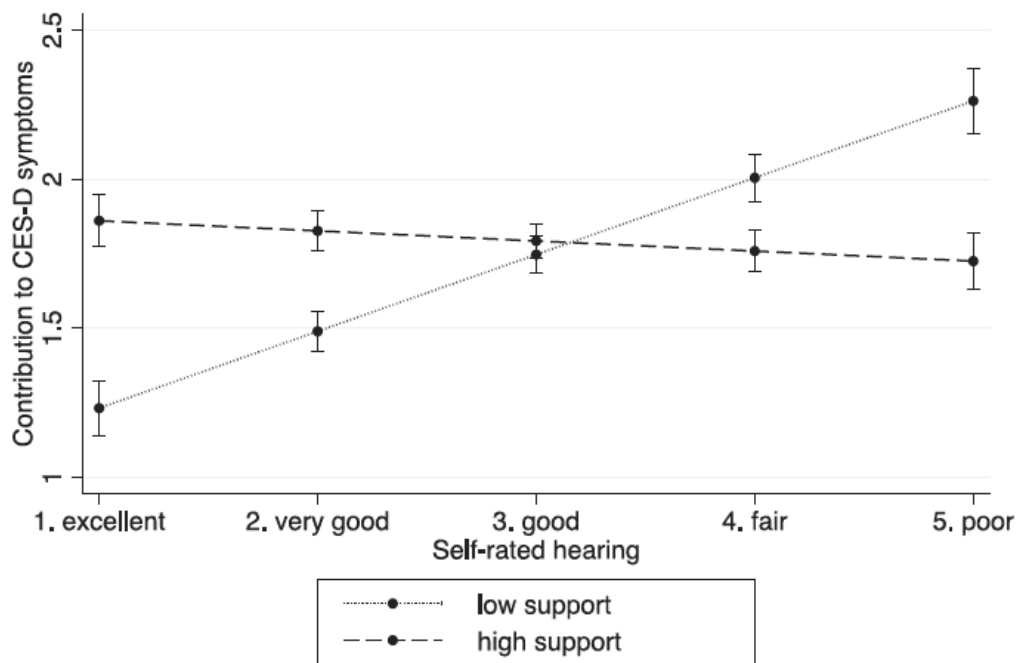


Figure 2. Hearing Ability, Social Support, and Depressive Symptoms: HRS, 2006, 2010, and 2016.

2.4 Discussion

Hearing impairment is an important and growing social and physical health problem, especially among older adults (Ciorba et al. 2012). It has also been linked to poor mental health outcomes, namely depression, though the findings on this point have been mixed. The goal of this study was to treat hearing impairment as a stressor in an effort to highlight the mental health implications for an aging society at increasing risk of hearing impairment. Indeed, approximately one fifth of the participants in this study reported fair to poor hearing, which is consistent with other population-based studies of adults aged 50 and older (Chou et al. 2011). This age group is also vulnerable in terms of

social isolation and a lack of social support, which is a resource that has been shown to mitigate the negative effects of poor health (Cheng 2017, Milner et al. 2016, Muramatsu, Yin and Hedeker 2010, Waverijn, Heijmans and Groenewegen 2017). An additional goal of this study was to examine the extent to which social support influences the relationship between hearing impairment and depressive symptoms.

The results suggest that hearing impairment has a direct effect on depressive symptoms, and that this relationship persists even after adding status characteristics associated with mental health and stress exposure. Individuals with worse self-rated hearing had higher levels of depressive symptoms. These findings clarify some of the conflicting literature regarding hearing impairment and depressive symptoms, some of which reports an association between the two (Kiely, Anstey and Luszcz 2013, Saito et al. 2010, Strawbridge et al. 2000, Wallhagen et al. 2001) and some of which does not (Chou 2008, Pronk et al. 2011, Pronk et al. 2014, Stam et al. 2016). Specifically, the use of a large, nationally representative sample (n=6,075) provides sufficient power to overcome some of the methodological obstacles that have contributed to these mixed results.

The second goal of the study was to test whether social support mediated or moderated the association between hearing impairment and depressive symptoms. The likelihood of experiencing an increase in depressive symptoms did not change once social support was added, offering little support for the idea that it buffered the relationship between hearing impairment and poor mental health. In contrast, the results found that social support interacted with hearing impairment to influence mental health. Among

those with worse self-rated hearing, high levels of social support reduced depressive symptoms while low levels of social support resulted in higher levels of depressive symptoms. Low levels of social support did not increase depressive symptoms among people with excellent hearing. This finding indicates that social support was most beneficial for those with worse hearing. Therefore, social support plays a significant role in moderating the relationship between hearing impairment and depressive symptoms. Overall, these findings suggest that hearing impairment is a chronic stressor in individuals' lives, and that responses to this stressor vary by the level of social resources available.

The fact that social support has consequences for mental health may not be surprising, but it is an important finding in the context of hearing impairment. Hearing impairment has a strong impact on individual well-being in that it is associated with social withdrawal and social and emotional loneliness (Mick, Kawachi and Lin 2014, Pronk, Deeg and Kramer 2013). Such a finding is particularly significant when combined with an aging population that is also at risk for social isolation. While it is encouraging that results from this study suggest that social support has mental health benefits for people with hearing impairment, a recent review finds that people still tend to deny that they have trouble hearing (Barker, Leighton and Ferguson 2017), be it due to stigma, a lack of coping mechanisms, or a lack of ways to disclose their hearing loss to others. This suggests that many people with hearing impairments may not be benefiting from sufficient levels of social support.

There are several ways to increase access to such support for people with hearing impairment. First, earlier identification of hearing impairment and/or the use of assistive technology may help individuals remain engaged. Second, audiologic (hearing) rehabilitation programs could include educational training for significant others regarding ways to support socially the person with hearing impairment (Preminger and Meeks 2010). Audiologists, primary care physicians, friends, and family are key resources and should be the targets of such rehabilitation programming.

Further, findings from this study suggest that sociology can provide important insights into the study of hearing impairment by extending the use of the stress process model to incorporate hearing impairment as a stressor. Previous research has treated functional limitations as a stressor, in general, and a chronic, ongoing strain, in particular, and reports that these limitations have negative consequences for mental health and can lead to the proliferation of other stressors (Pearlin, Aneshensel and LeBlanc 1997, Pearlin 1999). Hearing impairment is another source of stress or chronic strain that is experienced by many older adults. However, a comprehensive review of the literature found that no other study has applied the stress process model to hearing impairment. Moreover, looking only at the main effect between hearing and mental health is not sufficient for understanding this relationship. Instead, as per the stress-buffering model, research should explore how social support and other resources *interact* with hearing impairment to influence mental health.

This study is not without limitations. First, analysis is restricted to three waves. Questions about social support were added to the HRS in 2006, so data from prior waves

could not be analyzed. Second, the sample is limited to noninstitutionalized individuals. Institutions that may have a significant number of people with hearing impairment, such as hospitals or retirement homes, are excluded. Third, measures of the age of onset or duration of hearing impairment were not included. Measures of the timing and duration of events are increasingly recognized in stress research as important for outcomes (Bierman and Statland 2010) and including such measures could strengthen the application of the stress process in this study. Finally, a potential limitation of this study is that it does not include younger participants. Hearing impairment may be more distressing at younger ages, suggesting that the results from this study may underestimate the nature of the relationship between hearing impairment and depressive symptoms.

2.5 Conclusion

Research projects that the older population will increase from 40 to 72 million between 2010 and 2030 (Vincent and Velkoff 2010), underscoring the importance of examining the connection between mental and physical health in the context of aging. This population is vulnerable to social isolation, which is magnified by having a hearing impairment. As shown by the stress-buffering model, social support is particularly important for people with hearing impairment because it lowers depressive symptoms at high levels but increases depressive symptoms at low levels. Thus, findings from this study suggest both the need for increased vigilance regarding hearing impairment among older adults and the need for research that treats hearing impairment as a physical health stressor. Building on this study, future research could assess how social support influences the relationship between hearing impairment and other mental and physical

health outcomes. Since social support is an external resource, research might also consider the role of internal resources, such as mastery and self-esteem, in shaping the relationship between hearing impairment and mental health. Finally, future research could also explore how hearing impairment affects not only the individuals, themselves, but also close significant others such as spouses or children (Borren et al. 2015)

3. Hearing Impairment and Mental Health Among Married Couples³

As the global population of people aged 60 and older is predicted to rise (Bloom et al. 2015), the mental and physical functioning of these aging adults will pose increasing challenges. One of the most common age-related stressors is the emergence or worsening of physical and mental decline for one or both spouses (Muramatsu, Yin and Hedeker 2010). Although providing physical and emotional support or care for a spouse is an integral part of marriage, it can have consequences for the caregiver (Thomeer, Reczek and Umberson 2015). Spouses experience disability through their partner's impairment, which is called third-party disability (Scarinci, Worrall and Hickson 2012). This concept is similar to stress proliferation, which describes how stressors in one area of life can lead to the accumulation of stressors in other aspects of life (Pearlin 1989). Stress proliferation has since been extended to describe the collateral consequences when one person's stress spills over to others (Thoits 2010). In other words, since people exist in social networks, the development of health problems can impact not only the individual but also those close to them (Elder Jr, Shanahan and Jennings 2015).

Hearing impairment is one physical health condition that may be particularly salient in the marital context. Hearing connects an individual to the social and physical environments (Verbrugge and Jette 1994). Thus, hearing impairment has social implications because it affects one's ability to communicate with others (Dalton et al.

³ This chapter was published in 2020 in *The Journals of Gerontology Series B: Psychological Sciences & Social Sciences* (corrected proof) under a license from Oxford Academic.

2003). Prior research has explored the relationship between hearing impairment and negative health outcomes, revealing associations with depression (West 2017), cognitive impairment (Lin et al. 2011a), and poorer physical functioning (Dalton et al. 2003). In contrast, research on the spouses of those with hearing impairment is currently limited to qualitative studies or small, cross-sectional studies, as few nationally representative datasets include comprehensive data on spouses. Therefore, they offer limited knowledge on population-level causal processes. Given population aging and the fact that hearing impairment is one of the most common health problems in later life (Whitson et al. 2018), it will become increasingly important to understand how it spills over from focal individuals to partners.

