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Investigating Impacts Of Caregiving On Cognitive Function: Role Of Social Support

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INVESTIGATING IMPACTS OF CAREGIVING ON COGNITIVE FUNCTION: ROLE OF SOCIAL SUPPORT

by

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A DISSERTATION

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INVESTIGATING IMPACTS OF CAREGIVING ON COGNITIVE FUNCTION: THE ROLE OF SOCIAL SUPPORT

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MEDICAL SOCIOLOGY

ABSTRACT

Study Aim: Using the stress process model as a framework, this dissertation aims to investigate the role of social support on the influence of informal caregiving on cognitive function of caregivers aged 50 years and older and to look at potential gender and racial differences in this association.

Method: Leveraging data from the 2016 to 2020 waves of the Health and Retirement Study (HRS), this research employs Ordinary Least Squares (OLS) regression analysis to examine the influence of caregiving on the cognitive function of older adults. To comprehensively understand the pathways through which caregiving impacts cognitive outcomes, I use mediation analysis to assess the intervening role of social support. Further, the study explores the conditional effects of gender and race on the caregiving-cognitive function nexus through moderation analysis and extends this inquiry to examine moderated mediation.

Results and Conclusion: The findings reveal that caregiving has a protective effect on cognitive function. It found no gender-based disparities in cognitive function among older adult caregivers. Racial differences were observed, with Hispanic and Other caregivers exhibiting lower cognitive function than their counterparts, a disparity not evident among White and Black older adults. The study also found that social support does not mediate the relationship between caregiving and cognitive function. Instead, an increase in the number of close social ties associated with caregiving positively impacts cognitive function. Furthermore, the influence of social support or the quantity of close social ties on cognitive function is not moderated by gender or race.

ACKNOWLEDGEMENTS

In my memory, the image of my childhood home is painted in shades of grayish-blue and brown. My hometown is a small island city nestled in Jiangsu Province, China. This serene place was draped in tranquility, sometimes bordering on solitude. My parents, without the benefit of college education, instilled in me the importance of academic pursuit from a young age, especially in a community where education commands immense respect. Despite their high regard for diligence in study, their feelings were mixed when I chose to embark on a PhD journey in the United States. My heart sometimes grows heavy with the weight of absence from both important and trivial family occasions, from my father's surgery to his playful jokes. Nurturing these shades of melancholy is far from easy. Managing such negative feelings has been challenging, especially amid doubts about my suitability for research. Yet, as I delved into my dissertation work, trying to distinguish between the elements rooted in theoretical and analytical robustness and those that were not, I gained a clearer understanding of my direction and choices of my life.

I count myself incredibly lucky to have been accepted into the Medical Sociology program in April 2019. The world seems starkly different before and after 2019, not least due to the hurdles of the application process in an uncertain external environment. Dr. Patricia Drentea, who introduced me to the study of caregiving and aging, has been instrumental in these past five years of doctoral study, which have been deeply fulfilling.

Admittedly, sometimes I have worried that I have fallen short of Dr. Patricia Drentea's expectations, a fact that I am keenly aware of and am actively striving to surpass. My fascination with the topic of aging is just the beginning of a journey. I am committed to advancing my work on caregiving in the context of aging, aiming to fulfill and exceed those expectations in the future.

First, I want to express my appreciation for my mentor, Dr. Patricia Drentea. I am so grateful for your support and guidance, which have been a cornerstone of my training journey. My heartfelt thanks go to the esteemed members of my dissertation committee. To Dr. Scott Westenberger, whose valuable advice on my manuscript and support for my dedication to computational sociology. To Dr. Joseph Wolfe, who has profoundly shaped my approach to statistical analysis and critical thinking through your guidance. Dr. Greg Pavela has navigated me through the comprehensive HRS dataset, laying the groundwork for my research skills. Without your patient guidance, I would not have had the confidence to tackle such a complicated dataset on my own. Dr. Deborah Ejem, your insights on diversity have been crucial, enriching my dissertation with a nuanced understanding.

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My sincere thanks go to Dr. Cindy Cain and Dr. Irena Stepanikova for their patient explanation the role of theoretical frameworks in research, significantly improving my comprehension in the first year of the program.

I am grateful to Cliff Ross, Jill Deaver, Andria Cimino, Joshua Tobias, and Joshua Lewis, who are past and present students in the Medical Sociology Ph.D. Program. We have studied together and learned from each other. I will not forget the time spent with you, no matter where we will be. Thank you for your kindness and suggestions when I was new to this program. I am also thankful to the past and current coordinators and staff of the department, Charlotte Finley, Danita Clark-Waiters, and Sophia Chambers, for your help in the process of my affairs.

I owe special gratitude to Dr. Verna Keith, Dr. Patricia Drentea, and other faculties in the Medical Sociology Ph.D. program for their faith in me and for providing me with this precious opportunity to have a doctoral education in an interdisciplinary program. My gratitude extends to the financial assistance provided by the Medical Sociology department at UAB.

This visionary program at the University of Alabama at Birmingham has equipped me with a new perspective to view the world. I view my time here as just the beginning. The seed of interdisciplinary thought planted in my heart is poised to evolve into new avenues that will advance my career objective of extending human healthspan.

Thank you to my family for their unwavering spiritual and financial support throughout my journey towards realizing my dream. This love, trust, and sacrifice spanning generations have nurtured and guided me to where I stand today. Finally, I want to thank my husband for being there with me every step of the way.

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CHAPTER 1 INTRODUCTION

Statement of the Problem

Enhanced health and longevity have ushered in a novel stage of life. Termed the "Third Age," this phase is characterized by liberation from work-related commitments, offering opportunities for self-realization and contentment (Laslett 1991). However, exiting the workforce does not automatically grant individuals complete autonomy over their time and pursuits, as they might be engaged in unpaid caregiving roles. Longevity gains mean that older adults are more likely to assume the role of informal caregivers at later stages of life (Meyer and Kandic 2017a, Wolff, Spillman, Freedman and Kasper 2016). As Americans live longer and face more health issues in later life, the responsibility for caregiving increasingly falls on older individuals, coinciding with a time they might expect fewer obligations. This shift challenges traditional caregiving norms and adds strain to older caregivers, potentially affecting their health, mental well-being, and cognitive function. There is a pressing need for a robust support system and tailored resources to assist older caregivers, ensuring they can provide care without compromising their own health and quality of life, especially when dealing with their own age-related health challenges.

Caregiving is chronic stressor for older adults. More than half of Americans 50 and older in the United States provide informal care (National Alliance for Caregiving &

AARP, 2020, Kullgren 2022) to friends or family members. Informal (family) caregiving refers to personal care provided by family members, acquaintances, or neighbors, which may encompass a range of duties, such as assisting with daily household tasks or aiding with activities like dressing and bathing (Jakobsen et al., 2011). Informal caregivers commonly offer their services without receiving financial compensation, often experiencing a lack of visibility and social recognition for their valuable contributions (Coe and Werner 2022). Informal caregivers are more likely to be women and/or Black/African American (Lee and Tang 2015, Trivedi, Beaver, Bouldin et al. 2014). In order to pursue appropriate policies that aid informal caregivers in delivering and maintaining quality care, policymakers must possess a thorough understanding of the diverse experiences encountered by these caregivers.

Impacts of caregiving on Health

Providing care is a multifaceted and demanding task that necessitates the use of optimal cognitive abilities, including older adult's problem-solving (Tao, 2019), memory, and communication skills (Miller, Lewis, Williamson et al. 2006). Even mild cognitive impairments can have significant functional ramifications when caregivers take on the role of decision-makers for themselves and care recipients (Nicholas, Langa, Bynum and Hsu 2021). This can lead to errors in care, missed medications, or failure to recognize signs of health decline in the care recipients (Belle, Burgio, Burns et al. 2006, De Vugt, Jolles, Van Osch et al. 2006). Previous research has predominantly focused on the physical and mental well-being of informal caregivers (Zwar, König and Hajek 2018a), with limited attention on their cognitive health research (Allen, Curran, Duggan et al.

2017, Zwar et al. 2018a). It is concerning that the cognitive performance of elderly caregivers is often overlooked, given its crucial role in their quality of life and well-being. The decline in cognitive abilities can significantly impair their ability to provide care and carry out essential self-care activities (Zwar et al. 2018a). Numerous studies have consistently shown that older caregivers tend to experience challenges in cognitive processing, executive functions, attention, and memory tasks (Dassel, Carr and Vitaliano 2017, Pertl, Hannigan, Brennan et al. 2017). Considering the growing number of individuals who will assume the role of informal caregivers due to our aging population, there is a pressing need for more research that specifically examines the cognitive function of these caregivers.

Positive experiences for caregivers have been recognized (Lee and Li 2022), such as increased social interactions, positive outlook on life (Yu, Cheng and Wang 2018) and maintenance of well-being (Quinn and Toms 2019). Despite the various benefits and positive outcomes associated with caregiving, caregivers frequently endure substantial anxiety and stress due to the responsibilities of daily care (Delfino, Komatsu, Komatsu et al. 2018, Kruithof, Post, van Mierlo et al. 2016). This high level of stress can have detrimental effects on the cognitive well-being of caregivers (Dassel et al. 2017, Stewart, Morgan, Karunanayake et al. 2016). A systematic review demonstrated that family caregivers of older individuals with dementia frequently confront heightened levels of stress, which can have adverse effects on their attention and executive functions. Interventions aimed at reducing stress have displayed potential in positively affecting caregivers' cognitive function (Allen et al. 2017).

Social Support in Older Adults

Research has consistently emphasized the significance of having a social support network for the health of caregivers (del-Pino-Casado, Frías-Osuna, Palomino-Moral et al. 2018, Díaz, Estévez, Momeñe and Ozerinjauregi 2019, Ong, Vaingankar, Abdin et al. 2018). Scholars have examined these networks as a primary modifiable factor in interventions targeting enhancements in quality of life and overall health. Social support networks encompass a range of social relationships cultivated by individuals, facilitating the exchange of various forms of support such as financial, emotional, and tangible assistance (Holt-Lunstad 2018). These networks play a fundamental role in the well-being of older individuals, constituting an integral component of senior health (Guedes, Lima, Caldas and Veras 2017). A systematic review of 19 longitudinal articles investigated the link between social support and dementia, highlighting a significant relationship between reduced involvement in social activities, limited social contact, and feelings of loneliness with a higher risk of incident dementia (Kuiper, Zuidersma, Voshaar et al. 2015). However, the existing research on social support in the context of informal caregiving remains limited. Therefore, further studies are required to gain a comprehensive understanding of how different forms of social support influence caregiving dynamics, which are subject to frequent changes, and their impact on various outcomes.

Gender Difference in Caregiving and Social Support

In the ongoing debate, there is a lack of consensus regarding the relationship between informal caregiving and cognitive health, specifically concerning racial disparities and gender differences. Women bear the primary responsibility for providing informal care to individuals with chronic medical conditions or disabilities, including older adults and those with mental illnesses (Baker and Robertson 2008). Although family caregiving can be rewarding, female caregivers often face higher levels of caregiver burden and depression compared to male caregivers. They may also experience lower subjective well-being and poorer physical health. This disparity could be attributed to differences in caregiving intensity between male and female caregivers (Edwards, Anderson, Thompson and Deokar 2017, Pinquart and Sörensen 2006). In a study involving spousal caregivers after a stroke, female caregivers for patients with stroke displayed a greater capacity to adapt to the cognitive changes compared to their male counterparts. This suggests that despite the higher caregiving intensity experienced by females, they exhibit stronger coping abilities to navigate the various stressors associated with caring for a family member (Alexander and Wilz 2010). Additionally, studies have also identified gender differences in terms of how caregivers rely on coping resources within their social networks. For example, women tend to seek less assistance compared to men and often rely more on support from their relatives rather than formal support systems or paid help (del Río Lozano, García-Calvente, Calle-Romero et al. 2017). However, the existing body of research on the effects of caregiving on the overall health of female caregivers is relatively limited. Furthermore, there is a paucity of studies investigating the role of social support as a mediating factor in the relationship between caregiver burden and general health.

Racial/Ethnic Differences in Caregiving and Social Support

In comparison to White caregivers, Black caregivers tend to assume a greater responsibility for providing higher intensity care, which includes tasks such as assisting with bathing, dressing, feeding, and addressing issues related to incontinence (AARP 2020). Approximately 30% of Hispanic caregivers dedicate 40 hours or more weekly to elder care, whereas a mere 18% of non-Latino White caregivers exhibit a similar commitment (AARP Public Policy Institute and Caregiving 2015). Black and Hispanic American caregivers tend to allocate more time to caregiving responsibilities compared to non-Hispanic White caregivers. This is largely attributed to the elevated co-residency rates with care recipients (Rote and Moon 2018). Black caregivers report poorer physical health and higher levels of unmet social support needs when compared to White caregivers (Badana, Marino and Haley 2019, Black, Johnston, Rabins et al. 2013). Despite these disparities, certain analyses of caregivers reveal that Black caregivers tend to have a more positive perception of caregiving compared to their White counterparts (Roth, Dilworth-Anderson, Huang et al. 2015). There is still limited understanding of the role of social support. While some studies have indicated that Black caregivers report more limited social support networks than Whites (Miyawaki 2015), others suggest the opposite (Cudjoe, Roth, Szanton et al. 2020). Hispanic families predominantly depend on family members in contrast to their non-Hispanic White counterparts (Crist and Speaks 2011). With few exceptions (Fabius, Wolff and Kasper 2020, Wolff et al. 2016), the existing body of research on racial differences in social support networks has primarily focused on the general population of aging adults. There is limited understanding of social support networks among informal caregivers, who not only face similar risk factors as older adults, but also have the additional responsibility of providing care. In this study, I will examine the 1) the association between informal caregiving and cognitive function, 2) the effect of social support in this association, and 3) the influence of racial and gender differences in social support on the relationship between informal caregiving and cognitive function.

Structure of Dissertation

The dissertation is structured as follows. Chapter 1 presents the initial groundwork by introducing the distribution of caregiving by race and gender, the effects of caregiving on health outcomes, and the protective role of social support. After this, I outline the specific research questions this dissertation aims to address. Following this, Chapter 2 delves deeper into the existing literature on the relationship between caregiving, cognitive function, and social support, with a focus on the effect of race and gender. The stress process and coping model will be used to guide the dissertation. Chapter 3 overviews the data sources used for the study, including the design of the Psychosocial and Lifestyle Questionnaire of the Health Retirement Study, and delineates the steps employed to derive the final sample. It will also include the composition of respondents and the methodologies employed to analyze this data. Chapters 4 through 6 provide an exploration of the primary analysis, using Ordinary Least Squares (OLS) regression, Chapter 4 presents a general overview of the results. OLS regression will be employed to investigate the relationship between caregiving in 2016 and cognitive function in 2020 while accounting for cognitive function from 2016 and other control variables. After this analysis, the mediating influence of social support will be systematically assessed (Baron and Kenny 1986, Muller et al. 2005). Chapters 5 and 6 assess the potential moderating effects of gender and race on the outcomes above (Baron and Kenny 1986). Finally, Chapter 7 synthesizes the findings, relates them back to the theoretical framework presented in Chapter 2, discusses their implications, and concludes with recommendations for future research in the field.

CHAPTER 2 LITERATURE REVIEW

Stress Process Model

The Stress Process Model (SPM) is a comprehensive framework grounded in sociological perspectives of stress, which depicts the complex pathways from stressors to health outcomes, highlighting the pivotal roles of both mediators and moderators (Pearlin, Menaghan, Lieberman and Mullan 1981, Pearlin, Mullan, Semple and Skaff 1990b). According to them, stressors refer to immediate events (acute stressors) and ongoing conditions (chronic stressors) that test an individual's ability to cope, potentially leading to physical and/or mental strain and heightening the risk of developing health issues. These stressors are tied to social structural positions, such as demographic characteristics and social roles, with individuals of lower social status being disproportionately exposed to higher levels of stress and therefore more vulnerable to potential health problems.

In the caregiving context, SPM serves as a critical framework for understanding the complex stressors that caregivers face, offering insights into both their short- and long-term influence. Adverse consequences from caregiving can be accounted by a range of stressors, contextual factors and both mediator and moderators. Caregiving introduces a unique set of stressors arising from the caregiving demands themselves and the potential for these demands to spill over into various aspects of a caregiver's life (Aneshensel, Pearlin, Mullan et al. 1995, Pearlin, Mullan, Semple and Skaff 1990a). The need to provide care can lead to objective stressors such as managing cognitive impairments, behavioral issues, and a decline in the care recipient’s functional abilities (Aneshensel et al. 1995, Pearlin et al. 1990a). Moreover, caregivers frequently grapple with a subjective burden, where they perceive the caregiving demands as overwhelming and feel entrapped in their caregiving responsibilities, a condition known as role captivity (Aneshensel et al. 1995, Pearlin et al. 1990a). This subjective burden extends beyond the immediate tasks of caregiving, including the psychological strains that arise from secondary stressors. Such stressors can induce conflicts and tensions in both work and family life, further complicating the caregiver's situation (Aneshensel et al. 1995, Pearlin et al. 1990a). Additionally, the caregiver may experience a constricting of their social life, as the time and energy devoted to caregiving duties limit opportunities for social interaction and support. The intensity of caregiving can further restrict social interactions, as the caregivers’ time and energy are predominantly consumed by caregiving duties, limiting their ability to maintain social connections (Jawahir, Tan, Tan et al. 2021).

Within the framework, biological and psychosocial pathways elucidate how experiences of stress, particularly within caregiving contexts, may translate into tangible health effects. Prolonged exposure to caregiving may initiate the physiological response. Elevated cortisol levels over extended periods can negatively influence cognitive functions and overall brain health (Klein, Kim, Almeida et al. 2016, Savla, Roberto, Blieszner et al. 2011). Caregiving can also lead to emotional strain, resulting in burnout and exhaustion. These psychosocial stressors can manifest as depressive and anxiety symptoms, diminished self-control, and low self-esteem, all of which compromise the caregiver's ability to handle adversity, subsequently impacting cognitive functions and overall health (Mausbach, Chattillion, Moore et al. 2011, von Känel 2012).

Social support is an important element in mitigating the adverse effects of stressors on health outcomes (Pearlin et al. 1990a). Social support manifests in various forms, including emotional, instrumental, and informational support from family, friends, or community networks. In the caregiving context, access to adequate social support can play a pivotal role in buffering the caregiver against the strains and demands of their role. Social support improves coping capacities, alleviates feelings of isolation, and reduces the psychological burden associated with caregiving responsibilities (Thoits 2011). Thus, examining the availability and quality of social support is crucial to understanding the caregiving experience and its implications for caregiver health and well-being.

Contextual factors such as gender and race play a critical role in influencing the relationship between stressors and health outcomes (Aneshensel and Mitchell 2014). Women, often socialized to take on caregiving roles, may bear higher levels of stress due to the expectation to balance caregiving with other responsibilities (Pinquart and Sörensen 2006, Wolff, Mulcahy, Huang et al. 2018). This cumulative stress can have detrimental effects on their cognitive functions over time. The caregiving experience differs significantly among various racial and ethnic groups. Black caregivers tend to report lower levels of caregiver burden and depression compared to their White counterparts, while Hispanic caregivers often experience higher levels of depression than White caregivers (Pinquart and Sörensen 2005).

Extensive research has explored the various health implications of caregiving, demonstrating its negative effects on caregivers' physical health (Bom, Bakx, Schut and Van Doorslaer 2019), life satisfaction, and mental health (Ervin, Taouk, Fleitas Alfonzo et al. 2022, Kaschowitz and Brandt 2017, Le and Ibuka 2023). While the physical and mental health of caregivers has been well studied, there remains a gap in our understanding of how caregiving may affect cognitive function, particularly among older caregivers. Caregiving responsibilities, coupled with age-related cognitive changes, can contribute to a heightened risk of cognitive decline. The existing body of literature underscores a link between the caregiving role and cognitive impairments in older adults (Allen et al. 2017), necessitating a focused examination of cognitive function as a primary outcome. This research aims to elucidate the specific ways in which caregiving impacts the cognitive health of older caregivers, providing vital insights for tailored interventions and support mechanisms. I show my conceptual model in Figure 1.

The stress process model shows that caregivers are more likely to experience adverse health outcomes compared to noncaregivers. This is attributed to the elevated levels of stress they encounter, and the detrimental impact of chronic stress on both their physical and cognitive well-being (Pearlin et al. 1990a). The way caregivers handle stressors in challenging situations can be influenced by cultural appraisals of caregiving (Dilworth-Anderson, Brummett, Goodwin et al. 2005), which, in turn, may help alleviate the impact of stressors. Additionally, the availability of resources such as social support may also play a role in determining how race, gender and other stressors affect caregiving-related outcomes. This influence can be attributed to the challenges that arise due to limited access or availability of these resources (Alliance 2006, Pearlin et al. 1990b).

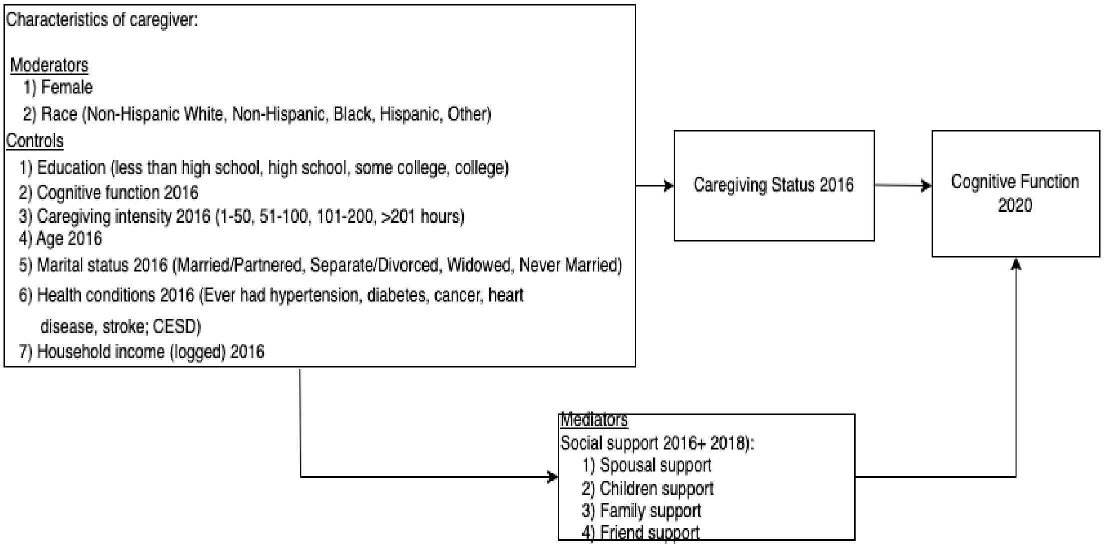


Figure 1. Revised Cognitive Function and Stress Process Model

Definition of Cognitive Function

Cognitive function includes a wide range of mental processes critical to daily living, including memory, problem-solving, attention, and executive functioning (Fisher, Chacon and Chaffee 2019). It underpins individual ability to autonomously navigate daily tasks, from managing a household to strategizing financial investments or providing care to others (Jekel, Damian, Wattmo et al. 2015). In later adulthood, these functions become even more critical as they form the basis for compensating for physical and sensory declines, maintaining social networks, and engaging in meaningful activities.

