Distribution Agreement

Signature:

______________________________ _______________

Heather Dawn Coffin Date

The Impact of Informal Caregiving on Physical and Mental Health

By

Heather Dawn Coffin
MSPH

Health Policy and Management

Joseph Lipscomb
Committee Chair

Laura M. Gaydos
MSPH Director

Zhou Yang
Committee Member

Kimberly J. Rask
Committee Member

The Impact of Informal Caregiving on Physical and Mental Health

By

Heather Dawn Coffin

BS, Humanities and Sciences
Massachusetts Institute of Technology
2007

Thesis Committee Chair: Joseph Lipscomb, PhD

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Science in Public Health
in Health Policy and Health Services Research
2011

Abstract

The Impact of Informal Caregiving on Physical and Mental Health

By Heather Dawn Coffin

Informal caregivers provide essential long-term care that allows aging and disabled individuals to safely remain in their community; however, previous studies have found that informal caregiving has health consequences for the caregiver. A growing need for informal caregivers is being driven by increased longevity and a desire for non-institutionalized care. A stronger understanding of caregiving consequences at a national level is needed to inform caregiver support policies. We examined the physical and mental health burden of informal caregiving in a recent population-based US sample. We analyzed the 2009 Behavioral Risk Factor Surveillance System data from DC, Illinois, Louisiana, and North Carolina (n=31,715). Using logistic regression, we examined the likelihood of being obese, having high blood pressure, and having poor mental health days, conditional on caregiver status and controlling for demographics, socioeconomic status, health behaviors, healthcare access, and emotional support. We then studied how the medical condition of the care recipient impacts caregiver health. We found caregivers had higher odds of being obese and of having poor mental health days than non-caregivers. Among caregivers, caregiving burden and caregiving activity were found to negatively influence mental health. In conclusion, informal caregivers are a population at risk for obesity and diminished mental health. Increased support services may be needed to help caregivers offset these health risks. The observed physical health impact of caregiving suggests that interventions should reach beyond mental health support, to also include physical health evaluation and education.

The Impact of Informal Caregiving on Physical and Mental Health

By

Heather Dawn Coffin

BS, Humanities and Sciences
Massachusetts Institute of Technology
2007

Thesis Committee Chair: Joseph Lipscomb, PhD

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Science in Public Health
in Health Policy and Health Services Research
2011

To my grandmother, for her perseverance in providing informal care for my grandfather, allowing him to remain at home despite many health conditions for several years.

And to my mom, for her endless dedication to helping both of my grandparents safely maintain their independent lifestyle.

I have learned many lessons from observing their personal strength, compassion, and selfless caregiving support over the past decade.

Acknowledgements

I would like to acknowledge the guidance, support, and encouragement I received from my committee members: Dr. Joseph Lipscomb, Dr. Laura Gaydos, Dr. Zhou Yang, and Dr. Kimberly Rask. Their guidance was invaluable to my success. I will carry the many lessons I learned from them with me as I move to the next phase of my public health career.

I would also like to thank Professor Allan Goldman for sparking my interest in caregiving as a policy issue in his course, Long Term Care Policy and Practice. Our class discussions provided me with a strong understanding of how societal and policy factors impact the need for informal care.

I am grateful to Kathy Wollenzien for her cheerful encouragement and calming reassurance. Thank you for always being there to put things in perspective, and for always doing so with an uplifting smile.

I am also thankful to my boyfriend, John Head IV, for all of his love and support. Your support and care helped me succeed. Thank you for being by my side every step of the way.

And, of course, I am thankful for the strong support network I had in my fellow MSPHers: Elizabeth Allen, Drew Warlick, Peiyin Hung, Maris Perlman, Prabhjyot Saini, and Hefei Wen. I could not have asked for a more wonderful group with whom to go through this process. Thank you for your advice, moral support, and many happy memories.

Table of Contents

List of Tables

Appendix

List of Figures

List of Abbreviations

AARP	AARP, formerly American Association of Retired Persons
ACA	Affordable Care Act (2010)
ADLs	Activities of Daily Living
BMI	Body Mass Index
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CLASS	Community Living Assistance Services and Supports
DSS	Disproportionate Stratified Sample
HRQOL	Health-Related Quality of Life
IADLs	Instrumental Activities of Daily Living
MS	Multiple Sclerosis
SES	Socioeconomic Status

1. Introduction

As the long-term care sector shifts its focus from institutional settings to home and community-based care, informal caregiving plays an increasingly prominent role in assuring care recipients' quality of life, and in reducing the costs that accompany long-term care. Increasing longevity has also contributed to growth in the demand for informal care. While technological and medical advancements have enabled people to live longer, chronic disease and disability still accompany aging. Thus, a greater need for informal care and assistance exists today than in the mid-20th century[1]. The aging of the Baby Boomer generation will also augment the growing elderly population and need for informal care as they begin to turn sixty-five in 2011[2]. As a result of these factors, the number of US adult informal caregivers has increased to 65.7 million in 2009[3] and is expected to grow.

Although informal caregiving avoids the need for expensive institutional care, serving as an informal caregiver (providing care for a relative or friend) has health consequences that must not be overlooked when considering the tradeoff between formal and informal care. By providing care, informal caregivers often sacrifice their own quality of life, as increased levels of stress accompany the time and often emotionally charged effort required to fulfill the needs of their loved ones. As a result, these caregivers may in turn develop chronic diseases earlier in life, and thus require costly medical care and informal care themselves for a longer period of time.

Studies examining caregiver health have demonstrated that caregiving stress leads to reduced quality of life and poor mental health in caregivers[4-7]. Specifically, studies have shown increased depression and anxiety among informal caregivers when compared to the general population[8]; however, many of these studies examine populations outside the US, and their findings may not apply to the US population due to demographic, societal, or cultural differences. Fewer studies have examined the physical health effects of providing care on informal caregivers. To our knowledge, ours is the first study to compare body mass index (BMI) in caregivers and non-caregivers using multivariable analysis. Furthermore, the health impact of providing informal care has not been compared across care recipient medical conditions in a large, population-based caregiver sample.

This study aims to determine the physical and mental health burden resulting from informal caregiving, and to examine the impact of the care recipient's medical condition on informal caregivers' health outcomes. Strengthening our understanding of informal caregiving health risks will aid the continued development of effective caregiver support programs. In addition, evaluating caregiver physical and mental health in a large population-based US sample will inform policy decisions related to public funding for caregiver support programs at the state or federal level.

Specifically, we will compare caregivers and non-caregivers using multivariable logistic regression analyses to determine the physical and mental health impact of informal caregiving. We hypothesize that given the stress and time commitment of caregiving, informal caregivers will have higher BMI, higher likelihood of having high blood pressure, and higher likelihood of reporting poor mental health than non-caregivers. Among caregivers, we examine the impact of care recipient medical condition on caregiver physical and mental health, while controlling for other caregiving characteristics and caregiver attributes. In this second analysis, we hypothesize that caregivers caring for someone with Alzheimer's disease will have higher BMI, higher likelihood of high blood pressure, and poorer mental health than caregivers caring for someone with other conditions.

2. Literature Review

INTRODUCTION

Longevity has increased during the past century due to technological and medical advances. However, these advances have not eliminated chronic disease and disability later in life. In fact, individuals now experience disabling illness over a longer period of time before death. These trends drive an increasing societal need for long-term care. At the same time, the elderly population will double by 2030 as the 78 million baby boomers reach age sixty-five[2]. Although the population in need of long-term care is growing rapidly, institutionalized care provision has not increased proportionally. Financial strain, staffing shortage, and personal preference have shifted long-term care models away from institutionalization in favor of community-based, patient-centered care. As community-based care increases, the need for informal care—the provision of care by family or friends instead of a paid health professional—is also growing. Only approximately 8% of long-term care recipients living at home receive formal care, while 78% receive informal care and 14% receive a combination of the two[9].

Clearly, as the long-term care sector shifts from institutional settings to home and community-based care, informal caregiving will play an increasingly prominent role in assuring care recipients' quality of life, and in avoiding the billion-dollar health system costs that accompany institutional long-term care. Currently, informal caregivers' contributions constitute an estimated $306 billion of formal, professional nursing and home health care annually—over twice the cost of nursing home care ($115 billion), and six times the cost of home health care ($43 billion)[2]. However, serving as an informal caregiver may have health-related and other consequences that must not be overlooked when evaluating the tradeoffs between formal and informal care. The increased levels of stress that accompany the often emotionally-charged provision of care can negatively affect informal caregivers' quality of life. In fact, the stress observed in informal caregivers has been used as a model to describe chronic stress processes[10]. Caregiver chronic stress has been associated with both psychological and physical health effects[2, 10, 11].

Despite four decades of exploration of caregiving health effects, informal caregiving has only recently gained attention as a common experience and important topic in American public health. Several recent policy initiatives reflect the emerging importance of informal caregiving in the long-term care system. In 2000, the National Family Caregiver Support Program established annual grants for states and territories to provide support services to informal caregivers[12]. However, significant variation in public support services between and within states existed as of 2004[13], and likely persists today. As the program celebrates its tenth anniversary this year (2011), publicly funded respite care and other caregiving support programs may be cut as states such as California attempt to balance their budgets[14, 15]. Other federal bills to provide informal caregivers with tax breaks have failed to pass into law[16]. Long-term care provisions in the recently passed Affordable Care Act may provide additional support to caregivers; however, implementation and evaluation of this support may take several years[17]. As the caregiver population increases with the growing demand for non-institutionalized long-term care, understanding the impact of informal caregiving on caregivers' health is increasingly important.

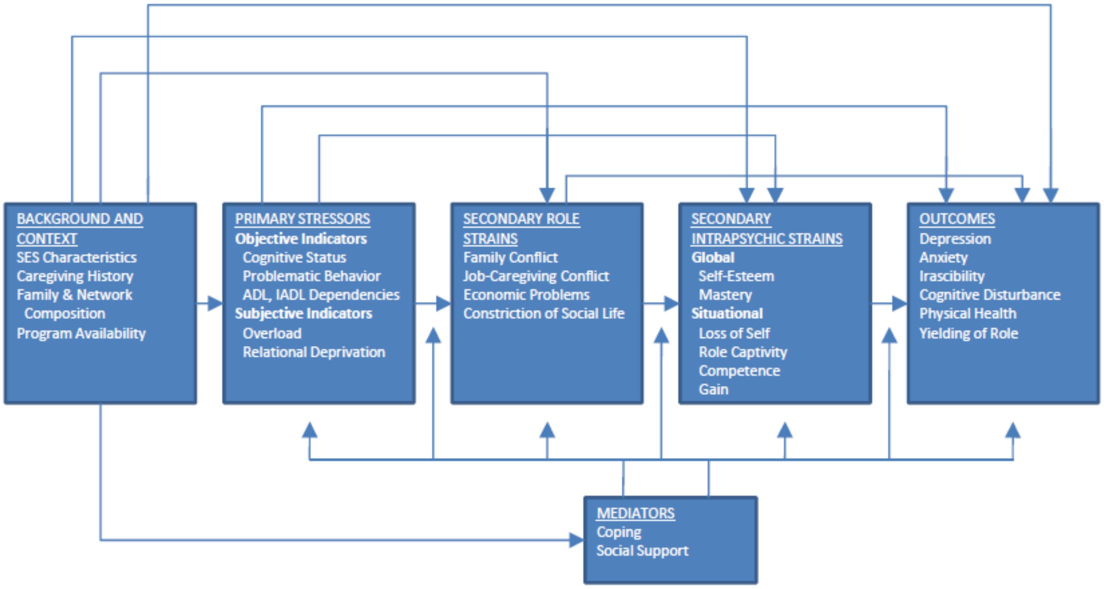
This literature review examines the connection between caregiving and health. Caregiver health outcomes examined include general mental health and health-related quality of life, and physical health as indicated by body mass index (BMI) and blood pressure. Previous literature places emphasis on studying the stress and mental health effects of caregiving, but a smaller, parallel body of research examines the physical health effects of providing informal care. To date, studies have yielded conflicting findings of associations with caregiving characteristics and health outcomes, largely due to reliance on small convenience samples and a focus on specific population demographics. In addition, the majority of recent studies examine caregivers for individuals with one specific diagnosis. Little attention has been given to population-based samples in these studies. Nevertheless, as the need for long-term informal care continues to grow, research focus has begun to shift towards identifying effective intervention strategies to mitigate caregivers' stress burden. Yet, without population-based sample analyses, identification of effective, widely applicable health interventions that merit legislative support is difficult. An understanding of population-wide caregiver health effects will better inform caregiver support policy, and allow for estimates of the medical cost burden associated with treating the diminished health of informal caregivers.

CAREGIVER BURDEN

Stress Process

Based on previous research into caregiver burden[18], Pearlin et al. outlined a pivotal conceptual scheme for the stress process experienced by informal caregivers for Alzheimer's patients[19]. This model has since been applied and adapted to caregivers of care recipients with other medical conditions[5-7]. The model describes four sequential domains that impact all caregiver outcomes of interest: the context of stress, stressors, mediators of stress, and stress manifestations (Figure 2.1).

Figure 2.1. Conceptual Model of Alzheimer's Caregivers' Stress[20]



Caregiver characteristics and the caregiver's familial, social, and formal support network form the context in which caregivers experience stress. Pearlin categorizes stressors, defined as the "conditions, experiences, and activities that are problematic for people,"[19] into primary and secondary factors. In the caregiver context, primary stressors consist of the care recipient's condition, as well as the caregiver's subjective perception of burnout; secondary stressors include consequential lifestyle shifts that result from providing care. For example, informal caregiving may interfere with employment, impose financial strains, cause family conflict, and lead to less time for social activities. Observable secondary stressors, such as role changes, influence unseen psychological strains affecting self-esteem. Coping and social support serve as mediators of the primary and secondary stressors. Other unobservable indirect mediating effects may also mitigate the stressors' effects. The stress domains and caregiving context directly impact health outcomes, consisting of both psychological and physical effects. The model highlights the many interdependencies among the four domains that complicate the elucidation of causal relationships between stressors and outcomes. Due to these intricacies, Pearlin suggests measurable outcomes cannot be used interchangeably to assess the impact of the caregiver stress process. Thus, specific health outcomes must be explored independently to observe the physical health effects of providing informal care. Several caregiver health outcome studies have been based on this model and its indicated measures[11, 20]. However, this model does not compare the caregiver stress process to the stress experience of non-caregivers. Thus, this model alone does not describe how stress burden in informal caregivers differs from stress in the general population. Yet, differentiating the stress and health of caregivers from non-caregivers would provide stronger support for caregiving policy initiatives.

In 2000, Chou further defined four distinct areas of caregiver burden—financial, social, physical and psychological—in an attempt to clarify the findings of caregiver burden research[20]. Again, this categorization intends to identify the source of caregiver stress while considering predisposing factors that influence caregivers' experience of burden. However, the concept provides little guidance as to how each burden type relates to mental versus physical health outcomes. Nevertheless, conceptually delineating caregiver stress and burden categories has allowed further research to contribute a stronger understanding of which caregiving characteristics relate to specific burden types[19].

Caregiver Burden Differs from Non-Caregiver Burden

The fact that caregivers experience chronic stress that differs from daily life stress has been supported by studies comparing caregivers to non-caregivers. Studies have explored differences in stress and health outcomes between the two populations. Outside the US, a study of 2,222 elderly Australians showed that caregivers report poorer mental and physical health than non-caregivers[5]. In addition, a cross-sectional comparison of primary informal caregivers to a matched control group of non-caregivers in Hong Kong found that caregivers were more likely to report poorer mental and physical health, and had higher risk of anxiety and depression, weight loss, and for female caregivers, chronic disease[8]. By using a matched caregiver-control sample, this study aimed to avoid selection bias and provide generalizable findings for caregiving in Hong Kong.

Research on the impact of informal caregiving in the United States has faced similar challenges. There are few comparisons between caregiver and non-caregiver populations. One observational study compared the prevalence of several health conditions in female caregivers and non-caregivers in the general Illinois population, and found that caregivers had higher prevalence of arthritis, high blood pressure, obesity, and activity limitations[21]. However, this study used a small sample of 206 female caregivers, and therefore findings may not be truly representative of the greater population, or may not be precise. Another prospective, population-based cohort study compared four-year mortality in elderly caregivers and non-caregivers in four US communities from 1993 to 1998, concluding that caregivers who experienced caregiver strain had 63% higher risk of mortality than non-caregivers[22]. Nevertheless, this finding may not accurately reflect the current caregiving experience due to implementation of the federal National Family Caregiver Support Program and development of evidence-based caregiving interventions in the 2000s.

HEALTH EFFECTS

As noted in Figure 2.1, chronic stress impacts mental and physical health. Furthermore, the secondary stressors experienced by caregivers may directly alter health behaviors. Thus, some recent studies have explored the effect of providing informal care on health behaviors as an additional component of mental and physical health outcomes.

Health Behaviors

Stress burden from caregiving has been associated with poor health behaviors. One of the few longitudinal caregiver studies monitored spouses of care recipients as they transitioned into and out of caregiver status. The results indicated that individuals providing a large amount of care were more likely to forget to take medications and less likely to make time to see a physician for themselves, despite having symptoms of a health problem[23]. This self-care neglect may lead to poorer physical health outcomes that require more care at greater cost later in life; however, the direct connection between these behaviors and physical health markers such as BMI and blood pressure has not been established in caregivers.

In addition to discouraging positive health behaviors, caregiver burden may also promote negative health behaviors. A recent study of 998 caregivers suggests that caregivers may have a higher likelihood of excessive alcohol consumption due to experiencing chronic social and emotional burdens[24]. However, because the study sample only included adult caregivers in Chicago, the results may not be generalizable.