The current study draws on research in marriage, gender, and stress to examine how stressors within the marital context can have consequences for partners. The primary objectives are to explore the relationship between hearing impairment in one spouse and mental health outcomes in the other spouse, and how gender shapes this relationship. To this end, the study uses the Health and Retirement Study (HRS), a nationally representative, longitudinal survey with detailed data on the focal participants' spouses to estimate the relationship between hearing impairment and spouse's mental health.

3.1 Background

3.1.1 Stress Proliferation and Linked Lives

Research over the past 70 years has demonstrated that stress undermines physical and mental health (Institute of Medicine 2001). One type of stressor, chronic strains, are ongoing, long-term difficulties that negatively affect well-being, such as living in poverty

or having a chronic illness (Pearlin 1989). Chronic stressors can be a source of stress proliferation, which has traditionally explained how stressors associated with one event or role (e.g., incarceration, chronic illness) can lead to the accumulation of stressors in other aspects of life (e.g., divorce, financial strain due to the inability to find work) (Pearlin 1989, Turney 2014). According to stress proliferation theory, experiencing poor health (e.g., hearing impairment) throughout adulthood can have spillover effects, especially regarding social and economic attainment.

Stress proliferation has been extended to explain the consequences of one person's stressors on others in their social environment (Thoits 2010). For example, adolescent children of mothers with severe hearing impairment have worse mental health than adolescent children of mothers without hearing impairment (Borren et al. 2015), suggesting that the stress associated with disability can proliferate to family members. The cross-person spillover effects of stressors illustrate the life course principle of linked lives, indicating that social changes not only have a direct impact on individuals, but can also affect individuals indirectly through other people (Elder, Johnson and Crosnoe 2003). For example, a person's well-being may be influenced by their family member's illness. Family members (particularly spouses) are interdependent and serve as important sources of both social influence and connection across the life course (Thomas, Liu and Umberson 2017).

3.1.2 Gender and Health Contingencies Within Marriage

The marital relationship has received a great deal of research attention and is considered one of the most important relationships for health (Umberson 1987). For decades, research has reported the health benefits of marriage: compared to unmarried people, married people have less psychological distress, are less often depressed, report fewer physical health problems, and have better overall physical health (Waite and Gallagher 2000). More recently, studies show that individuals who were never married or who experienced a marital dissolution were significantly more likely than continuously married individuals to die following a heart attack (Dupre and Nelson 2016).

Additionally, gendered expectations of spouses result in men and women experiencing marriage differently (Thomeer, Reczek and Umberson 2015). From a stress process perspective, the effect a chronic stressor has on health may depend on core social status characteristics (Pearlin and Bierman 2013). Gender is a core social status characteristic that may influence the relationship between disability and spousal mental health and lead to different experiences of depressive symptoms for men and women. For example, gendered expectations contribute to asymmetric caregiving in which men are more likely to rely exclusively on a spouse for companionship, emotional support, and caregiving (Umberson et al. 1996) while women are expected to provide emotional and instrumental support to their husbands (Behler, Donnelly and Umberson 2019). This asymmetry leads men to be less effective caregivers when called upon to perform care-related tasks (Thomeer, Reczek and Umberson 2015).

Some research on caregiving within marriages has explored those in which one partner is health impaired. Stress proliferation may be particularly important in such relationships because of third-party disability, which occurs when a significant other does not have a health condition but experiences disability through the partner's impairment (Scarinci, Worrall and Hickson 2012). Evidence suggests that wives are more likely to experience stress when caring for a health-impaired spouse because of additional tasks they must perform for their spouses' emotional well-being (Thomeer, Reczek and Umberson 2015). Other research shows that wives providing only personal care (i.e., care related to activities of daily living) to health-impaired spouses report more depressive symptoms than wives providing only instrumental care (i.e., care related to instrumental activities of daily living), while the mental health of husbands providing only personal or only instrumental care does not differ (Kim et al. 2017). Although not a study on caregiving, per se, Margolis (2013) found that while both men and women are more likely to quit smoking after reporting a new chronic condition, only women were more likely to quit smoking (to reduce negative effects of secondhand smoke the partner's health) or to start smoking (as a coping strategy) after their partners became ill. Such research suggests that when one spouse has health limitations, the other may take on more responsibilities and that this process may be gendered since wives perform more emotion and care work than husbands (Thomeer, Reczek and Umberson 2015). These patterns reveal the gendered experience of caregiving for health-impaired spouses.

3.1.3 Hearing Impairment Within Marriage

Despite a large body of literature on the marital relationship, comparatively less research has conceptualized hearing impairment as a physical health stressor that is linked to health outcomes in spouses. Hearing impairment may be particularly important to study in marital contexts since it affects communication. When poor hearing affects communication, interactions become impaired, which can reduce quality of life (Dalton et al. 2003).

Qualitative research studies and studies using larger, clinical samples provide important insights regarding the experience of hearing impairment within marital relationships. For example, one study of ten non-impaired spouses of hearing-impaired partners (five females, five males) revealed that the effects of hearing impairment on spouses include avoiding social situations, frustration with communication, and altered home environments (due to increased television volume) (Scarinci, Worrall and Hickson 2008). Subsequent research using the Significant Other Scale for Hearing Disability (SOS-HEAR) in a sample of 100 normally-hearing spouses in Australia reveals that spouses experience third-party disability in areas related to communication changes, use of communication strategies, and emotional problems (e.g., feeling frustrated or angry) (Scarinci, Worrall and Hickson 2012). In a randomized control trial of 36 couples in which one partner was a hearing aid or cochlear implant user, Preminger and Meeks (2010) randomly assigned couples to an audiological rehabilitation program for the hearing-impaired spouses only, or to a program that included a treatment designed for the spouses. All couples reported that the hearing impairment caused difficulties with

communication, activities of daily living, and social participation, but quality of life improved up to six months post-intervention. One important caveat is that to be included in the study, couples had to report that hearing impairment created quality of life disruptions in their lives. This research contributes to knowledge about the experiences of spouses whose partners are hearing-impaired.

Although there have been numerous qualitative and clinical samples examining hearing impairment within marriages, research using population-based, longitudinal data is limited. A recent review found only two studies that used large epidemiologic datasets to study the effect of hearing impairment on spouses (Lehane, Dammeyer and Elsass 2017). Using the Alameda County Study, Wallhagen et al. (2004) found that the spouse of a person with hearing loss is more likely to report poor physical functioning, not feeling happy, symptoms of depression, and having less energy five years after baseline measurement. Importantly, the analyses revealed a gender-moderated effect: while a husband's hearing impairment negatively affected his wife, a wife's impairment did not impact her husband. In contrast, a cross-sectional study in Norway found that spouses of people with hearing loss do *not* exhibit greater symptoms of decreased subjective well-being, depression, or anxiety compared to spouses of people without hearing loss (Ask, Krog and Tambs 2010). More recently, a cross-sectional study in Ireland found that partners of people with sensory losses (hearing, vision, or dual loss) had higher levels of depression (but not anxiety) than spouses of people without sensory loss (Lehane et al. 2017). Further analysis showed no significant differences according to whether the spouse had hearing, vision, or dual-sensory loss, suggesting that individuals tend to report

similar levels of distress, regardless of loss type. Given the limited population-based, longitudinal analysis and conflicting findings among them, the association between hearing impairment and spousal mental health remains uncertain. Moreover, there is limited evidence on how this relationship differs by gender.

3.1.4 Current Study

The current study aims to contribute to existing research on marriage, gender, and disability by addressing some of the limitations and contradictory findings in previous studies on the relationship between hearing impairment and spousal mental health. Drawing on the stress proliferation framework, hearing impairment is conceptualized as a physical health stressor and its impact on depressive symptoms in spouses is examined. Specifically, the study uses the HRS to assess: 1) to what extent does an individual's hearing impairment influence his/her spouse's depressive symptoms?; and 2) does the relationship between an individual's hearing impairment and the spouse's depressive symptoms depend on the gender of the non-hearing-impaired spouse?

3.2 Methods

3.2.1 Sample

The data for this study come from the Health and Retirement Study (HRS) Waves 4-13 (1998-2016), a nationally representative survey of U.S. adults aged 50 and older. Respondents' spouses are also recruited and surveyed, regardless of their age. Respondents and their spouses are interviewed for the HRS Core files every two years. The HRS Core starting sample is 42,053 individuals. The current sample is restricted to people who were present and had a spouse in the 1998 wave (n=13,820). The sample is

further restricted by eliminating individuals who report more than one spouse (n=486), live in a single-occupant household (n=820), or report a same-sex partner (n=1). From these 12,512 individuals, couples were matched on household identification number, resulting in 6,256 couples. Proxy responses are omitted because most proxies were used for focal respondents with cognitive impairment, which is linked to both hearing impairment and depressive symptoms (Djernes 2006, Lin et al. 2011a). Proxy respondents indicated that 37.44% of focal husbands and 14.61% of focal wives had hearing impairment. Exclusion of surveys completed by proxies (12.73% of husbands, 3.77% of wives) resulted in a sample of 5,658 couples. After listwise deletion of missing items and death, the final dataset is comprised of 5,485 couples, or 10,970 individuals. A sensitivity analysis using multiple imputation (not shown) revealed a similar pattern of results to listwise deletion.

3.2.2 Depressive Symptoms

Depressive symptomology is based on a summed score of responses to an eight-item version of the Center for Epidemiologic Studies Depression Scale (CES-D), a screening test for depression and depressive disorder (Radloff 1977). Items in the scale ask about having restless sleep, not being able to get going, enjoying life, and feeling lonely, sad, depressed, that everything was an effort, or happy. Participants reported whether the statements were true much of the time during the past week (no/yes). Responses are summed and range from zero to eight. Higher scores indicate more depressive symptoms.