Prevalence of Cognitive Impairment in Older Adults

The prevalence of cognitive impairment among older adults is a growing concern, with studies indicating a significant portion of the aging population is affected by conditions that impede cognitive function (Pais, Ruano, P. Carvalho and Barros 2020).

Around two-thirds of Americans experience some level of cognitive impairment by the age of 70 (Hale, Schneider, Mehta and Myrskylä 2020). Beyond these conditions, even mild cognitive impairment (MCI), which often precedes more severe forms of cognitive decline, affects approximately 12-18% of adults over the age of 60 (Association 2022). The implications of this are profound, as cognitive impairment can lead to diminished capacity for self-care, increased risk of accidents, and a greater need for caregiving support, all of which contribute to heightened healthcare utilization and associated costs.

Importance of Cognitive Function for Older Adult Caregivers

Investigating cognitive function in caregivers is essential, as aging-related cognitive decline may be further intensified by the demanding nature of caregiving tasks (Alves, Flesch, Cachioni et al. 2018). These tasks often include complex responsibilities like managing medication schedules, communicating with healthcare providers, and making critical day-to-day care decisions (Zwar, König and Hajek 2018b). These demands may shift and intensify as the condition and needs of the care recipient evolve, potentially escalating the strain over time (Uccheddu, Gauthier, Steverink and Emery 2019). Comprehending the effects of caregiving on cognitive function is imperative, as cognitive function are fundamental to maintaining the health and well-being of caregivers, and are essential in guaranteeing high-quality care. This understanding can inform the development of support systems and interventions aimed at preserving cognitive health and caregiver well-being, ultimately impacting the quality of care provided to the care recipient.

Most available studies suggest that informal caregivers may experience reduced cognitive performance compared to non-caregivers. Systematic reviews have supported a potential association between informal caregiving and cognitive deterioration, reinforcing conclusions drawn from earlier research (Allen et al., 2017). Yet, much of the research has concentrated on caregivers of older patients with dementia (Mallya and Fiocco 2018, Oken, Fonareva and Wahbeh 2011, Vitaliano, Ustundag and Borson 2017). It has been documented that dementia caregivers reported a greater cognitive decline than those caring for people without dementia (Dassel et al., 2017). Hence, these findings may not be universally applicable across different caregiving situations.

There is scant research regarding the cognitive function on general caregivers. Mackenzie and colleagues (2009) assessed cognitive functions of spousal caregivers against those of comparable non-caregivers using instruments such as the California Verbal Learning Test and the Working Memory Index, with results pointing to potential cognitive declines among the caregivers (Mackenzie, Wiprzycka, Hasher and Goldstein 2009) .In contrast, Bertrand et al. (2011) classified caregivers based on their assistance with daily tasks and tested their cognitive skills using the Hopkins Verbal Learning Test and the Digit Symbol Substitution Task, finding that those caring for individuals with osteoporotic fractures showed better cognitive function than non-caregivers (Bertrand, Saczynski, Mezzacappa et al. 2011). Nonetheless, these findings are from cross-sectional studies and could be prone to bias. Longitudinal research provides a more consistent picture. Zwar et al. (2018) utilized data from the German Aging Survey and reported cognitive benefits associated with caregiving, as measured by the Digit Symbol Test (Zwar et al., 2018). Similarly, a study leveraging the English Longitudinal Study of

Ageing, which evaluated memory and executive functions, indicated that caregiving was linked to improved memory in caregivers over 40 years of age (Yuan and Gruhn 2021).

Positive Impact of Caregiving on Cognitive Function

Engaging in caregiving activities can be intellectually stimulating and emotionally rewarding, often strengthening social connections and fostering a strong sense of purpose and identity (Lee and Li 2022, Quinn and Toms 2019, Yu et al. 2018). The act of caregiving requires complex social interactions and problem-solving, activities that may stimulate the brain and contribute to building a cognitive reserve (Corrêa, de Lima, Giacobbo et al. 2019). Cognitive reserve relates to cognitive functions that are strengthened over a lifetime, enhancing the brain's ability to manage damage and decline (Serra and Gelfo 2019, Stern 2009). The social engagement inherent in caregiving responsibilities could serve as a bolstering agent, fostering neural enrichment and robust defense mechanisms against neurological deterioration, thereby possibly mitigating the onset or progression of cognitive impairments (Stern, Alexander, Prohovnik and Mayeux 1992, Stern 2009).

Negative Consequences of Caregiving on Cognitive Function as a Chronic Stressor

While caregiving can bolster cognitive functions through social engagement, there is also a negative side to this role in cognitive function. Caregiving, often initiated by a family crisis or the sudden onset of a friend’s physical or cognitive challenges, thrusts individuals into an unexpected career (Pearlin and Aneshensel 1994).The unintended nature of caregiving, coupled with the lack of preparation and formal training, introduces significant emotional and cognitive demands. As an unexpected career, caregiving lacks the structured support and reward systems that accompany traditional professional roles. This absence of support can lead to feelings of isolation and a chronic sense of burden, with caregivers often finding themselves dealing with stressors that are enduring and multifaceted (Schulz and Sherwood 2008). The transition into caregiving can create a life dominated by the needs of another, with little room for self-care, potentially exacerbating cognitive decline in the caregiver (Pinquart and Sörensen 2003).

Unanticipated onset of caregiving responsibilities

Caregiving, often initiated by a family crisis or the sudden onset of a relative's illness, emerges as a role that many find themselves unprepared for, transitioning into what can be described as an unexpected career (Montgomery and Kosloski 2009). Unlike other life roles that individuals actively choose, the caregiving role is typically imposed on them, resulting in a potential source of chronic stress that is especially prevalent among older adults (Pearlin et al., 1990). The unintended nature of caregiving, coupled with the lack of preparation and formal training, introduces significant emotional and cognitive demands. Older caregivers may find themselves in a dual challenge, facing their own age-related cognitive changes while managing the complex needs of their care recipient (Alves et al. 2018). As an unexpected career, caregiving lacks the structured support systems that accompany traditional professional roles. This absence of support can lead to feelings of isolation and a chronic sense of burden, with caregivers often finding themselves dealing with stressors that are enduring and complex (Schulz and Sherwood 2008).

Social Support and Cognitive Function

The findings above suggest that caregiving may contribute to positive and negative cognitive functions. The active problem-solving and engagement required in caregiving may serve to keep the mind active, which could reduce the stress that caregivers often experience (Elayoubi, Nelson, Mu et al. 2023). Additionally, the sense of personal fulfillment gained from assisting someone in need represents another positive aspect of caregiving. These emotional benefits may act as a buffer against the pressures of the role (Elayoubi et al. 2023). Recognizing this, it becomes essential to consider the support systems that caregivers are in. Access to a diverse supportive network can play a pivotal role in mitigating the negative effect of caregiving experience on cognitive function. This broader view of caregiving underscores the importance of understanding both the challenges faced by caregivers and the resources they can draw upon to manage stress effectively.

Definition and Types of Social Support

Social support is defined as an exchange of resources between individuals intended to enhance the well-being of the recipient (Shumaker and Brownell 1984). It manifests in various forms, including emotional, informational, and instrumental support (Cutrona and Suhr 1992). Emotional support specifically entails acts that convey affection, esteem, encouragement, and concern (Thoits 1995, Uchino 2004). Informational support extends beyond basic information, encompassing appraisal support, which is feedback that aids in interpreting situations and advising on potential actions (Thoits 2011). Instrumental support, or practical assistance, involves direct aid in managing tasks or problems, ranging from simple errands to more complex assistance (Cohen 1992). Social support can originate from diverse sources, including family, friends, and neighbors, each offering distinct kinds of assistance. Family typically presents a broad and reliable support network, addressing various needs. Friends contribute by offering companionship and a sense of shared identity, while neighbors supply practical help that is rooted in the community and contribute to a feeling of connectedness (Wellman and Wortley 1990).

Emotional Support and Cognitive Function

The association between emotional support and cognitive function has been well-documented, with several studies underscoring a consistent positive association. For example, Seeman et al. (2001) discovered that emotional support was the only type of social support that predicted cognitive function over a 7.5 year follow-up period (Seeman, Lusignolo, Albert and Berkman 2001). This finding was echoed by Pillemer and Holtzer (2016), who also observed gender differences, with perceived emotional support being particularly beneficial for cognitive functioning in females (Pillemer and Holtzer 2016). Further supporting this finding, some studies compared different types of support and found that emotionally supportive relationships provided a stronger buffer against cognitive decline than instrumental support (Ellwardt, Aartsen, Deeg and Steverink 2013). Across the studies reviewed, emotional support appears to be an important factor in sustaining cognitive function, especially among aging populations, indicating that the quality of social interactions may be as crucial as their frequency.

Instrumental Support and Cognitive Function

The role of instrumental support, which involves assistance with daily tasks and needs, like cooking, cleaning, or managing bills, has mixed effects on cognitive function. Some have noted that a decline in instrumental social support was a predictor of cognitive deterioration, a relationship that remained even after controlling for various confounders (Dickinson, Potter, Hybels et al. 2011). Moreover, reduced levels of instrumental support has been correlated to an increased likelihood of cognitive impairment (Zamora-Macorra, de Castro, Ávila-Funes et al. 2017). However, some cohort studies reported non-significant or negative associations, indicating that the effect of instrumental support on cognitive function might be context-dependent and could vary according to the demographics and the existing levels of cognitive function of the study populations (Ayotte, Allaire and Whitfield 2013).

Informational Support and Cognitive Function

Informational support, characterized by the sharing of knowledge and advice, has also been explored for cognitive function. However, the literature presents a complex picture. While some studies have found positive association between informational support and cognitive function, the strength and direction of these associations vary. For instance, Ayotte et al. (2013) suggested that the provision, rather than the receipt, of social support was positively related to cognitive performance. This was echoed by findings indicating that higher perceived social support did not predict better cognitive function (Sims, Hosey, Levy et al. 2014).

In summary, the relationship between various forms of social support and cognitive function is blend and possibly influenced by various factors such as gender and individual differences in social network structures and personal preferences. The literature presents a complex picture with some inconsistencies, suggesting that the benefits of social support are not uniform across different populations or types of support. Future research should continue to explore these relationships, taking into account the diversity of social support and the individual characteristics of the recipients (Cloutier, Chertkow, Kergoat et al. 2015, Robertson, Savva and Kenny 2013).

Caregiving Status and Cognitive Function by Social Support

Research consistently recognizes that social support attenuates the harmful impact of stress on both physiological and psychological well-being (Cohen and Wills 1985). Social support is known to exert a substantial and beneficial effect on various health-related aspects, significantly bolstering mental and physical health, and contributing to an enriched sense of overall life satisfaction (Cohen 2004). The significance of social support emerges particularly in its capacity to counteract the negative ramifications of diverse life challenges, thereby promoting psychological endurance and resilience (Uchino 2006).

Within the context of caregiving, the role of social support is more salient. Caregiving is often accompanied by significant stress and burdens that can impact caregivers' cognitive function (Vitaliano, Zhang, Young et al. 2009). Older adults who assume caring roles have to face two prominent challenges. Frist, the demands and difficulties of caregiving become increasingly prominent as they grow older. Compared to younger adults, older caregivers are more likely to have their own health issues (Fong 2019). They face distinct challenges as they balance their caregiving duties with their own health needs. Their role often involves complex emotional and physical tasks, intensified by their personal aging process.

The particular demands on older caregivers necessitate a specialized approach to social support. Social support has the potential to mediate these effects by providing caregivers with the necessary resources to cope with the demands of their role. For example, emotional support can alleviate the psychological strain, while practical support can lessen the daily load of caregiving tasks (Pinquart and Sörensen 2006). The reciprocity of social interactions may shift, as caregivers might find themselves more in need of support than being able to provide it. Emotional support may address the specific emotional strains they encounter, such as the sorrow of witnessing a spouse's decline (Seeman, Lusignolo, Albert and Berkman 2001). Instrumental support becomes increasingly important to assist with daily caregiving tasks that may exceed their physical capabilities (Kent, Mollica, Dionne-Odom et al. 2020). Furthermore, informational support needs to be comprehensive, offering guidance on managing their health and navigating healthcare systems (Litzelman, Blanch-Hartigan, Lin and Han 2017). These nuanced support requirements highlight the importance of a tailored network that can adapt to the intricate needs of older caregivers.

Research has identified the mediating influence of social support in the caregiving experience is substantiated by empirical research. For example, the work of Díaz et al. (2019) underscored that social support mediates the relationship between perceived caregiving burden and health outcomes, indicating that a well-established network of support was integral to a caregiver's health perception and management. Adding to this, Pavarini and colleagues (2021) discovered a positive association between emotional support levels and cognitive performance among older caregivers (Pavarini, Ottaviani, Bregola et al. 2021). This correlation highlighted emotional support as a potential protective factor in maintaining cognitive function under the strain of caregiving responsibilities. Studies have consistently shown that the presence of emotional support and active social engagement plays a crucial mediating role, mitigating the mental health challenges associated with their role, notably in reducing the risk of depression and enhancing life quality (Sibalija, Savundranayagam, Orange and Kloseck 2017, Yi, Jiang, Jia et al. 2021). These findings illustrated that social support enhanced emotional well-being and overall quality of life, which is inextricably linked to cognitive health. These studies collectively form a body of evidence that reinforces the concept of social support as a mediator in the relationship between caregiving responsibilities and cognitive function. Multiple studies have consistently demonstrated the effectiveness of social support in enhancing the well-being of family caregivers (Coomber and King 2012, del-Pino-Casado et al. 2018). For instance, Pinquart et al. (2005) found that higher levels of social support mitigate the negative impact of caregiving and are associated with increased life satisfaction, reduced depression, and a lower risk of perceived burden. Furthermore, it has been observed that informal caregivers who dedicate extensive time to caregiving and have limited social connections are more likely to experience depressive symptoms (Cannuscio, Colditz, Rimm et al. 2004).

As per SPM, caregiving introduces specific stressors—such as the emotional weight of caring for a loved one and the physical demands that may accompany advanced age. These stressors can uniquely challenge cognitive function. However, social support may act as a crucial mediator, providing emotional solace, practical assistance, and necessary information to mitigate these potential cognitive risk. Having access to more resourceful social networks is expected to mitigate the impact of entering into caregiving on health. Social support is often recognized as a valuable social resource (Campbell, Marsden and Hurlbert 1986, Lin 1982) that helps individuals navigate stressful situations. Through various psychosocial mechanisms, social support enables individuals to cope with and alleviate the negative effects of these experiences on their well-being. These mechanisms include strengthening their sense of control, self-worth, and connection to others (Thoits 2011). Supportive network ties may evoke physiological responses that have positive effects on health, such as the reduction of blood pressure, heart rate, and stress hormones. These responses are advantageous as they help diminish uncomfortable arousal that can lead to the initiation of risky behaviors (Uchino 2006)

Social support becomes more pronounced in old age (Baron, Riva and Fletcher 2019). It serves as a predictor for better mental health (Ali et al. 2018, Talha et al. 2018), lower risk of depression (Bui 2020, Zhong, Wang and Nicholas 2020), reduced physical disability (James, Wilson, Barnes and Bennett 2011), and improvements in overall well-being and quality of life (Wang 2014). The literature has also identified a connection between social support and dementia, emphasizing the association between reduced engagement in social activities, limited social contact, and feelings of loneliness with an increased risk of developing dementia (Kuiper, Zuidersma, Oude Voshaar et al. 2015).

Recognizing the critical role of social support, it's important to note a significant issue faced by older caregivers: as their need for social support intensifies, they often encounter the challenge of a progressively diminishing support network. The social support networks of older adults tend to diminish due to retirement, the loss of loved ones, and debilitating conditions that limit their social interactions (Kelly, Duff, Kelly et al. 2017). Additionally, older caregivers may exhibit hesitancy in seeking external assistance or mobilizing social networks to coordinate care activities (Childers 2019).

Limited research has been conducted on the cognitive health implications of caregiving in informal caregivers, as well as the role of social support as a pathway in the association between caregiving and cognitive health. A recent study highlighted that while social support has the potential to enhance the well-being of caregivers (Díaz et al. 2019, Pavarini et al. 2021), there is insufficient evidence to determine if changes in social support serve as the underlying mediating factor. The interplay between caregiving, cognitive function, and social support in older adults necessitates a deeper understanding. Therefore, I suggest this hypothesis:

Given prior studies I expect that informal caregiving is associated with worse cognitive health with the following two hypotheses:

> **Hypothesis 1**: Older adults who are informal caregivers will have worse cognitive function compared to non-caregivers.
>
> **Hypothesis 2**: Social support will serve as the mediator between caregiving status and cognitive function.

Gender Differences in the Caregiving Status

Gender disparities in caregiving status are profoundly rooted in societal norms and cultural expectations (Pearlin et al. 1990). From early childhood, women are typically conditioned to embrace nurturing roles, an expectation that predestines them for family caregiving responsibilities (Calasanti 2010). Even in scenarios where men are present and capable of caregiving, prevailing cultural norms tend to assign these responsibilities to women (Calasanti and Bowen 2006, Chappell, Dujela and Smith 2015, Scerri 2014). This entrenched societal viewpoint leads to an overrepresentation of women in caregiving roles, a situation stemming not just from their numerical majority but also from a deeply ingrained societal perception of caregiving as inherently a woman's domain.

Women often face social expectations to fulfill caregiving roles, a pressure that can heighten feelings of guilt and inadequacy, particularly when juggling caregiving with other responsibilities such as work or parenting (del-Pino-Casado, Frías-Osuna, Palomino-Moral and Ramón Martínez-Riera 2012, Yee and Schulz 2000). Research has found that women tend to perceive a greater sense of responsibility and obligation towards caregiving, while men may be more inclined to distance themselves from such duties (Hong and Coogle 2016). Moreover, female caregivers often experience pressure to fulfill these roles, which can exacerbate feelings of guilt or inadequacy, especially if they face challenges in meeting these ingrained expectations (Yee and Schulz 2000). Caring for a spouse or a close family member can intensify the emotional strain for women as they confront the dual challenges of managing personal loss and caregiving stress. The convergence of these demands frequently results in heightened stress and emotional exhaustion, highlighting the multifaceted challenges faced by women in caregiving roles (Pinquart et al. 2006).

Male caregivers, on the other hand, might struggle with tasks traditionally not associated with male roles, such as personal care or domestic chores (Robinson, Bottorff, Pesut et al. 2014). They may also encounter social stigmas and a lack of societal support when engaging in caregiving roles, leading to feelings of isolation or inadequacy (Kramer and Thompson Jr 2001). Men may also experience difficulty in expressing emotional distress or seeking help, adhering to traditional masculine norms of self-reliance and stoicism (Russell 2007).

Reflecting on this disparity, research consistently shows that female caregivers tend to provide more hours of care (del-Pino-Casado et al. 2012) and experience a greater burden compared to their male counterparts (Mc Donnell and Ryan 2013, Penning and Wu 2016, Pinquart and Sörensen 2006). Female caregivers are more likely than males to provide assistance with intimate caregiving tasks such as bathing, dressing, feeding, and addressing incontinence issues. They also engage in activities such as shopping and meal preparation (Sharma, Chakrabarti and Grover 2016). In examining the physical demands of caregiving, this analysis specifically focuses on men and women. Within this scope, women might find the physical aspects of caregiving more taxing due to differences in physical strength, especially in tasks like lifting or moving a care recipient. Men might face challenges in tasks that require patience, areas where they might not have had much prior experience (Lopez–Anuarbe and Kohli 2019). Financially, female caregivers often encounter greater economic hardships, partly due to existing wage disparities and potential career disruptions caused by caregiving duties (Pavalko and Wolfe 2016). Men, while also facing financial challenges, might not experience the same degree of career interruption, although this can vary based on individual circumstances and the intensity of caregiving responsibilities.

Caregiving Status and Cognitive Function by Gender

The relationship between caregiving status and cognitive function exhibits notable differences when viewed through the lens of gender. For instance, Lee, Kawachi, and Grodstein (2004) found that the cumulative stress experienced by female caregivers could contribute to cognitive decline. More recent research indicates that the intense demands placed on female caregivers can lead to significant stress, which can adversely affect their cognitive health (Xiong, Biscardi, Astell et al. 2020). Female caregivers tend to spend more time with their care recipients compared to male caregivers, which results in a multi-dimensional burden such as physical and financial cost compared to males. High levels of stress arising from the burden of daily caregiving can potentially jeopardize the cognitive well-being of caregivers (Dassel et al. 2017, Luchesi, da Silva Alexandre, de Oliveira et al. 2016, Stewart et al. 2016). Extensive research has provided substantial evidence showcasing the influence of stress on cognitive function (Arnsten 2009, Lupien, McEwen, Gunnar and Heim 2009, McEwen 1998). Studies have specifically revealed that chronic stress can lead to excessive secretion of glucocorticoids, including cortisol, which may have enduring implications for the brain and body. These consequences encompass impaired immune functioning, cardiovascular disease, and accelerated cognitive decline (Lupien, McEwen, Gunnar et al. 2009, McEwen 1998). Moreover, research has specifically indicated that prolonged exposure to elevated glucocorticoid levels can lead to hippocampal damage (Lupien et al. 2009, Lupien, Juster, Raymond and Marin 2018, Marshall, Cooper, Segrave and Geeraert 2015) and that greater levels of stress have been associated with smaller hippocampal volume, which in turn affects the cognitive function (Zimmerman, Ezzati, Katz et al. 2016). However, contrasting findings exist, as seen in Bertrand, Saczynski, Mezzacappa et al. (2012), where older female caregivers demonstrated better memory performance and processing speed compared to non-caregivers, suggesting the possibility of domain-specific cognitive benefits linked to caregiving activities. Additional evidence is required to deepen our understanding of the gender disparities in the health outcomes associated with informal caregiving. Interestingly, a meta-analysis has revealed that female caregivers, including wives, daughters, and daughters-in-law, often report poorer health compared to male caregivers (Sharma et al. 2016)f. Furthermore, as many previous studies on caregivers' health have relied on cross-sectional data, it is crucial to validate gender differences in caregivers' health using more rigorous longitudinal models and nationally representative samples. The effects on male caregivers are less clear, with some studies suggesting different outcomes. For instance, Trivedi, Beaver, Bouldin et al. (2013) reported that male caregivers might experience worse health outcomes, including cognitive function, than their female counterparts. Conversely, Zwar, König, and Hajek (2018) observed a lack of positive association between caregiving status and cognitive function in male caregivers, a contrast to the benefits seen in female caregivers.