Mental Health

There is compelling evidence that primary and secondary stressors are linked to both negative and positive[25] mental health effects. A large portion of the literature in this area has focused on depression and health-related quality of life (HRQOL). Experience of depression and increased stress has been associated with caregiving characteristics such as the duration of and weekly time spent caregiving[7, 10]. Caregiver older age[10], female sex[2], lower socioeconomic status[2, 10], and limited support networks[10] were also associated with depression and increased caregiver stress. Despite the breadth of research examining the mental health effects of informal caregiving, few population-based studies have been conducted. One such study used the 2005 Behavioral Risk Factor Surveillance System (BRFSS) responses from North Carolina, which included a state-created caregiver module, to examine the mental health effect of whether caregivers felt they had a choice in providing care. The results suggested that caregivers who did not have a choice in caregiving had three times higher risk of experiencing a stress burden[26], which may lead to poorer mental health.

Depression

A meta-analysis of 228 research studies examining the association of various stressors with caregiver depression found that the care recipient's condition and time required to provide care were more strongly associated with depression for caregivers of dementia patients than for non-dementia caregivers[7]. This analysis also indicated associations were stronger in probability samples than in convenience samples, supporting recent efforts to utilize random samples in studies.

In contrast, another study of informal caregivers found that only contextual factors (e.g. caregiver age, income, and health) were related to caregiver depression, and that primary stressors such as care recipient's behavior problems, cognitive status, and caregiving tasks were not[6]. However, these findings may have been due to the fact that the care recipients lived in a nursing home rather than with the caregivers. As a result, caregivers in this sample (103 subjects in New York City) were not as burdened with the care recipient's characteristics or strenuous caregiving tasks.

Additionally, a small portion of the literature has studied the differences in caregiver depression in rural versus urban settings. Preliminary studies have found conflicting results, largely due to small sample size and varying sample population composition[27]. One study found that rural caregivers had fewer depressive symptoms than urban caregivers, despite no apparent difference in caregiver stress[28]. However, this finding may not be generalizable beyond the sample population, which consisted of Midwestern African-American female caregivers. Rural and urban differences in caregiver outcomes may become more apparent in analysis of population-based samples.

Health-Related Quality of Life

Health-related quality of life (HRQOL) was measured via SF-8 in a national survey of informal caregivers to individuals with multiple sclerosis (MS) [4]. Important factors associated with poorer HRQOL included primary stressors, such as the care recipient's poor health status, the caregiver's self-perceived difficulty of providing care, and the need for mental health counseling[4]. In contrast to other studies, caregiver sex and marital status were not found to impact caregiver HRQOL, while income was found to be a significant covariate.

Relationships between mental health status and Pearlin's "secondary stressors" and "mediators" have also been studied. A community survey of caregivers in Australia indicated that poorer mental health of caregivers was related to increased family conflict and lack of social support[5]. Financial factors and "role strain" were not related to poorer mental health. These findings were generated from one wave of a longitudinal study of 2,222 adults aged 64-69 years; therefore, they may not be representative of other age groups. Additionally, findings for this Australian population may not reflect relationships between secondary stressors and mental health outcomes for US caregivers.

Physical Health

Research has indicated specific stressors are linked to poorer physical health outcomes in caregivers, including weakened immune systems[2], slower wound healing, chronic disease, and increased risk of mortality[22]. The literature indicates that care recipient characteristics, length of time providing care, and cohabitation of caregiver and care recipient are the main factors in caregiver physical health outcomes[10]. Of particular interest, body mass index (BMI) has been found to differ in caregiver and non-caregiver samples in a descriptive comparison[21]. BMI and high blood pressure have also been examined jointly as metabolic syndrome indicators in caregiver health outcomes. Both of these physical health indicators merit attention when evaluating caregiver health due to recent federal initiatives to address these chronic diseases. For example, Healthy People 2020 objectives emphasize reducing obesity and high blood pressure prevalence in the US adult population to prevent heart disease and stroke[29].

Body Mass Index

Few caregiver studies have focused on BMI as a physical health indicator[30]. However, several studies have examined chronic work stress and health using BMI as an outcome. One such study found high job strain—a form of chronic stress—to be associated with increased BMI. However, the effect was mediated by other lifestyle factors[31]. Because caregiving often serves as an example of chronic stress experience, it is reasonable that findings from worksite studies may be similar to those expected in caregiver populations. Nevertheless, the caregiver stress process may differ from that of workers with "high job strain," and therefore may have fewer confounding factors in the relationship of stress and BMI.

Similarly, a population-based, nationally representative examination of psychological distress and BMI found an association between the two; extreme BMI (low or high) was related to a higher likelihood of serious psychological distress[32]. Although distress served as the outcome, this association suggests extreme BMI may result from severe psychological distress attributed to caregiving.

Metabolic Syndrome Indicators

BMI and high blood pressure have been used, in conjunction with other metabolic syndrome indicators, as measures of physical health outcomes in caregiver studies. A study showed that higher metabolic risk scores (composite scores of BMI greater than 30, and having or using medication for diabetes, hypertension, or high cholesterol) were associated with walking speed decline in long-term and dementia caregivers; no association was found for short-term caregivers and non-caregivers[33]. Although this study examined metabolic syndrome indicators' relation to walking speed decline, the findings suggest that caregivers caring for individuals with certain conditions experience heightened BMI and blood pressure and are at increased risk for metabolic syndrome. However, the relationship between caregiving and metabolic syndrome indicators must be evaluated as the primary, rather than secondary, relationship of interest to further substantiate these findings.

Larger waist circumference and high cholesterol were also associated with caregiver chronic stress in a study examining predisposition to metabolic syndrome as a result of psychological stress[34]. Although the study focused on chronic stress rather than caregiver status alone, the link between caregiver stress and these outcomes suggests studies evaluating the impact of caregiving on BMI and blood pressure—other metabolic syndrome indicators—may find similar trends.

COMPARISONS ACROSS CARE RECIPIENT CONDITIONS

The majority of studies evaluating caregiving burden and health focus on a sample of caregivers who care for individuals with one specific condition, such as Alzheimer's disease, diabetes, or multiple sclerosis. Few studies compare caregiving experiences across a range of care recipient medical conditions. DeFries et al. compared caregivers for elderly care recipients with and without cognitive impairment, and found caregivers for those with cognitive impairment more likely to be disabled, compensated, and to have provided care for longer[35]. Kim and Schulz evaluated caregiver burden from a nationally representative caregiver sample including caregivers for 99 cancer, 271 dementia, 101 diabetes, and 135 frail elderly care recipients surveyed by the National Alliance for Caregiving and AARP in 2003. They concluded that despite similar sociodemographic attributes across all four conditions, caregivers for cancer and dementia patients reported higher levels of physical and psychological caregiving burden[36]. Although these representative studies contribute to our understanding of unique caregiving populations and the burdens they most commonly encounter, larger sample sizes are needed to confirm these initial findings. Furthermore, while these studies identify differences in caregiver demographics and burden, they do not directly associate the variation in care recipient condition with caregiver health outcomes.

CONCLUSION

Caregiver burden and health outcomes have been examined from several angles. The caregiver stress process has been established, and studies have shown increased stress burden in the caregiver population. However, differences in health outcomes between caregivers and non-caregivers have not been explored in large-scale studies in the United States. While findings have identified trends in poorer mental and physical health related to the care recipient's condition, duration of caregiving, and the caregiver's perception of burden, very few studies have confirmed these associations in large or population-based samples. Furthermore, few studies have comprehensively examined a breadth of caregiving characteristics while controlling for an array of lifestyle factors, or examined a population of caregivers caring for individuals with a variety of medical conditions. Smaller studies have contributed to society's understanding of the caregiver stress process and opportunities for intervention over time, but without population-based findings the impact of state or federal-level support for informal caregivers cannot be evaluated. The comparison of caregiver and non-caregiver groups in a recent population-based analysis will provide further insight into the public health impact associated with providing informal care.

Furthermore, the literature emphasizes mental health outcomes and the identification of psychological interventions to mediate caregiver stress burden. Our study will examine mental health outcomes to confirm that providing informal care is associated with poorer mental health in a large, US population-based sample. However, the mental health focus overlooks the relationship between caregiver status and important physical health outcomes that indicate the need for preventative medical measures. Thus, we will also conduct a comparison of physical health outcomes—specifically, BMI and high blood pressure— in caregivers and non-caregivers in a representative sample.

Finally, studies report conflicting association findings between stressors and caregiver health outcomes. This effect is largely due to samples of caregivers providing care for individuals with one specific medical condition, or one category of condition (for example, dementia versus non-dementia). Sample sizes have generally not been large enough to compare caregiver health outcome differences across care recipient diagnoses. Our study will therefore address this gap in the literature by comparing health outcomes for caregivers of care recipients diagnosed with chronic, mobility-restricting, and other conditions, with those caring for someone with Alzheimer’s disease.

3. Methods

DATASET

This study used data from the 2009 Behavioral Risk Factor Surveillance System (BRFSS) survey[37]. The BRFSS, a state-based survey system designed by the Centers for Disease Control and Prevention (CDC), conducts telephone interviews of more than 350,000 adults age 18 and older each year to collect information on health risk behaviors, chronic disease, and injury. BRFSS surveys a random sample of one adult per household; therefore, the sample only includes adults who live in non-institutionalized settings.

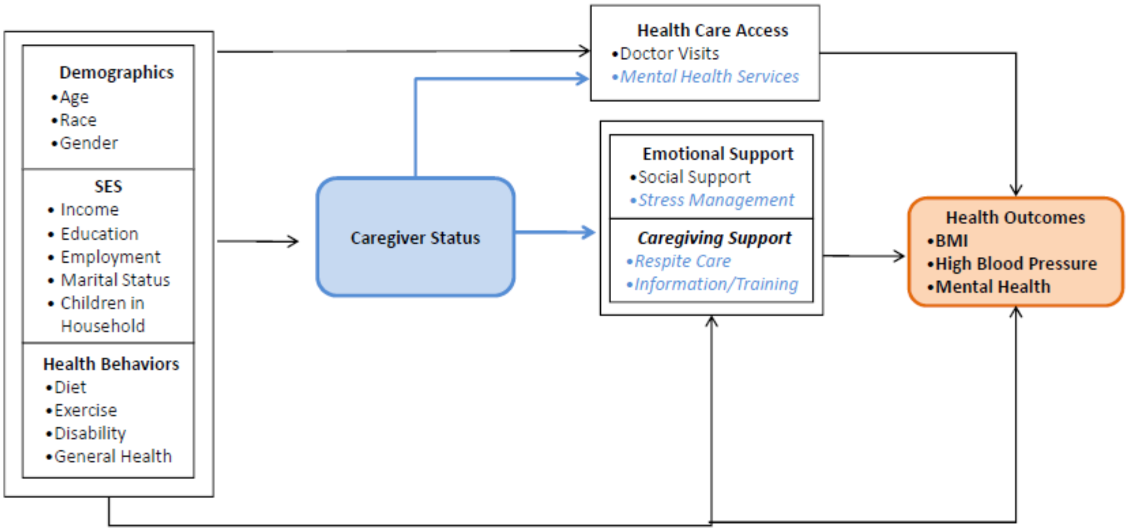
In 2009, an optional Caregiver Module was added to the BRFSS survey. This optional module was administered by three states: Illinois, Louisiana, and the District of Columbia (DC). North Carolina also asked approximately one-half of their subjects the Caregiver Module questions as “state-added” questions. In our study, we were interested in the health effects of providing informal care; therefore, subjects included in the study resided in these four states. Data from other states and territories were excluded because the Caregiver Module questions were not administered in their surveys. In addition, BRFSS data from additional years of data were not included in the study due to absence of the detailed Caregiver Module. The sample population consisted of 31,715 subjects, 7536 (23.8%) of which identified themselves as informal caregivers.

BRFSS subjects were chosen via random selection of telephone numbers. Sampling methods varied slightly by state, but DC, Illinois, Louisiana, and North Carolina all used a disproportionate stratified sample (DSS) design. In DC and Illinois, the state constituted a single stratum, while Louisiana and North Carolina sampled disproportionately from strata with smaller geographically defined populations of interest to obtain sufficient sample sizes. In the stratified sampling, telephone numbers were divided into two strata based on the telephone number density expected to belong to households (“high-density” and “medium-density”), and sampled separately. The two strata were then sampled to obtain a probability sample of all households with telephones. To generalize from this sample to the state population, weighting was applied to adjust for variation in respondents’ probability of selection, disproportionate selection of population subgroups relative to the state’s population distribution, and non-response[37]. Appropriate final weight variables provided by BRFSS were used to adjust for the sampling scheme. This study was approved as exempt by the Emory University IRB.

RESEARCH DESIGN

Our study aims to determine the impact of providing informal care on physical and mental health outcomes, and consists of two segments. In the first, the physical and mental health outcomes were compared for caregivers and non-caregivers. The conceptual model in Figure 3.1 below depicts the theoretical health outcome pathway for caregivers and non-caregivers.

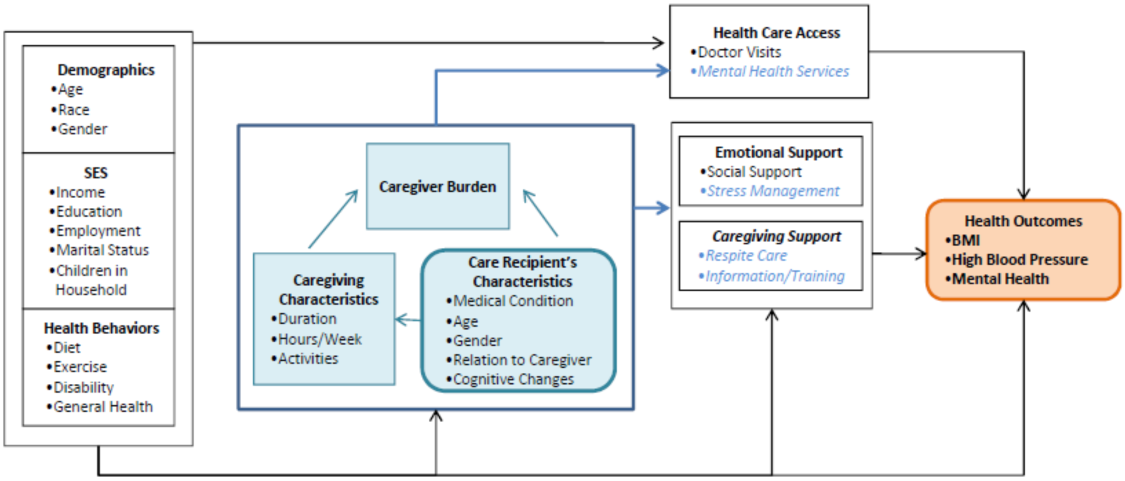
Figure 3.1. Health Outcomes Pathway for Caregivers and Non-Caregivers



The model depicts the pathway linking an individual's characteristics to their health outcomes. An individual's demographics, socioeconomic status (SES), and health behaviors all affect their health outcomes. Certain life events that result from those characteristics—traumatic incidents, work and child-rearing demands, for example—lead to stress, anxiety, and other conditions that negatively impact physical and mental health. Informal caregivers have the additional characteristic of providing care, which may contribute unique chronic stress and negatively impact physical and mental health. This contribution is depicted in the model as "caregiver status," denoting whether the subject provides care or not. The negative emotional, mental, and physical effects from life and caregiving stress are mitigated through formal health care, and formal and informal emotional support systems. Items italicized in the model are not captured in our data set.

The second segment examined only caregivers, and compared the health outcomes of caregivers who provide care for individuals with different medical conditions. Figure 3.2 depicts the theoretical relationship between caregiving characteristics and caregiver BMI, high blood pressure, and mental health.

Figure 3.2. Detailed Caregiver Health Outcomes Pathway



Among the population of caregivers, the same demographic, health behavior, health care access, and support factors impact physical and mental health outcomes. Additional caregiving characteristics that may contribute varying degrees of stress in the overall caregiving experience are depicted in shaded boxes in the center of the model. Caregiving may include emotionally or physically demanding tasks and lead to a reduction of personal time and increased stress. Furthermore, coping with the diagnosis and behavior of the care recipient may also affect caregivers' well-being. Both care recipient characteristics and caregiving characteristics impact the stress burden experienced by the caregiver. However, any of these factors may independently contribute to diminished physical or mental health in the caregiver.

Analysis 1: Impact of Informal Caregiving on Health Outcomes (Caregiver vs. Non-Caregiver)

This portion of the study employs a pre-experimental, posttest-only comparison group design[38-41], as shown in Figure 3.3. The "program" in this case is the action of providing informal care, and is denoted by an "X" in the figure. Subjects were categorized into two groups: informal caregivers and non-caregivers. Due to the nature of the proposed data set, no baseline data is available for either group. The 'O' in each row of Figure 3.3 represents 2009 BRFSS measurement of BMI, high blood pressure, and mental health.

Figure 3.3. Study Design: Impact of Informal Caregiving on Health Outcomes (Analysis 1)

Informal Caregivers	X	O_1
Non-Caregivers		O_2

The internal validity of this study design is threatened by selection bias and the interaction of selection and maturation because the BRFSS sampling was not designed to give comparable caregiver and non-caregiver populations. Additionally, the interaction of selection bias and historical context may pose threats to the design's external validity. We included several covariates in our models to control for selection bias; however, historical threats to external validity remain because we only examined one year of BRFSS data.