3.2.3 Hearing

All participants were asked to rate their hearing (while wearing a hearing aid as usual, if relevant) on a five-point scale (excellent, very good, good, fair, poor). While pure-tone audiometry is the gold standard for assessing hearing impairment, it has a limited relationship with the lived experience of disability, especially self-reported comprehension in noise (Kramer et al. 1996) or group conversations (Gatehouse and Noble 2004). Moreover, self-report measures are reliable indicators of hearing impairment (Chou et al. 2011).

3.2.4 Control Variables

The HRS collects detailed information on both main participants and their spouses, which is organized into two groups for this study: household-level variables (one variable collected per household) and individual-level variables (separate variables collected for both participants and spouses). The time-varying household-level variables include marriage length (continuous, in years) and wealth (logged continuous variable), which measures total household assets while subtracting out debt (Bugliari et al. 2016). A dummy variable for currently living in the South (reference) compared to other U.S. regions is included because research suggests that risk factors for hearing loss, including acute otitis media, are spatially distributed (Ren, Sethi and Stankovic 2018). Time-varying individual-level control variables include age (continuous) and a dichotomous measure of hearing aid use (1=use hearing aids), as using hearing aids can reduce depression (Mener et al. 2013). Time-invariant individual-level control variables include race/ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic other race,

Hispanic White, Hispanic Black, and Hispanic other race) and educational attainment (continuous).

Two health behaviors that are both gendered expressions of mental health and associated with hearing loss are included: smoking status (never smoker; ever smoker) and number of drinks per week (zero versus five or more) (McKee, Stransky and Reichard 2018, Read, Porter and Gorman 2016). Activities of daily living (ADLs: difficulty bathing, eating, dressing, walking across a room, or getting in or out of bed) and instrumental activities of daily living (IADLs: difficulty using a telephone, taking medication, or handling money) are included because functional limitation is a predictor of depressive symptoms (Djernes 2006). The indices range from 0-5 and 0-3, respectively. Since own hearing impairment is associated with own depressive symptoms (West 2017), own depressive symptoms are also included in the models.

3.2.5 Analysis

Fixed-effects models are used to examine how one spouse's hearing impairment impacts the other spouse's depressive symptoms. Fixed-effects models are longitudinal models that treat unobserved, time-invariant variables that differ across individuals as a set of fixed parameters (Allison 2009). Such models control for variables that either have not or cannot be measured and allows those variables to have an association with the variables that have been measured. Fixed effects models only capture within-individual differences or change, which makes them less subject to unobserved confounding than other models, but also reduces their efficiency. For fixed effects models, the dependent variable must be measured on at least two time points for each individual and the

predictor variable's values must change across those time points for a large portion of the sample (Allison 2009). The fixed effects model is written as follows:

$$y_{it} = \mu_i + \beta \text{hearing}_{it} + \gamma x_{it} + \alpha_t + \varepsilon_{it}$$

where y_{it} is the number of depressive symptoms for an individual i at time t , and $\beta \text{hearing}_{it}$ represents the effect of the focal analysis measure, or the change in self-rated hearing from 1998 to 2016. The parameter x_{it} is the vector of control variables. The μ_i term accounts for both observed and unobserved stable traits between individuals while α_t accounts for year fixed effects, therefore capturing trends that are constant across individuals over time.

Since models in the current study are estimated separately by gender, the model above can be re-written:

$$\text{Wife CESD}_{it} = \mu_i + \beta \text{Husband Hearing}_{it} + \gamma x_{it} + \alpha_t + \varepsilon_{it} \quad (1)$$

$$\text{Husband CESD}_{it} = \mu_i + \beta \text{Wife Hearing}_{it} + \gamma x_{it} + \alpha_t + \varepsilon_{it} \quad (2)$$

where (1) indicates the effect of a husband's hearing impairment on his wife's depressive symptoms, while (2) indicates the effect of a wife's hearing impairment on her husband's depressive symptoms. All analyses were conducted in Stata version 16.

3.3 Results

Table 3 presents descriptive statistics for the sample pooled across the ten waves and separated by husbands and wives. Women report a higher mean level of depressive symptoms than men (1.28 versus 0.99) and around 29% of men reported fair or poor hearing compared to 13% of women.

**Table 3. Sample Characteristics for Wives and Husbands: HRS, 1998-2016
(n=5,485 Couples, 10,970 Individuals).**

	Husbands	Wives	
Individual characteristics			
CES-D, mean (sd)	0.99 (1.53)	1.28 (1.80)	***
Self-rated hearing			
Excellent	11.11	23.18	*
Very good	22.20	32.47	**
Good	37.31	31.72	
Fair	22.29	10.10	
Poor	7.10	2.53	
Wear hearing aid	16.32	6.00	***
Age, mean (sd)	70.65 (8.82)	67.26 (9.36)	***
Range	30.92-99.83	25.5-102.25	
Race			
NH White	83.29	83.11	***
NH Black	8.15	8.09	***
NH Other	1.72	1.72	***
Hispanic White	5.40	5.63	***
Hispanic Black	0.12	0.13	***
Hispanic Other	1.33	1.32	***
Education, mean (sd)	12.79 (3.29)	12.65 (2.82)	***
Ever a smoker	70.74	46.66	***
Drinks per week, mean (sd)	3.29 (6.81)	1.59 (3.86)	***
ADL	0.21 (0.68)	0.22 (0.71)	
IADL	0.09 (0.37)	0.06 (0.32)	***
Couple characteristics			
Wealth (median)	\$257,000		
Live in South	39.94		
Marriage length, mean (sd) [range]	41.20 (13.66) [0.10-76.2]		

Note: ADL = activities of daily living; CES-D = Center for Epidemiologic Studies Depression Scale; HRS = Health and Retirement Study; IADL = instrumental activities of daily living; NH = non-Hispanic; sd = standard deviation.

*p < 0.05, **p < 0.01, ***p < 0.001.

Table 4 presents the fixed effects results showing the effect of wives' hearing impairment on their husbands' depressive symptoms. Control variables were sequentially added into the models in blocks: demographic, health behaviors, and other health variables. With only wives' hearing in the model (Model 1), wives' fair ($p=0.006$) or poor hearing ($p=0.006$) is associated with an increase in husbands' depressive symptoms. Specifically, compared to having a wife with excellent hearing, having a wife with fair self-rated hearing results in a 0.14-point-increase in the number of depressive symptoms reported by the husband while having a wife with poor self-hearing is associated with a 0.22-point-increase in a husband's depressive symptoms.

Table 4. Fixed Effects Regression Coefficients for Husbands' Depressive Symptoms: HRS, 1998-2016.

Variable	Model 1 Coef (SE)	Model 2 Coef (SE)	Model 3 Coef (SE)	Model 4 Coef (SE)
Wife hearing [excellent]				
Very good	0.03 (0.03)	0.03 (0.03)	0.04 (0.03)	0.04 (0.032)
Good	0.05 (0.04)	0.05 (0.04)	0.05 (0.04)	0.04 (0.04)
Fair	0.14 (0.05)**	0.14 (0.05)***	0.14 (0.05)**	0.11 (0.05)*
Poor	0.22 (0.08)**	0.22 (0.08)***	0.22 (0.08)**	0.16 (0.08)*
Husband age		-0.16 (0.10)	-0.17 (0.10)	-0.15 (0.10)
Wife age		0.13 (0.10)	0.13 (0.10)	0.10 (0.10)
Wealth (log)		-0.01 (0.005)	-0.01 (0.005)	-0.01 (0.005)
Live in south		-0.08 (0.07)	-0.09 (0.07)	-0.06 (0.06)
Marriage length		0.04 (0.01)***	0.04 (0.01)***	0.03 (0.01)***
Husband ever smoke			0.70 (0.30)*	0.77 (0.32)*
Wife ever smoke			-0.31 (0.231)	-0.25 (0.20)
Husband 5+ drinks			-0.02 (0.08)	-0.01 (0.08)
Wife 5+ drinks			-0.29 (0.18)	-0.29 (0.17)
Wife wears hearing aid(s)				-0.12 (0.07)
Husband hearing [excellent]				
Very good				-0.06 (0.04)
Good				0.01 (0.04)
Fair				0.09 (0.05)*
Poor				0.27 (0.06)***
Husband wears hearing aid(s)				0.15 (0.04)**
Husband Activities of Daily Living				0.34 (0.03)***
Husband Instrumental Activities of Daily Living				0.25 (0.05)***
Wife depressive symptoms				0.08 (0.01)***
Constant	0.93 (0.02)***	2.60 (0.39)***	2.27 (0.46)***	2.34 (0.48)***

Note: Race and education not included because they are time-invariant. Coef = coefficient; SE = standard error.

*p < 0.05, **p < 0.01, ***p < 0.001.

Table 5. Fixed Effects Regression Coefficients for Wives' Depressive Symptoms: HRS, 1998-2016.

Variable	Model 1 Coef (SE)	Model 2 Coef (SE)	Model 3 Coef (SE)	Model 4 Coef (SE)
Husband hearing [excellent]				
Very good	-0.01 (0.04)	-0.01 (0.04)	-0.01 (0.04)	0.002 (0.04)
Good	-0.003 (0.05)	0.01 (0.05)	0.01 (0.05)	0.01 (0.05)
Fair	0.01 (0.07)	0.02 (0.06)	0.02 (0.06)	0.01 (0.06)
Poor	0.10 (0.07)	0.12 (0.07)	0.11 (0.07)	0.06 (0.07)
Wife age		0.14 (0.14)	0.14 (0.14)	0.10 (0.13)
Husband age		-0.11 (0.14)	-0.11 (0.14)	-0.07 (0.13)
Wealth (log)		-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.005)
Live in south		-0.03 (0.12)	-0.03 (0.12)	0.02 (0.12)
Marriage length		-0.03 (0.01)**	-0.03 (0.01)**	-0.04 (0.01)***
Wife ever smoke			-0.09 (0.31)	0.01 (0.31)
Husband ever smoke			-0.68 (0.62)	-0.71 (0.62)
Wife 5+ drinks			0.004 (0.10)	0.01 (0.09)
Husband 5+ drinks			0.07 (0.23)	0.12 (0.22)
Husband wears hearing aid(s)				-0.001 (0.05)
Wife hearing [excellent]				
Very good				0.03 (0.03)
Good				0.15 (0.04)***
Fair				0.30 (0.06)***
Poor				0.46 (0.10)***
Wife wears hearing aid(s)				0.11 (0.09)
Wife Activities of Daily Living				0.35 (0.03)***
Wife Instrumental Activities of Daily Living				0.13 (0.05)*
Husband depressive symptoms				0.11 (0.01)***
Constant	1.24 (0.04)***	1.05 (0.56)	1.56 (0.74)*	1.33 (0.70)

Note: Race and education not included because they are time-invariant. Coef = coefficient; SE = standard error.