The mixed findings in this area underscores intricate nature of how caregiving status affects cognitive health. While some studies suggest that caregiving might have protective effects on cognitive function, particularly among women, others indicate that the stresses associated with caregiving could be detrimental, depending on factors like the caregiver's gender and the specific nature of their caregiving duties. Moreover, studies reveal that the correlation between deteriorating mental health and perceived cognitive decline in caregivers is consistent across genders, suggesting a universally significant impact of caregiving stress on cognitive health (Brown Monique and Cohen Steven 2020). In sum, there are many ways to hypothesize these relationships based on the mixed findings. I propose:

> **Hypothesis 3**: The effect of caregiving status on cognitive function will be moderated by gender.

Caregiving Status and Cognition by Race/Ethnicity

Prevalence of Caregiving Status by Race

In line with the broader demographic trends, the family caregiver population in the United States is becoming increasingly racially and ethnically diverse. Data and research reveal significant differences in caregiving roles among various racial and ethnic groups. For example, caregiving is more prevalent in Black and Hispanic communities than in White communities (Badana, Marino and Haley 2017, Do, Cohen and Brown 2014, Trivedi, Beaver, Bouldin et al. 2013). Caregivers from Black, Hispanic, and Asian American backgrounds typically encounter more significant and intense caregiving challenges than their White counterparts. These caregivers often provide a broader range of personal care, such as activities of daily living (ADLs) and instrumental activities of daily living (IADL). Additionally, they have more medical nursing tasks, dedicating more hours each week to caregiving over more extended periods as compared to others

(Cook, Snellings and Cohen 2018, Rote and Moon 2018). According to a recent national survey, a higher percentage of Black (54%) and Hispanic (49%) caregivers are engaged in high-intensity caregiving situations involving more hours and more complex tasks, compared to 35% of White and 32% of Asian American caregivers (AARP 2020). To create effective interventions that enhance the well-being and quality of life for caregivers and those they care for, especially from varied racial and ethnic backgrounds, it is essential to recognize the differences in caregiving experiences based on race and ethnicity.

Unique challenges and experiences by racial background

Cultural expectations. The variation in caregiving roles across different racial groups is often linked to familism and filial obligation (Guo, Kim and Dong 2019). For example, Black families typically have a deep-rooted tradition of family caregiving, frequently motivated by feelings of filial duty and community solidarity (Dilworth-Anderson, Williams and Gibson 2002). Likewise, in Hispanic cultures, the "familismo" principle stresses the significance of familial connections and collective welfare, commonly resulting in a higher incidence of caregiving within the family (Crist, McEwen, Herrera et al. 2009). Familism embodies a profound sense of loyalty and commitment to one's family, influencing the caregiving attitudes among many ethnic minority groups. It emphasizes the family's duty to care for each other. Consequently, caregivers from these backgrounds often embrace their caregiving roles more readily and with less anxiety (Guo et al. 2019, Johnson Jr and Appold 2017a, Johnson Jr and Appold 2017b). However, studies indicate that the ingrained sense of familism can lead to a heightened sense of obligation towards caregiving, resulting in more avoidant coping styles rather than proactive ones. Although filial obligation beliefs are stronger among ethnic minority caregivers (Guo et al. 2019, Pinquart and Sörensen 2005), White caregivers also experience a sense of familial obligation that has been linked with detrimental mental and physical health outcomes (Morgenstern, Hollenhorst, Gallo et al. 2021, Piedra, Howe, Francis et al. 2022). Because White caregivers are generally raised in a more individualistic culture, they may be more likely to perceive caregiving as a burden and disruption to their own life and personal goals (Meyer, Nguyen, Dao et al. 2015).

Resource accessibility and experience with discrimination. Cultural and language barriers for Black and Hispanic communities are evident. Black caregivers often navigate a complex landscape marked by cultural mismatch and mistrust. On one hand, these caregivers frequently encounter situations where their unique cultural norms and values are not recognized or respected by healthcare providers. This cultural mismatch can lead to critical misunderstandings and diminish trust, as healthcare professionals may not fully comprehend or acknowledge the cultural context influencing the caregivers' decisions and expectations (Betancourt 2003, Penner, Dovidio, West et al. 2010).

Black Americans have faced racism and mistreatment within the health care system (Alegría, Canino, Ríos et al. 2002), leading to a reluctance to seek specialty care. In a comprehensive national survey, 35% of Black respondents identified racism as a significant issue in healthcare, a view that contrasts sharply with only 16% of White respondents who felt the same way (Lillie-Blanton, Brodie, Rowland et al. 2000). Compounded by systemic economic disparities, many Black caregivers face financial challenges leading to delayed or inadequate care, further exacerbating their stress.

Hispanic caregivers encounter some similar challenges. Language barriers significantly hinder their ability to effectively navigate healthcare systems, contributing to increased stress and a sense of helplessness, with adverse implications for cognitive health (Nageswaran, Ellis and Beveridge 2021). Financial constraints further complicate their situation, limiting access to essential services and adding to the caregiving burden, which can subsequently affect their cognitive function (Theodoropoulos, Xie, Wang et al. 2022).

Impacts on the Cognitive Function of Caregivers

Racial differences in health and socioeconomic characteristics among older adults significantly influence the experiences of their family and unpaid caregivers. However, current understanding in this area is largely based on studies with convenience samples, which may not fully represent the broader population. For example, older Black adults are twice as likely to experience higher rates of dementia compared to other groups, and they often receive diagnoses later in the disease progression. This delay in diagnosis intensifies the caregiving demands placed on their family members (Robinson-Lane, Zhang and Patel 2021). In a similar vein, healthcare providers identified systemic issues affecting Hispanic communities, such as educational deficits, social isolation of patients, and difficulties in obtaining specialist referrals for undocumented individuals and uninsured persons (Rios 2017).

Given the higher frequency of engagement and time spent in caregiving activities by Black and Hispanic caregivers compared to their White counterparts (Cohen, Sabik, Cook et al. 2019, Rote and Moon 2018), it is plausible that these demanding caregiving responsibilities negatively impact the health of caregivers. As a result, Black and Hispanic informal caregivers may face an elevated risk of experiencing depressive symptoms, especially when providing objectively burdensome care (Ejem, Bauldry, Bakitas and Drentea 2018). Poor mental health may be associated with subjective cognitive decline (Monique and Steven 2020).

Upon reviewing existing literature, three critical gaps become apparent. First, Black and Hispanic caregivers, despite shouldering more significant caregiving burdens and facing more work-related challenges, are still underrepresented in research focusing on health outcomes. This oversight in research limits a comprehensive understanding of their experiences (Cothran, Chang, Beckett et al. 2021). The vast majority of available studies only compare non-Hispanic White caregivers with caregivers of other racial and/or ethnic groups (Liu et al. 2021), While many studies, such as those by Liu et al. (2021), compare non-Hispanic White caregivers with caregivers from other racial and ethnic groups, thereby addressing broader social and systemic inequalities, they often overlook nuances within each racial and ethnic group. This generalization can potentially obscure the unique challenges faced by different groups.

Second, the literature suggests that the undue stress associated with caregiving might contribute to cognitive health disparities among racial and ethnic minorities Older Black caregivers often face expectations to fulfill roles combining authority and nurturance, akin to parenting, contrasting with White caregivers who typically adopt less authoritative, more companionate roles (Kennedy 1990). These differing roles can heighten stress for Black caregivers, potentially affecting their cognitive function and increasing depressive symptoms risk (Sneed and Schulz 2019). While these observations apply broadly to caregivers, they are particularly pertinent in the context of grandparenting. Current research on the cognitive health impacts of these varied caregiving roles in diverse aging populations is notably limited.

Furthermore, the literature presents inconclusive findings regarding the health effects of caregiving across racial groups. For example, Black caregivers for dementia were found to have better psychological well-being compared to their White counterparts in a recent systematic review (Liu, Badana, Burgdorf et al. 2021). To further investigate the cognitive conditions of informal caregivers across racial groups, I suggest this hypothesis following the stress process perspective:

> **Hypothesis 4**: The effect of caregiving status on cognitive function will be moderated by race/ethnicity.

Gender, Race, Caregiving and the Consequence of Social Support for Cognitive Function

Social Support by Gender

Social support types accessed by gender. Research indicates that there may be distinct patterns in how male and female caregivers seek and benefit from various types of social support. For instance, women caregivers often gravitate towards emotional support — seeking empathy, understanding, and moral encouragement from their social networks (Pinquart et al. 2006). This preference could be attributed to traditional socialization patterns where women are more encouraged to express emotions and seek relational connections. In contrast, male caregivers might prioritize instrumental support, such as assistance with specific tasks or financial aid. This difference could stem from gender norms that dissuade men from expressing emotional needs and encourage a more solution-focused approach to problem-solving (Kramer and Thompson Jr 2001).

Sources of support by gender. The sources from which men and women caregivers receive support also exhibit gender-specific trends. Female caregivers often rely more on informal networks, such as friends, family members, or community groups. This tendency is supported by evidence suggesting that women generally have larger social networks, greater diversity in their networks and are more likely to engage in reciprocal support exchanges within these networks more frequent contact with network members (Fischer and Beresford 2015, McDonald and Mair 2010). On the other hand, male caregivers are more likely to utilize formal support services. They might seek assistance from professional care providers, healthcare services, or support groups, possibly due to a smaller informal support network or reluctance to impose on friends and family for caregiving support (Sharma et al. 2016).

Social Support by Race

Family structures. Family structures and their impact on caregiving vary considerably across racial and ethnic groups. For example, in many Hispanic and Black cultures, multi-generational living arrangements are more prevalent. These extended family settings can offer a more integrated support system for caregiving, with multiple family members contributing to the care of older adults. This contrasts with more nuclear family structures common in many Western societies, where caregiving responsibilities might fall more heavily on one or two family members (Dilworth-Anderson et al. 2002). Such differences in family structures can lead to varied caregiving dynamics, impacting the distribution of caregiving tasks and the availability of support within the family.

Community involvement. The role of community or religious institutions in providing support also differs across racial and ethnic groups. For African American and Hispanic communities, for instance, church and religious groups often play a pivotal role in providing emotional and sometimes practical support for caregivers (Taylor, Chatters and Levin 2003). These institutions can offer a sense of belonging, shared responsibility, and resources that are particularly valuable for caregivers. In contrast, other racial or ethnic groups may rely more on community organizations or formal support services. These variations highlight the importance of considering cultural and racial contexts in understanding and supporting the diverse needs of caregivers. While there has been some exploration into the influence of social support on cognitive function among caregivers, studies specifically focusing on gender and racial differences in this context remain relatively scarce. However, existing research does provide valuable insights. Multiple studies with convenience samples have demonstrated that African American caregivers tend to have more diverse social support networks, encompassing a wider range of relationship types, compared to their White counterparts (Ajrouch, Antonucci and Janevic 2001). Existing literature indicates that, on average, African American and Hispanic caregivers report lower levels of depression and elevated levels of life satisfaction relative to their White counterparts (Dilworth-Anderson et al. 2002, Roth et al. 2015). This observation is often ascribed to cultural values that accentuate the significance of the familial bond and its associated support mechanisms. For instance, in a randomized controlled trial, Hispanic, white, and Black caregivers who were part of the intervention group, which received social support, showed notable enhancements in their quality of life compared to the control group. The improvements were particularly significant among Hispanic and white caregivers. Additionally, a considerable improvement was also observed in Black spouse caregivers (Belle et al. 2006). This study highlights the positive impact of social support interventions across diverse caregiver groups.

> **Hypothesis 5**: The strength of the mediation effect of social support in the caregiving-cognitive function relationship will be different by gender.
>
> .
>
> **Hypothesis 6**: The strength of the mediation effect of social support in the caregiving-cognitive function relationship will be different in racial groups.

CHAPTER 3 DATA AND METHODS

I will use the Health and Retirement Study (HRS) data. The HRS is a longitudinal study of adults aged 50 and older in the United States, designed to explore the factors that influence health and well-being in later life. Since 1992, the HRS data collects data on a wide range of topics through face-to-face interviews, including physical health, mental health, social networks, economic resources, and caregiving, from around 26,000 individuals aged 50 and above. The RAND HRS Data File is a harmonized dataset of the Health and Retirement Study (HRS) created by RAND. HRS comprises several cohorts representing different age groups. The original HRS cohort, aged 51 to 61 at the study's inception in 1992, forms the core group of participants, born between 1931 and 1941. Other cohorts include Asset and Health Dynamics Among the Oldest Old (AHEAD), which covers older individuals, specifically those born in 1923 or earlier. Children of the Depression Age (CODA), which targets individuals born between 1924 and 1930, War Baby (WB) (born 1942-1947, aged 73 to 78) Early Baby Boomer (EBB) cohort (born 1948-1953, aged 67 to 72), Mid Baby Boomer (MBB) (born 1954-1959, aged 61 to 66), and the Late Baby Boomer (LBB) cohort (born 1960-1965, aged 55 to 60). Each cohort provides valuable insights into the health, retirement, and aging experiences of individuals across various stages of life, contributing to a comprehensive understanding of aging dynamics in the United States. The survey ensures national representativeness, but it deliberately oversamples Black, Hispanic, and Florida households. This intentional oversampling is aimed at better representing these specific populations and takes into account the uneven probabilities of selection by using sampling weights during data collection. My project consists of the cohorts from HRS, AHEAD, CODA, WB, EBB, MBB and LBB. The HRS cohort, which includes individuals born between 1931 and 1941, comprises the majority, representing approximately 58%. WB and EBB account for 17%, respectively. The total cognitive function score (dependent variable) is available from 1996 to 2020. I use cognitive function at latest wave 2020 as the dependent variable.

In addition, participants are asked to complete and return by mail a supplemental hardcopy survey called the Psychosocial and Lifestyle Questionnaire (PLQ). The Psychosocial and Lifestyle Questionnaire (PLQ gathers data on how participants perceive their life situations, their sense of well-being, and their lifestyle. If a proxy helped in filling out the survey, it is indicated (Smith et al., 2013). The PLQ follows a rotational study approach, surveying two equal-sized groups every 4 years. For instance, half of the HRS panel took the PLQ in 2016 and then did so again in 2020. The response rates of the PLQ were 64.7 in 2018 (Smith et al., 2023). Comprehensive information regarding the HRS, including details about the PLQ and the RAND HRS Data File, can be accessed online at http://hrsonline.isr.umich.edu/

To maximize the cases for analysis, I combined the 2016 PLQ half sample and the 2018 PLQ half sample. The latest cognitive function score data available is from the 2020 wave in the HRS. To capture the intricate relationship between caregiving status, social support, and cognitive function, it's essential to consider temporal order and potential lag effects. Having decided on using the 2020 cognitive function data as my outcome variable, it becomes critical to select predictor variables from preceding time points to ensure a logical progression of cause and effect. The choice of 2016 and 2018 social support allows to assess the potential mediating influence of support systems four years prior to our cognitive measurement. This time frame provides a reasonable window to capture the cumulative impact of social support on cognitive function. Similarly, selecting the 2016 cognitive function data as a control can ensure that baseline cognitive function four years prior is accounted for, offering a clearer picture of the trajectory of cognitive changes over time. This structure not only helps establish a sequence of events but also aids in isolating the individual and combined effects of caregiving and social support on cognitive outcomes in 2020.

As seen in Figure 2, in order to ensure the integrity of the study's dataset, stringent inclusion criteria were applied. Initially, the focus was on individuals who participated in complete interviews conducted in both 2016 and 2018. Within this cohort, respondents who did not personally complete the PLQ, along with those deemed ineligible for the PLQ or who did not self-administer the questionnaire, were excluded from the analysis. This preliminary screening yielded a sample of 12,011 respondents.

Subsequently, this cohort was merged with participants from the 2020 full sample. This integration process resulted in a slightly reduced collective of 11,915 individuals. Further refinement of the sample was conducted by excluding individuals who did not complete the 2020 interview, those who were ineligible for cognitive function imputation in both 2016 and 2020, which culminated in a pool of 9,645 respondents.

The final stage of the selection process involved the elimination of cases with missing data pertinent to cognitive function assessments in both 2016 and 2020, as well as missing marital status information After a systematic exclusion of incomplete and ineligible records, the sample arrived at 4,082 respondents.

Missing values were observed due to the fact that cognitive function questions were posed only to participants who were 65 years old and older. For each analysis, cases with missing data were excluded, employing a complete-case analysis approach.

Multiple imputation

Following the application of exclusion criteria and an age eligibility requirement of 65 years and older, the pooled sample comprised 4,707 respondents. Upon the exclusion of cases exhibiting less than 1% missing data in caregiving status and marital status, the final sample size was reduced to 4,679 respondents. The range of missing values for the study variables varied from 0% to 15%. There were 21.7% of the cases (1,017 respondents) with missing data on one or more study variables over the period from 2016 to 2020. This rate of missing data aligns with the prevalence observed in longitudinal survey research, as noted by Johnson and Young (2011). The investigation of missing data patterns was conducted through the comparison of mean values between respondents with and without missing data, utilizing Chi-square ($\chi2$) tests and t-tests. The absence of significant associations with respondent non-participation led to the conclusion that the missing data were Missing at Random (MAR), according to Johnson and Young (2011). To maintain a representative sample of caregivers and to minimize the risk of nonresponse bias, respondents with missing data were retained in the analysis, adhering to the recommendations of Johnson and Young (2011). Consequently, Multiple Imputation by Chained Equations (MICE) was used to do multiple imputation. In the 'mice' package in R version 4.2.2. Within this dataset, I conducted analyses equivalent to those performed in a dataset using listwise deletion. This included conducting mediation analyses, moderation analyses, and moderated mediation analyses. The core findings remained consistent, showing no difference when compared to results obtained from a listwise deletion dataset.

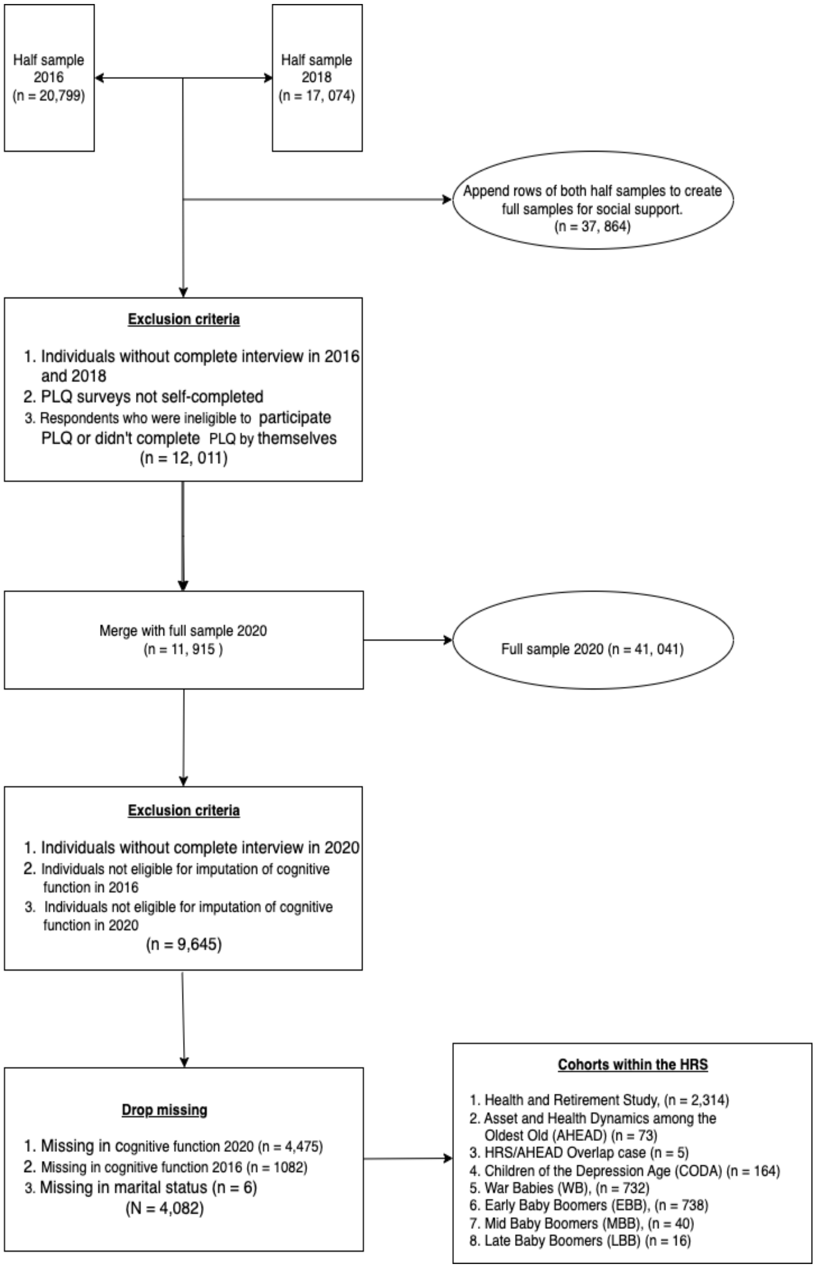


Figure 2. Flowchart of Sample Handling

Variables of Interest

Dependent Variable

Cognitive function in 2020. The focus of this study was cognitive function in 2020, measured through various scores encompassing time orientation (scored on a range of 0-4), semantic memory (scored on a range of 0-4), working memory (backwards counting with a range of 0-2; serial 7s with a range of 0-5 (this assessment requires participants to sequentially subtract 7 from the preceding number, starting from 100, across five attempts. Scoring for correct subtractions relies on the immediately preceding response, meaning that subsequent calculations are based on the prior answer provided, regardless of its accuracy), immediate recall (scored on a range of 0-10), and delayed recall (scored on a range of 0-10) (Ofstedal, Fisher and Herzog 2005, St Clair, Blake, Bugliari et al. 2011). The total cognitive function score was obtained by summing the word recall and mental status summary scores, ranging between 0 and 35, with higher scores indicating better cognitive function. The total word recall summary variables combined immediate and delayed word recall scores, ranging from 0 to 20. The mental status summary was derived from scores on serial 7's, backwards counting from 20, and object, date, and president/vice-president naming tasks, with a score range of 0-15 (Ofstedal et al. 2005). The construct validity of the HRS cognitive function measures has been supported by demonstrated relationships with demographic factors and physical and mental health. The individual items show consistent interrelationships, and factor analysis further justifies the computation of a total cognitive function score (Ofstedal et al. 2005). In addition, these measures have been extensively used in studies examining changes in cognitive function among older adults, demonstrating their validity and reliability (Lièvre, Alley and Crimmins 2008, Park, Kim, Amano and Chen 2019, Zivin, Kabeto, Kales and Langa 2009).