Analysis 2: How Care Recipient Condition Influences Caregiver Health

To examine the relationship between the care recipient's medical condition and caregiver health outcomes, a pre-experimental, posttest-only comparison group design[38-41] was also used. For this analysis, subjects were categorized into four groups based on whether the care recipient's primary medical condition was Alzheimer's disease, a chronic disease, a mobility-restricting disease, or other. Figure 3.4 shows the study design. We chose these categories because caring for these condition types may place different stress burdens on caregivers and have varying effects on caregiver health outcomes. In Figure 3.4, the 'X' in each row represents the provision of care to someone with the condition type listed in the left column; the 'O' in each row represents measurement of BMI, high blood pressure, and mental health via the 2009 BRFSS survey. This study design suffers from the same threats to validity as the caregiver versus non-caregiver comparison study design. Because North Carolina did not ask the Caregiver Module questions to all subjects, 1681 subjects who self-identified as caregivers were not included in Analysis 2.

Figure 3.4. Study Design: How Care Recipient's Condition Influences Caregiver Health (Analysis 2)

Care Recipient Condition Category	
Alzheimer's	X_A O_1
Chronic	X_C O_2
Mobility-Restricting	X_M O_3
Other	X_O O_4

Variable Description

Variables used in the study were selected based on the conceptual models (Figures 3.1 and 3.2), and the questions available in the 2009 BRFSS Core Questionnaire and Caregiver Module. Table 3.1 at the end of this section summarizes the variables.

Dependent Variables

Two physical health outcomes were examined as dependent variables—body mass index (BMI) and high blood pressure. A mental health outcome variable was also included.

BMI, calculated from self-reported height and weight values, was evaluated through two separate dichotomous dependent variables, indicating whether the subject was overweight or obese, and whether the subject was obese. We chose these categories for comparison due to the increased health care expenditures typically associated with obesity.

High blood pressure, a marker for metabolic syndrome that has been associated with informal caregiving[10], was also coded as a dichotomous outcome, based on responses to a question asking subjects whether a doctor had ever told them they had high blood pressure.

A mental health outcome was also included as a dependent variable for comparison with previous findings in the caregiver literature. One question in the BRFSS survey asked subjects how many days in the past 30 they felt their mental health was "not good." A dichotomous variable indicating whether the response was zero or non-zero (coded as 0 and 1, respectively) was created. This dichotomous mental health outcome indicated whether respondents had at least one day in the past 30 with "not good" mental health. However, this approach does not reflect the full breadth of information available in the responses, which ranged from 0 to 30. The mental health variable's distribution prevented us from evaluating the outcome as continuous. Thus, responses to this question were grouped into five categories, as displayed in Table 3.1, and examined as an ordinal categorical dependent variable. This categorization allowed us to determine whether using the additional information regarding "not good" mental health days available in the data would yield a stronger relationship between caregiving and mental health.

Primary Independent Variable for Analysis 1: Caregiver Status

As we were interested in how providing informal care to a family member or friend impacted health outcomes, our primary independent variable was a dichotomous variable indicating whether the subject served as an informal caregiver. Because caregiving would only impact our dependent variables if the subject had provided informal care for a prolonged period of time, only individuals who self-identified as caregivers who had provided care for at least 6 months were categorized as caregivers in our study. Using this definition, 3946 respondents (12.4% of total sample) were considered caregivers.

Primary Independent Variable for Analysis 2: Care Recipient Medical Condition

A categorical variable denoting the care recipient's medical condition (Alzheimer's, chronic disease, mobility-restricting, or other) was the primary independent variable for this portion of the study (Table 3.1). These categories were selected to group conditions that were hypothesized to have similar caregiving demands together, distinguishing Alzheimer's disease as the reference group.

Control Variables (Analyses 1 and 2)

The following variables were included in both analyses to control for other factors that impact physical and mental health outcomes. These variables are also summarized in Table 3.1.

Demographic Variables

Age, gender, and race were included in the model to control for their effects on the health outcomes under examination. Self-reported age in years was categorized into four groups based on comparisons of age distribution between the caregiver and non-caregiver groups. A dichotomous variable controlled for gender effects. A categorical variable denoting race was also included.

Socioeconomic Status Variables

Several categorical socioeconomic variables were included in the analysis due to their influence on access to health care and formal support (for both coping with caregiving and general mental health purposes), and their influence on the presence of other life stress factors (see Table 3.1). Income was included in the analyses as a categorical variable. Categorizations were made based on the poverty level for a family of 3-4 (the unweighted average household size found in the sample population was 2.3 (SD 1.3); weighted average was 3.1 (SD 40.3))[42] and the categories found in the BRFSS survey. Education level was also included as a categorical variable to control for health effects related with not graduating from high school, only graduating from high school, and having at least some college education. Current employment was included as a dichotomous variable to indicate whether the subject had the burden of working, and whether they were responsible for generating wages for their family. A categorical variable indicating marital status was also included to control for life stress factors and the effects of relationship status on general health. Finally, a continuous variable indicating the number of children living in the household was included to capture the stress associated with child rearing.

Health Behavior Variables

Variables related to individuals' health behaviors were included due to their influence on physical and mental health. A dichotomous variable indicating whether subjects' activities were limited due to physical, mental, or emotional problems in the past 30 days was included as an indicator of disability. Diet and exercise behaviors were indicated by dichotomous variables as described in Table 3.1. Finally, a self-rated overall general health status indicator was included to control for subjects' perception of their overall health status.

Health Care Access Variable

Previous studies have suggested that informal caregivers neglect their own doctor's visits due to having decreased time and resources to care for themselves[10]. For this reason, and the fact that increased health care access improves health status, a categorical variable indicating the amount of time since last routine checkup was used as an indicator of preventive service utilization.

Emotional Support Variable

An ordinal categorical variable indicating how often the subject receives the social emotional support they need was used to account for the mediation of negative health effects from caregiving and other forms of stress through informal support systems.

Additional Control Variables (Analysis 2 Only)

The following variables were only included in the second portion of our study, in which the caregiver population was examined to determine the impact of care recipient medical condition on caregiver health outcomes.

Care Recipient Characteristic Variables

The BRFSS caregiver module included several questions regarding the care recipient's characteristics, which allowed us to control for several factors that contribute to the caregiving experience. Categorical variables indicating the care recipient's age, and the relationship between the caregiver and care recipient were included due to the differences in caregiver-care recipient dynamics from these attributes (Table 3.1). Similarly, a dichotomous variable indicating the care recipient's sex was included in the model. To capture the emotional stress associated with care recipients' cognitive decline, a dichotomous variable describing whether the care recipient had changes in thinking or remembering in the past year was also included.

Caregiving Characteristic Variables

In addition to care recipient characteristics, the caregiver module included questions about the caregiving situation. Information regarding the caregiving activities, duration, number of hours per week, and caregiver burden were all included in the analyses to control for caregiving effects attributable to these characteristics. The type of activity performed most often by the caregiver was classified into four categories. These activity categorizations were chosen because they require differing levels of physical activity, and may also mentally and emotionally affect caregivers to differing degrees. Caregiving duration and hours per week spent caregiving were both included as categorical variables, with categories defined to be consistent with previous literature[35]. Finally, caregiver burden was included in five categories as described in Table 3.1, based on conceptual models of burden found in the literature[18, 20]. The categories were formed from a question in which caregivers were read a list of difficulties (options are in parentheses next to Burden categories in Table 3.1), and asked, "please indicate which one is the greatest difficulty you have faced as a caregiver."[37]

Table 3.1 displays a summary of all dependent and independent variables included in the analysis.

Table 3.1. Summary of Variables Used in Analyses

Dependent Variables	**Description**
Body Mass Index (BMI)	Evaluated as two dichotomous[1] variables: 1. Overweight or Obese (BMI >25 kg/m^2) or not, and 2. Obese (BMI >30 kg/m^2) or not
High Blood Pressure	Dichotomous variable indicating whether the subject has ever been told by a doctor that they had high blood pressure
Mental Health	Based on a survey question asking the number of days in the past 30 the subject felt that mental health was "not good" Categorized as a dichotomous variable for zero and non-zero responses, and evaluated separately as: 1. 0 days 2. 1-7 days 3. 8-15 days 4. 16-29 days 5. 30 days
Independent Variables	**Description**
Primary Independent Variable: Analysis 1	
Caregiver Status	Dichotomous variable indicating whether the subject has provided informal care for a relative or friend for at least 6 months
Primary Independent Variable: Analysis 2	
Care Recipient Medical Condition	Categorical variable indicating the condition type for which the care recipient requires care, categorized as: 1. Alzheimer's Disease 2. Chronic Diseases (for example: cancer, diabetes, stroke, asthma, heart disease) 3. Mobility-Restricting Diseases (for example: spinal injury, Parkinson's disease, osteoporosis, multiple sclerosis) 4. Other
Demographics	
Age	Categorized as: 1. 18-29 years old 2. 30-45 years old 3. 46-65 years old 4. > 65 years old
Sex	Categorized as female (coded as 1) or male (coded as 0)
Race	Categorized as: 1. Non-Hispanic white 2. Non-Hispanic black 3. Hispanic 4. Other
Socioeconomic Status	
Income	Total annual household income, categorized as: 1. > $75,000 2. $20,000-$75,000 3. < $20,000
Education	Categorized as: 1. Some high school 2. High school graduate 3. At least some college
Employment	Dichotomous variable indicating whether subject was employed (for wages or self-employed) at the time of the survey

Independent Variables	**Description**
Marital Status	Categorized as: 1. Never married 2. Married or part of an unmarried couple 3. Divorced or separated 4. Widowed
Children	Continuous variable for number of children in household
Health Behaviors	
Disability	Dichotomous variable indicating whether subject's activity was limited due to physical, mental, or emotional problems
Diet	Dichotomous variable indicating whether subject eats at least 5 servings of fruits and vegetables per day
Exercise	Dichotomous variable indicating whether subject has had any physical activity in the past 30 days
General Health	Categorized as: 1. Excellent 2. Very Good 3. Good 4. Fair 5. Poor
Health Care Access	
Routine Doctor Visit	Categorical variable indicating timing of last routine doctor visit: 1. Within the past year 2. 1-2 years ago 3. 2-5 years ago 4. More than 5 years ago
Emotional Support	
Social Support	Categorical variable indicating how often subject receives the social emotional support they need, categorized as: 1. Always 2. Usually 3. Sometimes 4. Rarely 5. Never
Care Recipient Characteristics (Used in Analysis 2 Only)	
Age	Categorized as: 1. < 20 years old 2. 20-60 years old 3. 61-75 years old 4. > 75 years old
Relation to Caregiver	Categorized as: 1. Parent or Parent-in-law 2. Child or Grandchild 3. Spouse 4. Sibling 5. Grandparent or Other relative 6. Non-relative
Sex	Dichotomous variable indicating whether care recipient was female (coded as 1) or male (coded as 0)
Cognitive Changes	Dichotomous variable indicating whether care recipient's ability to think or remember has changed in the past year

Independent Variables	**Description**
Caregiving Situation (Used in Analysis 2 Only)	
Activity	Categorical variable indicating the type of activity most often performed by the caregiver, categorized as: 1. Activities of daily living (ADLs) 2. Instrumental activities of daily living (IADLs) 3. Cognitive functions (communicating with others, learning or remembering, seeing or hearing, getting along with people, and relieving or decreasing anxiety or depression) 4. Mobility functions (moving around within the home, and transportation outside of the home)
Duration	The length of time the caregiver has provided care, categorized as: 1. 6 months-1 year 2. 1-5 years 3. > 5 years
Hours per Week	The number of hours per week caregivers spent providing care, categorized as: 1. < 10 hours/week 2. 10-20 hours/week 3. 21-40 hours/week 4. > 40 hours/week
Burden	Categorical variable indicating the greatest difficulty faced by the caregiver, categorized as: 1. No difficulty 2. Financial (interferes with work or creates a financial burden) 3. Social (doesn’t leave enough time for family, or affects family relationships) 4. Physical (creates or aggravates health problems) 5. Psychological (doesn’t leave enough time for subject, or creates stress)

[1] All dichotomous variables were coded as 1/0, where 1 indicates “Yes” and 0 indicates “No”

DATA ANALYSIS

We examined the impact of providing informal care on the physical and mental health of caregivers through two analyses. Specifically, the following research questions were addressed:

> Analysis 1: Does serving as an informal caregiver impact physical and mental health?
>
> Analysis 2: How does the care recipient’s condition impact the informal caregiver’s BMI, blood pressure, and mental health?

In Analysis 1, caregiver status was the primary independent variable of interest. We hypothesized the following health effects would be observed:

H_1: Providing informal care is related to higher BMI;

H_2: Providing informal care is related to having high blood pressure;

H_3: Providing informal care is related to poor mental health.

To address these three hypotheses, the general model below was estimated for each of our five separate outcomes (dichotomous Obese, Overweight or Obese, High Blood Pressure, and Mental Health variables, and the categorical Mental Health outcome):

$$Outcome = \alpha_0 + \alpha_1 caregiver\ status + [demographics] + [socioeconomic\ status] + [health\ behaviors] + [health\ care\ access] + [emotional\ support] + \varepsilon,$$

where $demographics = \alpha_2 age + \alpha_3 gender + \alpha_4 race,$

$$socioeconomic\ status = \alpha_5 income + \alpha_6 education + \alpha_7 employment + \alpha_8 marital\ status + \alpha_9 children\ in\ household,$$

$$health\ behaviors = \alpha_{10} disability + \alpha_{11} diet + \alpha_{12} exercise + \alpha_{13} general\ health,$$

$$health\ care\ access = \alpha_{14} routine\ doctor\ visits,$$

$$emotional\ support = \alpha_{15} social\ emotional\ support.$$

For the dichotomous dependent variables, analyses were based on the binary logit function,

$$p = \Pr(y = 1) = \frac{1}{1+e^{-X\beta}} ,$$

where β = the coefficient estimated by the model, and X = the independent variable value. An extension of the binary logit function was used for the categorical, ordinal mental health outcome. Thus, multivariable logistic regression analysis was carried out for each of the four dichotomous dependent variables, and multivariable ordered logistic regression analysis was used for the fifth, categorical dependent variable.

Ordered logistic regression allowed for comparison of the likelihood of each categorical outcome to the reference outcome (in the case of our mental health variable, zero days “not good”). Ordered logistic regression is typically used to predict conditional probabilities when the underlying “latent” distribution of an ordinal dependent variable is unknown (for example, for a Likert scale outcome of Excellent, Very Good, Good, Fair, and Poor). At first glance, our situation differs from the traditional use of the ordered logit model because we know the cut-off values between each category (defined as 0 days, 1-7 days, 8-15 days, 16-29 days, and 30 days). However, the distribution of our underlying mental health outcome variable shows that individuals tended to respond with rounded numbers, naturally trending their responses to a few options, as if they had been given a Likert scale. Thus, we formed categories to collapse the full range of possible responses (0 to 30) into the smaller number of categories reflected by the subjects’ natural response tendencies. We used ordered logistic regression to determine whether including this additional information about our mental health outcome would yield a different beta value and relationship between caregiving and days of “not good” mental health than when evaluated as a binary dependent variable.

In Analysis 2, an expanded model including all of the variables from Analysis 1 (except caregiver status), and the additional caregiving-related variables (Table 3.1), was used to analyze the sub-sample of subjects who identified themselves as informal caregivers who had provided care for at least 6 months. We were primarily interested in how care recipient medical condition, categorized as Alzheimer’s, chronic conditions, mobility-restricting conditions, and other conditions, impacted caregiver health outcomes. We hypothesized that:

H_1: Caregivers for Alzheimer’s patients have higher BMI than caregivers for people suffering from chronic or mobility-restricting conditions;

H_2: Caregivers for Alzheimer’s patients are more likely to have high blood pressure than caregivers for people suffering from chronic or mobility-restricting conditions;

H_3: Caregivers for Alzheimer’s patients have poorer mental health than caregivers for people suffering from chronic or mobility-restricting conditions.

The same five outcomes evaluated in Analysis 1 were analyzed via logistic (for the four dichotomous outcomes) or ordered logistic (for the categorical mental health variable) regression analysis. In this set of analyses, the primary independent variable was the care recipient's medical condition, as shown in the expanded model below:

$$\begin{aligned}\textit{Outcome} = \beta_0 + \beta_1 & \textit{ care recipient's medical condition} + [\textit{demographics}] + \\ & [\textit{socioeconomic status}] + [\textit{health behaviors}] + [\textit{health care access}] + \\ & [\textit{emotional support}] + [\textit{care recipient characteristics}] + \\ & [\textit{caregiving characteristics}] + \varepsilon,\end{aligned}$$

where *demographics*, *socioeconomic status*, *health behaviors*, *health care access*, and *emotional support* are defined as in Analysis 1, and

$$\begin{aligned}\textit{care recipient characteristics} = {} & \beta_{16}\textit{care recipient age} + \beta_{17}\textit{care recipient sex} \\ & + \beta_{18}\textit{relation to caregiver} \\ & + \beta_{19}\textit{cognitive changes},\end{aligned}$$

$$\begin{aligned}\textit{caregiving characteristics} = {} & \beta_{20}\textit{caregiving activities} + \beta_{21}\textit{caregiving duration} \\ & + \beta_{22}\textit{hours per week caregiving} \\ & + \beta_{23}\textit{caregiving burden}.\end{aligned}$$

Regressions for Analyses 1 and 2 were evaluated both unweighted and weighted. Weighted analyses used the final weight variables provided by BRFSS. Different perspectives exist on whether to use weighted or unweighted population-based data in multivariable regression analyses. The microeconometric perspective suggests that weights be used when describing populations or summarizing data, but that weights are not necessary when using an analytical approach, assuming that the impact of our independent variables on the dependent variable is modeled correctly[43]. If the model is indeed correctly specified, the beta estimates that result from the weighted and unweighted sample regressions should be similar. We have chosen to follow this approach. Thus, we present weighted descriptive statistics to describe the data source populations, but primarily present unweighted analytical regressions, assuming the models are accurately specified and will yield similar results to the weighted regressions. We also compared the unweighted and weighted regression results to determine whether they were similar as expected.