*p < 0.05, **p < 0.01, ***p < 0.001.

The significant relationship between wives' fair (coefficient=0.14, $p=0.006$) or poor (coefficient=0.22, $p=0.005$) hearing and husbands' depressive symptoms persisted after adding demographic variables in Model 2. Longer marriages are also significantly associated with an increase in husbands' depressive symptoms (coefficient=0.04, $p<0.001$). After adding time-varying health behaviors in Model 3, wives' fair (coefficient=0.14, $p=0.006$) and poor (coefficient=0.22, $p=0.005$) hearing is still associated with an increase in husbands' depressive symptoms. Other significant variables in the model are marriage length and husbands' own smoking behavior, with longer marriages ($p<0.001$) and ever having smoked associated with an increase in husbands' own depressive symptoms ($p=0.02$).

In Model 4, other time-varying health variables are added. The significant relationship between wives' fair or poor hearing and husbands' depressive symptoms persists but is slightly attenuated ($p=0.03$ and $p=0.046$, respectively). Longer marriages and husbands' own smoking behavior are still associated with an increase in own depressive symptoms ($p<0.001$ and $p=0.02$, respectively). Husbands' own fair ($p=0.05$) or poor ($p<0.001$) hearing and use of hearing aids ($p=0.001$) are associated with an increase in his own depressive symptoms. A husband's own increase in ADLs or in IADLs are both associated with an increase in his own depressive symptoms (p -values <0.001). Having a wife with more depressive symptoms is also associated with an increase in a husband's own depressive symptoms ($p<0.001$).

Overall effect sizes for wives' self-rated hearing appear modest. Nonetheless, it is important to note first, that these coefficients capture the effect of change in hearing on

change in depressive symptoms at a time in the life course for spouses when depressive symptoms tend to remain stable. Second, research generally finds that women report more depressive symptoms than men. Here, the difference in number of depressive symptoms is small: only 0.29 more symptoms reported by wives. The coefficients for men with wives with fair/poor hearing are relatively close to that difference in symptoms. Finally, the effect sizes of husbands' own hearing impairment on husbands' own depressive symptoms are of similar magnitude (0.27 for poor hearing and 0.09 for fair hearing).

Table 5 replicates Table 4 but shows the effect of husbands' hearing impairment on their wives' depressive symptoms. In Model 1, no level of husbands' self-reported hearing ability is significantly associated with an increase in wives' depressive symptoms. In Models 2 and 3, the relationship remains insignificant and the only significant relationship is that an increase in marriage length reduces a wife's depressive symptoms ($p=0.004$ in both models). In contrast, in Model 4, wives' own good, fair, or poor hearing ($p<0.001$ for each), an increase in own ADLs ($p<0.001$), and an increase in own IADLs ($p=0.01$) increase wives' own depressive symptoms. Additionally, having a husband with more depressive symptoms is associated with an increase in a wife's depressive symptoms ($p<0.001$).

3.4 Supplementary Analyses

Several sensitivity analyses were performed (results available on request). First, logging CES-D resulted in a similar pattern of results. Second, alternative measures of hearing impairment did not change the results. For example, self-rated hearing was dichotomized into no hearing impairment (excellent, very good, or good hearing) versus hearing impairment (fair or poor hearing) with individuals reporting use of a hearing aid also classified as hearing impaired. Third, since couples in longer marriages may be better able to cope with stressors, the moderating effect of length of marriage was tested by including an interaction term between self-rated hearing and marriage length. The interaction term was never significant, either when marriage length was a continuous or categorical variable.

3.5 Discussion

Hearing impairment is an important and growing disability with numerous implications for individuals at all stages of the life course (Stucky, Wolf and Kuo 2010). It also matters in the marital context because it impacts communication (Dalton et al. 2003). However, current research on hearing impairment among married couples is limited to small, unrepresentative qualitative studies and three population-level studies which yielded mixed results and were mostly cross-sectional. The goal of the current study was to examine the effect of hearing on spousal mental health outcomes in an effort to highlight the stress and mental health implications for an aging society at increasing risk of hearing impairment. Given the gendered dynamics of both hearing impairment

and the marital context, the current study also examined whether the relationship between hearing impairment and spousal depressive symptoms was gendered.

From a stress process perspective, results from this study indicate that the stress associated with one person's fair or poor hearing can spill over to the spouse, depending on gender. For male spouses, having a wife with fair or poor hearing has a direct effect on their depressive symptoms, and this relationship persists even after adding variables associated with mental health, including his wife's depressive symptoms. In contrast, husbands' fair/poor hearing is never significantly associated with wives' depressive symptoms. Previous qualitative research has revealed that third-party disability is a common experience for spouses but given small sample sizes that are not drawn randomly, these studies are limited in their ability to assess the impact of gender (Scarinci, Worrall and Hickson 2008, Scarinci, Worrall and Hickson 2012).

Of the three population-based studies on this topic, two found that the spouses of hearing-impaired individuals *do* report worse health outcomes (Lehane et al. 2017, Wallhagen et al. 2004), while one found that spouses do *not* exhibit worse health outcomes (Ask, Krog and Tambs 2010). The studies by Ask, Krog and Tambs (2010) and Lehane et al. (2017) are both cross-sectional and based on international samples, which may contribute to the mixed findings regarding this relationship. In contrast, the current study follows a large (n=5,485 couples), nationally representative sample over ten waves (1998-2016), which provides sufficient power to lend a causal interpretation to the association and to overcome some of the methodological obstacles that might have contributed to previous mixed results.

The main finding of the current study, that husbands' fair or poor hearing (hereafter, hearing impairment) does not impact wives' depressive symptoms, strays from past research that underscores the importance of husbands' impairment on wives' mental health (Wallhagen et al. 2004). There are several reasons to suspect why spousal hearing impairment matters more for husbands than for wives. First, structural systems of gender explain that within heterosexual marriages, women are more attuned to and responsive to their spouse's health, and also more likely than men to monitor and regulate their spouse's health behaviors in order to promote the health of their spouse (Umberson, Donnelly and Pollitt 2018). In other words, there are known gender differences in who takes responsibility for the health of other family members. According to the social control perspective on marriage, spouses will regulate one another's behaviors (e.g., encourage the partner to eat healthier food, reduce alcoholic beverage intake, exercise, quit smoking, etc.) (Umberson 1992), and that the use of social control to influence spousal behavior has gendered differences. For example, women are more likely to encourage healthy eating and compliance with a medical regime as well as to discourage unhealthy behaviors such as binge drinking or smoking (Umberson 1987, Umberson 1992, Waite and Gallagher 2000). In the case of hearing, since wives have traditionally been expected to serve as caregivers in marital relationships, their husbands' hearing impairment may not appear like an additional burden. Since women are already socialized to monitor health within the marital context, encouraging their husbands to get their hearing tested or helping their husbands find accommodations for hearing impairment may simply be another task they perform. In contrast, men are less

accustomed to monitoring and regulating their spouses' health within the marital relationship, and therefore may find accommodating their wives' hearing impairment unduly distressing.

Second, heterosexual marital relationships are often subject to asymmetric caregiving, in which men rely almost exclusively upon their wives for companionship, emotional support, and caregiving (Umberson et al. 1996). Marital role expectations vary for women and men, which often leads to women acting as their husbands' exclusive confidant or source of emotional and instrumental support (Behler, Donnelly and Umberson 2019). Moreover, women receive beneficial social support from a variety of sources – a recent study by Glauber and Day (2018) found that part-time employment (compared to full-time employment) reduced psychological distress among women serving as caregivers for their spouse, perhaps because these women could benefit from having social ties and coping resources outside of the home. As such, wives usually find sources of social support outside of the marital relationship, while husbands do not, which provides wives, but not husbands, with resources to cope with their spouses' hearing impairment.

Finally, the prevalence of hearing impairment is lower among women than men (Hoffman et al. 2017), which may make hearing-impaired wives more stigmatizing for their husbands. Mechanisms used to explain the gendered difference in prevalence usually include that men are more likely to work in occupations that entail excessive noise exposure, including construction or manufacturing. Additionally, men are more likely to engage in recreational activities that expose them to loud noises, including riding

motorcycles, using power tools, and shooting firearms (Lie et al. 2016). Given societal awareness that men engage in behaviors that are harmful to their hearing, wives may feel it is socially acceptable to have a hearing-impaired husband and may even be able to receive social support or other resources from other wives whose husbands are similarly impaired. In contrast, since fewer women are hearing impaired, their husbands may lack access to social support or resources.

It is also important to note that regardless of gender, individuals' own fair or poor hearing is significantly associated with an increase in their depressive symptoms. This is consistent with previous research which finds that self-rated hearing is associated with a significant increase in depressive symptoms among individuals (West 2017). In the current study, one's own fair or poor hearing remains a significant predictor of one's own depressive symptoms over and above other covariates.

3.5.1 Limitations

One limitation is that analysis is restricted to heterosexual couples due to the small, unrepresentative number of same-sex partners in the sample. Research by Kelly and Atcherson (2011) finds that significant others in same-sex relationships (n=10) with a partner with hearing impairment have both similar and different experiences to significant others in heterosexual relationships (n=10). Therefore, future research should explore the impact of hearing impairment on mental health outcomes among same-sex couples.