Independent Variable

*Caregiving role in 2016***.** Since 1998, the HRS surveys have inquired if participants provide unpaid support to friends and family members who do not reside with them. Starting with the 2002 survey, participants were asked to estimate the total hours they dedicated over the previous 12 months to assisting friends, neighbors, or relatives who lived outside their household and whom they helped without compensation. Starting from the 2004 survey up to the latest wave, rather than inquiring about the exact hours devoted to aiding friends and relatives, the question asked was, "In the past 12 months, have you dedicated any time to assisting friends, neighbors, or relatives who live separately from you and have not compensated you for your help?" Is the time spent under 50 hours, over 50 hours, or approximately at that mark? Is it below 100 hours, above 100 hours, or around that range? Similarly, is the duration less than 200 hours, more than 200 hours, or close to that figure? The potential responses outline caregiving intensity in 2016 as less than, approximately, or more than 50, 100, and 200 hours. Based on this, I established four caregiving intensity in 2016 categories accordingly following the method used in previous research (Barnett 2015, Heisler 2013). Due to the small number of respondents (only 12) who reported providing up to 50 hours of caregiving, I combined this group with those reporting over 50 hours and up to 100 hours of caregiving. This consolidation resulted in a revised variable with four distinct levels: no caregiving, up to 100 hours of caregiving, more than 100 but less than 200 hours of caregiving, and over 200 hours of caregiving.

Social support in 2016 and 2018. The concept of social support was evaluated using a social support scale created by Walen and Lachman (2000), which consisted of three specific items. These items have been proven to be reliable in previous research studies (Bertera 2005). The three items inquired about the level of understanding, reliability, and openness that participants experienced in their relationships. Exploratory factor analyses on all support variables revealed distinct underlying sources of social support, with eigenvalues exceeding 1 for each factor, highlighting their distinctiveness. Accordingly, four indices were constructed, each representing a unique source of social support as identified by the factor analysis. The questions were asked separately for participants' spouse/partner, children, family members, and friends, and were repeated four times in total. Participants were provided with response options on a scale of 1 to 4, where 1 represented a high level of social support, 2 indicated some level of support, 3 denoted a low level of support, and 4 indicated no support at all. I did reverse coding for the responses, so higher values reflected greater support. Then, I averaged the scores for three items per support source and rescaled this average to range from 0 to 3, aligning higher scores with higher perceived support. The reliability of these scales was confirmed with strong Cronbach's alpha coefficients: 0.83 for spouse/partner, 0.84 for children, 0.87 for family, and 0.85 for friends.

Controls

Subsequent to questions about caregiving status in 2016, respondents were asked three questions assessing the caregiving intensity in 2016: Is the time spent under 50 hours, over 50 hours, or approximately at that mark? Is it below 100 hours, above 100 hours, or around that range? Similarly, is the duration less than 200 hours, more than 200 hours, or close to that figure? The potential responses outline caregiving intensity in 2016 as less than, approximately, or more than 50, 100, and 200 hours. Based on this, I established four caregiving intensity in 2016 categories, representing ranges of 1-50 hours, 51-100 hours, 101-200 hours, and over 201 hours, respectively. To isolate the relationship between caregiving status in 2016 and older adults' cognitive function in 2020, the analysis will also include ten potentially confounding variables, collected from three domains. The first set of variables represents *ascribed characteristics*: respondent's age in 2016, marital status in 2016. I integrate key demographic variables from the HRS tracker file: race, gender and education. The correlation between caregiving status in 2016 and cognitive function in 2020 can be driven by unobserved factors, such as education. Respondents have a range of education from 0 to 17 years. Education categorized into four types: less than high school (< 12 years), high school (12 years), some college degree (13-15 years), and college degree (16+ years). I also control for six health conditions in 2016 that respondents have ever had, including hypertension diabetes, lung disease, kidney disease, heart disease, and cancer. To assess depressive symptoms in older adults, I include the 8-item CES-D scale, which has a comparable internal consistency and accuracy as the 20-item CES-D scale (Andresen, Malmgren, Carter and Patrick 1994). The 8-item CES-D, as a count variable, is calculated from the total of eight binary (yes/no) questions. Those questions are about the following sentiments all or most of the time over the week prior to the interview: depression, everything is an effort, sleep is restless, felt alone, felt sad, and could not get going, felt happy, and enjoyed life. A higher number indicates more depressive symptomatology. Lastly, cognitive function in 2016 will be included to control for the baseline effects.

Analytical Strategy

First, I will present a descriptive table with means, standard deviations, and maximum and minimum values of each variable. To test the hypotheses, OLS regression models will be used to explore the relationship between caregiving status in 2016 and cognitive health in 2020 controlling for a series of health conditions including cognitive function, marital status, and age in 2016, Demographic characteristics will also be adjusted, such as education, gender, and race. In the full model, I will test the effect social support in 2016 and 2018 as mediator to test hypothesis 2 (Baron and Kenny 1986). If both the direct effect from caregiving status in 2016 on cognitive function in 2020 and the indirect effect (path through social support in 2016 and 2018) are significant, social support serves as the mediator. For hypotheses 5 and 6, I will run separate models on women and for race through moderation (Baron and Kenny 1986). Research suggests that women often benefit from a strong network of social support, and this may contribute to cognitive function. If we examine the correlation between social support and cognitive function, we may find variations between men and women. Furthermore, there might be differences in caregiving intensity and levels of social support among various racial groups. It is possible that the relationship between social support and cognitive function varies across racial backgrounds. All the analyses will be performed with R 4.2.2.

CHAPTER 4 FINDINGS

As seen in Table 1, the cognitive function in 2020 of older adults ranged from 1 to 35. About half of the older adults assumed the caregiving role. More than half of those caregivers were White married women. Their summary cognitive scores in 2016 ranged from 6 to 35, with an average around 22. The cognitive scores in 2016 were 0.6 points higher than it in 2020. The average age was around 74 years old. Health conditions prevalent in 2016 were also documented. A significant proportion, 68%, reported having experienced hypertension, while 28% had diabetes, 19% had cancer, 29% had heart disease, and 9% had suffered a stroke. The average score for depressive symptoms, measured by the CES-D scale, was 1.156 (sd=1.741), varying widely among participants (range: 0 to 8), suggesting diverse mental health statuses. As for social support, measured in 2016 and 2018, the average scores on a scale from 0 (not at all) to 3 (a lot) were as follows: Spousal support averaged at 0.326, indicating relatively lower perceived support from spouses. Support from children was higher, with an average score of 0.596. Family support registered the highest average at 0.992, while friend support was also higher, averaging at 0.861. Figure 3 shows the correlation between variables.

Table 1. Descriptive Table for Caregiving Status, Social Support and Cognitive function (N = 4,082)

Variables	Labels	Mean (%)	SD	Min	Max
Outcome Variable					
Cognitive Function 2020		21.893	5.163	1	35
Independent Variables					
Caregiving in 2016					
No caregiving		51.5		0	1
(Reference group)					
Caregiving intensity (≤ 100 hrs)		0.393		0	1
Caregiving intensity (> 100 & ≤ 200 hrs)		0.054		0	1
Caregiving intensity (>200 hrs)		0.038		0	1
Covariates					
Cognitive Function 2016		22.464	4.439	6	35
Demographic Variables					
Age 2016		74.390	6.620	55	99
Female		0.612		0	1
Non-Hispanic White		0.713		0	1
Non-Hispanic Black		0.157		0	1
Hispanic		0.106		0	1
Other		0.024		0	1
Married/Partnered 2016		0.619		0	1
Separate/Divorced 2016		0.113		0	1
Widowed 2016		0.240		0	1
Never Married 2016		0.028		0	1
SES					
Less than high school		0.171		0	1
High school		0.337		0	1
Some college		0.238		0	1
College		0.252		0	1
Household Income (logged) 2016		10.579	1.139	0	14.228
Health Conditions 2016					
Ever had hypertension		0.68		0	1
Ever had diabetes		0.28		0	1
Ever had cancer		0.19		0	1
Ever had heart disease		0.29		0	1
Ever had stroke		0.09		0	1
CES-D		1.156	1.741	0	8
Mediator					

Social Support 2016 and 2018 *(0 = not at all, 1 = a little, 2 = some , 3 = a lot)*			
Spousal Support	0.326	0	3
Children Support	0.596	0	3
Family Support	0.992	0	3
Friend Support	0.861	0	3

Before modeling, Pearson correlation tests were conducted (see Figure 3). Before conducting the modeling process, Pearson correlation tests were administered to assess the relationships between variables. The results revealed several notable associations. Providing caregiving exhibited a positive correlation with cognitive function ($p < 0.05$). Black or Hispanic older adults were less likely to provide caregiving, as evidenced by a significant negative correlation ($p < 0.05$) between these racial/ethnic groups and caregiving activities. Being female exhibited a negative association with social support ($p < 0.05$), indicating that women tended to perceive lower levels of social support compared to their male counterparts. White individuals showed a positive correlation with multiple variables, including caregiving, cognitive function, and support from children and family members ($p<0.05$). This suggests that individuals identifying as White were more inclined to engage in caregiving activities and tended to report higher cognitive function levels and greater support from children and family members. However, no significant relationships were observed between the various sources of social support and individuals from other racial or ethnic groups.

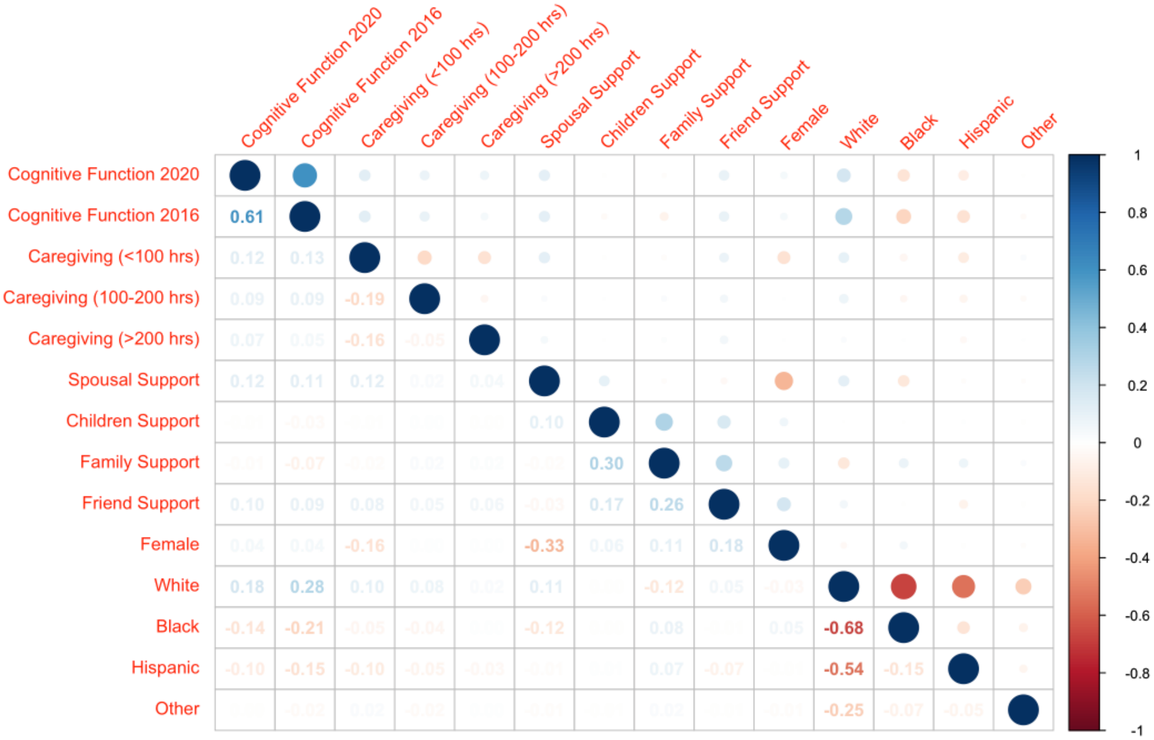


Figure 3. Correlation Matrix Among Caregiving, Social Support, Gender, Race/Ethnicity, and Cognitive Function.

Note: *Red indicates a negative correlation, blue a positive correlation. Visible numbers denote significance, while blanks indicate insignificance*.

The primary procedure used to test the hypotheses was OLS regressions to test the effects of caregiving on cognitive function and social support. To test the mediation and moderated mediation effects that I proposed in Hypotheses 2, 5 and 6, I followed methods suggested by Baron and Kenny (1986), Muller and colleagues (Muller, Judd and Yzerbyt 2005) and Preacher and Leonardelli (2007).

The first set of analysis explored the relationship between caregiving and cognitive function. The results are presented in Table 2. Hypothesis 1 states that a negative direct effect would exist between caregiving and cognitive function. The results from Models 1 to 7 did not support the hypothesis, showing a positive main effect of caregiving. In the supplementary analysis, I examined the interaction between caregiving status and caregiving intensity. However, due to multicollinearity issues, the model omitted the category for caregiving hours greater than 200. To fully take advantage of caregiving variables, I chose the approach that utilized 4 categories of caregiving intensity. Specifically, the regression analysis investigated the relationship between caregiving, demographic factors, and cognitive function. Model 1 examines caregiving status in 2016 and its relationship with cognitive function in 2020. The results showed a strong and significant positive association ($p < 0.01$). Providing caregiving in 2016 had a protective role for cognitive function in 2020. Model 2 included cognitive function in 2016 along with caregiving status in 2016, both variables maintained significant positive associations with cognitive function in 2020 ($p < 0.01$). Demographic variables including age, gender, race and marital status are considered in Model 3. Some demographic features demonstrated significant relationships ($p<0.05$) with cognitive function in 2020. Specifically, age showed a negative association, indicating that older age corresponds with decreased cognitive function. Conversely, being female was positively associated with cognitive function, suggesting that females may experience a relative protective effect in cognitive function compared to males. Black and Hispanic older adults had lower cognitive function compared to their White counterparts ($p < 0.01$). Other older adults did not show a significant relationship. Being separated/divorced and never married was linked with lower cognitive function ($p<0.01$) compared to being married or partnered. Being widowed did not show a significant association with cognitive function. Educational attainment and income are integrated to Model 4. Greater levels of educational and income were positively linked with better cognitive function ($p<0.001$).

Model 5 considers physical health of adults, ever having diabetes and higher CES-D were significantly associated with lower cognitive function ($p<0.01$).

Hypothesis 2 stated that social support is a mediator between caregiving and cognitive function. In Model 5social support was non-significant except spousal support. It's negatively associated with cognitive function ($p < 0.05$). Following the approach by Baron et al. (1985), it is suggested that there was no association between spousal support and caregiving status (results not shown). Therefore, it is not a mediator in this study. In sensitivity analysis, I also tested a global positive social support scale. It was created by averaging the social support scores across all relationship types. The global measure of social support yielded a consistent Cronbach's alpha of 0.79 for both 2016 and 2018. However, this global social support was non-significant. Thus, Hypothesis 2 was not supported.

Table 2. OLS Regression Models Predicting Cognitive Function as A Function of Caregiving Status and Social Support (N = 4,082)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Caregiving Status 2016						
Caregiving Intensity (≤100 hrs)	1.653***	0.574***	0.388**	0.269*	0.220	0.203
	(0.168)	(0.134)	(0.134)	(0.133)	(0.133)	(0.134)
Caregiving Intensity (>100 hrs & <=200 hrs)	2.744***	0.986***	0.643*	0.505	0.452	0.430
	(0.359)	(0.286)	(0.279)	(0.276)	(0.275)	(0.276)
Caregiving Intensity (>200 hrs)	2.768***	1.411***	1.084***	0.904**	0.810*	0.790*
	(0.423)	(0.335)	(0.326)	(0.323)	(0.323)	(0.324)
Cognitive Function 2016		0.715***	0.656***	0.602***	0.588***	0.587***
		(0.014)	(0.015)	(0.016)	(0.016)	(0.016)
Age 2016			-0.155***	-0.153***	-0.159***	-0.161***
			(0.010)	(0.010)	(0.010)	(0.010)
Female			0.376**	0.433**	0.458***	0.369**
			(0.133)	(0.133)	(0.134)	(0.137)
Non-Hispanic Black			-0.551**	-0.408*	-0.385*	-0.416*
			(0.182)	(0.182)	(0.183)	(0.184)
Hispanic			-0.557**	0.040	0.093	0.057
			(0.211)	(0.219)	(0.220)	(0.220)
Non-Hispanic Other			-0.051	-0.034	0.038	0.009
			(0.397)	(0.393)	(0.392)	(0.392)
Marital Status in 2016						
Separate/Divorced			-0.546**	-0.357	-0.258	-0.619*
			(0.202)	(0.206)	(0.206)	(0.274)
Widowed			-0.192	0.045	0.116	-0.273
			(0.162)	(0.166)	(0.166)	(0.243)
Never Married			-0.943*	-0.747*	-0.746*	-1.002*
			(0.371)	(0.370)	(0.370)	(0.417)
High School				1.097***	1.050***	1.054***
				(0.191)	(0.191)	(0.191)
Some College				1.662***	1.620***	1.634***
				(0.206)	(0.206)	(0.206)
College				1.582***	1.541***	1.582***

				(0.221)	(0.220)	(0.221)
Household Income (logged) 2016				0.233^{***}	0.206^{**}	0.206^{**}
				(0.063)	(0.063)	(0.063)
Health Conditions in 2016						
Ever Had Hypertension					0.044	0.048
					(0.135)	(0.135)
Ever Had Diabetes					-0.275^{*}	-0.283^{*}
					(0.138)	(0.139)
Ever Had Cancer					0.111	0.107
					(0.153)	(0.153)
Ever Had Heart Disease					-0.054	-0.055
					(0.136)	(0.136)
Ever Had Stroke					-0.271	-0.258
					(0.215)	(0.215)
CES-D =					-0.186^{***}	-0.179^{***}
					(0.036)	(0.037)
Social Support (2016+2018)						
Spouse Support						-0.179^{*}
						(0.085)
Children Support						0.107
						(0.063)
Family Support						0.097
						(0.066)
Friend Support						0.052
						(0.069)
Constant	20.992^{***}	5.476^{***}	5.521^{***}	18.561^{***}	15.853^{***}	17.150^{***}
	(0.111)	(0.323)	(0.324)	(0.913)	(1.123)	(1.144)
R^2	0.032	0.399	0.400	0.438	0.451	0.456
Adjusted R^2	0.032	0.398	0.399	0.436	0.449	0.453

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Sensitivity Analysis

Mediating effect of number of close social ties

Since both measurements of social support above were not significant, I examined post hoc the composition of social network and number of close social ties following the method by Latham-Mintus and her colleague (Latham-Mintus, Vowels and Huskins 2018) to see if those measures would better predict cognitive function. Specifically, the mediating effect of number and composition of close social ties was explored. The composition of the social network was evaluated based on the availability of different social relationships, encompassing a partner, adult children, immediate family, and friends. This composition was scored on a scale from 0 to 4, with 0 indicating the absence of any social network members and 4 indicating the presence of all mentioned types of social network members. Additionally, the number of close ties was quantified as a cumulative index of close family members and friends, excluding spouses. Due to its extensive range (exceeding 100), this index was capped at 26, approximately two standard deviations above the mean, to manage its broad distribution. I examined the relationship between these social network factors and caregiving status. Both the composition of social network and the number of close ties had a positive significant association with caregiving status. The result indicated that caregivers had more diverse social network and closer social ties ($p<0.05$), meaning these levels of caregiving significantly affect the composition of social ties and number of close ties (For complete results, see Table 1S).

In Table 3, caregiver generally exhibited better cognitive function compared ($p<0.05$) to non-caregivers, especially for those who provided caregiving for more than 200 hours. This pattern remained across all models. Model 2 incorporated the number of close social ties, which exhibited a statistically significant positive effect ($p<0.05$). This pattern is also observed in Table 1S. When both the number of close social ties and the composition of social ties were controlled for in Model 4, neither were significant. Model 5 further extended the analysis by including four sources of social support, the effects of number of close social ties and the composition of social ties were not significant.

Table 3. OLS Regression Models Predicting Cognitive Function as A Function of Caregiving Status and Three Types of Social Support (N = 4,082)

	Model 1	Model 2	Model 3	Model 4	Model 5
Caregiving Status in 2016					
Caregiving Intensity (≤ 100 hrs)	0.220	0.193	0.200	0.180	0.185
	(0.133)	(0.133)	(0.133)	(0.134)	(0.134)
Caregiving Intensity (> 100 & ≤ 200 hrs)	0.452	0.407	0.431	0.397	0.405
	(0.275)	(0.276)	(0.275)	(0.276)	(0.276)
Caregiving Intensity (> 200 hrs)	0.810*	0.777*	0.798*	0.773*	0.779*
	(0.323)	(0.323)	(0.323)	(0.323)	(0.324)
Social Network Related Features 2016+2018					
Composition of Social Ties			0.188*	0.161	0.142
			(0.085)	(0.094)	(0.011)
Number of Close Ties		0.021*		0.017	0.014
		(0.010)		(0.010)	(0.011)
Spouse Support					-0.201*
					(0.085)
Children Support					0.047
					(0.068)
Family Support					0.066
					(0.068)
Friend Support					0.010
					(0.072)
Constant	17.150***	17.081***	16.620***	16.642***	16.760***
	(1.144)	(1.144)	(1.168)	(1.168)	(1.177)
R^2	0.456	0.457	0.457	0.457	0.458
Adjusted R^2	0.453	0.453	0.454	0.454	0.454

Notes: Cognitive function in 2016, caregiving intensity in 2016, demographics, SES, health conditions are adjusted in all models.

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

Figure 4 illustrates significant mediation results for Table 1S and Table 3. Providing caregiving for more than 200 hours was positively related to the number of close social ties, which met with the requirement of path a ($\beta = 1.537$, $p < 0.01$) (see Table 1S). In Models 1 and 2 of Table 3, the significant association between caregiving status and the older adults' cognitive function persisted both with and without the adjustment of the number of close social ties. This fulfilled path c ($\beta = 0.813$, $p<0.05$) and path c′ ($\beta = 0.780$, $p < 0.05$), and the magnitude of caregiving status decreased when the number of close social ties was controlled. The Preacher and Hayes bootstrap test (Preacher, Rucker and Hayes 2007) indicated a significant indirect effect (test value = 0.032, $p < 0.05$), further suggesting that the association of caregiving status and cognitive function was mediated by the number of close social ties when older individuals provided more than 200 hours of caregiving. While the remaining type of caregiving intensity (less than 100 and more than 100 but less than 200 hours) are associated with expanded social networks, this increased social engagement does not directly translate to enhanced cognition scores in the way over 200 hours of caregiving does. The observation that caregiving intensity under 100 hours and those over 100 but under 200 hours are associated with an increase in social ties suggests that engaging in caregiving to a certain extent can expand an individual's social network. However, this increase in social ties does not directly lead to improved cognition scores, unlike caregiving for over 200 hours, which shows a direct positive effect on cognitive function. Likewise, there was no evidence supporting the presumed mediating role of the composition of social tie, given the lack of a direct impact on cognitive function from providing care for up to 100 hours or up to 200 hours.