Additionally, the pooled regressions were run with direct state shift variables to test for state effects. To further evaluate suspected cross-state differences, individual state-specific models were also analyzed. We also examined the robustness of our model against endogeneity between our outcomes and four independent variables: general health, routine doctor visit, social emotional support, and exercise. These four variables were thought to potentially have two-way (endogenous) relationships with our health outcomes. All four were examined for the BMI outcomes, general health was examined for the high blood pressure outcome, and general health and routine doctor visit were examined for the mental health outcomes. We removed each variable from each model individually and all variables in question as a group, and examined changes in beta values' direction and significance, and each model's overall goodness of fit (as measured by Somers' D).

For all models, an alpha level of 0.05 was used to determine statistical significance. All data cleaning, variable creation, and data management was performed using SAS v9.2 (SAS Institute, Cary, NC, 2008). Regression analyses were conducted in Stata 10.1 and 11.1 (Stata Statistical Software, StataCorp, College Station, TX, 2009).

4. Results

We compared the descriptive statistics for the caregiver and non-caregiver samples, and evaluated differences in caregivers for care recipients with Alzheimer's disease, and chronic, mobility-restricting, and other conditions. Next, we conducted our analyses of the impact of caregiving on BMI, high blood pressure, and mental health, and our analyses of the impact of care recipient medical condition on caregivers' outcomes. Finally, state effects were also examined.

DESCRIPTIVE STATISTICS

Analysis 1: Caregivers vs. Non-Caregivers

The sample population consisted of 31,715 subjects, 3946 (12.4%) of which identified themselves as informal caregivers and had provided care for at least 6 months. The demographics of these informal caregivers were compared with the rest of the subjects. Table 4.1 below summarizes the descriptive statistics for each population. All comparisons were statistically significant at the $p<0.0001$ level, except for the number of children in the household, which was significant at the $p<0.05$ level ($p=0.0227$).

Table 4.1. Weighted Descriptive Statistics for Informal Caregivers and Non-Caregivers

Factor	Overall n=31715 [(%) or mean (SD)][2]	Caregivers n=3946	Non-Caregivers n=27769
Age			
18-29	20.4	13.9	21.3
30-45	30.3	28.3	30.6
46-65	33.5	44.0	32.0
> 65	15.8	13.9	16.1
Female	51.7	60.2	50.5
Race			
Non-Hispanic White	67.6	68.9	67.4
Non-Hispanic Black	18.2	22.2	17.6
Hispanic	8.5	4.7	9.0
Other	5.7	4.3	5.9
Income			
< $20,000	17.2	16.0	17.3
$20,000-$75,000	49.3	54.5	48.6
> $75,000	33.5	29.5	34.1
Education			
Some High School	10.0	7.0	10.4
High School Graduate	27.9	28.9	27.8
At Least Some College	62.1	64.1	61.8
Employed	57.0	57.2	57.0
Marital Status			
Never Married	21.1	18.4	21.4
Married	62.6	65.2	62.2
Divorced/Separated	10.1	11.6	9.8
Widowed	6.3	4.8	6.5
Number of Children in Household	0.8 (30.1)	0.8 (30.3)	0.8 (30.0)
Disabled	18.2	21.3	17.7
Healthy Diet	21.2	24.9	20.6
Exercised	74.7	77.3	74.3
General Health			
Excellent	19.6	17.8	19.8
Very Good	33.5	31.3	33.8
Good	29.9	32.9	29.5
Fair	12.6	14.5	12.4
Poor	4.4	3.6	4.5
Routine Doctor Visit			
Within Past Year	68.7	69.3	68.6
1-2 Years Ago	14.3	14.5	14.3
2-5 Years Ago	8.6	8.6	8.6
> 5 Years Ago	8.4	7.7	8.5
Social Emotional Support			
Always	48.8	45.8	49.2
Usually	29.2	29.1	29.2
Sometimes	14.0	16.2	13.7
Rarely	3.6	4.1	3.6
Never	4.4	4.9	4.3
Outcomes			
Overweight or Obese	64.3	68.2	63.8
Obese	28.4	34.6	27.5
Ever Had High Blood Pressure	30.9	33.0	30.6

Factor	Overall n=31715 [(%) or mean (SD)][2]	Caregivers n=3946	Non-Caregivers n=27769
Mental Health "Not Good"			
0 Days	64.8	57.6	65.8
1-7 Days	21.2	24.3	20.8
8-15 Days	6.4	7.2	6.3
16-29 Days	2.6	3.6	2.5
30 Days	5.0	7.3	4.7

[1] Percentages weighted to represent state-wide populations

[2] Chi-square results are displayed as %; t-test results are displayed as mean (SD)

[3] $p=0.0227$, significant at $p<0.05$. All other comparisons were statistically significant at the $p<0.0001$ level

In particular, 44.0% of caregivers were age 45-65, while only 32.0% of the non-caregiver population fell within this age group. In addition, the caregiver population had a higher percentage of females than the non-caregiver population (60.2% versus 50.5%, respectively; 51.7% overall). Our data also indicated that caregivers have more physical activity and eat more servings of fruit and vegetables than non-caregivers. However, 34.6% of caregivers were categorized as obese, compared to only 27.5% of non-caregivers. Fewer caregivers than non-caregivers reported having no poor mental health days (57.6% versus 65.8%, respectively).

Analysis 2: Caregiver Comparison by Care Recipient Medical Condition

Within the informal caregiver sample, caregivers were categorized based on the care recipient’s primary medical condition. Demographics were compared across these groups. Table 4.2 shows the results of the comparison. All comparisons were significant at the $p<0.0001$ level, with the exception of income level, which was significant at the $p<0.001$ level ($p=0.0009$).

Table 4.2. Weighted Descriptive Statistics for Informal Caregivers by Recipient's Condition

Factor	Overall n=3685 [(%)[1] or mean (SD)][2]	Alzheimer's Disease n = 369	Chronic n = 1467	Mobility-Restricting n = 600	Other n = 1249
Age					
18-29	13.9	7.2	13.2	9.4	18.0
30-45	27.3	16.5	29.3	30.7	26.6
46-65	44.7	59.5	44.7	44.2	41.3
> 65	14.1	16.7	12.7	15.7	14.1
Female	60.9	64.7	61.8	62.0	58.7
Race					
Non-Hispanic White	69.8	82.2	61.4	75.0	72.8
Non-Hispanic Black	21.4	12.7	28.5	16.6	18.7
Hispanic	4.9	4.8	5.1	5.9	4.5
Other	3.9	0.4	5.1	2.6	4.1
Income[3]					
< $20,000	15.6	11.9	17.4	16.1	14.7
$20,000-$75,000	54.7	49.1	56.2	54.6	54.6
> $75,000	29.7	39.1	26.5	29.3	30.7
Education					
Some High School	6.7	5.1	7.3	5.6	6.8
High School Graduate	28.7	27.8	32.6	24.1	26.9
At Least Some College	64.7	67.1	60.1	70.3	66.3
Employed	57.0	59.9	56.7	52.8	58.2
Marital Status					
Never Married	18.0	11.0	19.3	14.8	19.8
Married	65.4	72.2	63.9	65.8	65.2
Divorced/Separated	11.6	10.7	12.8	13.6	9.8
Widowed	5.0	6.1	4.1	5.9	5.2
Number of Children in Household	0.5 (1.0)	0.3 (0.7)	0.5 (1.0)	0.5 (0.9)	0.5 (1.0)
Disabled	21.3	21.9	22.7	22.9	19.4
Healthy Diet	25.0	24.0	23.4	21.0	28.2
Exercise	77.7	75.5	77.9	77.6	78.0
General Health					
Excellent	17.6	18.1	14.8	18.1	20.1
Very Good	31.4	30.7	30.4	32.3	32.2
Good	32.9	33.7	34.9	28.8	32.3
Fair	14.4	13.9	15.7	17.1	12.2
Poor	3.7	3.6	4.2	3.8	3.2
Routine Doctor Visit					
Within Past Year	70.0	75.9	71.0	69.3	67.9
1-2 Years Ago	14.4	14.3	13.8	12.1	15.9
2-5 Years Ago	8.1	7.4	9.5	5.8	7.8
> 5 Years Ago	7.5	2.4	5.7	12.8	8.4
Social Emotional Support					
Always	46.2	44.6	44.3	44.6	49.0
Usually	29.7	35.0	28.7	31.0	28.8
Sometimes	15.3	10.8	17.7	16.9	13.5
Rarely	4.2	5.1	5.1	5.4	2.7
Never	4.6	4.6	4.2	2.1	6.0
Care Recipient Age					
< 20	5.6	0.0	3.3	2.6	10.3
20-60	20.4	0.4	16.9	25.4	26.8
61-75	24.3	9.2	33.3	22.1	19.9
> 75	49.8	90.4	46.5	49.9	43.0

Factor	Overall n=3685 [(%)[1] or mean (SD)][2]	Alzheimer's Disease n = 369	Chronic n = 1467	Mobility-Restricting n = 600	Other n = 1249
Relationship to Caregiver					
Parent/Parent-in-law	45.9	65.0	48.8	51.5	36.0
Spouse	9.9	8.0	11.0	11.2	8.6
Sibling	5.3	1.6	4.3	3.9	7.8
Child/Grandchild	7.5	0.0	4.2	7.0	12.8
Other Relative	19.5	17.1	19.9	16.2	20.9
Non-Relative	12.0	8.3	11.8	10.2	13.9
Female Care Recipient	65.9	73.3	66.2	65.3	64.1
Cognitive Changes	56.4	93.5	55.7	52.5	49.7
Caregiving Activity					
ADLs	19.9	36.3	22.3	20.9	13.4
IADLs	34.5	33.0	36.5	34.9	32.7
Cognitive	15.6	18.7	11.4	11.1	21.0
Mobility	30.0	12.0	29.8	33.2	33.0
Caregiving Duration					
6mo-1 Year	9.0	10.9	10.5	6.6	8.0
1-5 Years	51.3	50.4	52.6	50.9	50.3
> 5 Years	39.8	38.7	37.0	42.4	41.6
Caregiving Hours/Week					
< 10	52.0	45.3	52.6	48.1	54.7
10-20	16.5	20.0	15.8	20.3	14.7
21-40	19.4	18.4	21.5	19.7	17.6
> 40	12.1	16.3	10.2	12.0	13.0
Caregiver Burden					
No Difficulty	35.4	23.5	36.9	39.0	35.3
Financial	12.1	7.7	11.7	13.7	12.9
Social	10.7	10.5	9.0	9.6	12.9
Physical	4.1	4.5	4.0	4.3	4.1
Psychological	37.7	53.8	38.4	33.4	34.9
Outcomes					
Overweight or Obese	68.0	67.3	69.9	69.2	65.9
Obese	35.3	36.3	38.7	36.1	31.6
Had High Blood Pressure	33.4	33.6	36.1	34.3	30.3
Mental Health "Not Good"					
0 Days	58.0	60.0	59.0	61.4	55.1
1-7 Days	24.0	20.2	21.7	22.4	27.8
8-15 Days	7.3	8.4	8.0	5.1	7.4
16-29 Days	3.6	1.4	3.9	5.0	3.3
30 Days	7.1	10.0	7.5	6.2	6.5

261 caregiver subjects missing condition response. ADL=Activities of Daily Living; IADL=Instrumental Activities of Daily Living

[1] Percentages weighted to represent state-wide populations

[2] Chi-square results are displayed as %; t-test results are displayed as mean (SD)

[3] Mantel-Haenszel chi-square=0.0009

For any of the four care recipient condition categories, the majority of caregivers provide care for a parent or parent-in-law (range from 36.0% (other) to 65.0% (Alzheimer's)). Caregivers who care for friends or relatives with chronic conditions differed most from the other caregiver groups. About 28.5% percent of caregivers for care recipients with chronic diseases were non-Hispanic black, compared to 12.7% to 18.7% of caregivers for care recipients with other medical conditions. A higher percentage of caregivers for someone with chronic conditions had graduated high school, but never attended college (32.6%, compared to 24.1% to 27.8% in other medical condition categories). Our reference group, caregivers caring for Alzheimer's patients, also differed in age distribution and marital status compared to our other condition categories. Alzheimer's caregivers had the highest percentage married (72.2%, compared to 63.9% to 65.8%), and the smallest percentage that were never married (11.0%, compared to 14.8% to 19.8%). About 59.5% of caregivers for Alzheimer's patients were age 45-65, compared to 41.3% to 44.7% of caregivers for care recipients with other medical conditions.

Most informal caregivers helped care recipients with activities of daily living (ADLs) (19.9%) and instrumental activities of daily living (IADLs) (34.5%). In all four condition categories, most caregivers (33.4-53.8%) experiencing a caregiving burden felt a psychological burden from providing care. The greatest psychological burden was observed in the population of caregivers caring for someone with Alzheimer's disease (53.8% of Alzheimer's sample, compared to 33.4-38.4% of the other categories). Approximately 4.0% of caregivers in each medical condition category experienced a direct physical health burden from providing care.

ANALYSIS RESULTS

Analysis 1: Caregivers vs. Non-Caregivers

We performed binary logistic regression analysis to determine whether caregiver status independently affects physical and mental health. Additionally, we performed ordered logistic regression analysis to determine whether caregiver status independently affects the categorical amount of days during which the subject's mental health was "not good." Results from our unweighted, full-sample models are presented in this chapter; weighted full-sample regression results are presented in the Appendix. The weighted regression analyses reported the same statistically significant relationships between key caregiving variables and outcomes as found in the unweighted regression analyses. In each table, beta coefficients reflect the same effects as the odds ratios presented for each model.

Body Mass Index

Using our full model (Table 4.3), we analyzed whether informal caregivers were more likely to be obese, or either overweight or obese compared with non-caregivers. We hypothesized that informal caregivers would have higher body mass index (BMI) than non-caregivers, and would therefore be more likely to be obese or overweight.

Table 4.3. Analysis 1 Results: Caregiver Status and BMI

BMI	**Obese**		**Overweight or Obese**	
	n = 24843		n = 24843	
Characteristic	**β**	**OR [95% CI]**	**β**	**OR [95% CI]**
Caregiver	0.1814***	1.199 [1.1049,1.3009]	0.1855***	1.204 [1.1088,1.3069]
Age (18-29)				
30-45	0.2684***	1.308 [1.1484,1.4895]	0.3543***	1.425 [1.2687,1.6008]
46-65	0.3166***	1.372 [1.2070,1.5605]	0.4864***	1.627 [1.4500,1.8245]
> 65	-0.3000***	0.741 [0.6401,0.8574]	0.0596	1.061 [0.9313,1.2097]
Female	-0.0392	0.962 [0.9042,1.0224]	-0.6234***	0.536 [0.5046,0.5696]
Race (Non-Hispanic White)				
Non-Hispanic Black	0.4554***	1.577 [1.4625,1.7002]	0.5829***	1.791 [1.6494,1.9453]
Hispanic	-0.0169	0.983 [0.8344,1.1585]	0.1219	1.130 [0.9640,1.3238]
Other	-0.1243	0.883 [0.7519,1.0372]	-0.1692*	0.844 [0.7289,0.9780]
Income (> $75,000)				
< $20,000	0.2398***	1.271 [1.1377,1.4200]	0.1826**	1.200 [1.0783,1.3360]
$20,000-$75,000	0.2146***	1.239 [1.1485,1.3373]	0.2648***	1.303 [1.2154,1.3974]
Education (Some High School)				
High School Graduate	-0.0432	0.958 [0.8611,1.0652]	-0.0238	0.976 [0.8725,1.0929]
At Least Some College	-0.1003	0.905 [0.8126,1.0070]	-0.2059**	0.814 [0.7276,0.9106]
Employed	0.1313**	1.140 [1.0630,1.2233]	0.1775***	1.194 [1.1162,1.2776]
Marital Status (Never Married)				
Married	0.0213	1.021 [0.9281,1.1243]	0.2194***	1.245 [1.1349,1.3664]
Divorced/Separated	-0.0931	0.911 [0.8175,1.0153]	0.0754	1.078 [0.9688,1.2002]
Widowed	-0.0585	0.943 [0.8316,1.0698]	0.1760*	1.192 [1.0562,1.3464]
Number of Children in Household	0.0376*	1.038 [1.0035,1.0744]	0.0195	1.020 [0.9862,1.0544]
Disabled	0.2846***	1.329 [1.2334,1.4324]	0.2460***	1.279 [1.1829,1.3827]
Healthy Diet	0.1239**	1.132 [1.0539,1.2158]	0.1680***	1.183 [1.1089,1.2621]
Exercise	-0.3764***	0.686 [0.6428,0.7329]	-0.2508***	0.778 [0.7265,0.8336]
General Health (Excellent)				
Very Good	0.6740***	1.962 [1.7750,2.1690]	0.6498***	1.915 [1.7737,2.0678]
Good	1.1616***	3.195 [2.8857,3.5375]	0.8996***	2.459 [2.2617,2.6727]
Fair	1.3219***	3.751 [3.3221,4.2341]	0.9637***	2.621 [2.3444,2.9310]
Poor	1.1511***	3.162 [2.7084,3.6909]	0.7260***	2.067 [1.7782,2.4024]
Routine Doctor Visit (< 1 Yr Ago)				
1-2 Years Ago	-0.1789**	0.836 [0.7608,0.9191]	-0.1851***	0.831 [0.7615,0.9070]
2-5 Years Ago	-0.1574*	0.854 [0.7546,0.9674]	-0.2696***	0.764 [0.6811,0.8563]
> 5 Years Ago	-0.3568***	0.700 [0.6176,0.7932]	-0.3338***	0.716 [0.6392,0.8024]
Social Emotional Support (Always)				
Usually	-0.1295**	0.879 [0.8201,0.9412]	-0.1159**	0.891 [0.8351,0.9497]
Sometimes	-0.1317*	0.877 [0.8038,0.9559]	-0.1533**	0.858 [0.7865,0.9356]
Rarely	0.0016	1.002 [0.8692,1.1541]	-0.0393	0.961 [0.8283,1.1160]
Never	-0.1321	0.876 [0.7571,1.0140]	-0.1861*	0.830 [0.7155,0.9632]
Constant	-1.8979***		-0.1900	

* $p < 0.05$ **$p < 0.001$ ***$p<0.0001$; OR= odds ratio, CI= confidence interval. For obese model, Pseudo r^2=0.073; Somers' D=0.368; c-statistic=0.684

For overweight or obese model, Pseudo r^2=0.068; Somers' D=0.351; c-statistic=0.676

After controlling for other factors, informal caregivers have 20% higher odds of being obese, or of being overweight or obese than non-caregivers ($p<0.0001$ for both BMI outcomes; 95% CI 1.105, 1.301 and 1.109, 1.307, respectively). In addition, adults ages 30-65 were found to have a higher likelihood of being obese than adults aged 18-29, and non-Hispanic blacks had higher odds of being obese than non-Hispanic whites. Lower income also significantly impacted obesity, with the lower and middle income groups having higher odds of being obese than the high income group. Other variables found to significantly increase the likelihood of being obese at the $p<0.001$ level included being employed or disabled, and having poorer general health. Older age and exercise were observed to reduce the likelihood of being obese. Adults ages 66 and older had lower odds of being obese than adults age 18-29, and physically active subjects had lower odds of being obese than non-physically active subjects.