Second, measures of positive or negative marital quality were not included. Marital quality has been shown to play an important role for health outcomes among

married couples (e.g., Carr, Cornman and Freedman 2017). The HRS does include measures of marital quality, but these measures are only asked in self-administered questionnaires (SAQ). In each wave of the HRS, a randomly selected half of the sample is eligible for the SAQ such that individuals eligible in 2008 were eligible again in 2012, while those eligible in 2006 were eligible again in 2010 and 2014. Including the marital quality measures would preclude inclusion of the 1998 through 2004 waves, thus limiting the longitudinal nature of the study. Future research could focus specifically on examining whether marital quality moderates the relationship between hearing impairment and spousal mental health.

Third, the study assumes that hearing impairment will impact mental health but does not consider strategies that individuals may have for coping, including marital dissolution. It is plausible that the onset of hearing impairment may lead certain spouses to seek divorce or separation. Such a hypothesis is empirically testable, and future research should examine how hearing impairment influences marital status. Finally, the study relies on self-reported hearing impairment, while pure-tone audiometry is the gold standard for evaluation. However, Chou et al. (2011) report that a single item about hearing impairment yields results almost as accurate as those provided by portable audiometric devices or more extensive questionnaires.

3.6 Conclusion

As the older population in the U.S. increases, hearing impairment will affect a larger proportion of the population (Whitson et al. 2018), underscoring the importance of examining health and marital relationships in the context of aging. This population is

vulnerable to hearing impairment, which can negatively impact communication (Dalton et al. 2003). According to the stress proliferation model, wives' hearing impairment spills over to husbands in the form of increased depressive symptoms. In contrast, husbands' hearing impairment does not result in an increase in wives' depressive symptoms. Thus, findings from this study suggest the need for increased vigilance regarding hearing impairment among both older adults *and* their spouses.

4. Conclusion

Throughout the life course, disability can be a chronic strain that negatively affects the well-being of individuals. While research has traditionally focused on *individuals* with disabilities, disability can also be a source of stress proliferation when the stress associated with one individual's disability spills over to their spouse. Sociological and demographic research on disability has had limited focus on hearing impairment, a disability that is very common at older ages and has negative consequences for quality of life not only of individuals but also for those close to them. In this dissertation, I applied a life course and stress process framework to the experience of hearing impairment and demonstrated that it has major implications for the mental health both of the focal individual and of their spouse.

In Chapter 2, I found that worse self-rated hearing was associated with a significant increase in depressive symptoms, and that social support interacted with hearing impairment: low levels of social support were associated with more depressive symptoms but only among people with poor self-rated hearing. Moreover, high levels of social support reduced depressive symptoms for those with poor hearing. These findings suggest that hearing impairment is a chronic stressor in individuals' lives, and that responses to this stressor vary by the availability of social resources.

In Chapter 3, I examined stress proliferation within married couples. I found that wives' hearing impairment is associated with a significant increase in husbands' depressive symptoms, but that husbands' hearing impairment is not significantly associated with wives' depressive symptoms. These findings suggest that the stress

associated with hearing impairment can spill over from one spouse to another, depending on gender.

Overall, this dissertation demonstrates that hearing impairment is a chronic stressor that has major implications for individuals' mental health. Moreover, the mental health consequences of hearing impairment are not only limited to individuals but can also spill over to impact spouses. Further research is needed to extend our understanding of how disability, in general, and hearing impairment, specifically, shapes health across the life course for individuals and those close to them.

References

- Agrawal, Yuri, Elizabeth A. Platz and John K. Niparko. 2008. "Prevalence of Hearing Loss and Differences by Demographic Characteristics among US Adults: Data from the National Health and Nutrition Examination Survey, 1999-2004." *Archives of Internal Medicine* 168(14):1522-30. doi: 10.1001/archinte.168.14.1522.
- Alang, Sirry M., Donna D. McAlpine and Carrie E. Henning-Smith. 2014. "Disability, Health Insurance and Psychological Distress among US Adults: An Application of the Stress Process." *Society and Mental Health* 4(3):164-78. doi: 10.1177/2156869314532376.
- Allison, Paul D. 2009. *Fixed Effects Regression Models*. Thousand Oaks, CA: SAGE Publications, Inc.
- Aneshensel, Carol S. 1992. "Social Stress: Theory and Research." *Annual Review of Sociology* 18:15-38. doi: 10.1146/annurev.so.18.080192.000311.
- Aneshensel, Carol S., Jo C. Phelan and Alex Bierman. 2013. "The Sociology of Mental Health: Surveying the Field." Pp. 1-19 in *Handbook of the Sociology of Mental Health*, edited by C. S. Aneshensel, J. C. Phelan and A. Bierman. Dordrecht: Springer Netherlands.
- Ask, Helga, Norun H. Krog and Kristian Tambs. 2010. "Impact of Hearing Impairment on Spousal Mental Health: The Nord-Trøndelag Health Study." *European Journal of Public Health* 20(3):271-75. doi: 10.1093/eurpub/ckp176.
- Bagai, Akshay, Paaladinesh Thavendiranathan and Allan S. Detsky. 2006. "Does This Patient Have Hearing Impairment?". *Journal of the American Medical Association* 295(4):416-28. doi: 10.1001/jama.295.4.416.
- Barker, Alex B., Paul Leighton and Melanie A. Ferguson. 2017. "Coping Together with Hearing Loss: A Qualitative Meta-Synthesis of the Psychosocial Experiences of People with Hearing Loss and Their Communication Partners." *International Journal of Audiology* 56(5):297-305. doi: 10.1080/14992027.2017.1286695.
- Behler, Rachel, Rachel Donnelly and Debra Umberson. 2019. "Psychological Distress Transmission in Same-Sex and Different-Sex Marriages." *Journal of Health and Social Behavior* 60(1):18-35. doi: 10.1093/eurpub/ckp176.
- Bierman, A. and D. Statland. 2010. "Timing, Social Support, and the Effects of Physical Limitations on Psychological Distress in Late Life." *Journals of Gerontology*

Series B: Psychological Sciences & Social Sciences 65B(5):631-39. doi: 10.1093/geronb/gbp128.

- Bloom, David E., Somnath Chatterji, Paul Kowal, Peter Lloyd-Sherlock, Martin McKee, Bernd Rechel, Larry Rosenberg and James P. Smith. 2015. "Macroeconomic Implications of Population Ageing and Selected Policy Responses." *Lancet* 385(9968):649-57. doi: 10.1016/s0140-6736(14)61464-1.
- Borren, Ingrid, Kristian Tambs, Kristin Gustavson, Helga Ask, Bo Engdahl and Jon Martin Sundet. 2015. "Associations between Parental Hearing Impairment and Children's Mental Health: Results from the Nord-Trøndelag Health Study." *Social Science & Medicine* 147:252–60. doi: 10.1016/j.socscimed.2015.11.011.
- Brown, Robyn Lewis and R. Jay Turner. 2012. "Physical Limitation and Anger: Stress Exposure and Assessing the Role of Psychosocial Resources." *Society and Mental Health* 2(2):69-84. doi: 10.1177/2156869312444441.
- Brueggemann, Brenda Jo. 2009. *Deaf Subjects: Between Identities and Places*. New York, NY: New York University Press.
- Bugliari, Delia, Campbell Nancy, Chan Chris, Hayden Orla, Hurd Michael, Main Regan, Mallett Joshua, McCullough Colleen, Meijer Erik, Moldoff Michael, Pantoja Philip, Rohwedder Susann and Patricia St. Clair. 2016. *RAND HRS Data Documentation, Version P*. Labor & Population Program: RAND Center for the Study of Aging.
- Capella-McDonnall, Michele E. 2005. "The Effects of Single and Dual Sensory Loss on Symptoms of Depression in the Elderly." *International Journal of Geriatric Psychiatry* 20(9):855-61. doi: 10.1002/gps.1368.
- Carr, Deborah, Jennifer C. Cornman and Vicki A. Freedman. 2017. "Disability and Activity-Related Emotion in Later Life: Are Effects Buffered by Intimate Relationship Support and Strain?". *Journal of Health and Social Behavior* 58(3):387-403. doi: 10.1177/0022146517713551.
- CDC. 2017, "Table a-6a. Age-Adjusted Percentages (with Standard Errors) of Hearing Trouble, Vision Trouble, and Absence of Teeth among Adults Aged 18 and over, by Selected Characteristics: United States, 2017" *Summary Health Statistics: National Health Interview Survey, 2017*: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. Retrieved from, (https://ftp.cdc.gov/pub/Health_Statistics/NCHS/NHIS/SHS/2017_SHS_Table_A-6.pdf).