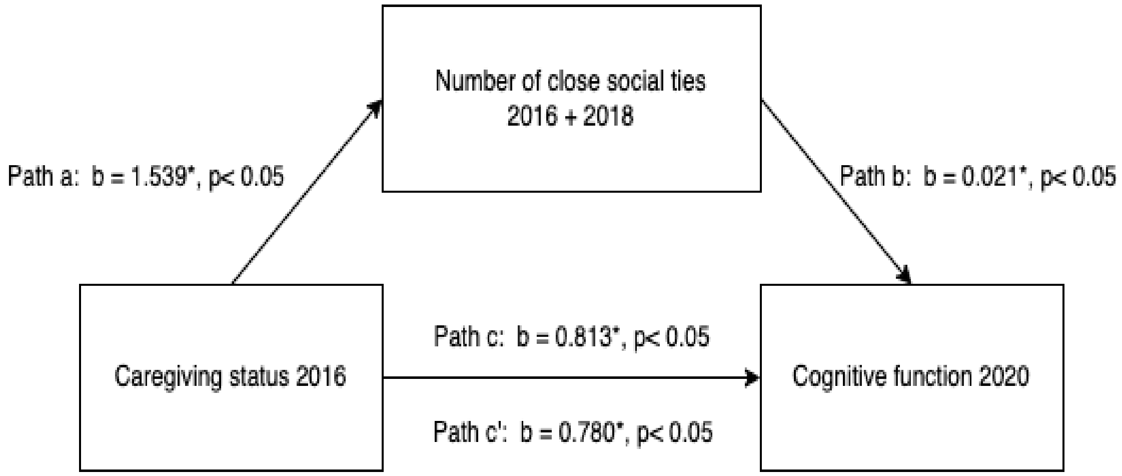


Figure 4. Mediation Effect of the Number of Close Social Ties on Caregiving Status and Cognitive Function

Moderating effects of gender and race/ethnicity

Hypotheses 3 and 4 tested the moderating effect of gender and race on the relationship between caregiving and cognitive function. They were tested with interaction terms in Table 4. The interaction between gender and caregiving was non-significant. Therefore Hypothesis 3 was not supported. The moderation analysis evolved through subsequent models to explore the interaction of caregiving status with demographic factors. Specifically, Model 2 incorporated an interaction term between caregiving status and gender, while Model 3 included an interaction between caregiving status and race/ethnicity. Of note is the interaction between caregiving status and race/ethnicity, specifically Hispanic and Other, which emerged as significant ($p < 0.05$), indicating a detrimental impact on cognitive function for caregivers within these groups. When older individuals provide over 100 but less than 200 hours, those who are from Hispanic or Other groups experience cognitive function declines compared to their White counterpart.

As such, Hypothesis 4 was partially supported. This moderating effect was further elucidated in Figure 5, which portrayed a comparative analysis of cognitive function across different racial groups by caregiving status. It revealed that Non-Hispanic White older adults consistently exhibited higher cognitive function compared to other racial groups, a trend that persisted irrespective of caregiving intensityintensity. For the non-caregivers , some older adults from Hispanic and Non-Hispanic Other group reported better cognitive function, while this advantage is not significant. Non-Hispanic individuals reported lower cognitive function than their Non-Hispanic White counterparts. When looking at the cognitive function of older adult with up to 100 hours of caregiving, this figure does not show a clear pattern of differences between racial/ethnic groups in terms of cognitive function. In the highest caregiving category (over 200 hours of caregiving), variations in cognitive function is observed across racial groups, however, such difference is non-significant. What captures interest is the cohort of individuals who dedicated between 100 and 200 hours of caregiving. This plot shows a significant interaction effect where the Non-Hispanic Other and Hispanic groups show lower predicted cognitive function scores compared to the Non-Hispanic White and group ($p < 0.05$). This could suggest that providing between 100 and 200 hours of care has a more pronounced negative impact on cognitive function for the Non-Hispanic Other and Hispanic caregivers. The Non-Hispanic Other group, in particular, shows the most substantial decrease in cognitive function within this caregiving category, with the lowest predicted score and a relatively wide confidence interval. This indicates not only a significant effect but also more uncertainty in the estimate for this group. The Hispanic group also shows a decline in cognitive function scores compared to Non-Hispanic White caregivers but to a lesser extent than the Non-Hispanic Other group. In contrast, Non-Hispanic White and Non- Hispanic Black groups do not seem to experience the same level of decline in cognitive function scores in this caregiving category, as their predicted scores are relatively closer and do not diverge as sharply from the no caregiving category.

Additionally, given previous sensitivity analysis indicated that the number of close social ties was the only significant mediator, I replaced 4 sources of social support with it in Table 4, as shown in Model 4. This replacement did not alter the core findings regarding the interaction effects (see Models 5 and 6), thereby reinforcing the robustness of the initial findings.

Table 4. Moderation Effect of Gender and Race/Ethnicity on Caregiving Status and Cognitive Function (N = 4,082)

	Model 1	Model 2	Model 3	Model4	Model 5	Model 6
Caregiving Status 2016						
Caregiving Intensity (≤ 100 hrs)	0.203	0.340	0.207	0.193	0.327	0.195
	(0.134)	(0.206)	(0.155)	(0.133)	(0.206)	(0.155)
Caregiving Intensity (> 100 & ≤ 200 hrs)	0.430	0.536	0.781**	0.407	0.472	0.760*
	(0.276)	(0.447)	(0.300)	(0.276)	(0.447)	(0.300)
Caregiving Intensity (> 200 hrs)	0.790*	1.014	1.035**	0.777*	0.971	1.015**
	(0.324)	(0.524)	(0.371)	(0.323)	(0.524)	(0.371)
Demographics						
Women	0.369**	0.487**	0.388**	0.451***	0.562**	0.392**
	(0.137)	(0.188)	(0.137)	(0.133)	(0.186)	(0.137)
Non-Hispanic Black	-0.416*	-0.414*	-0.450	-0.428*	-0.426*	-0.474*
	(0.184)	(0.184)	(0.235)	(0.185)	(0.185)	(0.236)
Hispanic	0.057	0.067	0.337	0.074	0.083	0.326
	(0.220)	(0.221)	(0.263)	(0.220)	(0.220)	(0.263)
Non-Hispanic Other	0.009	0.020	0.196	0.014	0.025	0.176
	(0.392)	(0.392)	(0.565)	(0.392)	(0.392)	(0.566)
Social Network Related Features 2016 +2018						
Spouse Support	-0.179*	-0.182*	-0.181*	-0.186*	-0.189*	-0.187*
	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)
Children Support	0.107	0.105	0.101	0.095	0.093	0.090
	(0.063)	(0.063)	(0.063)	(0.064)	(0.064)	(0.064)
Family Support	0.097	0.096	0.095	0.077	0.077	0.078
	(0.066)	(0.066)	(0.066)	(0.068)	(0.068)	(0.068)
Friend Support	0.052	0.051	0.045	0.029	0.028	0.023
	(0.069)	(0.069)	(0.069)	(0.071)	(0.071)	(0.071)
Number of Close Social ties				0.021*	0.021*	0.014
				(0.010)	(0.010)	(0.011)
Interaction Terms						

Caregiving Intensity (≤ 100 hrs)*Women		-0.226			-0.222	
		(0.263)			(0.263)	
Caregiving Intensity (> 100 & ≤ 200 hrs) * Women		-0.159			0.144	
		(0.561)			(0.561)	
Caregiving Intensity (> 200 hrs) * Women		-0.349			-0.326	
		(0.660)			(0.660)	
Caregiving Intensity (≤100 hrs)* Black			0.292			0.293
			(0.359)			(0.339)
Caregiving Intensity (> 100 & ≤ 200 hrs) * Black			-0.918			-0.904
			(0.906)			(0.906)
Caregiving Intensity (> 200 hrs) * Black			-0.322			-0.295
			(0.871)			(0.872)
Caregiving Intensity (≤ 100 hrs) * Hispanic			-0.435			-0.435
			(0.457)			(0.457)
Caregiving Intensity (> 100 & ≤200 hrs) * Hispanic			-5.009^{***}			-4.965^{***}
			(1.400)			(1.400)
Caregiving Intensity (> 200 hrs) * Hispanic			-1.866			-1.828
			(1.417)			(1.417)
Caregiving Intensity (≤100 hrs) * Other			0.158			0.171
			(0.804)			(0.804)
Caregiving Intensity (> 100 & ≤200 hrs) * Other			-6.163^{*}			-6.212^{*}
			(2.777)			(2.777)
Caregiving Intensity (> 200 hrs) * Other			-2.904			-2.821
			(2.021)			(2.021)
Constant	17.298^{***}	17.221^{***}	17.198^{***}	17.344^{***}	17.268^{***}	17.239^{***}

	(1.177)	(1.180)	(1.178)	(1.177)	(1.181)	(1.179)
R^2	0.457	0.457	0.460	0.457	0.458	0.461
Adjusted R^2	0.454	0.453	0.456	0.454	0.454	0.456

Notes: Cognitive function in 2016, caregiving intensity in 2016, demographics, SES, health conditions are adjusted in all models.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$--Figure 4 about here --

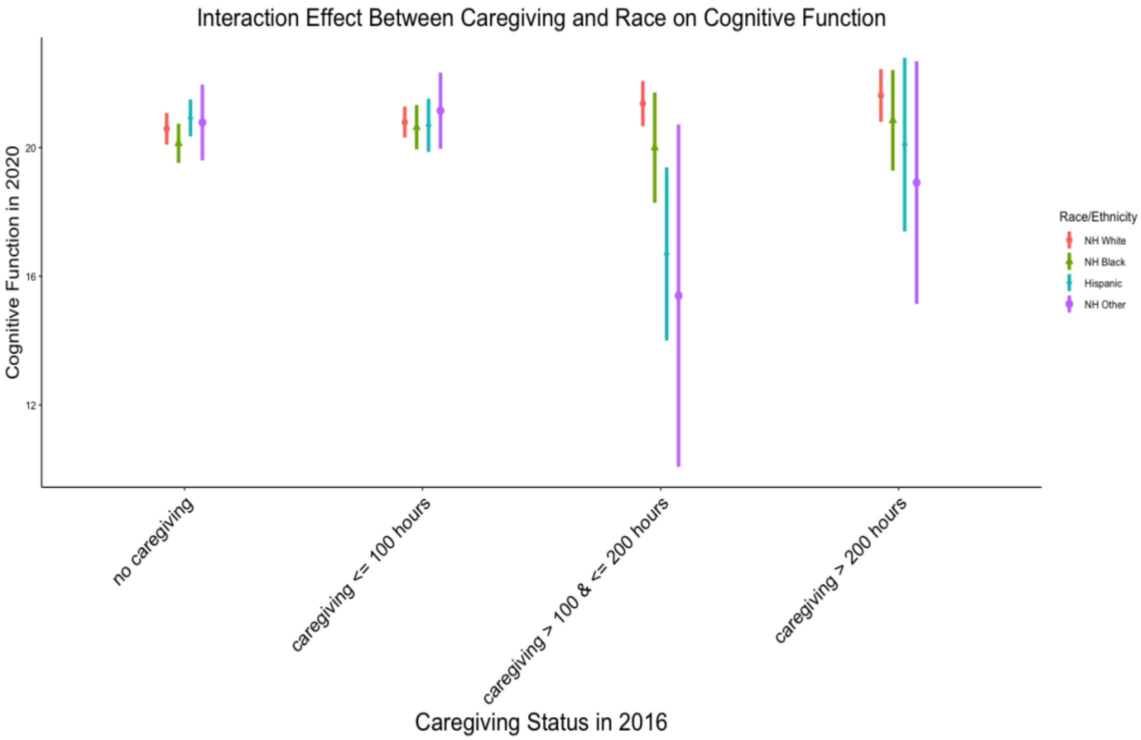


Figure 5. Interaction Effect Between Caregiving Status in 2016 and Race/Ethnicity on Cognitive Function in 2020

Hypotheses 5 and 6 posited a moderated mediation effect, whereby the mitigating effect would vary by gender and race. Since social support was not a significant mediator, Hypotheses 5 and 6 were not supported. I also explored the moderating influences of race and gender on the mediating impact of social network-related factors, particularly focusing on the number of close social ties. To examine the moderated mediation effect, I adhered to the method outlined by Muller and colleagues (2005). The results of this analysis are detailed in Table 5, showcasing Models 1- 3 for the effect of gender and Models 4 – 6 for race. Figures 6 and 7 present the effect of gender and race respectively. As per the guidelines provided by Muller et al., evidence of moderated mediation is established if: (a) there is a significant main effect of the independent variable on the dependent variable; and (b) the independent variable's main effect on the mediator remains significant after accounting for the moderator, alongside a significant variation in the mediator's impact on the dependent variable as a function of the moderator.

Prior analyses have established that the quantity of close social ties is the sole significant mediator in this context. In Figure 6, for the proposed effects of gender, the analyses indicate a significant main effect of caregiving status on cognitive function when caregiving hours exceed 200 ($\beta = 1.040$, $p < 0.01$, Model 1). The analyses also show a significant main effect of caregiving status at different levels of caregiving intensity on the number of social ties. It also demonstrates a significant interaction effect between engaging in more than 200 hours of caregiving and being female ($p < 0.05$, Model 2). However, both the number of close ties and interaction term of number of close tie and women are non-significant In Model 3. Therefore, this study did not find evidence to support hypothesis 5. Following the same steps, there is no racial variations either seen in Figure 7, rejecting hypothesis 6.

I examined the interplay between caregiving, cognitive function, gender, race, and social support among older adults. The investigation revealed caregiving's protective effect on cognitive health. The intensity of caregiving showed mixed effects, with lower hours being associated with reduced cognitive function. Social support indicators showed no significant direct effect, while the quantity of close social ties emerged as a positive mediator. The analysis also uncovered significant interactions between caregiving status and race/ethnicity, particularly affecting Hispanic caregivers, underlining the need for targeted caregiving support that acknowledges these nuanced relationships. The role of gender in the context of caregiving and cognitive function was not a significant factor in the findings. Neither gender nor racial differences significantly affecting this mediating role of the number of social ties.

Table 5.Moderated Mediation Analysis of the Effects of Caregiving and Social Support on Cognitive Function: The Moderating Roles of Gender and Race (N = 4,082)

	Model 1[a]	Model 2[b]	Model 3[a]	Model 4[a]	Model 5[b]	Model 6[a]
Caregiving Status 2016						
Caregiving Intensity (<= 100 hrs)	0.362	1.673***	0.338	0.223	1.414***	0.198
	(0.205)	(0.319)	(0.206)	(0.154)	(0.240)	(0.155)
Caregiving Intensity (> 100 & <= 200 hrs)	0.528	2.670***	0.489	0.807**	2.516***	0.764*
	(0.446)	(0.693)	(0.447)	(0.299)	(0.465)	(0.300)
Caregiving Intensity (> 200 hrs)	1.040*	3.331***	0.995	1.051**	2.166***	1.014**
	(0.523)	(0.812)	(0.525)	(0.370)	(0.576)	(0.371)
Women	0.579**	0.779**	0.438	0.475***	0.402	0.466***
	(0.186)	(0.289)	(0.253)	(0.134)	(0.208)	(0.134)
Non-Hispanic Black	-0.384*	1.997***	-0.428*	-0.427	2.125***	-0.309
	(0.183)	(0.285)	(0.184)	(0.234)	(0.365)	(0.340)
Hispanic	0.103	0.971**	0.082	0.384	1.266**	0.181
	(0.220)	(0.342)	(0.220)	(0.262)	(0.407)	(0.380)
Non-Hispanic Other	0.049	1.141	0.024	0.251	2.394**	-0.706
	(0.392)	(0.609)	(0.392)	(0.565)	(0.879)	(0.800)
Number of Close Social Ties			0.012			0.017
			(0.015)			(0.012)
Caregiving Status 2016 * Gender						
Caregiving Intensity (<= 100 hrs) * Women	-0.236	-0.578	-0.240			
	(0.263)	(0.408)	(0.263)			
Caregiving Intensity (> 100 & <= 200 hrs) * Women	-0.108	-0.776	-0.117			
	(0.561)	(0.872)	(0.562)			
Caregiving Intensity (> 200 hrs) * Women	-0.361	-2.859**	-0.326			
	(0.659)	(1.024)	(0.661)			
Social Ties * Women						

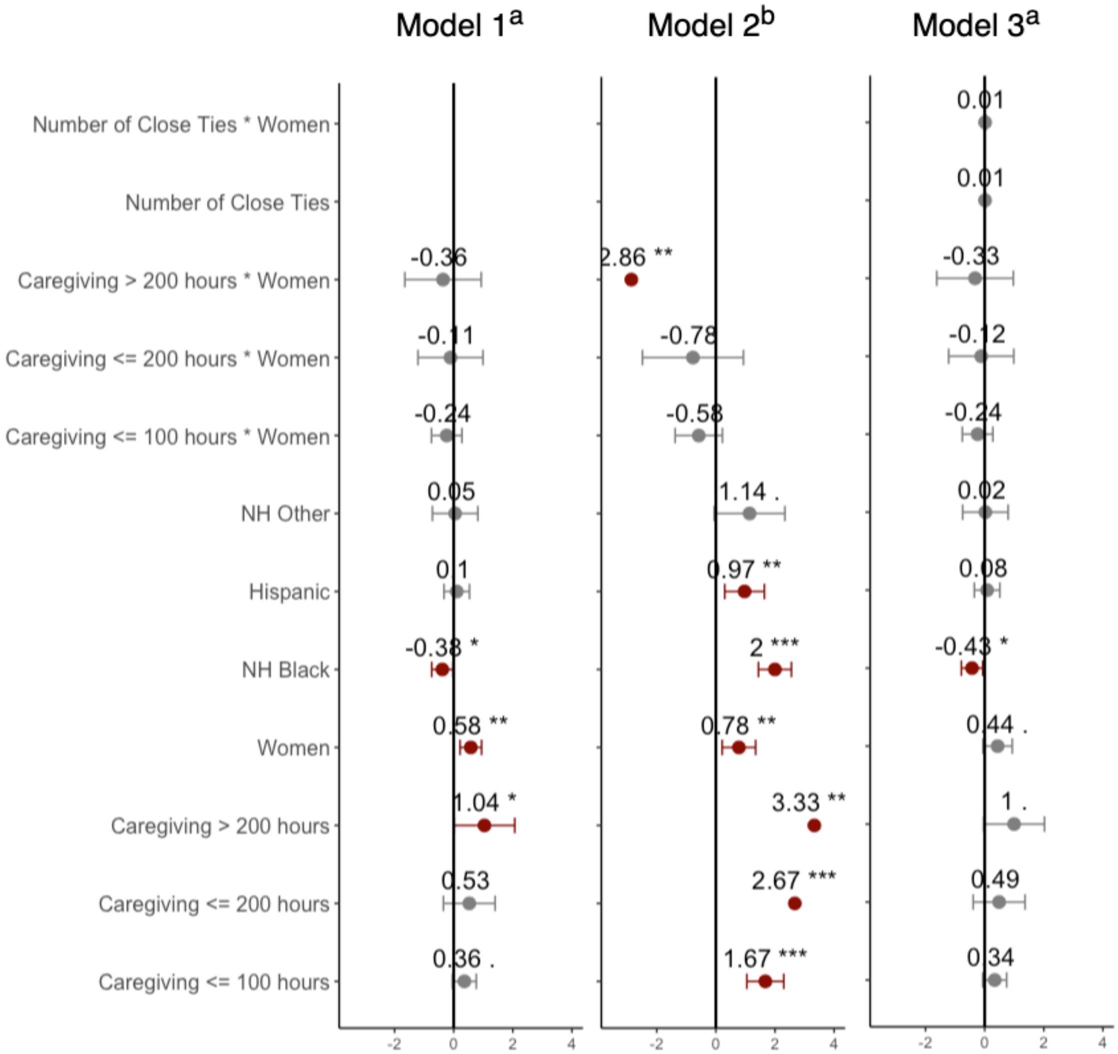
Number of Close Social Ties * Women	0.015			
	(0.020)			
*Caregiving Status 2016 * Race/Ethnicity*				
Caregiving Intensity (<= 100 hrs) * Black		0.311	0.040	0.327
		(0.359)	(0.559)	(0.360)
Caregiving Intensity (> 100 & <= 200 hrs) * Black		-0.920	-1.266	-0.885
		(0.906)	(1.410)	(0.906)
Caregiving Intensity (> 200 hrs) * Black		-0.294	-1.603	-0.262
		(0.872)	(1.357)	(0.872)
Caregiving Intensity (<= 100 hrs) * Hispanic		-0.456	-0.337	-0.464
		(0.457)	(0.711)	(0.457)
Caregiving Intensity (> 100 & <= 200 hrs) * Hispanic		-5.155***	-5.310*	-4.997***
		(1.400)	(2.179)	(1.403)
Caregiving Intensity (> 200 hrs) * Hispanic		-2.013	-4.136	-1.901
		(1.417)	(2.206)	(1.418)
Caregiving Intensity (<= 100 hrs) * Other		0.087	-2.340	0.204
		(0.804)	(1.251)	(0.805)
Caregiving Intensity (> 100 & <= 200 hrs) * Other		-6.075*	2.020	-6.543*
		(2.774)	(4.317)	(2.785)
Caregiving Intensity (> 200 hrs) * Other		-2.745	-5.050	-2.370
		(2.022)	(3.147)	(2.029)
Number of Close Social Ties * Black				-0.015
				(0.026)
Number of Close Social Ties * Hispanic				0.020
				(0.031)
Number of Close Social Ties * Other				0.093

						(0.058)
Constant	16.999^{***}	2.947	17.017^{***}	16.968^{***}	3.116	16.869^{***}
	(1.148)	(1.784)	(1.153)	(1.146)	(1.784)	(1.146)
R^2	0.456	0.049	0.456	0.459	0.051	0.460
Adjusted R^2	0.453	0.043	0.453	0.455	0.044	0.455

Notes: Cognitive function in 2016, demographics, SES, health conditions are adjusted in all model*s*

[a]Dependent variable: Cognitive function 2020. [b]Dependent variable: Number of close social ties