Our model examining the likelihood of being either overweight or obese yielded similar significant findings. Middle age, being non-Hispanic black (as compared to non-Hispanic white), lower income, being employed or disabled, and poorer general health were all found to significantly increase the likelihood of being overweight or obese at the $p<0.001$ level. Additionally, being married led to higher odds of being overweight or obese. As expected, factors that significantly reduced the likelihood of being overweight or obese at the $p<0.001$ level included being female, having some college education or higher, exercise, and receiving social emotional support. Having a less recent routine doctor visit was associated with lower likelihood of being overweight or obese.

High Blood Pressure

Using our full model, we analyzed whether informal caregivers were more likely to have ever been diagnosed with high blood pressure than non-caregivers (Table 4.4). We hypothesized that informal caregivers would be more likely to have had high blood pressure.

Table 4.4. Analysis 1 Results: Caregiver Status and High Blood Pressure

Characteristic	**High Blood Pressure** n = 25469 **β**	**OR [95% CI]**
Caregiver	0.0397	1.040 [0.9584,1.1296]
Age (18-29)		
30-45	0.8670***	2.380 [1.9992,2.8325]
46-65	1.7147***	5.555 [4.6883,6.5815]
> 65	2.1871***	8.909 [7.4366,10.6734]
Female	-0.2653***	0.767 [0.7211,0.8158]
Race (Non-Hispanic White)		
Non-Hispanic Black	0.5215***	1.684 [1.5566,1.8229]
Hispanic	-0.3056**	0.737 [0.6162,0.8807]
Other	-0.0607	0.941 [0.8002,1.1068]
Income (> $75,000)		
< $20,000	0.2340***	1.264 [1.1310,1.4117]
$20,000-$75,000	0.1740***	1.190 [1.1043,1.2824]
Education (Some High School)		
High School Graduate	-0.0637	0.938 [0.8402,1.0478]
At Least Some College	-0.1427*	0.867 [0.7762,0.9686]
Employed	-0.1261**	0.882 [0.8225,0.9447]
Marital Status (Never Married)		
Married	0.0086	1.009 [0.9130,1.1143]
Divorced/Separated	0.0295	1.030 [0.9222,1.1503]
Widowed	0.2076*	1.231 [1.0864,1.3943]
Number of Children in Household	-0.0979***	0.907 [0.8727,0.9420]
Disabled	0.1601***	1.174 [1.0882,1.2657]
Healthy Diet	0.0785*	1.082 [1.0088,1.1598]
Exercise	-0.0594	0.942 [0.8805,1.0085]
General Health (Excellent)		
Very Good	0.7415***	2.099 [1.9092,2.3078]
Good	1.1866***	3.276 [2.9730,3.6095]
Fair	1.5746***	4.829 [4.2873,5.4385]
Poor	1.7477***	5.741 [4.8977,6.7306]
Routine Doctor Visit (< 1 Yr Ago)		
1-2 Years Ago	-0.5370***	0.584 [0.5306,0.6438]
2-5 Years Ago	-0.7703***	0.463 [0.4042,0.5301]
> 5 Years Ago	-1.1080***	0.330 [0.2879,0.3788]
Social Emotional Support (Always)		
Usually	-0.0606	0.941 [0.8790,1.0078]
Sometimes	-0.0166	0.984 [0.9009,1.0737]
Rarely	0.1068	1.113 [0.9608,1.2888]
Never	-0.1697*	0.844 [0.7287,0.9774]
Constant	-2.6755***	

* $p < 0.05$ **$p < 0.001$ ***$p<0.0001$; OR= odds ratio, CI= confidence interval
Pseudo r^2=0.187; Somers' D=0.564; c-statistic=0.782

Caregiver status was found to slightly increase the likelihood of having ever been diagnosed with high blood pressure, but the result was not significant at the $p<0.05$ level (p=0.3437). Factors found to significantly increase the likelihood of a high blood pressure diagnosis were older age, being non-Hispanic black (as compared to non-Hispanic white), lower income, being disabled, and poorer general health (p<0.001 for each variable). A less frequent routine doctor visit, and being female or being employed were observed to reduce the likelihood of being diagnosed with high blood pressure. Hispanics were found to have lower odds of being diagnosed with high blood pressure than non-Hispanic whites.

Mental Health

Using our full model, we analyzed whether informal caregivers were more likely to have days in which their mental health was “not good” than non-caregivers (Table 4.5). We evaluated days of "not good" mental health as both a dichotomous and categorical outcome. We hypothesized a positive association between caregiving and having poor mental health days.

Table 4.5. Analysis 1 Results: Caregiver Status and Mental Health

Mental Health	**At Least One Day “Not Good”** n = 25286		**Categorical**^{1} n = 25286	
Characteristic	**β**	**OR [95% CI]**	**β**	**OR [95% CI]**
Caregiver	0.2657***	1.304 [1.2018,1.4158]	0.2775***	1.320 [1.2219,1.4257]
Age (18-29)				
30-45	-0.2005**	0.818 [0.7277,0.9202]	-0.1767*	0.838 [0.7510,0.9352]
46-65	-0.6085***	0.544 [0.4839,0.6118]	-0.5617***	0.570 [0.5108,0.6366]
> 65	-1.4065***	0.245 [0.2131,0.2816]	-1.4460***	0.236 [0.2062,0.2689]
Female	0.5461***	1.726 [1.6207,1.8392]	0.5043***	1.656 [1.5580,1.7597]
Race (Non-Hispanic White)				
Non-Hispanic Black	-0.2142***	0.807 [0.7452,0.8744]	-0.2491***	0.780 [0.7223,0.8414]
Hispanic	-0.0961	0.908 [0.7743,1.0656]	-0.1123	0.894 [0.7678,1.0405]
Other	0.0408	1.042 [0.8922,1.2161]	-0.0119	0.988 [0.8533,1.1443]
Income (> $75,000)				
< $20,000	0.2457***	1.279 [1.1443,1.4287]	0.3274***	1.387 [1.2486,1.5416]
$20,000-$75,000	0.1271**	1.136 [1.0538,1.2236]	0.1545***	1.167 [1.0863,1.2539]
Education (Some High School)				
High School Graduate	0.0136	1.014 [0.9057,1.1345]	-0.0291	0.971 [0.8723,1.0817]
At Least Some College	0.1560*	1.169 [1.0439,1.3088]	0.0920	1.096 [0.9843,1.2213]
Employed	-0.0470	0.954 [0.8897,1.0230]	-0.0907*	0.913 [0.8546,0.9760]
Marital Status (Never Married)				
Married	-0.1337*	0.875 [0.7968,0.9605]	-0.0928*	0.911 [0.8345,0.9954]
Divorced/Separated	-0.0287	0.972 [0.8734,1.0811]	0.0429	1.044 [0.9446,1.1536]
Widowed	-0.1919*	0.825 [0.7261,0.9384]	-0.1323*	0.876 [0.7745,0.9909]
Number of Children in Household	0.0339*	1.034 [1.0007,1.0694]	0.0305	1.031 [0.9991,1.0638]
Disabled	0.5961***	1.815 [1.6822,1.9585]	0.6491***	1.914 [1.7814,2.0559]
Healthy Diet	0.0223	1.023 [0.9533,1.0968]	0.0180	1.018 [0.9521,1.0889]
Exercise	-0.0484	0.953 [0.8897,1.0203]	-0.0966*	0.908 [0.8509,0.9688]
General Health (Excellent)				
Very Good	0.3300***	1.391 [1.2718,1.5212]	0.2887***	1.335 [1.2229,1.4566]
Good	0.4771***	1.611 [1.4668,1.7703]	0.4568***	1.579 [1.4410,1.7302]
Fair	0.9171***	2.502 [2.2275,2.8102]	0.9637***	2.621 [2.3461,2.9292]
Poor	1.2349***	3.438 [2.9512,4.0052]	1.4808***	4.396 [3.8076,5.0761]
Routine Doctor Visit (< 1 Yr Ago)				
1-2 Years Ago	0.0865	1.090 [0.9955,1.1942]	0.0903*	1.095 [1.0042,1.1930]
2-5 Years Ago	0.1934*	1.213 [1.0783,1.3653]	0.1803*	1.198 [1.0726,1.3372]
> 5 Years Ago	0.1399*	1.150 [1.0234,1.2926]	0.1382*	1.148 [1.0289,1.2813]
Social Emotional Support (Always)				
Usually	0.6895***	1.993 [1.8625,2.1319]	0.6243***	1.867 [1.7484,1.9935]
Sometimes	1.1255***	3.082 [2.8305,3.3553]	1.1003***	3.005 [2.7742,3.2552]
Rarely	1.3808***	3.978 [3.4478,4.5902]	1.5171***	4.559 [4.0115,5.1812]
Never	0.5802***	1.786 [1.5400,2.0722]	0.7079***	2.030 [1.7587,2.3425]
Constant	-1.6697***			

Mental Health	**At Least One Day "Not Good"** n = 25286		**Categorical[1]** n = 25286	
Characteristic	**β**	**OR [95% CI]**	**β**	**OR [95% CI]**
1 Day "Not Good"[2]			1.5951***	
8 Days "Not Good"[2]			2.8531***	
16 Days "Not Good"[2]			3.5959***	
29 Days "Not Good"[2]			4.0092***	

[1] Days in which mental health was "not good," categorized as 0 days, 1-7 days, 8-15 days, 16-29 days, 30 days

[2] Represent ordered logit Tau cutpoints, not Beta values

* $p < 0.05$ **$p < 0.001$ ***$p<0.0001$; OR= odds ratio, CI= confidence interval

For the dichotomous model, Pseudo r^2=0.120; Somers' D=0.452; c-statistic=0.726

For the categorical model, Pseudo r^2=0.093; Somers' D=-0.432; c-statistic=0.716

Caregivers were found to have 30% higher odds of having at least one day during which their mental health was "not good" (95% CI 1.202, 1.416). When analyzed as a categorical dependent variable, caregivers had 32% higher odds of having additional days in which their mental health was "not good" compared to non-caregivers (95% CI 1.221, 1.425). Being female, disabled, and having lower income, less emotional support, and poorer general health were found to significantly increase the likelihood of having days in which mental health was "not good" at the p<0.0001 level. Alternatively, several factors were found to significantly reduce the likelihood of days in which mental health was "not good," including older age and being non-Hispanic black (as compared to non-Hispanic white). For example, we observed adults age 46-65 have lower odds of having at least one "not good" mental health day compared with adults age 18-29.

Impact of Care Recipient Medical Condition on Caregiver Health Outcomes

Within the caregiver sample, we analyzed whether the care recipient’s medical condition impacted the caregiver’s BMI, likelihood of having high blood pressure, or likelihood of having “not good” mental health days. We controlled for caregiving situation attributes and care recipient characteristics in our model. The coefficients, odds ratios, and 95% confidence intervals for each outcome’s model are displayed in Tables 4.6, 4.7, and 4.8.

Table 4.6. Analysis 2 Results: Care Recipient Condition and Caregiver BMI

BMI		**Obese** n = 2533		**Overweight or Obese** n = 2533
Characteristic	**β**	**OR [95% CI]**	**β**	**OR [95% CI]**
Recipient Condition (Alzheimer’s)				
Chronic	0.0238	1.024 [0.7393,1.4187]	-0.0049	0.995 [0.7185,1.3783]
Mobility-Restricting	0.2097	1.233 [0.8563,1.7765]	0.1037	1.109 [0.7672,1.6038]
Other	0.0165	1.017 [0.7237,1.4280]	0.0797	1.083 [0.7710,1.5211]
Care Recipient Age (< 20)				
20-60	0.0545	1.056 [0.6065,1.8388]	0.0506	1.052 [0.5697,1.9424]
61-75	-0.0864	0.917 [0.4978,1.6901]	0.0422	1.043 [0.5356,2.0314]
> 75	-0.2109	0.810 [0.4343,1.5102]	-0.0917	0.912 [0.4642,1.7933]
Relationship (Caring for Parent)				
Caring for Child	0.0585	1.060 [0.6495,1.7307]	0.2775	1.320 [0.7697,2.2629]
Caring for Spouse	0.0282	1.029 [0.7151,1.4796]	-0.0666	0.936 [0.6378,1.3723]
Caring for Sibling	-0.1012	0.904 [0.5991,1.3632]	-0.4421*	0.643 [0.4234,0.9755]
Caring for Grandparent	0.0402	1.041 [0.7870,1.3771]	-0.1732	0.841 [0.6311,1.1206]
Caring for Non-Relative	-0.0460	0.955 [0.7084,1.2877]	-0.2194	0.803 [0.5933,1.0870]
Female Care Recipient	0.0531	1.055 [0.8685,1.2805]	0.2267*	1.254 [1.0278,1.5311]
Cognitive Change	0.0262	1.027 [0.8479,1.2427]	0.0323	1.033 [0.8465,1.2602]
Caregiving Activity (Cognitive)				
ADLs	0.1948	1.215 [0.8990,1.6424]	0.0107	1.011 [0.7458,1.3698]
IADLs	0.0010	1.001 [0.7529,1.3307]	0.0721	1.075 [0.8093,1.4272]
Mobility	0.2563	1.292 [0.9631,1.7335]	0.1683	1.183 [0.8792,1.5925]
Caregiving Duration (6mo-1yr)				
1-5 Years	0.0152	1.015 [0.7350,1.4026]	-0.1622	0.850 [0.6123,1.1806]
> 5 Years	0.0236	1.024 [0.7354,1.4257]	-0.0706	0.932 [0.6640,1.3077]
Caregiving Hours/Week (< 10)				
10-20	0.2264	1.254 [0.9795,1.6056]	0.1209	1.128 [0.8675,1.4681]
21-40	-0.0061	0.994 [0.7765,1.2721]	0.0010	1.001 [0.7723,1.2974]
> 40	-0.0737	0.929 [0.6886,1.2532]	-0.1789	0.836 [0.6153,1.1364]
Caregiving Burden				
Financial	0.0206	1.021 [0.7555,1.3791]	-0.2506	0.778 [0.5658,1.0707]
Social	-0.2895	0.749 [0.5372,1.0433]	-0.3530*	0.703 [0.5061,0.9754]
Physical	-0.2531	0.776 [0.4668,1.2914]	-0.5173	0.596 [0.3442,1.0324]
Psychological	-0.0956	0.909 [0.7332,1.1265]	-0.1257	0.882 [0.7059,1.1019]