- Cederroth, Christopher R., Barbara Canlon and Berthold Langguth. 2013. "Hearing Loss and Tinnitus - Are Funders and Industry Listening?". *Nature Biotechnology* 31(11):972-74. doi: 10.1038/nbt.2736.
- Charmaz, Kathy. 1983. "Loss of Self: A Fundamental Form of Suffering in the Chronically Ill." *Sociology of Health & Illness* 5(2):168-95. doi: 10.1111/1467-9566.ep10491512.
- Cheng, Cheng. 2017. "Anticipated Support from Children and Later-Life Health in the United States and China." *Social Science & Medicine* 179:201–09. doi: 10.1016/j.socscimed.2017.03.007.
- Chou, Kee-Lee. 2008. "Combined Effect of Vision and Hearing Impairment on Depression in Older Adults: Evidence from the English Longitudinal Study of Ageing." *Journal of Affective Disorders* 106(1–2):191-96. doi: 10.1016/j.jad.2007.05.028.
- Chou, Roger, Tracy Dana, Christina Bougatsos, Craig Fleming and Tracy Beil. 2011. *Screening for Hearing Loss in Adults Ages 50 Years and Older: A Review of the Evidence for the U.S. Preventive Services Task Force*. Rockville, MD: Agency for Healthcare Research and Quality.
- Ciorba, Andrea, Chiara Bianchini, Stefano Pelucchi and Antonio Pastore. 2012. "The Impact of Hearing Loss on the Quality of Life of Elderly Adults." *Clinical Interventions in Aging* 7:159-63. doi: 10.2147/CIA.S26059.
- Clarke, Philippa and Kenzie Latham. 2014. "Life Course Health and Socioeconomic Profiles of Americans Aging with Disability." *Disability and Health Journal* 7(1 0):S15-S23. doi: 10.1016/j.dhjo.2013.08.008.
- Cohen, Sheldon and Thomas A. Wills. 1985. "Stress, Social Support, and the Buffering Hypothesis." *Psychological Bulletin* 98(2):310-57. doi: 10.1037/0033-2909.98.2.310.
- Cohen, Sheldon. 2004. "Social Relationships and Health." *American Psychologist* 59:676-84. doi: 10.1037/0003-066X.59.8.676.
- Dalton, Dayna S., Karen J. Cruickshanks, Barbara E. K. Klein, Ronald Klein, Terry L. Wiley and David M. Nondahl. 2003. "The Impact of Hearing Loss on Quality of Life in Older Adults." *The Gerontologist* 43(5):661-68. doi: 10.1093/geront/43.5.661.
- Deeg, Dorly J. H. 2016. "Gender and Physical Health in Later Life." Pp. 1-6 in *The Encyclopedia of Adulthood and Aging*, edited by S. K. Whitbourne: Wiley-Blackwell.

- Djernes, Jens Kronborg. 2006. "Prevalence and Predictors of Depression in Populations of Elderly: A Review." *Acta Psychiatr Scand* 113(5):372-87. doi: 10.1111/j.1600-0447.2006.00770.x.
- Dupre, Matthew E. and Alicia Nelson. 2016. "Marital History and Survival after a Heart Attack." *Social Science & Medicine* 170:114-23. doi: 10.1016/j.socscimed.2016.10.013.
- Elder, Glen H. 1998. "The Life Course as Developmental Theory." *Child Dev* 69(1):1-12. doi: 10.2307/1132065.
- Elder, Glen H., Monica K. Johnson and Robert Crosnoe. 2003. "The Emergence and Development of Life Course Theory." Pp. 3-19 in *Handbook of the Life Course*, edited by J. T. Mortimer and M. J. Shanahan. Boston, MA: Springer US.
- Elder Jr, Glen H., Michael J. Shanahan and Julia A. Jennings. 2015. "Human Development in Time and Place." in *Ecological Settings and Processes in Developmental Systems*, Vol. Volume 4 of R.M. Lerner (eds.) *The Handbook of Child Psychology and Developmental Science*, edited by M. Bornstein and T. Leventhal. New York, NY: Wiley.
- Erler, Susan F. and Dean C. Garstecki. 2002. "Hearing Loss- and Hearing Aid-Related Stigma Perceptions of Women with Age-Normal Hearing." *American Journal of Audiology* 11(2):83-91. doi: 10.1044/1059-0889(2002/020).
- Gage-Bouchard, Elizabeth A. 2017. "Social Support, Flexible Resources, and Health Care Navigation." *Social Science & Medicine* 190:111-18. doi: 10.1016/j.socscimed.2017.08.015.
- Gatehouse, Stuart and William Noble. 2004. "The Speech, Spatial and Qualities of Hearing Scale (SSQ)." *International Journal of Audiology* 43(2):85-99. doi: 10.1080/14992020400050014.
- Glauber, Rebecca and Melissa D. Day. 2018. "Gender, Spousal Caregiving, and Depression: Does Paid Work Matter?". *Journal of Marriage and Family* 80(2):537-54. doi: 10.1111/jomf.12446.
- Goman, Adele M., Nicholas S. Reed and Frank R. Lin. 2017. "Addressing Estimated Hearing Loss in Adults in 2060." *JAMA Otolaryngology-Head & Neck Surgery* 143(7):733-34. doi: 10.1001/jamaoto.2016.4642.
- Gopinath, Bamini, Louise Hickson, Julie Schneider, Catherine M. McMahon, George Burlutsky, Stephen R. Leeder and Paul Mitchell. 2012. "Hearing-Impaired Adults Are at Increased Risk of Experiencing Emotional Distress and Social Engagement

Restrictions Five Years Later." *Age & Ageing* 41(5):618-23. doi: 10.1093/ageing/afs058.

Hoffman, Howard J., Robert A. Dobie, Katalin G. Losonczy, Christa L. Themann and Gregory A. Flamme. 2017. "Declining Prevalence of Hearing Loss in US Adults Aged 20 to 69 Years." *JAMA Otolaryngology–Head & Neck Surgery* 143(3):274-85. doi: 10.1001/jamaoto.2016.3527.

Hollingshaus, Michael S. and Rebecca L. Utz. 2013. "Depressive Symptoms Following the Diagnosis of Major Chronic Illness." *Society and Mental Health* 3(1):22-39. doi: 10.1177/2156869312464788.

Institute of Medicine. 2001. *Research, Practice, and Policy. Health and Behavior: The Interplay of Biological, Behavioral, and Societal Influences*, Edited by Committee on Health and Behavior. Washington, D.C.: National Academies Press.

Ishine, Masayuki, Kiyohito Okumiya and Kozo Matsubayashi. 2007. "A Close Association between Hearing Impairment and Activities of Daily Living, Depression, and Quality of Life in Community-Dwelling Older People in Japan." *Journal of the American Geriatrics Society* 55(2):316-17. doi: 10.1111/j.1532-5415.2007.01067.x.

Katz, Sidney, Amasa B. Ford, Roland W. Moskowitz, Beverly A. Jackson and Marjorie W. Jaffe. 1963. "Studies of Illness in the Aged. The Index of ADL: A Standardized Measure of Biological and Psychosocial Function." *Journal of the American Medical Association* 185:914-9. doi: 10.1001/jama.1963.03060120024016.

Kelley-Moore, Jessica A. and Kenneth F. Ferraro. 2005. "A 3-D Model of Health Decline: Disease, Disability, and Depression among Black and White Older Adults." *Journal of Health and Social Behavior* 46(4):376-91. doi: 10.1177/002214650504600405.

Kelly, Rebecca J. and Samuel R. Atcherson. 2011. "Quality of Life for Individuals with Hearing Impairment Who Have Not Consulted for Services and Their Significant Others: Same- and Different-Sex Couples." *Journal of Communication Disorders* 44(3):336-44. doi: 10.1016/j.jcomdis.2011.01.004.

Kiely, Kim M., Kaarin J. Anstey and Mary A. Luszcz. 2013. "Dual Sensory Loss and Depressive Symptoms: The Importance of Hearing, Daily Functioning, and Activity Engagement." *Frontiers in Human Neuroscience* 7:1-13. doi: 10.3389/fnhum.2013.00837.

Kim, Min Hee, Ruth E. Dunkle, Amanda J. Lehning, Huei-Wern Shen, Sheila Feld and Angela K. Perone. 2017. "Caregiver Stressors and Depressive Symptoms among

- Older Husbands and Wives in the United States." *Journal of Women & Aging* 29(6):494-504. doi: 10.1080/08952841.2016.1223962.
- Krahn, Gloria L., Deborah Klein Walker and Rosaly Correa-De-Araujo. 2015. "Persons with Disabilities as an Unrecognized Health Disparity Population." *American Journal of Public Health* 105(Suppl 2):S198-S206. doi: 10.2105/AJPH.2014.302182.
- Kramer, Sophia E., Theo S. Kapteyn, Joost M. Festen and Hilde Tobi. 1996. "The Relationships between Self-Reported Hearing Disability and Measures of Auditory Disability." *Audiology* 35(5):277-87. doi: 10.3109/00206099609071948.
- Kramer, Sophia E., Theo S. Kapteyn, Dirk J. Kuik and Dorly J. H. Deeg. 2002. "The Association of Hearing Impairment and Chronic Diseases with Psychosocial Health Status in Older Age." *Journal of Aging and Health* 14(1):122-37. doi: 10.1177/089826430201400107.
- Lee, Alex T., Michael C. Tong, Kevin C. Yuen, P.S.O. Tang and Charles A. Van Hasselt. 2010. "Hearing Impairment and Depressive Symptoms in an Older Chinese Population." *Journal of Otolaryngology-Head & Neck Surgery* 39(5):498-503. doi: 10.2310/7070.2010.090265.
- Lee, Yeonjung and Alex Bierman. 2018. "A Longitudinal Assessment of Perceived Discrimination and Maladaptive Expressions of Anger among Older Adults: Does Subjective Social Power Buffer the Association?". *Journals of Gerontology Series B: Psychological Sciences & Social Sciences* 73(8):e120-e30. doi: 10.1093/geronb/gbw110.
- Lehane, Christine M., Jesper Dammeyer and Peter Elsass. 2017. "Sensory Loss and Its Consequences for Couples' Psychosocial and Relational Wellbeing: An Integrative Review." *Aging & Mental Health* 21(4):337-47. doi: 10.1080/13607863.2015.1132675.
- Lehane, Christine M., Sofia Maria Hofsöe, Walter Wittich and Jesper Dammeyer. 2017. "Mental Health and Spouse Support among Older Couples Living with Sensory Loss." *Journal of Aging and Health* 30(8):1205-23. doi: 10.1177/0898264317713135.
- Li, Chuan-Ming, Xinzhi Zhang, Howard J. Hoffman, Mary Cotch, Christa L. Themann and Michael Wilson. 2014. "Hearing Impairment Associated with Depression in Us Adults, National Health and Nutrition Examination Survey 2005-2010." *JAMA Otolaryngology-Head & Neck Surgery* 140(4):293-302. doi: 10.1001/jamaoto.2014.42.