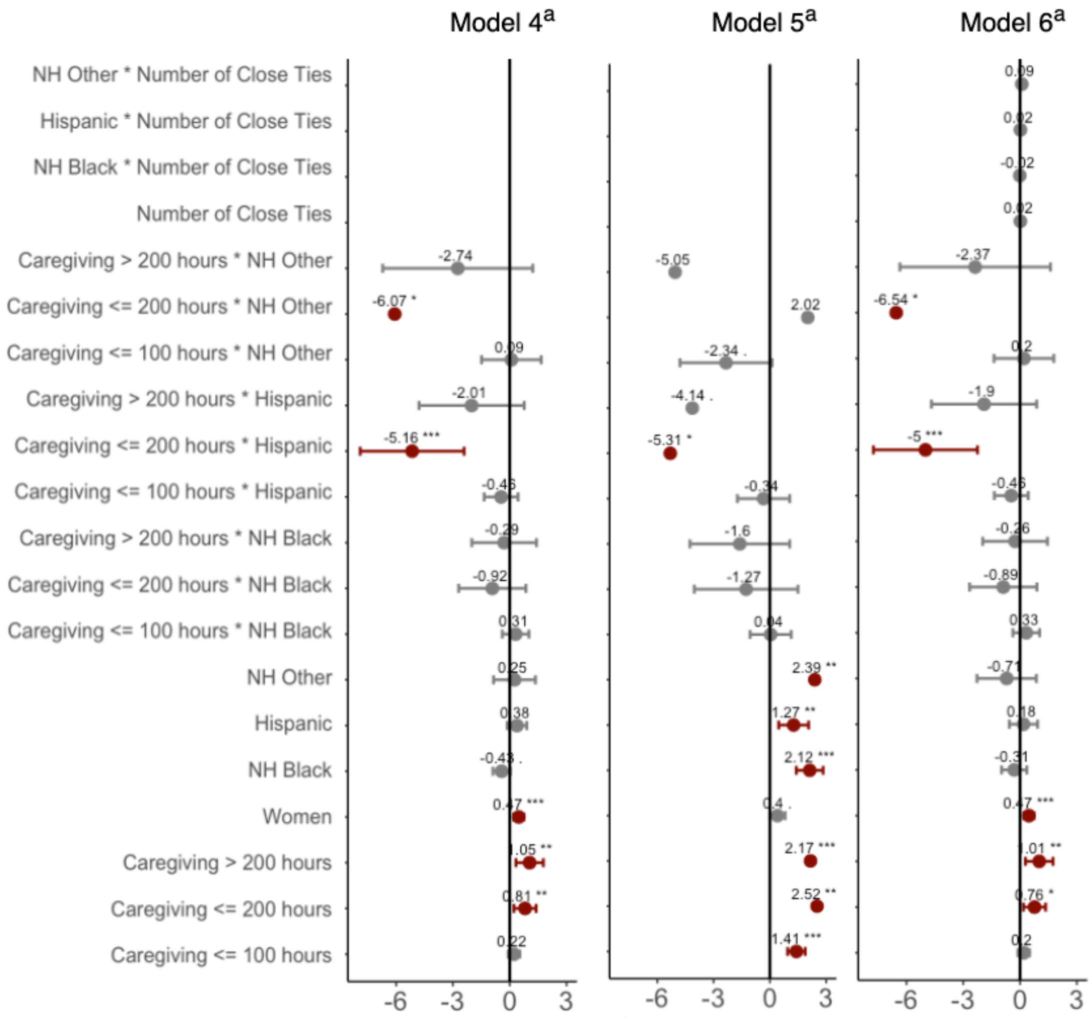
$* p < 0.05$, $** p < 0.01$, $*** p < 0.001$



Note: ^{a}Dependent variable: Cognitive function 2020. ^{b}Dependent variable: Number of close social ties
Cognitive function in 2016, demographics, SES, health conditions are adjusted in all models.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 6. Moderated Mediation Analysis of the Effects of Caregiving and Social Support on Cognitive Function: The Moderating Roles of Gender

Note: *In the forest plot, if the confidence interval overlaps 0, the difference is not considered statistically significant at the .05 level. Numbers in red indicate statistical significance.*



Note: ^{a}Dependent variable: Cognitive function 2020. ^{b}Dependent variable: Number of close social ties cognitive function in 2016, demographics, SES, health conditions are adjusted in all models.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 7. Moderated Mediation Analysis of the Effects of Caregiving and Social Support on Cognitive Function: The Moderating Roles of Race/Ethnicity

Note: *In the forest plot, if the confidence interval overlaps 0, the difference is not considered statistically significant at the .05 level. Numbers in red indicate statistical significance.*

Post-hoc analysis

I employed propensity score matching to address potential biases in the caregiving and noncaregiving groups, given that the average age of older adults is approximately 74. This approach aims to balance the groups by matching them on key demographic and health-related factors, including age, gender, race/ethnicity, education, marital status, and health conditions. By doing so, influence of confounding variables can be mitigated, ensuring a more accurate comparison between the two groups. I found no significant difference between caregivers and non-caregivers (results not shown).

CHAPTER 5 DISCUSSION

In the pursuit of understanding the interplay between social roles and cognitive health, this study emerges at the crossroads of sociological inquiry and cognitive sciences, exploring the nuanced ramifications of caregiving status on cognitive functions among older adults. More specifically, my objectives were fourfold: (1) to explore the impact of caregiving on cognitive function among older adults; (2) to assess the mediating role of social support in the relationship between caregiving status and cognitive function; (3) to examine gender and racial disparities within the caregiving-cognitive function dynamic; and (4) to investigate how the influence of social support on the caregiving-cognitive function relationship varies across gender and racial groups. Drawing from the Stress Process Model, it advances our comprehension of how social support, emerging as a foundational pillar in caregiving, intricately shapes cognitive functioning. This investigation distinguishes itself by not only charting the direct impact of caregiving on cognitive outcomes but also by investigating the mediating influence of social support, thereby shedding light on a previously underexplored area of the caregiving experience. In doing so, it fills a critical gap in the existing body of research, which has largely focused on the physical and psychological burdens of caregiving, by unraveling the complex interdependencies between caregiving roles, social support structures, and cognitive health. In the observed period of four years from 2016 to 2020, contrary to the anticipation that caregiving would serve as a chronic stressor, being a caregiver demonstrated a protective effect on cognitive function. This study found no evidence to suggest that caregiving contributes to disparities in cognitive function among older adults based on gender. However, there was partial support for racial/ethnic differences in cognitive function, with Hispanic caregivers exhibiting worse cognitive function compared to non-caregivers. This racial disparity was not observed among White and Black older adults.

The analyses revealed no support for the hypothesis that social support mediates the relationship between caregiving and cognitive function. Consequently, alternative aspects of social networks were considered, such as their composition and the number of close social networks. It was found that providing caregiving was associated with an increase in the number of close social ties, which in turn had a positive impact on cognitive function. Finally, there was no evidence to suggest that gender or race moderated the influence of social support or the quantity of close social ties on cognitive function.

The prevailing literature has consistently highlighted the potential psychological and physical burdens of caregiving, suggesting a possible detrimental impact on cognitive well-being (Pearlin et al. 1990b, Schulz and Sherwood 2008). Yet, my study contributes to an emergent area of research that challenges this view, suggesting that the relationship between caregiving and cognitive function is not uniformly detrimental. This finding is further enriched by empirical findings from various studies that have observed caregiving's protective effects on cognitive abilities (Elayoubi et al. 2023, Lin and Duan 2022, Su 2023). Such research has demonstrated that providing family caregiving often exhibit better cognitive functioning, including enhanced global cognitive performance and improved word list learning capabilities. In line with the positive results, researchers have also documented the psychological rewards of caregiving, noting that it provides emotional fulfillment and fosters personal development (Marino, Haley and Roth 2017). Contrary to early findings, studies have shown that informal caregivers experience lower mortality rates than those who do not provide care (Mehri, Kinney, Brown and Rajabi Rostami 2019, Roth, Haley, Hovater et al. 2013). Furthermore, research indicates that while greater depressive symptoms and perceived stress are linked to higher mortality in non-caregivers, these factors do not have the same predictive power for caregivers. This disparity suggests that provision of caregiving may create avenues for enhanced health benefit (Roth, Brown, Rhodes and Haley 2018).

Second, the investigation of the social support found no evidence of mediating effects. Instead, there was evidence of mediation of the number of social ties. Although the link between caregiving and social support is frequently observed, there have been repeated calls for understanding the role of social support. The lack of protective effects of social support on cognitive function was unexpected based on previous studies in several areas. A connection between social support and positive health outcomes has been established, including extended life expectancy and decreased risk of cardiovascular disease and cancer (Lyyra and Heikkinen 2006, Penwell and Larkin 2010). This divergence may stem from differences in how social support is measured and the composition of study samples. Unlike previous studies that often relied on smaller clinical samples or focused on older adults with specific diseases, this research leveraged a more diverse national sample of community-dwelling Americans. This approach allowed for a broader exploration of cognitive function and everyday social interactions.

The absence of social support's mediating role could stem from its alignment with the caregiver's specific needs and the caregiving context. Emotional, instrumental, and informational supports are theorized to play distinctive roles in buffering caregivers from the stressors of their role (Thoits 2011, Cohen 1992). Yet, the qualitative aspects of support—such as perceived adequacy, reliability, and the emotional quality of support—might influence its impact more profoundly than the mere presence of support (Seeman et al.,2001, Pillemer and Holtzer 2016). This discrepancy may reflect the complexity of caregiving experiences and the multifaceted nature of social support, suggesting that while social support is crucial for caregivers' well-being, its role in directly influencing cognitive outcomes may not be straightforward. The findings call for a deeper exploration of the nuanced pathways through which social support and caregiving interact to affect cognitive function, considering the diversity of caregiving contexts and the multidimensional nature of social support. As the literature suggests that the benefits of social support are not uniformly experienced across caregiver populations, potentially due to differences in the caregivingh, caregiver's gender, the nature of the caregiving relationship, and the social network's structure (Ellwardt et al., 2013, Dickinson et al., 2011).

Moving beyond the qualitative aspects of support, the findings suggest that the number of close social ties, one structural feature of caregivers' social networks, mediates the effects of caregiving and cognitive function. Social connectivity of caregivers serves as a means to support their cognitive well-being. Research has demonstrated that social ties can offer emotional reassurance, practical assistance, and essential information, helping individuals navigate the caregiving experience more effectively (Thoits 2011).

These social connections can also stimulate positive physiological responses, such as reduced blood pressure and stress hormone levels, which are beneficial for overall health (Uchino 2006). Furthermore, engaging in social interactions and maintaining close relationships may stimulate cognitive activities through socialization, contributing to better cognitive outcomes (Berkman, Glass, Brissette and Seeman 2000). This pivot underscores the need for a broader understanding of the social determinants of caregiving, particularly how the quantity and quality of social ties contribute to cognitive resilience or vulnerability among caregivers.

Third, whereas prior research has demonstrated that the cognitive function of women is more likely to be compromised by caregiving given the cumulative stress and intense demands of caregiving roles (Xiong et al., 2020), this study does not find a significant interaction effect. Older adult caregivers, irrespective of gender, face unique challenges associated with aging, such as managing their health conditions while providing care (Meyer and Kandic 2017b, Wolff et al. 2016) The evolving nature of caregiving in contemporary society, with fluid gender roles_and increasing involvement of men in caregiving tasks, may contribute to the non-significant gender differences observed in cognitive outcomes. The non-significant gender interaction underscores the notion that cognitive outcomes in caregiving are influenced more profoundly by the caregiving experience itself—including the intensity of caregiving, the caregiver-care recipient relationship's quality, and the caregiver's coping mechanisms—than by gender alone.

Prior studies have indicated that caregiving roles are more prevalent in Black and Hispanic communities than in White communities, with caregivers from these backgrounds typically encountering more significant and intense caregiving challenges (Badana Marino and Haley 2017, Trivedi Beaver Bouldin et al. 2013). Partially consistent with it, the study finds that Hispanic caregivers have worse cognitive function compared to non-caregivers. Cultural expectations around caregiving also vary significantly by race and ethnicity. Similarly, in Hispanic cultures, the principle of "familismo" emphasizes the importance of familial connections and collective welfare, which often results in a higher incidence of caregiving within the family (Crist McEwen Herrera et al. 2009, Guo Kim and Dong 2019). However, this deep-seated sense of duty and commitment to family care can also lead to caregivers prioritizing the needs of the care recipient over their own well-being, potentially neglecting their health, social life, and emotional needs. Such prioritization can result in caregivers adopting more avoidant coping strategies, where they might delay seeking help or support for themselves, ignore their own health problems, or avoid confronting and managing the stressors associated with caregiving effectively (Balbim, Marques, Cortez et al. 2019, Fink, Valenti, Kline and Fischer 2023).

The findings regarding the non-significant difference in cognitive function among Non-Hispanic Black caregivers, in contrast to Hispanic caregivers, could be attributed to several factors. First, the deep-rooted tradition of family caregiving and community solidarity within Black communities may provide a form of resilience that buffers against the cognitive declines associated with caregiving stress (Pickard, Witt and Aitch 2018).

Resilience in this context encompasses the ability to withstand stress and bounce back from caregiving adversities, such as emotional, physical, and financial burdens. It involves utilizing personal, familial, and community resources to maintain well-being and continue providing care (Pickard et al. 2018). Faith plays a critical role in the lives of many African American caregivers, offering a source of comfort, hope, and strength. It could provide a sense of purpose and meaning in caregiving roles, help in coping with the uncertainties and difficulties of caring for a loved one, and foster a sense of community and support through religious or spiritual affiliations (Pickard and King 2011). Together, resilience and faith contribute to the coping strategies employed by African American caregivers. They enable caregivers to maintain their health and well-being, support their loved ones effectively, and navigate the complex emotional landscape of caregiving with strength and grace. These attributes highlight the importance of cultural, familial, and spiritual values in shaping the caregiving experience and the ways African American caregivers manage and adapt to the challenges they face.

Lastly, there was no evidence to support the moderated mediation effect of social support as well as the number of close social ties. This finding diverged from previous findings that underscored the protective effects of social support (Pinquart and Sörensen 2006, Shor et al., 2013). This discrepancy may be attributed to the diverse operationalization of social support across studies and the specific cognitive function measures employed. For instance, while the general expectation based on literature suggests that social support should buffer the adverse effects of caregiving stress (Cohen 2004, Uchino 2006), the results from this study highlight the possibility that the types of social support measured (e.g., emotional vs. instrumental support) may not fully capture the complexity of caregiving that contains various levels of intensity. Another possible explanation is that the mechanisms through which social support influences cognitive function may not be directly related to the caregiving role but rather to broader social and psychological factors that are similarly experienced across multiple groups.

Cultural expectations and norms significantly influence caregiving practices and perceptions of social support. For instance, the evolving nature of gender roles, particularly in caregiving, suggests that both male and female caregivers might similarly value and benefit from social support and close social ties, challenging traditional assumptions about gender-specific support needs (Kramer and Thompson Jr, 200, Sharma et al., 2016). In terms of race, Hispanic cultures underscores the collective welfare and familial caregiving, potentially leading to different expectations and perceptions of support compared to other racial groups (Valle et al 2006). Similarly, Black caregivers often navigate a complex landscape marked by cultural mismatch and mistrust, which can influence their access to and utilization of social support (Betancour 2003, Penner et al., 2010). In conclusion, the absence of significant variations in social support's mediating role across gender and race highlights the need for a more nuanced understanding of the caregiving experience and its impact on cognitive function. This insight calls for a broader conceptualization of social support in caregiving research, considering the complex interplay of cultural, social, and individual factors that shape caregiving experiences and outcomes across diverse populations.

In conclusion, while this study found little support for a direct relationship between social support and cognitive function, it opens the door for further inquiry into this complex and multifaceted topic. By refining research methodologies and exploring new questions, future studies can shed light on the nuanced ways in which social networks and support systems contribute to cognitive health and overall well-being.

Limitations

There are several limitations to consider in this study. A potential bias could arise from healthier individuals being more inclined to assume caregiving roles, which might distort results. To address this concern, I used a propensity-matching approach in my post-hoc analysis that included health-related variables. To rigorously establish the causal relationship between offering assistance and health outcomes, the most robust research methodology would entail a randomized assignment of participants to either provide or receive support, with subsequent observation of the effects on their health indicators. If the observed health outcomes were solely due to unaccounted confounding variables, the health impacts related to the varying hours of caregiving provided would likely not have emerged in my results.

Another limitation was the reliance on baseline data for determining caregiving status, preventing an analysis of the continuity of caregiving activities over time or how changes in caregiving roles might influence the link between caregiving and cognitive health. This issue has been a recurring challenge in longitudinal studies based on population samples (Dassel et al., 2017). Future studies should overcome these limitations by tracking caregiving status and cognitive health changes over time, potentially revealing how specific caregiving factors (like care intensity, caregiving duration, and caregiving for individuals with dementia) influence cognitive functions.

It's crucial to continue examining caregiving not only as a potentially stressful task but also as a valuable family role that might offer personal benefits and positive health outcomes. While many interventions aim to reduce the stress and burden of caregiving, exploring the concept of benefit finding or focusing on the positive aspects of caregiving could offer insights into stress resilience mechanisms in caregivers. Future research should delve into understanding the protective factors that can alleviate caregiver stress, thereby enhancing their well-being.

CHAPTER 6 CONCLUSION

This research underscores a nuanced understanding of the relationship between social support and cognitive function. Despite the anticipation that social support would play a significant role in cognitive health, the findings of this study provide limited support for this hypothesis. This outcome prompts a critical evaluation of potential factors that may account for the lack of observed impact.

Firstly, it's essential to acknowledge that the absence of a strong correlation between social support and cognitive function in this study does not necessarily negate the potential influence of social networks on cognitive health. It suggests, however, that the relationship may be more complex and not as direct as previously assumed. Several reasons could explain why social support did not emerge as a significant factor in this context. One potential explanation could be the methodological approaches employed in assessing social support and cognitive function. While the measures used were designed to capture the essence of social networks and cognitive health accurately, they may not fully encapsulate the multifaceted nature of these constructs. Social support, for instance, encompasses various dimensions, including emotional, informational, and instrumental support. The tools used to measure social support might not have adequately distinguished between these different types or the quality of social interactions, which could have a differential impact on cognitive function. Furthermore, cognitive function itself is a broad term that covers a range of abilities, such as memory, attention, and executive function. The cognitive tests used in this study may not have been sensitive enough to detect subtle changes or specific aspects of cognitive health that might be more closely related to social support.

Another consideration is the possibility that social support does not directly influence cognitive function but rather affects it through mediating variables not accounted for in this study. For example, social support could indirectly benefit cognitive health by reducing stress, improving mental health, or encouraging healthier lifestyle choices, which in turn support cognitive function. Future research should explore these potential mediating pathways to gain a more comprehensive understanding of how social support might influence cognitive health.

In light of these reflections, future research directions could include a more examination of the types and quality of social support, utilizing measures that can capture the complexity of social interactions and their impact on cognitive health. Additionally, studies could investigate the role of mediating factors in the relationship between social support and cognitive function, which may provide insights into indirect pathways of influence.

In conclusion, this study examined the relationship between caregiving, social support, and cognitive function among older adults. The investigation revealed caregiving's protective effect on cognitive health. Social support indicators showed no significant direct effect, while the quantity of close social ties served as a positive mediator. The analysis also uncovered significant interactions between caregiving status and race/ethnicity, particularly affecting Hispanic caregivers, underlining the need for targeted caregiving support that acknowledges these nuanced relationships. The role of gender in the context of caregiving and cognitive function was not a significant factor in the findings. Neither gender nor racial differences exert their influence on the relationship between social support and cognitive function among older caregivers. Future research should look at other measures of social support and how the effect of them varies by gender and race/ethnicity on cognitive function among older caregivers.

REFERENCES

AARP. 2020, "Caregiving in the United States 2020". (https://www.aarp.org/ppi/info-2020/caregiving-in-the-united-states.html).

AARP Public Policy Institute and National Alliance for Caregiving. 2015. "Caregiving in the Us."

Ajrouch, Kristine J, Toni C Antonucci and Mary R Janevic. 2001. "Social Networks among Blacks and Whites: The Interaction between Race and Age." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 56(2):S112-S18.

Alegría, Margarita, Glorisa Canino, Ruth Ríos, Mildred Vera, José Calderón, Dana Rusch and Alexander N. Ortega. 2002. "Mental Health Care for Latinos: Inequalities in Use of Specialty Mental Health Services among Latinos, African Americans, and Non-Latino Whites." *Psychiatric Services* 53(12):1547-55. doi: 10.1176/appi.ps.53.12.1547.

Alexander, Tatjana and Gabriele Wilz. 2010. "Family Caregivers: Gender Differences in Adjustment to Stroke Survivors' Mental Changes." *Rehabilitation Psychology* 55(2):159.

Allen, Andrew P, Eileen A Curran, Áine Duggan, John F Cryan, Aoife Ní Chorcoráin, Timothy G Dinan, D William Molloy, Patricia M Kearney and Gerard Clarke. 2017. "A Systematic Review of the Psychobiological Burden of Informal Caregiving for Patients with Dementia: Focus on Cognitive and Biological Markers of Chronic Stress." *Neuroscience & Biobehavioral Reviews* 73:123-64.

Alves, Erika Valeska da Costa, Letícia Decimo Flesch, Meire Cachioni, Anita Liberalesso Neri and Samila Sathler Tavares Batistoni. 2018. "The Double Vulnerability of Elderly Caregivers: Multimorbidity and Perceived Burden and Their Associations with Frailty." *Revista Brasileira de Geriatria e Gerontologia* 21.

Andresen, Elena M, Judith A Malmgren, William B Carter and Donald L Patrick. 1994. "Screening for Depression in Well Older Adults: Evaluation of a Short Form of the Ces-D." *American journal of preventive medicine* 10(2):77-84.

Aneshensel, Carol S, Leonard I Pearlin, Joseph T Mullan, Steven H Zarit and Carol J Whitlatch. 1995. *Profiles in Caregiving: The Unexpected Career*: Elsevier.

Aneshensel, Carol S and Uchechi A Mitchell. 2014. "The Stress Process: Its Origins, Evolution, and Future." Pp. 53-74 in *Sociology of Mental Health: Selected Topics from Forty Years 1970s-2010s*: Springer.

Arnsten, Amy F. T. 2009. "Stress Signalling Pathways That Impair Prefrontal Cortex Structure and Function." *Nature Reviews Neuroscience* 10(6):410-22. doi: 10.1038/nrn2648.

Association, Alzheimer's. 2022. "More Than Normal Aging: Understanding Mild Cognitive Impairment." *Alzheimer's Disease Facts and Figures*.

Ayotte, Brian J, Jason C Allaire and Keith E Whitfield. 2013. "Social Support, Physical Functioning, and Cognitive Functioning among Older African American Adults." *Aging, Neuropsychology, and Cognition* 20(4):494-510.