BMI	**Obese** n = 2533		**Overweight or Obese** n = 2533	
Characteristic	**β**	**OR [95% CI]**	**β**	**OR [95% CI]**
Age (18-29)				
30-45	0.3415	1.407 [0.9020,2.1948]	0.1185	1.126 [0.7138,1.7756]
46-65	0.1664	1.181 [0.7516,1.8560]	0.0206	1.021 [0.6449,1.6159]
> 65	-0.1822	0.833 [0.4936,1.4074]	-0.1040	0.901 [0.5330,1.5240]
Female	-0.1032	0.902 [0.7416,1.0969]	-0.6758***	0.509 [0.4110,0.6299]
Race (Non-Hispanic White)				
Non-Hispanic Black	0.4880***	1.629 [1.2969,2.0463]	0.7409***	2.098 [1.6023,2.7464]
Hispanic	0.1339	1.143 [0.6886,1.8980]	0.5211	1.684 [0.9631,2.9439]
Other	0.1637	1.178 [0.6954,1.9950]	0.0064	1.006 [0.5809,1.7436]
Income (> $75,000)				
< $20,000	-0.0495	0.952 [0.6815,1.3291]	0.0520	1.053 [0.7403,1.4989]
$20,000-$75,000	0.0171	1.017 [0.8143,1.2708]	0.2044	1.227 [0.9814,1.5336]
Education (Some High School)				
High School Graduate	0.0339	1.034 [0.6994,1.5302]	-0.0418	0.959 [0.6173,1.4898]
At Least Some College	0.0046	1.005 [0.6828,1.4781]	-0.1905	0.827 [0.5358,1.2751]
Employed	0.1493	1.161 [0.9495,1.4196]	0.3021*	1.353 [1.0995,1.6641]
Marital Status (Never Married)				
Married	-0.0656	0.936 [0.6978,1.2568]	0.1705	1.186 [0.8684,1.6194]
Divorced/Separated	-0.0570	0.945 [0.6794,1.3134]	0.2653	1.304 [0.9136,1.8607]
Widowed	-0.2756	0.759 [0.4975,1.1584]	0.3564	1.428 [0.9209,2.2148]
Number of Children in Household	0.0425	1.043 [0.9376,1.1612]	-0.0624	0.940 [0.8410,1.0497]
Disabled	0.3407*	1.406 [1.1240,1.7584]	0.2440	1.276 [0.9932,1.6401]
Healthy Diet	0.1729	1.189 [0.9621,1.4688]	0.1232	1.131 [0.9191,1.3921]
Exercise	-0.4177**	0.659 [0.5332,0.8133]	-0.4223**	0.656 [0.5131,0.8374]
General Health (Excellent)				
Very Good	0.7382***	2.092 [1.5484,2.8268]	0.6407***	1.898 [1.4734,2.4445]
Good	1.1544***	3.172 [2.3314,4.3161]	0.8366***	2.309 [1.7574,3.0325]
Fair	1.3054***	3.689 [2.5552,5.3262]	1.2909***	3.636 [2.4805,5.3303]
Poor	1.0201**	2.773 [1.6554,4.6467]	0.7497*	2.116 [1.2233,3.6612]
Routine Doctor Visit (< 1 Yr Ago)				
1-2 Years Ago	-0.1899	0.827 [0.6279,1.0892]	0.0671	1.069 [0.8053,1.4202]
2-5 Years Ago	-0.0884	0.915 [0.6334,1.3227]	-0.2972	0.743 [0.5154,1.0707]
> 5 Years Ago	-0.4872*	0.614 [0.4140,0.9116]	-0.4240*	0.654 [0.4509,0.9497]
Social Emotional Support (Always)				
Usually	0.1406	1.151 [0.9323,1.4211]	0.1334	1.143 [0.9198,1.4197]
Sometimes	-0.0260	0.974 [0.7487,1.2680]	-0.1562	0.855 [0.6471,1.1306]
Rarely	0.0808	1.084 [0.7267,1.6175]	0.0012	1.001 [0.6407,1.5646]
Never	-0.4268	0.653 [0.3966,1.0739]	-0.4932	0.611 [0.3693,1.0098]
Constant	-1.6816*		0.4950	

* $p < 0.05$ **$p < 0.001$ ***$p<0.0001$; OR= odds ratio, CI= confidence interval

For the obese model, Pseudo r^2=0.073; Somers' D=0.362; c-statistic=0.681

For the overweight or obese model, Pseudo r^2=0.082; Somers' D=0.286; c-statistic=0.643

The care recipient’s medical condition was not found to significantly affect the likelihood that the caregiver would be obese, or overweight or obese. Furthermore, none of the caregiving situation or care recipient characteristic variables were found to significantly impact the likelihood of being in a high BMI category. Among caregivers, factors found to increase the likelihood of obesity were being non-Hispanic black (as compared to non-Hispanic white), being disabled, and poorer general health. Caregivers who exercised had lower odds of being obese than those who did not. Similar factors were found to significantly increase the likelihood of caregivers being overweight or obese. Female caregivers also had lower odds of being either overweight or obese.

Table 4.7. Analysis 2 Results: Care Recipient Condition and High Blood Pressure

	High Blood Pressure n = 2590	
Characteristic	**β**	**OR [95% CI]**
Care Recipient Condition (Alzheimer's)		
Chronic	0.0776	1.081 [0.7806,1.4963]
Mobility-Restricting	0.1232	1.131 [0.7841,1.6317]
Other	0.1075	1.113 [0.7930,1.5636]
Care Recipient Age (< 20)		
20-60	0.0795	1.083 [0.5900,1.9872]
61-75	0.2837	1.328 [0.6856,2.5721]
> 75	0.3627	1.437 [0.7344,2.8125]
Relationship (Caring for Parent)		
Caring for Child	0.0408	1.042 [0.6246,1.7370]
Caring for Spouse	0.1842	1.202 [0.8344,1.7323]
Caring for Sibling	0.2801	1.323 [0.8727,2.0062]
Caring for Grandparent	0.0122	1.012 [0.7528,1.3612]
Caring for Non-Relative	0.2194	1.245 [0.9200,1.6857]
Female Care Recipient	-0.0064	0.994 [0.8152,1.2111]
Cognitive Change	0.1099	1.116 [0.9184,1.3565]
Caregiving Activity (Cognitive)		
ADLs	0.1808	1.198 [0.8824,1.6270]
IADLs	0.1291	1.138 [0.8535,1.5168]
Mobility	0.2862	1.331 [0.9894,1.7914]
Caregiving Duration (6mo-1yr)		
1-5 Years	-0.3535*	0.702 [0.5088,0.9692]
> 5 Years	-0.2003	0.819 [0.5886,1.1383]
Caregiving Hours/Week (< 10)		
10-20	0.0995	1.105 [0.8564,1.4249]
21-40	0.1213	1.129 [0.8796,1.4489]
> 40	0.0253	1.026 [0.7580,1.3878]
Caregiving Burden		
Financial	0.2174	1.243 [0.9105,1.6964]
Social	-0.2400	0.787 [0.5578,1.1092]
Physical	0.0369	1.038 [0.6137,1.7544]
Psychological	0.1148	1.122 [0.9023,1.3944]
Age (18-29)		
30-45	0.6480*	1.912 [1.0826,3.3755]
46-65	1.2816***	3.602 [2.0406,6.3592]
> 65	1.8670***	6.469 [3.4745,12.0443]
Female	-0.3989***	0.671 [0.5494,0.8196]
Race (Non-Hispanic White)		
Non-Hispanic Black	0.6066***	1.834 [1.4450,2.3284]
Hispanic	0.1563	1.169 [0.6830,2.0015]
Other	-0.1366	0.872 [0.4990,1.5248]
Income (> $75,000)		
< $20,000	0.2537	1.289 [0.9179,1.8095]
$20,000-$75,000	0.0008	1.001 [0.7989,1.2536]

	High Blood Pressure n = 2590	
Characteristic	**β**	**OR [95% CI]**
Education (Some High School)		
High School Graduate	-0.3085	0.735 [0.4836,1.1157]
At Least Some College	-0.3155	0.729 [0.4839,1.0996]
Employed	-0.0335	0.967 [0.7898,1.1841]
Marital Status (Never Married)		
Married	0.0966	1.101 [0.8104,1.4970]
Divorced/Separated	0.0555	1.057 [0.7531,1.4837]
Widowed	0.2915	1.338 [0.8812,2.0330]
Number of Children in Household	-0.1099	0.896 [0.7920,1.0134]
Disabled	-0.0247	0.976 [0.7747,1.2288]
Healthy Diet	-0.0368	0.964 [0.7801,1.1909]
Exercise	-0.2582*	0.772 [0.6209,0.9610]
General Health (Excellent)		
Very Good	0.8568***	2.356 [1.7387,3.1912]
Good	1.3011***	3.673 [2.6905,5.0148]
Fair	1.7721***	5.883 [4.0270,8.5950]
Poor	1.8186***	6.163 [3.5983,10.5565]
Routine Doctor Visit (< 1 Yr Ago)		
1-2 Years Ago	-0.5102**	0.600 [0.4522,0.7970]
2-5 Years Ago	-0.7118**	0.491 [0.3259,0.7390]
> 5 Years Ago	-0.9357***	0.392 [0.2600,0.5920]
Social Emotional Support (Always)		
Usually	0.1755	1.192 [0.9615,1.4774]
Sometimes	0.2386	1.269 [0.9693,1.6625]
Rarely	0.2921	1.339 [0.8845,2.0278]
Never	-0.2963	0.744 [0.4538,1.2184]
Constant	-2.4623***	

* $p < 0.05$ **$p < 0.001$ ***$p<0.0001$; OR= odds ratio, CI= confidence interval
Pseudo r^2=0.161; Somers' D=0.157; c-statistic=0.579

Care recipient medical condition was not found to significantly affect the likelihood of having been diagnosed with high blood pressure. Furthermore, none of the caregiving situation or care recipient characteristic variables were found to significantly impact high blood pressure. Factors found to increase the likelihood of a caregiver to have ever been told they had high blood pressure were older age, being non-Hispanic black (as compared to non-Hispanic whites), and poorer general health. Being female and having a less recent doctor visit were found to decrease the likelihood of having been diagnosed with high blood pressure.

Table 4.8. Analysis 2 Results: Care Recipient Condition and Mental Health

Mental Health	**At Least One Day "Not Good"** n = 2580		**Categorical[1]** n = 2580	
Characteristic	**β**	**OR [95% CI]**	**β**	**OR [95% CI]**
Care Recipient Condition (Alzheimer's)				
Chronic	0.0555	1.057 [0.7603,1.4697]	0.0651	1.067 [0.7847,1.4516]
Mobility-Restricting	0.0640	1.066 [0.7339,1.5487]	0.0624	1.064 [0.7509,1.5089]
Other	0.1256	1.134 [0.8027,1.6016]	0.0671	1.069 [0.7758,1.4741]
Care Recipient Age (< 20)				
20-60	-0.0001	1.000 [0.5621,1.7786]	0.1964	1.217 [0.7221,2.0514]
61-75	-0.2046	0.815 [0.4334,1.5324]	-0.0146	0.986 [0.5563,1.7459]
> 75	-0.1182	0.888 [0.4677,1.6880]	0.0984	1.103 [0.6155,1.9783]
Relationship (Caring for Parent)				
Caring for Child	-0.2713	0.762 [0.4568,1.2723]	-0.1586	0.853 [0.5314,1.3704]
Caring for Spouse	0.2024	1.224 [0.8368,1.7914]	0.2275	1.255 [0.8809,1.7891]
Caring for Sibling	0.1010	1.106 [0.7208,1.6978]	0.0151	1.015 [0.6820,1.5112]
Caring for Grandparent	-0.0684	0.934 [0.6996,1.2467]	0.0260	1.026 [0.7864,1.3396]
Caring for Non-Relative	0.1706	1.186 [0.8696,1.6175]	0.1940	1.214 [0.9156,1.6100]
Female Care Recipient	-0.1246	0.883 [0.7236,1.0771]	-0.1026	0.902 [0.7505,1.0853]
Cognitive Change	0.1758	1.192 [0.9777,1.4537]	0.1786	1.195 [0.9940,1.4379]
Caregiving Activity (Cognitive)				
ADLs	-0.4549*	0.634 [0.4684,0.8595]	-0.4036*	0.668[0.5055,0.8824]
IADLs	-0.3248*	0.723 [0.5450,0.9584]	-0.2612*	0.770 [0.5949,0.9969]
Mobility	-0.1452	0.865 [0.6451,1.1594]	-0.1164	0.890 [0.6814,1.1629]
Caregiving Duration (6mo-1yr)				
1-5 Years	-0.0562	0.945 [0.6808,1.3128]	-0.1029	0.902 [0.6617,1.2302]
> 5 Years	0.1093	1.115 [0.7973,1.5606]	0.0525	1.054 [0.7681,1.4461]
Caregiving Hours/Week (< 10)				
10-20	-0.1491	0.862 [0.6641,1.1176]	-0.0937	0.911 [0.7149,1.1598]
21-40	0.0081	1.008 [0.7820,1.2997]	0.1148	1.122 [0.8890,1.4152]
> 40	0.0692	1.072 [0.7890,1.4555]	0.2590	1.296 [0.9788,1.7149]
Caregiving Burden				
Financial	0.6468***	1.909 [1.3907,2.6217]	0.6172***	1.854 [1.3780,2.4936]
Social	0.6672***	1.949 [1.4044,2.7042]	0.5685**	1.766 [1.2990,2.3996]
Physical	0.8545*	2.350 [1.3852,3.9874]	0.8857**	2.425 [1.5216,3.8637]
Psychological	0.9861***	2.681 [2.1431,3.3530]	0.9324***	2.541 [2.0571,3.1378]
Age (18-29)				
30-45	-0.4309	0.650 [0.4154,1.0169]	-0.3672	0.693 [0.4687,1.0238]
46-65	-0.8591**	0.424 [0.2687,0.6676]	-0.6977**	0.498 [0.3338,0.7420]
> 65	-1.4988***	0.223 [0.1310,0.3810]	-1.4879***	0.226 [0.1398,0.3649]
Female	0.3282*	1.388 [1.1290,1.7076]	0.2906*	1.337 [1.1026,1.6217]
Race (Non-Hispanic White)				
Non-Hispanic Black	-0.1064	0.899 [0.7055,1.1457]	-0.1627	0.850 [0.6801,1.0620]
Hispanic	-0.0206	0.980 [0.5746,1.6700]	0.2009	1.223[0.7425,2.0128]
Other	0.0358	1.036 [0.6088,1.7644]	0.0209	1.021 [0.6272,1.6625]
Income (> $75,000)				
< $20,000	0.5011*	1.651 [1.1738,2.3210]	0.4824*	1.620[1.1872,2.2104]
$20,000-$75,000	0.0446	1.046 [0.8337,1.3113]	0.0534	1.055 [0.8515,1.3068]

Mental Health	**At Least One Day "Not Good"** n = 2580		**Categorical**[1] n = 2580	
Characteristic	**β**	**OR [95% CI]**	**β**	**OR [95% CI]**
Education (Some High School)				
High School Graduate	0.2478	1.281 [0.8339,1.9685]	0.1006	1.106 [0.7470,1.6370]
At Least Some College	0.4034	1.497 [0.9788,2.2893]	0.2177	1.243 [0.8439,1.8314]
Employed	-0.0413	0.960 [0.7787,1.1825]	-0.0827	0.921 [0.7598,1.1154]
Marital Status (Never Married)				
Married	-0.1313	0.877 [0.6473,1.1881]	-0.0063	0.994 [0.7556,1.3069]
Divorced/Separated	-0.1495	0.861 [0.6114,1.2129]	0.0549	1.056 [0.7788,1.4329]
Widowed	-0.1087	0.897 [0.5819,1.3828]	-0.0019	0.998 [0.6698,1.4874]
Number of Children in Household	0.0502	1.051 [0.9401,1.1759]	0.0482	1.049 [0.9498,1.1594]
Disabled	0.6581***	1.931 [1.5294,2.4380]	0.6232***	1.865 [1.5148,2.2959]
Healthy Diet	-0.1133	0.893 [0.7221,1.1040]	-0.1221	0.885 [0.7273,1.0770]
Exercise	0.0980	1.103 [0.8791,1.3839]	0.0465	1.048 [0.8506,1.2901]
General Health (Excellent)				
Very Good	0.7289***	2.073 [1.5512,2.7699]	0.7077***	2.029 [1.5336,2.6856]
Good	0.7483***	2.113 [1.5607,2.8618]	0.7653***	2.150 [1.6057,2.8780]
Fair	1.0128***	2.753 [1.8953,3.9998]	1.1278***	3.089 [2.1760,4.3846]
Poor	1.2982***	3.663 [2.1465,6.2501]	1.6280***	5.094[3.1528,8.2299]
Routine Doctor Visit (< 1 Yr Ago)				
1-2 Years Ago	0.1680	1.183 [0.8946,1.5642]	0.1326	1.142 [0.8866,1.4705]
2-5 Years Ago	0.2024	1.224 [0.8419,1.7804]	0.1857	1.204 [0.8636,1.6788]
> 5 Years Ago	0.2531	1.288 [0.8794,1.8864]	0.2111	1.235 [0.8812,1.7308]
Social Emotional Support (Always)				
Usually	0.6156***	1.851 [1.4959,2.2900]	0.5353***	1.708[1.3945,2.0918]
Sometimes	0.9978***	2.712 [2.0777,3.5409]	0.9713***	2.641 [2.0687,3.3729]
Rarely	1.5535***	4.728 [3.0647,7.2940]	1.5775***	4.843 [3.3829,6.9331]
Never	0.9318**	2.539 [1.5380,4.1919]	1.1481***	3.152 [2.0007,4.9665]
Constant	-1.8787**			
1 Day "Not Good"[2]			2.0541***	
8 Days "Not Good"[2]			3.4221***	
16 Days "Not Good"[2]			4.0857***	
29 Days "Not Good"[2]			4.5060***	

[1] Days in which mental health was "not good," categorized as 0 days, 1-7 days, 8-14 days, 15-21 days, 22-30 days

[2] Represent ordered logit Tau cutpoints, not Beta values

* $p < 0.05$ **$p < 0.001$ ***$p<0.0001$; OR= odds ratio, CI= confidence interval

For the dichotomous outcome, Pseudo r^2=0.161; Somers' D=0.142; c-statistic=0.571

For the categorical outcome, Pseudo r^2=0.115; Somers' D=-0.481; c-statistic=0.741

Care recipient medical condition was not found to significantly affect the likelihood of having had "not good" mental health days. However, the caregiving burden felt by the caregiver and caregiving activities were found to significantly impact the likelihood of having poor mental health days. Caregivers providing assistance with activities of daily living (ADLs) and instrumental activities of daily living (IADLs) had 37% (OR=0.63, 95% CI

0.468, 0.860) and 28% (OR=0.72, 95% CI 0.545, 0.958) lower odds, respectively, of having at least one “not good” mental health day compared with caregivers providing assistance with cognitive functions, such as remembering or understanding. In contrast, caregivers experiencing any type of caregiving burden (financial, social, physical, or psychological) had higher odds of having at least one “not good” mental health day than caregivers who did not feel burdened from caregiving. Other factors that were found to increase caregivers’ likelihood of having poor mental health days included being disabled, less frequent social emotional support, or poorer general health. Older age was found to significantly reduce the likelihood of having days in which mental health was “not good.”