- Lie, Arve, Marit Skogstad, Håkon A. Johannessen, Tore Tynes, Ingrid Sivesind Mehlum, Karl-Christian Nordby, Bo Engdahl and Kristian Tambs. 2016. "Occupational Noise Exposure and Hearing: A Systematic Review." *International Archives of Occupational and Environmental Health* 89(3):351-72. doi: 10.1007/s00420-015-1083-5.
- Lin, Frank R., Luigi Ferrucci, E. Jeffrey Metter, Yang An, Alan B. Zonderman and Susan M. Resnick. 2011a. "Hearing Loss and Cognition in the Baltimore Longitudinal Study of Aging." *Neuropsychology* 25(6):763-70. doi: 10.1037/a0024238.
- Lin, Frank R., Roland Thorpe, Sandra Gordon-Salant and Luigi Ferrucci. 2011b. "Hearing Loss Prevalence and Risk Factors among Older Adults in the United States." *Journals of Gerontology Series A: Biological Sciences & Medical Sciences* 66A(5):582-90. doi: 10.1093/gerona/qlr002.
- Linton, Simi. 1998. *Claiming Disability: Knowledge and Identity*. New York, NY: New York University.
- Margolis, Rachel. 2013. "Health Shocks in the Family: Gender Differences in Smoking Changes." *Journal of Aging and Health* 25(5):882-903. doi: 10.1177/0898264313494411.
- Marmot, Michael. 2015. *The Health Gap: The Challenge of an Unequal World*. New York, NY: Bloomsbury Press.
- McGee, Marjorie G. 2015. "Peer Victimization as a Mediator of the Relationship between Disability Status and Psychosocial Distress." *Disability and Health Journal* 8(2):250-57. doi: 10.1016/j.dhjo.2014.09.006.
- McKee, Michael M., Michelle L. Stransky and Amanda Reichard. 2018. "Hearing Loss and Associated Medical Conditions among Individuals 65 Years and Older." *Disability and Health Journal* 11(1):122-25. doi: 10.1016/j.dhjo.2017.05.007.
- Mener, David J., Joshua Betz, Dane J. Genther, David Chen and Frank R. Lin. 2013. "Hearing Loss and Depression in Older Adults." *Journal of the American Geriatrics Society* 61(9):1627-29. doi: 10.1111/jgs.12429.
- Mick, Paul, Ichiro Kawachi and Frank R. Lin. 2014. "The Association between Hearing Loss and Social Isolation in Older Adults." *Otolaryngology-Head and Neck Surgery* 150(3):378-84. doi: 10.1177/0194599813518021.
- Milner, Allison, Lauren Krnjacki, Peter Butterworth and Anthony D. LaMontagne. 2016. "The Role of Social Support in Protecting Mental Health When Employed and Unemployed: A Longitudinal Fixed-Effects Analysis Using 12 Annual Waves of

the Hilda Cohort." *Social Science & Medicine* 153:20-6. doi: 10.1016/j.socscimed.2016.01.050.

Muramatsu, Naoko, Hongjun Yin and Donald Hedeker. 2010. "Functional Declines, Social Support, and Mental Health in the Elderly: Does Living in a State Supportive of Home and Community-Based Services Make a Difference?". *Social Science & Medicine* 70(7):1050-8. doi: 10.1016/j.socscimed.2009.12.005.

Nachtegaal, Janneke, Jan H. Smit, Cas Smits, Peter D. Bezemer, Johannes H. van Beek, Joost M. Festen and Sophia E. Kramer. 2009. "The Association between Hearing Status and Psychosocial Health before the Age of 70 Years: Results from an Internet-Based National Survey on Hearing." *Ear and Hearing* 30(3):302-12. doi: 10.1097/AUD.0b013e31819c6e01.

Nagi, Saad Z. 1965. "Some Conceptual Issues in Disability and Rehabilitation." Pp. 100-13 in *Sociology and Rehabilitation*, edited by M. B. Sussman. Washington, D.C.: American Sociological Association.

Nagi, Saad Z. 1979. "The Concept and Measurement of Disability." Pp. 1-15 in *Disability Policies and Government Programs*, edited by E. D. Berkowitz. New York: Praeger.

Nagi, Saad Z. 1991. "Disability Concepts Revisited: Implications for Prevention." Pp. 309-39 in *Disability in America: Toward a National Agenda for Prevention*, edited by A. M. Pope and A. R. Tarlov. Washington, D.C.: National Academies Press.

Nieman, Carrie L., Nicole Marrone, Sarah L. Szanton, Roland J. Thorpe and Frank R. Lin. 2016. "Racial/Ethnic and Socioeconomic Disparities in Hearing Health Care among Older Americans." *Journal of Aging and Health* 28(1):68-94. doi: 10.1177/0898264315585505.

Pearlin, Leonard I., Elizabeth G. Menaghan, Morton A. Lieberman and Joseph T. Mullan. 1981. "The Stress Process." *Journal of Health and Social Behavior* 22(4):337-56. doi: 10.2307/2136676.

Pearlin, Leonard I. 1989. "The Sociological Study of Stress." *Journal of Health and Social Behavior* 30(3):241-56. doi: 10.2307/2136956.

Pearlin, Leonard I., Carol S. Aneshensel and Allen J. LeBlanc. 1997. "The Forms and Mechanisms of Stress Proliferation: The Case of AIDS Caregivers." *Journal of Health and Social Behavior* 38(3):223. doi: 10.2307/2955368.

Pearlin, Leonard I. 1999. "Stress and Mental Health: A Conceptual Overview." in *A Handbook for the Study of Mental Health: Social Contexts, Theories, and*

Systems, edited by A. V. Horwitz and T. L. Scheid. Cambridge, UK: Cambridge University Press.

- Pearlin, Leonard I., William R. Avison and Elena M. Fazio. 2007. "Sociology, Psychiatry, and the Production of Knowledge About Mental Illness and Its Treatment." Pp. 33-53 in *Mental Health, Social Mirror*, edited by W. R. Avison, J. D. McLeod and B. A. Pescosolido. New York, NY: Springer Press.
- Pearlin, Leonard I. 2010. "The Life Course and the Stress Process: Some Conceptual Comparisons." *Journals of Gerontology Series B: Psychological Sciences & Social Sciences* 65b(2):207-15. doi: 10.1093/geronb/gbp106.
- Pearlin, Leonard I. and Alex Bierman. 2013. "Current Issues and Future Directions in Research into the Stress Process." Pp. 325-40 in *Handbook of the Sociology of Mental Health*, edited by C. S. Aneshensel, J. C. Phelan and A. Bierman. Dordrecht: Springer Netherlands.
- Polsky, Daniel, Jalpa A. Doshi, Steven Marcus, David Oslin, Aileen Rothbard, Niku Thomas and Christy L. Thompson. 2005. "Long-Term Risk for Depressive Symptoms after a Medical Diagnosis." *Archives of Internal Medicine* 165(11):1260-66. doi: 10.1001/archinte.165.11.1260.
- Preminger, Jill E. and Suzanne Meeks. 2010. "Evaluation of an Audiological Rehabilitation Program for Spouses of People with Hearing Loss." *J Am Acad Audiol* 21(5):315-28. doi: 10.3766/jaaa.21.5.4.
- Pronk, Marieke, Dorly J.H. Deeg, Cas Smits, Theo G. van Tilburg, Dirk Joop Kuik, Joost M. Festen and Sophia E. Kramer. 2011. "Prospective Effects of Hearing Status on Loneliness and Depression in Older Persons: Identification of Subgroups." *International Journal of Audiology* 50(12):887-96. doi: 10.3109/14992027.2011.599871.
- Pronk, Marieke, Dorly J.H. Deeg and Sophia E. Kramer. 2013. "Hearing Status in Older Persons: A Significant Determinant of Depression and Loneliness?". *American Journal of Audiology* 22(2):316-20. doi: 10.1044/1059-0889(2013/12-0069).
- Pronk, Marieke, Dorly J.H. Deeg, Cas Smits, Jos W. Twisk, Theo G. van Tilburg, Joost M. Festen and Sophia E. Kramer. 2014. "Hearing Loss in Older Persons: Does the Rate of Decline Affect Psychosocial Health?". *Journal of Aging and Health* 26(5):703-23. doi: 10.1177/0898264314529329.
- Radloff, Lenore Sawyer. 1977. "The CES-D Scale: A Self-Report Depression Scale for Research in the General Population." *Applied Psychological Measurement* 1(3):385-401. doi: 10.1177/014662167700100306.

- Read, Jen'nan G., Jeremy R. Porter and Bridget K. Gorman. 2016. "Gender and the Mental–Physical Health Connection among U.S. Adults." *Sociological Forum* 31(4):1104-25. doi: 10.1111/socf.12298.
- Ren, Yin, Rosh K. V. Sethi and Konstantina M. Stankovic. 2018. "Acute Otitis Media and Associated Complications in United States Emergency Departments." *Otology & Neurotology* 39(8):1005-11. doi: 10.1097/MAO.0000000000001929.
- Saito, Hideyuki, Yuji Nishiwaki, Takehiro Michikawa, Yuriko Kikuchi, Kunio Mizutari, Toru Takebayashi and Kaoru Ogawa. 2010. "Hearing Handicap Predicts the Development of Depressive Symptoms after 3 Years in Older Community-Dwelling Japanese." *Journal of the American Geriatrics Society* 58(1):93-97. doi: 10.1111/j.1532-5415.2009.02615.x.
- Scarinci, Nerina, Linda Worrall and Louise Hickson. 2008. "The Effect of Hearing Impairment in Older People on the Spouse." *International Journal of Audiology* 47(3):141-51. doi: 10.1080/14992020701689696.
- Scarinci, Nerina, Linda Worrall and Louise Hickson. 2012. "Factors Associated with Third-Party Disability in Spouses of Older People with Hearing Impairment." *Ear and Hearing* 33(6):698-708. doi: 10.1097/AUD.0b013e31825aab39.
- Schnittker, Jason. 2005. "Chronic Illness and Depressive Symptoms in Late Life." *Social Science & Medicine* 60(1):13-23. doi: 10.1016/j.socscimed.2004.04.020.
- Sindhusake, Doungkamol, Paul Mitchell, Wayne Smith, Maryanne Golding, Philip Newall, David Hartley and George Rubin. 2001. "Validation of Self-Reported Hearing Loss. The Blue Mountains Hearing Study." *International Journal of Epidemiology* 30(6):1371-78. doi: 10.1093/ije/30.6.1371.
- Smith, Jacqui, Gwenith Fisher, Lindsay Ryan, Philippa Clarke, Jim House and David Weir. 2013. *Psychosocial and Lifestyle Questionnaire, 2006-2010: Documentation Report*. University of Michigan: Survey Research Center.
- Stam, Mariska, Jan H. Smit, Jos W.R. Twisk, Ulrike Lemke, Cas Smits, Joost M. Festen and Sophia E. Kramer. 2016. "Change in Psychosocial Health Status over 5 Years in Relation to Adults' Hearing Ability in Noise." *Ear and Hearing* 37(6):680-89. doi: 10.1097/AUD.0000000000000332.
- Stanton, Annette L., Tracey A. Revenson and Howard Tennen. 2007. "Health Psychology: Psychological Adjustment to Chronic Disease." *Annual Review of Psychology* 58:565-92. doi: 10.1146/annurev.psych.58.110405.085615.
- StataCorp. 2015. *Stata Statistical Software: Release 14*. College Station, TX: StataCorp LP.