Badana, Adrian N. S., Victoria Marino and William E. Haley. 2017. "Racial Differences in Caregiving: Variation by Relationship Type and Dementia Care Status." *Journal of Aging and Health* 31(6):925-46. doi: 10.1177/0898264317743611.

Badana, Adrian NS, Victoria Marino and William E Haley. 2019. "Racial Differences in Caregiving: Variation by Relationship Type and Dementia Care Status." *Journal of Aging and Health* 31(6):925-46.

Baker, Kevin L and Noelle Robertson. 2008. "Coping with Caring for Someone with Dementia: Reviewing the Literature About Men." *Aging and Mental Health* 12(4):413-22.

Balbim, Guilherme M, Isabela G Marques, Claudia Cortez, Melissa Magallanes, Judith Rocha and David X Marquez. 2019. "Coping Strategies Utilized by Middle-Aged and Older Latino Caregivers of Loved Ones with Alzheimer's Disease and Related Dementia." *Journal of cross-cultural gerontology* 34:355-71.

Baron, Marie, Mylène Riva and Christopher Fletcher. 2019. "The Social Determinants of Healthy Ageing in the Canadian Arctic." *International Journal of Circumpolar Health* 78(1):1630234. doi: 10.1080/22423982.2019.1630234.

Baron, Reuben M and David A Kenny. 1986. "The Moderator–Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations." *Journal of personality and social psychology* 51(6):1173.

Belle, Steven H, Louis Burgio, Robert Burns, David Coon, Sara J Czaja, Dolores Gallagher-Thompson, Laura N Gitlin, Julie Klinger, Kathy Mann Koepke and Chin Chin Lee. 2006. "Enhancing the Quality of Life of Dementia Caregivers from Different Ethnic or Racial Groups: A Randomized, Controlled Trial." *Annals of internal medicine* 145(10):727-38.

Berkman, Lisa F., Thomas Glass, Ian Brissette and Teresa E. Seeman. 2000. "From Social Integration to Health: Durkheim in the New Millennium." *Social Science & Medicine* 51(6):843-57. doi: https://doi.org/10.1016/S0277-9536(00)00065-4.

Bertera, Elizabeth M. 2005. "Mental Health in Us Adults: The Role of Positive Social Support and Social Negativity in Personal Relationships." *Journal of Social and Personal Relationships* 22(1):33-48.

Bertrand, Rosanna M., Jane S. Saczynski, Catherine Mezzacappa, Mallorie Hulse, Kristine Ensrud and Lisa Fredman. 2011. "Caregiving and Cognitive Function in Older Women: Evidence for the Healthy Caregiver Hypothesis." *Journal of Aging and Health* 24(1):48-66. doi: 10.1177/0898264311421367.

Betancourt, Joseph R. 2003. "Cross-Cultural Medical Education: Conceptual Approaches and Frameworks for Evaluation." *Academic Medicine* 78(6):560-69.

Black, Betty S, Deirdre Johnston, Peter V Rabins, Ann Morrison, Constantine Lyketsos and Quincy M Samus. 2013. "Unmet Needs of Community-Residing Persons with Dementia and Their Informal Caregivers: Findings from the Maximizing Independence at Home Study." *Journal of the American Geriatrics Society* 61(12):2087-95.

Bom, Judith, Pieter Bakx, Frederik Schut and Eddy Van Doorslaer. 2019. "The Impact of Informal Caregiving for Older Adults on the Health of Various Types of Caregivers: A Systematic Review." *The Gerontologist* 59(5):e629-e42.

Brown Monique, J. and A. Cohen Steven. 2020. "Informal Caregiving, Poor Mental Health, and Subjective Cognitive Decline: Results from a Population-Based

Sample." *Journal of Gerontological Nursing* 46(12):31-41. doi: 10.3928/00989134-20201106-04.

Bui, Bonnie Khanh Ha. 2020. "The Relationship between Social Network Characteristics and Depressive Symptoms among Older Adults in the United States: Differentiating between Network Structure and Network Function." *Psychogeriatrics* 20(4):458-68. doi: https://doi.org/10.1111/psyg.12530.

Calasanti, Toni and Mary Elizabeth Bowen. 2006. "Spousal Caregiving and Crossing Gender Boundaries: Maintaining Gendered Identities." *Journal of Aging Studies* 20(3):253-63.

Calasanti, Toni. 2010. "Gender Relations and Applied Research on Aging." *The Gerontologist* 50(6):720-34. doi: 10.1093/geront/gnq085.

Campbell, Karen E, Peter V Marsden and Jeanne S Hurlbert. 1986. "Social Resources and Socioeconomic Status." *Social networks* 8(1):97-117.

Chappell, Neena L, Carren Dujela and André Smith. 2015. "Caregiver Well-Being: Intersections of Relationship and Gender." *Research on Aging* 37(6):623-45.

Cloutier, Simon, Howard Chertkow, Marie-Jeanne Kergoat, Serge Gauthier and Sylvie Belleville. 2015. "Patterns of Cognitive Decline Prior to Dementia in Persons with Mild Cognitive Impairment." *Journal of Alzheimer's disease* 47(4):901-13.

Coe, Norma B. and Rachel M. Werner. 2022. "Informal Caregivers Provide Considerable Front-Line Support in Residential Care Facilities and Nursing Homes." *Health Affairs* 41(1):105-11. doi: 10.1377/hlthaff.2021.01239.

Cohen, Sheldon and Thomas A Wills. 1985. "Stress, Social Support, and the Buffering Hypothesis." *Psychological Bulletin* 98(2):310.

Cohen, Sheldon. 1992. "Stress, Social Support, and Disorder." *The meaning and measurement of social support* 109:124.

Cohen, Sheldon. 2004. "Social Relationships and Health." *American psychologist* 59(8):676.

Cohen, Steven A., Natalie J. Sabik, Sarah K. Cook, Ariana B. Azzoli and Carolyn A. Mendez-Luck. 2019. "Differences within Differences: Gender Inequalities in Caregiving Intensity Vary by Race and Ethnicity in Informal Caregivers." *Journal of cross-cultural gerontology* 34(3):245-63. doi: 10.1007/s10823-019-09381-9.

Cook, Sarah K, Lauren Snellings and Steven A Cohen. 2018. "Socioeconomic and Demographic Factors Modify Observed Relationship between Caregiving Intensity and Three Dimensions of Quality of Life in Informal Adult Children Caregivers." *Health and quality of life outcomes* 16:1-12.

Corrêa, Márcio Silveira, Daiane Borba de Lima, Bruno Lima Giacobbo, Kelem Vedovelli, Irani Iracema de Lima Argimon and Elke Bromberg. 2019. "Mental Health in Familial Caregivers of Alzheimer’s Disease Patients: Are the Effects of Chronic Stress on Cognition Inevitable?". *Stress* 22(1):83-92. doi: 10.1080/10253890.2018.1510485.

Cothran, Fawn A., Emily Chang, Laurel Beckett, Julie T. Bidwell, Candice A. Price and Dolores Gallagher-Thompson. 2021. "A Landscape of Subjective and Objective Stress in African-American Dementia Family Caregivers." *Western Journal of Nursing Research* 44(3):239-49. doi: 10.1177/01939459211062956.

Crist, Janice D, Marylyn Morris McEwen, Angelica P Herrera, Suk-Sun Kim, Alice Pasvogel and Joseph T Hepworth. 2009. "Caregiving Burden, Acculturation, Familism, and Mexican American Elders' Use of Home Care Services." *Research and Theory for Nursing Practice* 23(3):165-80.

Crist, Janice D and Patricia Speaks. 2011. "Keeping It in the Family: When Mexican American Older Adults Choose Not to Use Home Healthcare Services." *Home Healthcare Now* 29(5):282-90.

Cudjoe, Thomas KM, David L Roth, Sarah L Szanton, Jennifer L Wolff, Cynthia M Boyd and Roland J Thorpe Jr. 2020. "The Epidemiology of Social Isolation: National Health and Aging Trends Study." *The Journals of Gerontology: Series B* 75(1):107-13.

Cutrona, Carolyn E and Julie A Suhr. 1992. "Controllability of Stressful Events and Satisfaction with Spouse Support Behaviors." *Communication research* 19(2):154-74.

Dassel, Kara Bottiggi, Dawn C Carr and Peter Vitaliano. 2017. "Does Caring for a Spouse with Dementia Accelerate Cognitive Decline? Findings from the Health and Retirement Study." *The Gerontologist* 57(2):319-28.

De Vugt, Marjolein E, Jelle Jolles, Liesbeth Van Osch, Fred Stevens, Pauline Aalten, Richel Lousberg and Frans RJ Verhey. 2006. "Cognitive Functioning in Spousal Caregivers of Dementia Patients: Findings from the Prospective Maasbed Study." *Age and Ageing* 35(2):160-66.

del-Pino-Casado, Rafael, Antonio Frías-Osuna, Pedro A Palomino-Moral, María Ruzafa-Martínez and Antonio J Ramos-Morcillo. 2018. "Social Support and Subjective Burden in Caregivers of Adults and Older Adults: A Meta-Analysis." *PLoS One* 13(1):e0189874.

del‑Pino‑Casado, Rafael, Antonio Frías‑Osuna, Pedro A Palomino‑Moral and José Ramón Martínez‑Riera. 2012. "Gender Differences Regarding Informal Caregivers of Older People." *Journal of nursing scholarship* 44(4):349-57.

Delfino, Lais L, Ricardo S Komatsu, Caroline Komatsu, Anita L Neri and Meire Cachioni. 2018. "Path Analysis of Caregiver Characteristics and Neuropsychiatric Symptoms in Alzheimer's Disease Patients." *Geriatrics & gerontology international* 18(8):1177-82.

Díaz, Marisol, Ana Estévez, Janire Momeñe and Nagore Ozerinjauregi. 2019. "Social Support in the Relationship between Perceived Informal Caregiver Burden and General Health of Female Caregivers." *Ansiedad y Estrés* 25(1):20-27.

Dickinson, Whitney J, Guy G Potter, Celia F Hybels, Douglas R McQuoid and David C Steffens. 2011. "Change in Stress and Social Support as Predictors of Cognitive Decline in Older Adults with and without Depression." *International journal of geriatric psychiatry* 26(12):1267-74.

Dilworth-Anderson, Peggye, Ishan Canty Williams and Brent E Gibson. 2002. "Issues of Race, Ethnicity, and Culture in Caregiving Research: A 20-Year Review (1980–2000)." *The Gerontologist* 42(2):237-72.

Do, Elizabeth K., Steven A. Cohen and Monique J. Brown. 2014. "Socioeconomic and Demographic Factors Modify the Association between Informal Caregiving and Health in the Sandwich Generation." *BMC public health* 14(1):362. doi: 10.1186/1471-2458-14-362.

Edwards, Valerie J, Lynda A Anderson, William W Thompson and Angela J Deokar. 2017. "Mental Health Differences between Men and Women Caregivers, Brfss 2009." *Journal of Women & Aging* 29(5):385-91.

Ejem, Deborah, Shawn Bauldry, Marie Bakitas and Patricia Drentea. 2018. "Caregiver Burden, Care Recipient Depressive Symptomology, and Social Exchange: Does Race Matter?". *Journal of Palliative Care* 33(2):100-08.

Elayoubi, Joanne, Monica E Nelson, Christina X Mu, William E Haley, Virginia G Wadley, Olivio J Clay, Michael Crowe, Mary Cushman, Joan S Grant and David L Roth. 2023. "The Role of Caregiving in Cognitive Function and Change: The Regards Study." *Psychology and aging* 38(7):712–24. doi: https://doi.org/10.1037/pag0000766.

Ellwardt, Lea, Marja Aartsen, Dorly Deeg and Nardi Steverink. 2013. "Does Loneliness Mediate the Relation between Social Support and Cognitive Functioning in Later Life?". *Social Science & Medicine* 98:116-24.

Ervin, Jennifer, Yamna Taouk, Ludmila Fleitas Alfonzo, Tessa Peasgood and Tania King. 2022. "Longitudinal Association between Informal Unpaid Caregiving and Mental Health Amongst Working Age Adults in High-Income Oecd Countries: A Systematic Review." *eClinicalMedicine* 53:101711. doi: https://doi.org/10.1016/j.eclinm.2022.101711.

Fabius, Chanee D, Jennifer L Wolff and Judith D Kasper. 2020. "Race Differences in Characteristics and Experiences of Black and White Caregivers of Older Americans." *The Gerontologist* 60(7):1244-53.

Fink, Regina M, Korijna G Valenti, Danielle M Kline and Stacy M Fischer. 2023. "Reality of Family Caregiving for Hispanics with Alzheimer's Disease and Related Dementias: A Qualitative Analysis." *Journal of palliative medicine*.

Fischer, Claude S and Lauren Beresford. 2015. "Changes in Support Networks in Late Middle Age: The Extension of Gender and Educational Differences." *Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 70(1):123-31.

Fisher, Gwenith G., Marisol Chacon and Dorey S. Chaffee. 2019. "Chapter 2 - Theories of Cognitive Aging and Work." Pp. 17-45 in *Work across the Lifespan*, edited by B. B. Baltes, C. W. Rudolph and H. Zacher: Academic Press.

Guedes, MBOG, KC Lima, CP Caldas and RP Veras. 2017. "Social Support and Comprehensive Health Care for the Elderly." *Physis* 27(4):1185-204.

Guo, Man, Sohyun Kim and XinQi Dong. 2019. "Sense of Filial Obligation and Caregiving Burdens among Chinese Immigrants in the United States." *Journal of the American Geriatrics Society* 67(S3):S564-S70.

Hale, Jo Mhairi, Daniel C Schneider, Neil K Mehta and Mikko Myrskylä. 2020. "Cognitive Impairment in the Us: Lifetime Risk, Age at Onset, and Years Impaired." *SSM-Population Health* 11:100577.

Holt-Lunstad, Julianne. 2018. "Why Social Relationships Are Important for Physical Health: A Systems Approach to Understanding and Modifying Risk and Protection." *Annual Review of Psychology* 69:437-58.

Hong, Sung-chull and Constance L Coogle. 2016. "Spousal Caregiving for Partners with Dementia: A Deductive Literature Review Testing Calasanti’s Gendered View of Care Work." *Journal of Applied Gerontology* 35(7):759-87.

James, Bryan D., Robert S. Wilson, Lisa L. Barnes and David A. Bennett. 2011. "Late-Life Social Activity and Cognitive Decline in Old Age." *Journal of the International Neuropsychological Society* 17(6):998-1005. doi: 10.1017/S1355617711000531.

Jawahir, Suhana, Ee Hong Tan, Yeung R’ong Tan, Sarah Nurain Mohd Noh and Iqbal Ab Rahim. 2021. "The Impacts of Caregiving Intensity on Informal Caregivers in Malaysia: Findings from a National Survey." *BMC Health Services Research* 21(1):391. doi: 10.1186/s12913-021-06412-5.

Jekel, Katrin, Marinella Damian, Carina Wattmo, Lucrezia Hausner, Roger Bullock, Peter J Connelly, Bruno Dubois, Maria Eriksdotter, Michael Ewers and Elmar Graessel. 2015. "Mild Cognitive Impairment and Deficits in Instrumental Activities of Daily Living: A Systematic Review." *Alzheimer's Research & Therapy* 7(1):1-20.

Johnson Jr, James H and Stephen J Appold. 2017a. "Us Older Adults: Demographics, Living Arrangements, and Barriers to Aging in Place." *Kenan Institute*, pp. 1-29.

Johnson Jr, James H and Stephen J Appold. 2017b. "Us Older Adults: Demographics, Living Arrangements, and Barriers to Aging in Place." *Kenan Institute*.

Kaschowitz, Judith and Martina Brandt. 2017. "Health Effects of Informal Caregiving across Europe: A Longitudinal Approach." *Social Science & Medicine* 173:72-80.

Kennedy, Gregory E. 1990. "College Students' Expectations of Grandparent and Grandchild Role Behaviors." *The Gerontologist* 30(1):43-48.

Kent, Erin E, Michelle A Mollica, J Nicholas Dionne-Odom, Rebecca A Ferrer, Roxanne E Jensen, Katherine A Ornstein and Ashley Wilder Smith. 2020. "Effect of

Instrumental Support on Distress among Family Caregivers: Findings from a Nationally Representative Study." *Palliative & Supportive Care* 18(5):519-27.

Klein, Laura Cousino, Kyungmin Kim, David M Almeida, Elia E Femia, Michael J Rovine and Steven H Zarit. 2016. "Anticipating an Easier Day: Effects of Adult Day Services on Daily Cortisol and Stress." *The Gerontologist* 56(2):303-12.

Kramer, Betty J and Edward H Thompson Jr. 2001. *Men as Caregivers: Theory, Research, and Service Implications*, Vol. 13: Springer Publishing Company.

Kruithof, Willeke J, Marcel WM Post, Maria L van Mierlo, Geertrudis AM van den Bos, Janneke M de Man-van Ginkel and Johanna MA Visser-Meily. 2016. "Caregiver Burden and Emotional Problems in Partners of Stroke Patients at Two Months and One Year Post-Stroke: Determinants and Prediction." *Patient education and counseling* 99(10):1632-40.

Kuiper, Jisca S, Marij Zuidersma, Richard C Oude Voshaar, Sytse U Zuidema, Edwin R van den Heuvel, Ronald P Stolk and Nynke Smidt. 2015. "Social Relationships and Risk of Dementia: A Systematic Review and Meta-Analysis of Longitudinal Cohort Studies." *Ageing Research Reviews* 22:39-57.

Kuiper, Jisca S., Marij Zuidersma, Richard C. Oude Voshaar, Sytse U. Zuidema, Edwin R. van den Heuvel, Ronald P. Stolk and Nynke Smidt. 2015. "Social Relationships and Risk of Dementia: A Systematic Review and Meta-Analysis of Longitudinal Cohort Studies." *Ageing Research Reviews* 22:39-57. doi: https://doi.org/10.1016/j.arr.2015.04.006.

Laslett, Peter. 1991. *A Fresh Map of Life: The Emergence of the Third Age*: Harvard University Press.

Latham-Mintus, Kenzie, Ashley Vowels and Kyle Huskins. 2018. "Healthy Aging among Older Black and White Men: What Is the Role of Mastery?". *The Journals of Gerontology: Series B* 73(2):248-57. doi: 10.1093/geronb/gbx105.

Le, Duc Dung and Yoko Ibuka. 2023. "Understanding the Effects of Informal Caregiving on Health and Well-Being: Heterogeneity and Mechanisms." *Social Science & Medicine* 317:115630. doi: https://doi.org/10.1016/j.socscimed.2022.115630.

Lee, Yeonjung and Fengyan Tang. 2015. "More Caregiving, Less Working: Caregiving Roles and Gender Difference." *Journal of Applied Gerontology* 34(4):465-83.

Lee, Yeonjung and Lun Li. 2022. "Evaluating the Positive Experience of Caregiving: A Systematic Review of the Positive Aspects of Caregiving Scale." *The Gerontologist* 62(9):e493-e507. doi: 10.1093/geront/gnab092.

Lièvre, Agnès, Dawn Alley and Eileen M. Crimmins. 2008. "Educational Differentials in Life Expectancy with Cognitive Impairment among the Elderly in the United States." *Journal of Aging and Health* 20(4):456-77. doi: 10.1177/0898264308315857.

Lillie-Blanton, Marsha, Mollyann Brodie, Diane Rowland, Drew Altman and Mary McIntosh. 2000. "Race, Ethnicity, and the Health Care System: Public Perceptions and Experiences." *Medical care research and review* 57(1_suppl):218-35.

Lin, Nan. 1982. "Social Ressources and Instrumental Action." *Marsden et N. Lin (éds.). Social Structure and Network Analysis. Beverly Hills: Sage*.

Lin, Zhiyong and Haoshu Duan. 2022. "Caring for Parents and in-Laws in China: Implications for Cognitive Functioning of Adult Child Caregivers." *Innovation in Aging* 6(Suppl 1):694.

Litzelman, Kristin, Danielle Blanch-Hartigan, Chun Cheih Lin and Xuesong Han. 2017. "Correlates of the Positive Psychological Byproducts of Cancer: Role of Family Caregivers and Informational Support." *Palliative & Supportive Care* 15(6):693-703. doi: 10.1017/S1478951517000050.

Liu, Chelsea, Adrian NS Badana, Julia Burgdorf, Chanee D Fabius, David L Roth and William E Haley. 2021. "Systematic Review and Meta-Analysis of Racial and Ethnic Differences in Dementia Caregivers' Well-Being." *The Gerontologist* 61(5):e228-e43.

Lopez–Anuarbe, Monika and Priya Kohli. 2019. "Understanding Male Caregivers' Emotional, Financial, and Physical Burden in the United States." Pp. 72 in *Healthcare*, Vol. 7: MDPI.

Luchesi, Bruna Moretti, Tiago da Silva Alexandre, Nathalia Alves de Oliveira, Allan Gustavo Brigola, Luciana Kusumota, Sofia Cristina Iost Pavarini and Sueli Marques. 2016. "Factors Associated with Attitudes toward the Elderly in a Sample of Elderly Caregivers." *International Psychogeriatrics* 28(12):2079-89.

Lupien, Sonia J, Bruce S McEwen, Megan R Gunnar and Christine Heim. 2009. "Effects of Stress Throughout the Lifespan on the Brain, Behaviour and Cognition." *Nature Reviews Neuroscience* 10(6):434-45.

Lupien, Sonia J., Robert-Paul Juster, Catherine Raymond and Marie-France Marin. 2018. "The Effects of Chronic Stress on the Human Brain: From Neurotoxicity, to

Vulnerability, to Opportunity." *Frontiers in Neuroendocrinology* 49:91-105. doi: https://doi.org/10.1016/j.yfrne.2018.02.001.

Lyyra, Tiina-Mari and Riitta-Liisa Heikkinen. 2006. "Perceived Social Support and Mortality in Older People." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 61(3):S147-S52.

Mackenzie, Corey S., Ursula J. Wiprzycka, Lynn Hasher and David Goldstein. 2009. "Associations between Psychological Distress, Learning, and Memory in Spouse Caregivers of Older Adults." *The Journals of Gerontology: Series B* 64B(6):742-46. doi: 10.1093/geronb/gbp076.

Mallya, Sasha and Alexandra J. Fiocco. 2018. "Impact of Informal Caregiving on Cognitive Function and Well-Being in Canada." *International Psychogeriatrics* 30(7):1049-55. doi: 10.1017/S1041610217002605.

Marino, Victoria R, William E Haley and David L Roth. 2017. "Beyond Hedonia: A Theoretical Reframing of Caregiver Well-Being." *Translational Issues in Psychological Science* 3(4):400.

Marshall, Amanda C., Nicholas R. Cooper, Rebecca Segrave and Nicolas Geeraert. 2015. "The Effects of Long-Term Stress Exposure on Aging Cognition: A behavioral and Eeg Investigation." *Neurobiology of aging* 36(6):2136-44. doi: https://doi.org/10.1016/j.neurobiolaging.2015.02.026.