The observed effects were similar in both the dichotomous and ordered logistic regression analyses. The ordered logit analysis evaluated the number of days in which mental health was “not good." This categorization examined the mental health outcome in greater detail, showing the likelihood of additional days of poor mental health, rather than the likelihood of having at least one day in which mental health was “not good.” For example, caregivers experiencing a financial burden from providing care had 85% higher odds of having additional days of "not good" mental health than caregivers who did not experience a burden from caregiving.

Variations Across States

State effect models and individual state regression results examining caregiver status are presented in the Appendix. For the individual state regressions, sample sizes for each state were similar to sample sizes in some of the larger studies previously conducted in the literature (476, 928, 1454, and 1088 caregivers, and 3365, 4889, 7404, and 12111 non-caregivers in DC, IL, LA, and NC, respectively).

In our pooled models with state effects, North Carolina served as the reference group. Subjects in DC were found to have a significantly lower likelihood of being obese, or either overweight or obese, than those in North Carolina ($p<0.0001$). Subjects in Illinois were more likely than those in North Carolina to have at least one poor mental health day, or to have additional days of poor mental health ($p<0.0001$). In contrast, Louisiana's subjects were less likely than North Carolina's to have poor mental health ($p<0.0001$). In our analysis of the caregiver sample, DC caregivers were less likely to be overweight or obese than those in North Carolina ($p<0.05$), but the likelihood of having at least one poor mental health day was higher in DC than in North Carolina ($p<0.05$). Caregivers in Illinois were also found to have higher likelihood of having at least one poor mental health day than those in North Carolina ($p<0.05$).

Our individual state regressions evaluating caregiver status found similar results to the pooled model with state effects. Although some control variables differed in direction across the individual state regressions, there was little variation in performance of key variables. Serving as an informal caregiver increased the likelihood of being obese, being either overweight or obese, and of having poor mental health days in each state's regression analysis. The impact of caregiver status on high blood pressure was not significant in any of the four state models. Level of significance for the other outcomes varied across the state models. For example, the association between providing informal care and being obese was significant in the DC and Illinois models ($p<0.05$), but was not significant for Louisiana or North Carolina. Caregiver status was significantly associated with poorer mental health in both mental health outcomes at the $p<0.001$ level for all states except North Carolina. For North Carolina, caregiver status was only significantly associated with increased likelihood of having additional days of poor mental health ($p<0.05$).

Endogeneity

We checked for endogeneity of the general health, routine doctor visit, social emotional support, and exercise variables with each outcome for which a two-way relationship may have existed. As each variable was removed from the models, the direction and statistical significance of the remaining variables did not change. Crucially, the beta values for our caregiving variables of interest did not change direction or statistical significance. Removing all four variables at once from the BMI outcome models yielded similar results as removing each variable individually. In all cases, the Somers' D value decreased slightly when the variables were removed, as expected, but no significant decrease was observed.

Summary

Caregiver status was found to significantly influence the likelihood of being obese, either overweight or obese, and of having at least one day in which mental health was “not good,” or having additional days in which mental health was “not good.” In each instance, we found caregivers were more likely to have the poorer health condition (obesity or poor mental health) than non-caregivers. Caregivers had 20% higher odds of being obese, or either overweight or obese, and had 28% higher odds of having at least one poor mental health day than non-caregivers. However, caregivers were not found to be more likely to have had high blood pressure than non-caregivers.

Among caregivers, care recipient medical condition was not associated with physical or mental health outcomes. No caregiving characteristics significantly impacted either the likelihood of being obese, either overweight or obese, or of having had high blood pressure. Caregiver burden and caregiving activity type were both found to significantly impact the likelihood of caregivers to have poor mental health days, when evaluated as either a dichotomous or categorical outcome.

5. Discussion

KEY FINDINGS

Caregivers had higher odds of being overweight or obese than non-caregivers. Caregivers also had higher odds of having poor mental health days than non-caregivers. Among caregivers, BMI category and mental health were not related to the care recipient's medical condition. Alternatively, caregiving activity and caregiving burden were found to significantly impact caregivers' mental health. Caregivers who help with cognitive functions such as remembering or understanding had higher odds of having poor mental health days than caregivers who primarily assist with ADLs or IADLs. Furthermore, caregivers who experienced any category of burden from providing care—whether financial, social, physical, or psychological—had increased odds of having poor mental health days compared to those who felt no burden from caregiving. State effects in the pooled model were found to significantly contribute to the likelihood of being obese, being either overweight or obese, or having poor mental health. Serving as an informal caregiver increased the likelihood of being obese, being either overweight or obese, and of having poor mental health days in each individual state's regression analysis.

Our findings contribute additional understanding of caregivers' physical health as the first study, to our knowledge, which compares obesity and overweight status between caregivers and non-caregivers using multivariable regression analysis in a population-based sample. In addition, our analysis of caregiving characteristics' impact on caregiver health outcomes contributes to understanding which caregiving aspects most directly influence caregiver health.

CLINICAL IMPLICATIONS

Analysis 1: Caregiver vs. Non-Caregiver

Our analysis of the relationship between caregiver status and health outcomes evaluated the following hypotheses:

H_1: Serving as an informal caregiver is related to higher BMI;

H_2: Serving as an informal caregiver is related to having high blood pressure;

H_3: Serving as an informal caregiver is related to poor mental health.

The conclusions associated with our findings have important implications.

H_1: Caregiver Status and BMI

Our finding that informal caregivers are more likely to be classified as overweight or obese than non-caregivers supports our hypothesis that serving as an informal caregiver is related to higher BMI. Therefore, we conclude that whether or not the relationship between providing informal care and being overweight or obese is causal in nature, informal caregivers are a population at risk for obesity. This finding is consistent with previous literature that has found caregiving to have a negative effect on caregiver physical health[10]; however, to our knowledge, no direct multivariable examination of the relationship between BMI category and caregiver status has previously been conducted.

Some studies have suggested that informal caregivers burdened by caregiving may forgo preventative or corrective actions to improve their physical health[1, 11]. In our sample, despite generally similar reported levels of health insurance coverage across caregivers and non-caregivers (83.6% vs. 84.2%, respectively), 21.4% of caregivers indicated that they could not see a doctor because of cost, while only 14.3% of non-caregivers faced this financial barrier to medical care ($p<0.0001$). The combined effect of higher likelihood for being overweight or obese and reduced access to care suggests that informal caregivers are also more likely to contract chronic diseases, perhaps earlier and in a more severe form than the non-caregiver population. If the physical health impact of caregiving is not addressed, informal caregivers may themselves eventually require informal caregiving for a longer period of time than their care recipients. In addition, as a result, their poorer health may prevent them from providing informal care. As the long-term care system continues to shift away from institutionalization and towards community-based care, more individuals will join this at-risk population. As this cycle perpetuates, the cost of informal caregivers delaying treatment may become an important issue in the development of a successful community-based long-term care system. For these reasons, it is important to support informal caregivers in seeking medical care and programs to improve their physical health.

H_2: Caregiver Status and High Blood Pressure

Our findings did not support our hypothesis that caregivers would have higher likelihood of having high blood pressure. This result is contradictory to other studies, which have determined an association between informal caregiving and high blood pressure[10]. However, our analysis regarding high blood pressure was limited by the survey question, which asked whether the subject had "EVER been told by a doctor, nurse or other health professional that [they] had high blood pressure" [37]. Therefore, "yes" responses only indicated that the subject had ever had high blood pressure, rather than that they had high blood pressure at the time of the survey—while they were providing informal care. In addition, subjects who did not have access to care, or delayed medical care, may have unknowingly had high blood pressure, which is often asymptomatic. Thus, we believe this outcome may only reflect diagnosis of high blood pressure, as indicated by our finding that subjects with a less recent doctor visit were less likely to have high blood pressure. In either case, our analysis may not reflect the true relationship between caregiving and high blood pressure diagnosis due to the low validity of our outcome variable for our intended purpose.

H_3: *Caregiver Status and Mental Health*

Our results supported our hypothesis that caregivers have a higher likelihood than non-caregivers of having poor mental health days. These findings are consistent with previous literature regarding caregiver mental health[10, 20]. Our analysis examined the likelihood of having at least one poor mental health day in the past 30 days, as well as the likelihood of having additional days of poor mental health. Thus, our results do not describe the severity of poor mental health, nor do they explicitly show the range of poor mental health days experienced by caregivers or non-caregivers. However, the similarity between our dichotomous and ordinal outcomes suggests that across the range of reportable poor mental health days, caregivers have higher likelihood of having more poor mental health days than non-caregivers. The results of our second analysis indicate that the increased likelihood of having poor mental health days is primarily related to feeling a caregiving burden, and to the type of caregiving activity performed. Therefore, the informal caregiver population is also at-risk for poor mental health status, which may lead to conditions such as depression or anxiety[10]. The association between poor mental health and informal caregiving indicates the importance of providing support to relieve informal caregivers' mental burden and protect their well-being.

Analysis 2: Impact of Care Recipient Condition on Caregiver Health

We found that our hypotheses regarding care recipients' condition and caregiver likelihood of having higher BMI, high blood pressure, and poor mental health were not supported by our results. The care recipient medical condition categories—Alzheimer's disease, chronic conditions, mobility-restricting conditions, and other—did not significantly impact any of our caregiver health outcomes. Our finding therefore suggests that determination of whether or not an informal caregiver requires any type of support should not be based on care recipient medical condition alone. This finding departs from prior studies with smaller, more homogeneous samples that suggest caregivers caring for someone with Alzheimer's disease or cancer require more support than other caregivers[10, 36]. We theorize that caregiver health outcomes could not be predicted by care recipient medical condition because of the variation in caregiver situation present within each of our disease categories. Within each of our categories, different conditions may have differing demands; for example, caring for an individual with diabetes may differ significantly from caring for an individual with asthma. Additionally, within each disease, the caregiving demands may differ drastically; for example, providing care for an individual with early stage cancer may constitute a very different experience from caring for an end-stage cancer patient. Each experience in turn may lead to unique caregiver health outcomes. Thus, we conclude that differences in caregiving situation that impact caregiver health are not adequately delineated by our disease categories. Our sample size did not permit creating more specific categories to test for an effect based on specific condition.

Although our results did not support our hypotheses regarding care recipient condition, they did indicate strong relationships for both caregiving activity type and experiencing caregiving burden on a caregivers' likelihood to have poor mental health days. Caregivers who felt a psychological or physical health burden from caregiving had 1.4-1.8 times higher odds of having poor mental health days than those who felt a social or financial burden. In our models, other caregiving situation attributes were not significantly related to caregiver mental health. Thus, our results suggest that these two attributes of the caregiving situation impact caregiver mental health over other caregiving attributes. The relationships observed in our analysis suggest that any difference in experience for Alzheimer's caregivers, a group often viewed as at higher risk than other caregivers[10], is related to their having to help care recipients with cognitive activities, and to the fact that they feel a caregiving burden more often than caregivers for other conditions. These findings are also consistent with existing literature that finds care recipients' cognitive impairment and functional disabilities associated with diminished caregiver mental health[5, 7, 10]. However, previous findings of an association between increased caregiving duration and amount of care provided and poorer caregiver mental health[7, 10] were not supported by our analyses.

PROGRAM AND POLICY IMPLICATIONS

The issue of addressing the mental health impact of informal caregiving has recently gained much attention, as the population ages and more individuals must provide informal care to their relatives or friends who wish to live as independently as possible for as long as possible. As more caregivers seek support, counseling interventions are being developed to help caregivers cope with the mental health impact of caregiving. For example, caregiver counseling support programs have successfully been adopted by the Veterans Administration[44]. However, these programs may be less accessible to a large portion of informal caregivers unaffiliated with specific institutions.

Another source of support for informal caregivers, respite care and adult day health care centers provide caregivers with much-needed downtime, allowing them to recuperate their mental health. Addressing caregiver mental health seems to be of primary importance, given our analyses. However, many respite care programs are state-funded, and the recent budget crisis has led several states to slate these programs for elimination[45, 46]. At the same time, federal respite care support through the 2006 Lifespan Respite Care Act ended in FY 2010 and has not been renewed[47], and additional funding measures have stalled in Congress[48].

While our results do not directly indicate the effectiveness of any specific caregiver intervention, the fact that burdened caregivers are more likely to have poor mental health suggests that alleviating caregiver burden through support programs may improve caregiver mental health. Because caregivers experiencing all categories of burden have higher odds of having poor mental health days, a mixture of support options may be considered. Some form of financial support would address financial burden. The CLASS Act in the 2010 Affordable Care Act (ACA) touches on this issue by allowing working citizens to voluntarily set aside money to use for non-medical long-term care services later in life. These funds will help allow care recipients to purchase alternate formal care options, reducing the need for informal caregiving. However, the benefits of such a program may be missed by ineligible unemployed and individuals who are unable to set aside these funds. Furthermore, the effects of this program will be felt only in the long term, and will not provide relief for current informal caregivers (the first payouts will occur in 2017)[49]. Additionally, the CLASS program will not remain solvent as established in the ACA, and must be revised before becoming effective[17]. As a result, it faces challenges from those opposed to health care reform, and may not be implemented.

Our findings also suggest providing counseling to informal caregivers as a potentially effective intervention, as “feeling a psychological burden” was strongly associated with caregiver mental health impact. However, because all four types of caregiving burden increased the likelihood of poor mental health days, we suggest that respite care, if made readily available to informal caregivers at a low cost, may be the optimal solution to alleviating caregiver burden and potentially improving caregiver mental health status. Respite care can simultaneously relieve all four categories of caregiver burden explored in our analysis by allowing caregivers time to counteract financial, social, physical, or psychological effects of providing care. Thus, it may potentially improve mental health in the largest group of caregivers.

Opponents of cuts to publicly funded respite care programs argue that removing respite care increases the likelihood that care recipients will end up in costly nursing home care earlier due to the incapacity of informal caregivers to provide care without respite. In addition, the related diminished mental health of informal caregivers may reduce the quality of care they provide. Although smaller in magnitude, the increased mental and physical health burdens placed on informal caregivers from providing care without respite, and potentially delaying their own care, represent another societal and medical cost to be considered in the debate. If caregivers feel an additional burden, they may be more likely to become ill earlier or more severely, and may require additional costly long term care earlier than if they had not been required to provide the extra informal care. Our findings suggest that if counseling support programs and respite care services provide informal caregivers with burden relief and improve mental health, their funding should be continued in order to improve the well-being of informal caregivers and avoid additional illness and medical care costs in the caregiver population.

Summary

With the exception of the results for high blood pressure outcomes, our findings support and extend current theoretical positions about the impact of providing informal care on caregiver physical and mental health. Results from both portions of our study indicate that caregivers are at heightened risk of poor physical health (as indicated by higher BMI category) and poor mental health (as indicated by the likelihood of having poor mental health days). Furthermore, the strength of association between feeling a physical health burden from caregiving and having poor mental health days link caregivers' physical well-being to the mental health effects normally singled out by current interventions. The close association between physical and mental health outcomes suggests that for some caregivers, addressing the physical health effects from caregiving will serve as another pathway to improve caregiver mental health status. Thus, interventions such as physical health evaluations and diet and exercise education should be included in caregiver support programs. For example, counseling programs should address both physical and mental well-being. In addition, respite care centers could provide educational materials about diet and exercise to caregivers, or offer low-cost physical health evaluations to caregivers. Such interventions would help caregivers improve both aspects of their well-being, and reduce the likelihood of informal caregivers requiring expensive care, or additional caregiving themselves, at an earlier point in life. This issue is increasingly pertinent as the caregiving population has grown to 65.7 million in 2009[3] and continues to grow. The medical and societal costs of caregiver health effects have the potential to spiral upward as the population ages, longevity increases, and people are forced into the informal caregiver role earlier and more frequently.

LIMITATIONS

The characteristics of our dataset led to certain limitations in our analysis. First, our use of cross-sectional data prohibits us from concluding a causal relationship between caregiver status, caregiving attributes, and caregiver health outcomes; thus, our findings only indicate associations between the variables. However, for our mental health outcome we analyzed caregivers who had provided care for at least six months, and examined days in which their mental health was "not good" in the past 30 days. Thus, we are certain that the relationship between caregiving and our mental health outcomes followed a proper causal order. Another limitation was that the BRFSS dataset was not specifically designed for a study of caregivers. As a result, the caregiver and non-caregiver populations surveyed were not matched on the basis of other characteristics. However, we controlled for differences in demographics, socioeconomic status, health behaviors, health care access, and emotional support in our model. Unfortunately, the dataset did not include data for some contributing factors mentioned in our conceptual model—specifically, we were unable to control for whether caregivers participated in caregiver support programs. If caregivers included in our study had been receiving these support services at the time of the survey, their health outcomes would likely be better than anticipated by our model, and our results would underestimate the association between caregiving without these supports and health outcomes. However, the socioeconomic status and other caregiving situation factors such as hours per week spent caregiving should help control for the absence of this information. In addition, we were unable to control for cultural differences in caregiving expectations, which may have impacted subjects' perception of caregiving burden. Because our results indicated that caregiving burden is strongly related to caregiver mental health, understanding cultural differences in caregiving experience may be an important factor in determining which caregiver populations have the greatest need for support.