- Steffick, Diane E. 2000. *Documentation of Affective Functioning Measures in the Health and Retirement Study (HRS/Ahead Documentation Report)*. University of Michigan: Survey Research Center.
- Strawbridge, William J., Margaret I. Wallhagen, Sarah J. Shema and George A. Kaplan. 2000. "Negative Consequences of Hearing Impairment in Old Age: A Longitudinal Analysis." *The Gerontologist* 40(3):320-26. doi: 10.1093/geront/40.3.320.
- Stucky, Shelese R., Kenneth E. Wolf and Tony Kuo. 2010. "The Economic Effect of Age-Related Hearing Loss: National, State, and Local Estimates, 2002 and 2030." *Journal of the American Geriatrics Society* 58(3):618-19. doi: 10.1111/j.1532-5415.2010.02746.x.
- Tambs, Kristian E. 2004. "Moderate Effects of Hearing Loss on Mental Health and Subjective Well-Being: Results from the Nord-Trøndelag Hearing Loss Study." *Psychosomatic Medicine* 66(5):776-82. doi: 10.1097/01.psy.0000133328.03596.fb.
- Thoits, Peggy A. 2010. "Stress and Health: Major Findings and Policy Implications." *Journal of Health and Social Behavior* 51(1):S41-53. doi: 10.1177/0022146510383499.
- Thomas, Patricia A., Hui Liu and Debra Umberson. 2017. "Family Relationships and Well-Being." *Innovation in Aging* 1(3):1-11. doi: 10.1093/geroni/igx025.
- Thomeer, Mieke Beth, Corinne Reczek and Debra Umberson. 2015. "Gendered Emotion Work around Physical Health Problems in Mid- and Later-Life Marriages." *Journal of Aging Studies* 32:12-22. doi: 10.1016/j.jaging.2014.12.001.
- Turner, R. Jay. 2013. "Understanding Health Disparities: The Relevance of the Stress Process Model." *Society and Mental Health* 3(3):170-86. doi: 10.1177/2156869313488121.
- Turney, Kristin. 2014. "Stress Proliferation across Generations? Examining the Relationship between Parental Incarceration and Childhood Health." *Journal of Health and Social Behavior* 55(3):302-19. doi: 10.1177/0022146514544173.
- Umberson, Debra. 1987. "Family Status and Health Behaviors: Social Control as a Dimension of Social Integration." *Journal of Health and Social Behavior* 28(3):306-19. doi: 10.2307/2136848.
- Umberson, Debra. 1992. "Gender, Marital Status and the Social Control of Health Behavior." *Social Science & Medicine* 34(8):907-17. doi: 10.1016/0277-9536(92)90259-S.

- Umberson, Debra, Meichu D. Chen, James S. House, Kristine Hopkins and Ellen Slaten. 1996. "The Effect of Social Relationships on Psychological Well-Being: Are Men and Women Really So Different?". *American Sociological Review* 61(5):837-57. doi: 10.2307/2096456.
- Umberson, Debra, Rachel Donnelly and Amanda M. Pollitt. 2018. "Marriage, Social Control, and Health Behavior: A Dyadic Analysis of Same-Sex and Different-Sex Couples." *Journal of Health and Social Behavior* 59(3):429-46. doi: 10.1177/0022146518790560.
- Verbrugge, Lois M. and Alan M. Jette. 1994. "The Disablement Process." *Social Science & Medicine* 38(1):1-14. doi: 10.1016/0277-9536(94)90294-1.
- Vincent, Grayson K. and Victoria A. Velkoff. 2010. "The Next Four Decades, the Older Population in the United States: 2010 to 2050." Pp. 25-1138 in *Current Population Reports*. Washington, D.C.: U.S. Census Bureau.
- Waite, Linda J. and Maggie Gallagher. 2000. *The Case for Marriage: Why Married People Are Happier, Healthier, and Better Off Financially*. New York, NY: DoubleDay.
- Wallhagen, Margaret I., William J. Strawbridge, Sarah J. Shema, John Kurata and George A. Kaplan. 2001. "Comparative Impact of Hearing and Vision Impairment on Subsequent Functioning." *Journal of the American Geriatrics Society* 49(8):1086-92. doi: 10.1046/j.1532-5415.2001.49213.x.
- Wallhagen, Margaret I., William J. Strawbridge, Sarah J. Shema and George A. Kaplan. 2004. "Impact of Self-Assessed Hearing Loss on a Spouse: A Longitudinal Analysis of Couples." *Journals of Gerontology Series B: Psychological Sciences & Social Sciences* 59(3):S190-6. doi: 10.1093/geronb/59.3.S190.
- Wang, Xingmin, Lin Cai, Jing Qian and Jiayi Peng. 2014. "Social Support Moderates Stress Effects on Depression." *International Journal of Mental Health Systems* 8(1):41-45. doi: 10.1186/1752-4458-8-41.
- Waverijn, Geeke, Monique Heijmans and Peter P. Groenewegen. 2017. "Neighbourly Support of People with Chronic Illness; Is It Related to Neighbourhood Social Capital?". *Social Science & Medicine* 173:110-17. doi: 10.1016/j.socscimed.2016.12.004.
- West, Jessica S. 2017. "Hearing Impairment, Social Support, and Depressive Symptoms among U.S. Adults: A Test of the Stress Process Paradigm." *Social Science & Medicine* 192(Supplement C):94-101. doi: 10.1016/j.socscimed.2017.09.031.

- West, Jessica S. 2020. "Hearing Impairment and Mental Health among Married Couples." *Journals of Gerontology Series B: Psychological Sciences & Social Sciences* (corrected proof):1-11. doi: 10.1093/geronb/gbaa023.
- West, Jessica S. and Scott M. Lynch. 2020. "Demographic and Socioeconomic Disparities in Life Expectancy with Hearing Impairment in the U.S." *Journals of Gerontology Series B: Psychological Sciences & Social Sciences* (corrected proof):1-12. doi: 10.1093/geronb/gbaa166.
- Whitson, Heather E., Alice Cronin-Golomb, Karen J. Cruickshanks, Grover C. Gilmore, Cynthia Owsley, Jonathan E. Peelle, Gregg Recanzone, Anu Sharma, Bonnielin Swenor, Kristine Yaffe and Frank R. Lin. 2018. "American Geriatrics Society and National Institute on Aging Bench-to-Bedside Conference: Sensory Impairment and Cognitive Decline in Older Adults." *Journal of the American Geriatrics Society* 66(11):2052-58. doi: 10.1111/jgs.15506.

Biography

Jessica S. West received a B.A. in Sociology Anthropology from the University of Michigan in 2012, an M.P.H. in Sociomedical Sciences from Columbia University's Mailman School of Public Health in 2015, and an M.A. in Sociology from Duke University in 2018. At Duke, Jessica received the Duke Graduate School Phillip Jackson Baugh Fellowship and was invited to serve as a consultant to the Lancet Commission on Hearing Loss. Jessica solo-authored two publications: "Hearing Impairment, Social Support, and Depressive Symptoms Among U.S. Adults: A Test of the Stress Process Paradigm" (*Social Science & Medicine*, 2017) and "Hearing Impairment and Mental Health Among Married Couples" (*The Journals of Gerontology: Series B*, 2020), the latter of which was awarded Graduate Student Paper Award Honorable Mention from the American Sociological Association Section on the Life Course. She is lead co-author of three publications: "Providing Health Care to Patients with Hearing Loss During COVID-19 and Physical Distancing" (*Laryngoscope Investigative Otolaryngology*, 2020), "Demographic and Socioeconomic Disparities in Life Expectancy with Hearing Impairment in the United States" (*The Journals of Gerontology: Series B*, 2020), and "Hearing Loss" (*Encyclopedia of Gerontology and Population Health*, 2021). She is co-author on four publications: "Disparities in Disability among Arab Americans by Nativity, Immigrant Arrival Cohort, and Country of Birth" (*SSM-Population Health*, 2019), "Immigration and Health among Non-Hispanic Whites: The Impact of Arrival Cohort and Region of Birth" (*Social Science & Medicine*, 2020), "Regional Differences in the Impact of Diabetes on Population Health in the United States" (*Journal of*

Epidemiology & Community Health, 2020), and “Disaggregating Heterogeneity among Non-Hispanic Whites: Evidence and Implications for U.S. Racial/Ethnic Health Disparities” (*Population Research & Policy Review*, 2021). After completing her Ph.D., Jessica will continue her academic career as a Postdoctoral Associate within the Duke Center for the Study of Aging under the mentorship of Matthew E. Dupre (Department of Population Health Sciences) and Sherri L. Smith (Chief of Audiology, Duke University Hospital).