Mausbach, Brent T, Elizabeth A Chattillion, Raeanne C Moore, Susan K Roepke, Colin A Depp and Scott Roesch. 2011. "Activity Restriction and Depression in Medical Patients and Their Caregivers: A Meta-Analysis." *Clinical Psychology Review* 31(6):900-08.

Mc Donnell, Eilis and Assumpta Ryan. 2013. "Male Caregiving in Dementia: A Review and Commentary." *Dementia* 12(2):238-50.

McDonald, Steve and Christine A Mair. 2010. "Social Capital across the Life Course: Age and Gendered Patterns of Network Resources 1." Pp. 335-59 in *Sociological Forum*, Vol. 25: Wiley Online Library.

McEwen, Bruce S. 1998. "Stress, Adaptation, and Disease: Allostasis and Allostatic Load." *Annals of the new York Academy of Sciences* 840(1):33-44.

Mehri, Nader, Jennifer Kinney, Scott Brown and Mahdie Rajabi Rostami. 2019. "Informal Caregiving and All-Cause Mortality: A Meta-Analysis of Longitudinal Population-Based Studies." *Journal of Applied Gerontology* 40(7):781-91. doi: 10.1177/0733464819893603.

Meyer, Madonna Harrington and Amra Kandic. 2017a. "Grandparenting in the United States." *Innovation in Aging* 1(2):igx023.

Meyer, Madonna Harrington and Amra Kandic. 2017b. "Grandparenting in the United States." *Innovation in Aging* 1(2). doi: 10.1093/geroni/igx023.

Meyer, Oanh L, Kim Hanh Nguyen, To Nhu Dao, Phuoc Vu, Patricia Arean and Ladson Hinton. 2015. "The Sociocultural Context of Caregiving Experiences for Vietnamese Dementia Family Caregivers." *Asian American Journal of Psychology* 6(3):263.

Miller, LS, MS Lewis, GM Williamson, CE Lance, WK Dooley, R Schulz and MF Weiner. 2006. "Caregiver Cognitive Status and Potentially Harmful Caregiver Behavior." *Aging and Mental Health* 10(2):125-33.

Miyawaki, Christina E. 2015. "Association of Social Isolation and Health across Different Racial and Ethnic Groups of Older Americans." *Ageing & Society* 35(10):2201-28.

Montgomery, Rhonda and Karl Kosloski. 2009. "Caregiving as a Process of Changing Identity: Implications for Caregiver Support." *Generations* 33(1):47-52.

Morgenstern, Lewis B, Cecilia N Hollenhorst, Linda C Gallo, Chia-Wei Hsu, Sehee Kim, River Gibbs, Erin Case and Lynda D Lisabeth. 2021. "Ethnic Differences in Informal Caregiving after Stroke." *Stroke* 52(12):3938-43.

Muller, Dominique, Charles M Judd and Vincent Y Yzerbyt. 2005. "When Moderation Is Mediated and Mediation Is Moderated." *Journal of personality and social psychology* 89(6):852.

Nageswaran, Savithri, Margaret B Ellis and Mark S Beveridge. 2021. "Communication Challenges Faced by Spanish-Speaking Caregivers of Children with Medical Complexity: A Qualitative Study." *Journal of Racial and Ethnic Health Disparities*:1-9.

Nicholas, Lauren Hersch, Kenneth M Langa, Julie PW Bynum and Joanne W Hsu. 2021. "Financial Presentation of Alzheimer Disease and Related Dementias." *JAMA Internal Medicine* 181(2):220-27.

Ofstedal, Mary Beth, Gwenith G Fisher and A Regula Herzog. 2005. "Documentation of Cognitive Functioning Measures in the Health and Retirement Study." *Ann Arbor, MI: University of Michigan* 10:1114577250.662476251-381895763.662476251.

Oken, Barry S, Irina Fonareva and Helane Wahbeh. 2011. "Stress-Related Cognitive Dysfunction in Dementia Caregivers." *Journal of geriatric psychiatry and neurology* 24(4):191-98.

Ong, Hui Lin, Janhavi Ajit Vaingankar, Edimansyah Abdin, Rajeswari Sambasivam, Restria Fauziana, Min-En Tan, Siow Ann Chong, Richard Roshan Goveas, Peak Chiang Chiam and Mythily Subramaniam. 2018. "Resilience and Burden in Caregivers of Older Adults: Moderating and Mediating Effects of Perceived Social Support." *BMC Psychiatry* 18(1):1-9.

Pais, Ricardo, Luís Ruano, Ofélia P. Carvalho and Henrique Barros. 2020. "Global Cognitive Impairment Prevalence and Incidence in Community Dwelling Older Adults—a Systematic Review." *Geriatrics* 5(4):84.

Park, Sojung, BoRin Kim, Takashi Amano and Qingru Chen. 2019. "Home Environment, Living Alone, and Trajectories of Cognitive Function among Older Adults with Functional Limitations." *Environment and Behavior* 53(3):252-76. doi: 10.1177/0013916519879772.

Pavalko, Eliza K. and Joseph D. Wolfe. 2016. "Do Women Still Care? Cohort Changes in Us Women's Care for the Ill or Disabled." *Social Forces* 94(3):1359-84. doi: 10.1093/sf/sov101.

Pavarini, Sofia Cristina Iost, Ana Carolina Ottaviani, Allan Gustavo Bregola, Francisco J Fraga, Marcos Hortes Nisihara Chagas, Nathalia Alves de Oliveira and Tábatta Renata Pereira de Brito. 2021. "Association between Perceived Social Support and Better Cognitive Performance among Caregivers and Non-Caregivers." *Revista brasileira de enfermagem* 74.

Pearlin, L. I., J. T. Mullan, S. J. Semple and M. M. Skaff. 1990a. "Caregiving and the Stress Process: An Overview of Concepts and Their Measures." *Gerontologist* 30(5):583-94. doi: 10.1093/geront/30.5.583.

Pearlin, Leonard I, Elizabeth G Menaghan, Morton A Lieberman and Joseph T Mullan. 1981. "The Stress Process." *Journal of Health and Social Behavior*:337-56.

Pearlin, Leonard I and Carol S Aneshensel. 1994. "Caregiving: The Unexpected Career." *Social Justice Research* 7:373-90.

Pearlin, Leonard I., Joseph T. Mullan, Shirley J. Semple and Marilyn M. Skaff. 1990b. "Caregiving and the Stress Process: An Overview of Concepts and Their Measures1." *The Gerontologist* 30(5):583-94. doi: 10.1093/geront/30.5.583.

Penner, Louis A, John F Dovidio, Tessa V West, Samuel L Gaertner, Terrance L Albrecht, Rhonda K Dailey and Tsveti Markova. 2010. "Aversive Racism and Medical Interactions with Black Patients: A Field Study." *Journal of Experimental Social Psychology* 46(2):436-40.

Penning, Margaret J and Zheng Wu. 2016. "Caregiver Stress and Mental Health: Impact of Caregiving Relationship and Gender." *The Gerontologist* 56(6):1102-13.

Penwell, Lauren M and Kevin T Larkin. 2010. "Social Support and Risk for Cardiovascular Disease and Cancer: A Qualitative Review Examining the Role of Inflammatory Processes." *Health Psychology Review* 4(1):42-55.

Pertl, Maria M, Caoimhe Hannigan, Sabina Brennan, Ian H Robertson and Brian A Lawlor. 2017. "Cognitive Reserve and Self-Efficacy as Moderators of the Relationship between Stress Exposure and Executive Functioning among Spousal Dementia Caregivers." *International Psychogeriatrics* 29(4):615-25.

Pickard, Joseph G and M Denise King. 2011. "African American Caregivers Finding Resilience through Faith." *Resilience in Aging: Concepts, Research, and Outcomes*:261-71.

Pickard, Joseph G, John-Paul R Witt and Gina T Aitch. 2018. "Resilience and Faith of African American Caregivers." *Resilience in Aging: Concepts, Research, and Outcomes*:281-95.

Piedra, Lissette M, Melissa JK Howe, John Francis, Yadira Montoya and Melissa Gutwein. 2022. "Latinos and the Pandemic: Results from the National Social Life, Health, and Aging Project—Covid-19 Study." *Journal of Applied Gerontology* 41(5):1465-72.

Pillemer, Sarah C and Roee Holtzer. 2016. "The Differential Relationships of Dimensions of Perceived Social Support with Cognitive Function among Older Adults." *Aging & Mental Health* 20(7):727-35.

Pinquart, Martin and Silvia Sörensen. 2003. "Differences between Caregivers and Noncaregivers in Psychological Health and Physical Health: A Meta-Analysis." *Psychology and aging* 18(2):250.

Pinquart, Martin and Silvia Sörensen. 2005. "Ethnic Differences in Stressors, Resources, and Psychological Outcomes of Family Caregiving: A Meta-Analysis." *The Gerontologist* 45(1):90-106. doi: 10.1093/geront/45.1.90.

Pinquart, Martin and Silvia Sörensen. 2006. "Gender Differences in Caregiver Stressors, Social Resources, and Health: An Updated Meta-Analysis." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 61(1):P33-P45.

Preacher, Kristopher J., Derek D. Rucker and Andrew F. Hayes. 2007. "Addressing Moderated Mediation Hypotheses: Theory, Methods, and Prescriptions." *Multivariate Behavioral Research* 42(1):185-227. doi: 10.1080/00273170701341316.

Quinn, Catherine and Gill Toms. 2019. "Influence of Positive Aspects of Dementia Caregiving on Caregivers' Well-Being: A Systematic Review." *The Gerontologist* 59(5):e584-e96. doi: 10.1093/geront/gny168.

Rios, Brittany L. 2017. "Barriers to Healthcare in the Hispanic Population of Dekalb County: A Healthcare Provider Perspective."

Robertson, Deirdre A., George M. Savva and Rose Anne Kenny. 2013. "Frailty and Cognitive Impairment—a Review of the Evidence and Causal Mechanisms." *Ageing Research Reviews* 12(4):840-51. doi: https://doi.org/10.1016/j.arr.2013.06.004.

Robinson, Carole A, Joan L Bottorff, Barbara Pesut, John L Oliffe and Jamie Tomlinson. 2014. "The Male Face of Caregiving: A Scoping Review of Men Caring for a Person with Dementia." *American journal of men's health* 8(5):409-26.

Robinson-Lane, Sheria G, Xingyu Zhang and Armaan Patel. 2021. "Coping and Adaptation to Dementia Family Caregiving: A Pilot Study." *Geriatric Nursing* 42(1):256-61.

Rote, Sunshine M. and Heehyul Moon. 2018. "Racial/Ethnic Differences in Caregiving Frequency: Does Immigrant Status Matter?". *The Journals of Gerontology: Series B* 73(6):1088-98. doi: 10.1093/geronb/gbw106.

Roth, David L, Peggye Dilworth-Anderson, Jin Huang, Alden L Gross and Laura N Gitlin. 2015. "Positive Aspects of Family Caregiving for Dementia: Differential Item Functioning by Race." *Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 70(6):813-19.

Roth, David L, Stephanie L Brown, J David Rhodes and William E Haley. 2018. "Reduced Mortality Rates among Caregivers: Does Family Caregiving Provide a Stress-Buffering Effect?". *Psychology and aging* 33(4):619.

Roth, David L., William E. Haley, Martha Hovater, Martinique Perkins, Virginia G. Wadley and Suzanne Judd. 2013. "Family Caregiving and All-Cause Mortality: Findings from a Population-Based Propensity-Matched Analysis." *American Journal of Epidemiology* 178(10):1571-78. doi: 10.1093/aje/kwt225.

Russell, Richard. 2007. "The Work of Elderly Men Caregivers: From Public Careers to an Unseen World." *Men and masculinities* 9(3):298-314.

Savla, Jyoti, Karen A. Roberto, Rosemary Blieszner, Matthew Cox and Frank Gwazdauskas. 2011. "Effects of Daily Stressors on the Psychological and Biological Well-Being of Spouses of Persons with Mild Cognitive Impairment." *The Journals of Gerontology: Series B* 66B(6):653-64. doi: 10.1093/geronb/gbr041.

Scerri, Charles. 2014. "The Curvy Side of Dementia: The Impact of Gender on Prevalence and Caregiving."

Schulz, Richard and Paula R Sherwood. 2008. "Physical and Mental Health Effects of Family Caregiving." *Journal of Social Work Education* 44(sup3):105-13.

Seeman, Teresa E, Tina M Lusignolo, Marilyn Albert and Lisa Berkman. 2001. "Social Relationships, Social Support, and Patterns of Cognitive Aging in Healthy, High-Functioning Older Adults: Macarthur Studies of Successful Aging." *Health Psychology* 20(4):243.

Serra, Laura and Francesca Gelfo. 2019. "What Good Is the Reserve? A Translational Perspective for the Managing of Cognitive Decline." *Neural Regeneration Research* 14(7):1219.

Sharma, N., S. Chakrabarti and S. Grover. 2016. "Gender Differences in Caregiving among Family - Caregivers of People with Mental Illnesses." *World J Psychiatry* 6(1):7-17. doi: 10.5498/wjp.v6.i1.7.

Shumaker, Sally A and Arlene Brownell. 1984. "Toward a Theory of Social Support: Closing Conceptual Gaps." *Journal of social issues* 40(4):11-36.

Sibalija, J., M. Y. Savundranayagam, J. B. Orange and M. Kloseck. 2017. "Social Support, Social Participation and Depression among Caregivers and Non-Caregivers in Canada." *Innovation in Aging* 1(suppl_1):1206-06. doi: 10.1093/geroni/igx004.4387.

Sims, Regina C, Megan Hosey, Shellie-Anne Levy, Keith E Whitfield, Leslie I Katzel and Shari R Waldstein. 2014. "Distinct Functions of Social Support and Cognitive Function among Older Adults." *Experimental aging research* 40(1):40-59.

Sneed, R. S. and R. Schulz. 2019. "Grandparent Caregiving, Race, and Cognitive Functioning in a Population-Based Sample of Older Adults." *J Aging Health* 31(3):415-38. doi: 10.1177/0898264317733362.

St Clair, Patricia, Darlene Blake, Delia Bugliari, Sandy Chien, Orla Hayden, Michael Hurd, Serhii Ilchuk, Fuan-Yue Kung, Angela Miu and Constantijn Panis. 2011. "Rand Hrs Data Documentation, Version J." *RAND Center for the Study of Aging*.

Stern, Yaakov, Gene E Alexander, Isak Prohovnik and Richard Mayeux. 1992. "Inverse Relationship between Education and Parietotemporal Perfusion Deficit in Alzheimer's Disease." *Annals of Neurology: Official Journal of the American Neurological Association and the Child Neurology Society* 32(3):371-75.

Stern, Yaakov. 2009. "Cognitive Reserve." *Neuropsychologia* 47(10):2015-28.

Stewart, Norma J, Debra G Morgan, Chandima P Karunanayake, Joseph P Wickenhauser, Allison Cammer, Duane Minish, Megan E O'Connell and Leslie A Hayduk. 2016. "Rural Caregivers for a Family Member with Dementia: Models of Burden and Distress Differ for Women and Men." *Journal of Applied Gerontology* 35(2):150-78.

Su, Qing. 2023. "Impact of Caregiving on Cognitive Functioning: Evidence from the China Health and Retirement Longitudinal Study." *The Journals of Gerontology: Series B*:gbad090. doi: 10.1093/geronb/gbad090.

Taylor, Robert Joseph, Linda M Chatters and Jeff Levin. 2003. *Religion in the Lives of African Americans: Social, Psychological, and Health Perspectives*: Sage Publications.

Theodoropoulos, Nicholas, Hui Xie, Qian Wang, Yannan Li and Chi Wen. 2022. "Financial Stress and Burden among Caregivers of Cancer Survivors in the United States." *Journal of Clinical Oncology* 40(16_suppl):12027-27. doi: 10.1200/JCO.2022.40.16_suppl.12027.

Thoits, Peggy A. 1995. "Stress, Coping, and Social Support Processes: Where Are We? What Next?". *Journal of Health and Social Behavior*:53-79.

Thoits, Peggy A. 2011. "Mechanisms Linking Social Ties and Support to Physical and Mental Health." *Journal of Health and Social Behavior* 52(2):145-61.

Trivedi, Ranak, Kristine Beaver, Erin D. Bouldin, Evercita Eugenio, Steven B. Zeliadt, Karin Nelson, Ann-Marie Rosland, Jackie G. Szarka and John D. Piette. 2013. "Characteristics and Well-Being of Informal Caregivers: Results from a Nationally-Representative Us Survey." *Chronic Illness* 10(3):167-79. doi: 10.1177/1742395313506947.

Trivedi, Ranak, Kristine Beaver, Erin D Bouldin, Evercita Eugenio, Steven B Zeliadt, Karin Nelson, Ann-Marie Rosland, Jackie G Szarka and John D Piette. 2014. "Characteristics and Well-Being of Informal Caregivers: Results from a Nationally-Representative Us Survey." *Chronic Illness* 10(3):167-79.

Uccheddu, Damiano, Anne H. Gauthier, Nardi Steverink and Tom Emery. 2019. "The Pains and Reliefs of the Transitions into and out of Spousal Caregiving. A Cross-National Comparison of the Health Consequences of Caregiving by Gender." *Social Science & Medicine* 240:112517. doi: https://doi.org/10.1016/j.socscimed.2019.112517.

Uchino, Bert N. 2004. *Social Support and Physical Health: Understanding the Health Consequences of Relationships*: Yale university press.

Uchino, Bert N. 2006. "Social Support and Health: A Review of Physiological Processes Potentially Underlying Links to Disease Outcomes." *Journal of behavioral medicine* 29:377-87.

Vitaliano, Peter P, Jianping Zhang, Heather M Young, Lisa W Caswell, James M Scanlan and Diana Echeverria. 2009. "Depressed Mood Mediates Decline in Cognitive Processing Speed in Caregivers." *The Gerontologist* 49(1):12-22.

Vitaliano, Peter P, Ozge Ustundag and Soo Borson. 2017. "Objective and Subjective Cognitive Problems among Caregivers and Matched Non-Caregivers." *The Gerontologist* 57(4):637-47.

von Känel, Roland. 2012. "Psychosocial Stress and Cardiovascular Risk–Current Opinion." *Swiss Medical Weekly* 142(0304):w13502-w02.

Wang, Xingmin. 2014. "Subjective Well-Being Associated with Size of Social Network and Social Support of Elderly." *Journal of Health Psychology* 21(6):1037-42. doi: 10.1177/1359105314544136.

Wellman, Barry and Scot Wortley. 1990. "Different Strokes from Different Folks: Community Ties and Social Support." *American Journal of Sociology* 96(3):558-88. doi: 10.1086/229572.

Wolff, Jennifer L, Brenda C Spillman, Vicki A Freedman and Judith D Kasper. 2016. "A National Profile of Family and Unpaid Caregivers Who Assist Older Adults with Health Care Activities." *JAMA Internal Medicine* 176(3):372-79.

Wolff, Jennifer L., John Mulcahy, Jin Huang, David L. Roth, Kenneth Covinsky and Judith D. Kasper. 2018. "Family Caregivers of Older Adults, 1999–2015: Trends in Characteristics, Circumstances, and Role-Related Appraisal." *The Gerontologist* 58(6):1021-32. doi: 10.1093/geront/gnx093.

Xiong, C., M. Biscardi, A. Astell, E. Nalder, J. I. Cameron, A. Mihailidis and A. Colantonio. 2020. "Sex and Gender Differences in Caregiving Burden

Experienced by Family Caregivers of Persons with Dementia: A Systematic Review." *PLoS One* 15(4):e0231848. doi: 10.1371/journal.pone.0231848.

Yee, Jennifer L. and Richard Schulz. 2000. "Gender Differences in Psychiatric Morbidity among Family Caregivers: A Review and Analysis." *The Gerontologist* 40(2):147-64. doi: 10.1093/geront/40.2.147.

Yi, Mo, Di Jiang, Yuanmin Jia, Wei Xu, Haixia Wang, Yizhang Li, Zeyi Zhang, Jingjing Wang and Ou Chen. 2021. "Impact of Caregiving Burden on Quality of Life of Caregivers of Copd Patients: The Chain Mediating Role of Social Support and Negative Coping Styles." *International Journal of Chronic Obstructive Pulmonary Disease* 16(null):2245-55. doi: 10.2147/COPD.S311772.

Yu, Doris S. F., Sheung-Tak Cheng and Jungfang Wang. 2018. "Unravelling Positive Aspects of Caregiving in Dementia: An Integrative Review of Research Literature." *International Journal of Nursing Studies* 79:1-26. doi: https://doi.org/10.1016/j.ijnurstu.2017.10.008.

Zamora-Macorra, Mireya, Elga Filipa Amorin de Castro, José Alberto Ávila-Funes, Betty Soledad Manrique-Espinoza, Ruy López-Ridaura, Ana Luisa Sosa-Ortiz, Pamela L Shields and Daniel Samano Martin Del Campo. 2017. "The Association between Social Support and Cognitive Function in Mexican Adults Aged 50 and Older." *Archives of Gerontology and Geriatrics* 68:113-18.

Zhong, Yaqin, Jian Wang and Stephen Nicholas. 2020. "Social Support and Depressive Symptoms among Family Caregivers of Older People with Disabilities in Four Provinces of Urban China: The Mediating Role of Caregiver Burden." *BMC Geriatrics* 20(1):3. doi: 10.1186/s12877-019-1403-9.

Zimmerman, Molly E., Ali Ezzati, Mindy J. Katz, Michael L. Lipton, Adam M. Brickman, Martin J. Sliwinski and Richard B. Lipton. 2016. "Perceived Stress Is Differentially Related to Hippocampal Subfield Volumes among Older Adults." *PLoS One* 11(5):e0154530. doi: 10.1371/journal.pone.0154530.

Zivin, Kara, Mohammed U Kabeto, Helen C Kales and Kenneth M Langa. 2009. "The Effect of Depression and Cognitive Impairment on Enrollment in Medicare Part D." *Journal of the American Geriatrics Society* 57(8):1433-40.

Zwar, Larissa, Hans-Helmut König and André Hajek. 2018a. "The Impact of Informal Caregiving on the Cognitive Function of Older Caregivers: Evidence from a Longitudinal, Population-Based Study." *The American Journal of Geriatric Psychiatry* 26(3):S151-S52. doi: 10.1016/j.jagp.2018.01.183.

Zwar, Larissa, Hans-Helmut König and André Hajek. 2018b. "The Impact of Different Types of Informal Caregiving on Cognitive Functioning of Older Caregivers: Evidence from a Longitudinal, Population-Based Study in Germany." *Social Science & Medicine* 214:12-19. doi: https://doi.org/10.1016/j.socscimed.2018.07.048.