Our high blood pressure and care recipient condition measures also presented limitations to our study. As previously mentioned, the question used to collect information about high blood pressure status did not ask whether subjects had high blood pressure at the time of the survey. This fact may have contributed to the insignificance of caregiver status on our high blood pressure outcome. Similarly, the data collected for care recipient condition indicated the "major" health problem of the person requiring care. In actuality, it is probable that most individuals requiring long term informal care have more than one health problem, especially as they age. This lack of information regarding care recipients' full list of conditions may have contributed to our insignificant association between care recipient condition and caregiver health outcomes. Although some of our independent variables have the potential to have endogenous relationships with our health outcomes, any such relationships had no material impact on the performance of the models' other predictor variables.

Finally, the data analyzed in this study came from subjects in Washington DC, Illinois, Louisiana, and North Carolina. Therefore, our results are representative of the populations in these states. Our findings may not be generalizable to other states, or to regions not represented in the sample, such as the West or Northeast. However, nothing in our data suggests that this is the case. Additionally, differences in policy setting between the states included and excluded in our analysis may limit the generalizability of our findings.

FUTURE RESEARCH

In light of policy proposals to cut funding for adult day health care, studies to determine the health impact on informal caregivers when these programs are removed should be pursued. Conducting more studies that evaluate the change in caregiver health status as the availability of support programs changes can contribute to the debate over public funding for respite care services. Additionally, similar studies should be conducted to determine whether the incorporation of physical health evaluation or education into intervention programs would improve caregiver physical and mental health. The ACA directs the creation of a program to offer “comprehensive health risk assessment” and formation of “personalized prevention plans” to all Medicare beneficiaries[50]; a similar program could be offered to informal caregivers if the Medicare pilot program is successful, and its effect on caregiver health outcomes could be determined. Funding for these programs could in principle become available through grants also appropriated by the ACA for “…community-based prevention and wellness services aimed at strengthening prevention activities, reducing chronic disease rates and addressing health disparities.”[50]

In general, large-scale nationally representative longitudinal studies following cohorts of caregivers through the entire process of caregiving would provide the empirical base for the causal relationship between providing informal care and changes in physical and mental health. Furthermore, such data sources would enable identification of similarities among populations that experience different types of caregiving burden. This knowledge could contribute to policy discussions about which types of caregiver support—pure monetary support or respite care services, for example—should be provided by the government. Such studies would also allow for analysis of state-effects, or urban-rural effects. For example, Medicaid Money Follows the Person grants, first authorized by the Deficit Reduction Act in 2005, support states in their efforts to develop home and community-based long-term care services. Because these demonstration grants increase the availability of non-institutionalized formal care in the 30 states currently participating (including the four states used in this study)[51], there may be differences in caregiver burden between participating and non-participating states. Health care reform has extended the program into 2016 with additional funding. As 14 additional states prepare to apply for the demonstration grant[52], studies could be designed to examine how caregiver burden and health change with funding for formal substitute services. More information regarding variations in caregiver health and experiences by state or region could have implications for state-based versus federal support for caregiving programs. The Caregiver Module in the CDC's BRFSS annual survey represents one viable means to cross-sectionally examine differences by state and region, and more states should consider use of this module. The state-representative information gathered through this survey could be used to form additional hypotheses regarding caregiver situation and health impact, and more costly longitudinal cohort studies could then be conducted to evaluate specific hypotheses.

Finally, once more detailed longitudinal data describing the caregiving experience has been collected, economic evaluations should be conducted to estimate the health costs associated with informal caregiving. These estimates would allow us to form a more accurate picture of the trade-off between home assistance services and the financial costs of providing informal care. Currently, an accurate comparison of these two costs has not been discussed in policy or literature. If these costs are not currently similar, the costs associated with the adverse health effects from informal caregiving may, in time, prove to be comparable to the costs of home assistance services. While the medical and societal costs may be less, or more tolerable, than the cost of institutionalized long-term care, understanding the medical costs associated with caregiver health effects may prove useful in policy discussions regarding funding for other forms of formal care, such as in-home assistance or palliative care. It is possible that over time the medical and societal costs associated with informal caregiving may equal those of formal long-term care. Therefore, discussions about reforming the long-term care system should take these costs into consideration.

6. Conclusion

To our knowledge, this is the first study to compare overweight and obesity in a large US sample of caregivers and non-caregivers. Our results suggest that informal caregivers are a population at risk for obesity or being overweight, and diminished mental health. Increased support services may be needed to help caregivers offset these health risks. The observed physical health impact of caregiving suggests interventions should reach beyond mental health support, to also include physical health evaluation and education.

Evaluations of current caregiver support programs should be conducted to determine their impact on caregiver mental and physical health. Furthermore, ongoing assessment of caregivers’ health at a state, regional, or national level will allow these interventions to be better tailored to current caregiver health needs. In addition, evaluating caregiver physical and mental health in large population-based US samples will inform policy decisions related to public funding for caregiver support programs at the state or federal level. The impact of state and federal policies on availability of caregiver support, and on caregivers’ well-being should also be evaluated. Finally, costs associated with diminished caregiver health should be monitored as the societal need for long-term care grows, to more accurately determine the trade-off between the costs of formal and informal care services.

Appendix

Table A.1. Analysis 1 Results: Weighted Models Testing Caregiver Status

Category	Variable	Obese Beta	Overweight or Obese Beta	High Blood Pressure Beta	Mental Health (Dichotomous) Beta	Mental Health (Categorical) Beta
Caregiver Status	Caregiver	0.2359**	0.1371	-0.0459	0.3037***	0.3017***
Age *(18-29)*	30-45	0.2402*	0.4144***	0.7086***	-0.2849*	-0.2319*
	46-65	0.2436*	0.5088***	1.5276***	-0.6989***	-0.6566***
	> 65	-0.4140**	0.1565	2.1315***	-1.4111***	-1.4801***
	Female	-0.1430*	-0.7188***	-0.3799***	0.5441***	0.4977***
Race *(Non-Hispanic White)*	Non-Hispanic Black	0.4070***	0.4493***	0.5099***	-0.2912**	-0.2644*
	Hispanic	-0.0805	0.1741	-0.5709**	0.0684	-0.0030
	Other Race	-0.5014*	-0.3910*	-0.1031	-0.2492	-0.2827
Income *(> $75,000)*	< $20,000	0.1741	0.1407	0.2108*	0.1273	0.2085
	$20,000-$75,000	0.1866*	0.2133**	0.2005*	0.1010	0.1279*
Education *(Some High School)*	High School Graduate	-0.0431	-0.1049	-0.0980	-0.0372	-0.1133
	At Least Some College	-0.0970	-0.3350*	-0.2428*	0.0725	-0.0203
	Employed	0.2713***	0.3471***	-0.1074	-0.1250	-0.1721*
Marital Status *(Single)*	Married	0.0466	0.2306*	0.1148	-0.3306**	-0.2488*
	Divorced/Separated	-0.0047	0.0922	0.1290	-0.1037	0.0420
	Widowed	0.1314	0.2625*	0.4126**	-0.3162*	-0.2048
	Children in Household	0.0009	0.0055	-0.0569	-0.0040	-0.0129
	Disabled	0.2870***	0.2694**	0.2048*	0.6217***	0.7183***
	Healthy Diet	0.0987	0.2258**	-0.0044	0.1336*	0.1067
	Exercised	-0.3459***	-0.1855*	-0.0085	-0.0245	-0.0854
General Health *(Excellent)*	Very Good	0.6608***	0.6968***	0.8013***	0.2676*	0.2128*
	Good	1.2140***	0.9387***	1.3122***	0.4168***	0.3976***
	Fair	1.4418***	1.0468***	1.7447***	0.7987***	0.8309***
	Poor	1.2188***	0.9641***	2.0430***	1.2974***	1.5618***
Routine Doctor Visit *(< 1 Yr Ago)*	1-2 Years Ago	-0.2271*	-0.2612*	-0.5215***	0.0610	0.0638
	2-5 Years Ago	-0.1760	-0.1371	-0.6662***	0.1791	0.1314
	> 5 Years Ago	-0.2551*	-0.2428*	-0.9255***	0.0075	0.0214
Social Emotional Support *(Always)*	Usually	-0.1668*	-0.0675	-0.0327	0.5767***	0.5218***
	Sometimes	-0.2821**	-0.2030*	-0.1025	1.1246***	1.1045***
	Rarely	0.1216	-0.0454	0.1196	1.1971***	1.3967***
	Never	-0.3227*	-0.3344*	-0.1342	0.5103*	0.5701*
Cutpoints[1]	Constant	-1.8170***	-0.2220	-2.6320***	-1.1590***	
	1 Day "Not Good"					1.0496***
	8 Days "Not Good"					2.4420***
	16 Days "Not Good"					3.2352***
	30 Days "Not Good"					3.7297***

*p<0.05, ** p<0.001, ***p<0.0001

Reference groups are listed in *italics* below each category name; Key variables are highlighted in blue

[1] Represent ordered logit Tau cutpoints, not Beta values

Table A.2. Analysis 2 Results: Weighted Models Testing Care Recipient Condition

Category	Variable	Obese Beta	Overweight or Obese Beta	High Blood Pressure Beta	Mental Health (Dichotomous) Beta	Mental Health (Categorical) Beta
Care Recipient Condition *(Alzheimer's)*	Chronic	-0.1537	0.1882	0.2945	-0.1562	-0.1350
	Mobility-Restricting	-0.1833	0.0820	0.0812	-0.3531	-0.3764
	Other	-0.3132	0.2508	0.1564	0.0398	-0.0941
Care Recipient Age *(< 20)*	20-60	0.1724	0.4322	0.7870	-0.8374	-0.4151
	61-75	-0.3230	0.3367	0.8469	-0.9904	-0.6712
	> 75	-0.4717	0.3402	0.9932	-0.8730	-0.4481
Relationship *(Caring for Parent)*	Caring for Child	-0.6644	0.0411	0.0015	-0.3360	-0.0934
	Caring for Spouse	-0.0951	0.1182	0.1453	0.0201	0.1935
	Caring for Sibling	-0.2632	-0.3875	0.1666	0.1729	0.1238
	Caring for Grandparent	-0.0538	-0.1765	0.1118	-0.1299	0.0820
	Caring for Non-Relative	-0.0922	-0.1086	0.4646*	0.1859	0.2497
	Female Care Recipient	0.0367	0.2086	-0.0722	-0.2284	-0.2291
	Cognitive Changes	-0.0228	0.0641	0.0751	0.0990	0.1492
Caregiving Activity *(Cognitive)*	ADLs	0.1329	-0.0985	0.0446	-0.2698	-0.3624
	IADLs	0.1572	0.0794	-0.1047	-0.4294*	-0.2772
	Mobility	0.3479	0.0468	0.1030	-0.0600	-0.0591
Caregiving Duration *(6mo-1yr)*	1-5 Yrs	0.1959	-0.0021	-0.1225	-0.4648	-0.5547*
	> 5 Yrs	0.0105	0.1035	-0.1222	-0.2952	-0.3426
Hours/Week Caregiving *(< 10)*	10-20	0.3678*	0.1056	0.1449	-0.5057*	-0.4612*
	21-40	-0.1504	-0.1766	0.4368*	0.1034	0.2603
	> 40	0.0984	-0.2915	0.2013	-0.1310	-0.0585
Caregiving Burden *(No Burden)*	Financial	-0.1112	-0.2575	0.4187	0.7134*	0.5932*
	Social	-0.2921	-0.2657	-0.1535	0.8060**	0.6484*
	Physical	-0.2487	-0.4422	-0.2869	1.2810**	1.2057**
	Psychological	-0.1864	-0.0427	0.2799	0.9204***	0.8488***
Age *(18-29)*	30-45	-0.0372	-0.3426	0.5151	-0.6453*	-0.4812
	46-65	-0.3994	-0.4813	1.4163**	-0.9537**	-0.7397*
	> 65	-0.3549	-0.4130	2.2130***	-1.6801***	-1.6739***
	Female	-0.1944	-0.7005***	-0.6274***	0.2309	0.2053
Race *(Non-Hispanic White)*	Non-Hispanic Black	0.3727*	0.4377	0.4484*	-0.0821	-0.1691
	Hispanic	0.1593	0.7030	-0.1597	-0.0444	0.3290
	Other Race	0.1705	-0.6209	0.3165	0.6447	0.4739
Income *(> $75,000)*	< $20,000	-0.1527	-0.0604	-0.1650	0.2607	0.2648
	$20,000-$75,000	-0.0634	0.1850	-0.1142	0.0735	0.0728
Education *(Some High School)*	High School Graduate	0.1185	-0.0546	-0.6028	0.1121	-0.1087
	At Least Some College	0.0852	-0.3214	-0.5090	0.2370	-0.0060
	Employed	0.6158***	0.4665*	-0.2482	-0.1412	-0.1737
Marital Status *(Single)*	Married	0.0772	0.3758	0.0593	-0.2270	0.0211
	Divorced/Separated	-0.1176	0.4499	-0.1859	0.0058	0.4231
	Widowed	0.0197	0.4832	0.5780	0.2314	0.3577
	Children in Household	0.0113	-0.0744	-0.0420	0.0019	-0.0150
	Disabled	0.6033**	0.5171*	-0.1118	0.3042	0.2780

Category	Variable	Obese Beta	Overweight or Obese Beta	High Blood Pressure Beta	Mental Health (Dichotomous) Beta	Mental Health (Categorical) Beta
	Healthy Diet	0.3877*	0.3817*	-0.0852	-0.1135	-0.0731
	Exercised	-0.4308*	-0.3978*	-0.1850	0.1785	0.1348
General Health *(Excellent)*	Very Good	0.8484*	0.4822*	0.5555*	0.8333***	0.7440**
	Good	1.2595***	0.7025**	1.1479***	0.8770***	0.8959***
	Fair	1.7301***	1.4624***	1.9024***	1.1379***	1.3599***
	Poor	1.4324**	1.0498*	2.5074***	1.7215*	2.1208***
Routine Doctor Visit *(< 1 Yr)*	1-2 Years Ago	-0.2891	0.3120	-0.4443*	0.3391	0.2668
	2-5 Years Ago	-0.3196	-0.2737	-0.9016*	0.6249*	0.5330*
	> 5 Years Ago	-0.1266	-0.3679	-0.7352*	0.1379	0.1910
Social Emotional Support *(Always)*	Usually	0.1966	0.2458	0.2210	0.6872***	0.5003**
	Sometimes	-0.2387	-0.4196	0.2666	1.0500***	1.0436***
	Rarely	0.1205	0.1428	0.2109	1.4634***	1.4677***
	Never	-0.0990	0.0811	0.0706	1.8036**	2.1193***
General Health *(Excellent)*	Very Good	0.8484*	0.4822*	0.5555*	0.8333***	0.7440**
	Good	1.2595***	0.7025**	1.1479***	0.8770***	0.8959***
	Fair	1.7301***	1.4624***	1.9024***	1.1379***	1.3599***
	Poor	1.4324**	1.0498*	2.5074***	1.7215*	2.1208***
Cutpoints[1]	Constant	-1.4160	0.0257	-2.8179**	-0.0724	
	1 Day “Not Good”					0.4909
	8 Days “Not Good”					1.9993*
	16 Days “Not Good”					2.8144***
	30 Days “Not Good”					3.2735***

*p<0.05, ** p<0.001, ***p<0.0001

Reference groups are listed in *italics* below each category name

Key variables are highlighted

[1] Represent ordered logit Tau cutpoints, not Beta values

Table A.3. Analysis 1: Unweighted Pooled Model with State Effects

Category	Variable	Obese Beta	Overweight or Obese Beta	High Blood Pressure Beta	Mental Health (Dichotomous) Beta	Mental Health (Categorical) Beta
Caregiver Status	Caregiver	0.1714 ***	0.1785 ***	0.0263	0.2678 ***	0.2816 ***
State *(North Carolina)*	DC	-0.5109 ***	-0.5437 ***	-0.1501 *	0.1252 *	0.0921
	Illinois	0.0099	0.0382	-0.0028	0.2479 ***	0.1823 ***
	Louisiana	0.0877 *	0.0263	0.1345 **	-0.1595 ***	-0.1488 ***
Age *(18-29)*	Age 30-45	0.2898 ***	0.3790 ***	0.8792 ***	-0.2117 **	-0.1848 **
	Age 46-65	0.3315 ***	0.4964 ***	1.7249 ***	-0.6239 ***	-0.5715 ***
	Age > 65	-0.2690 **	0.0920	2.2083 ***	-1.4428 ***	-1.4717 ***
	Female	-0.0477	-0.6338 ***	-0.2702 ***	0.5548 ***	0.5107 ***
Race *(Non-Hispanic White)*	Non-Hispanic Black	0.5482 ***	0.7064 ***	0.5466 ***	-0.2042 ***	-0.2377 ***
	Hispanic	0.0386	0.1813 *	-0.2772 *	-0.1476	-0.1552 *
	Other Race	-0.0893	-0.1322	-0.0436	0.0254	-0.0256
Income *(> $75,000)*	< $20,000	0.1627 *	0.0904	0.2038 **	0.2902 ***	0.3602 ***
	$20,000-$75,000	0.1583 ***	0.1921 ***	0.1526 ***	0.1544 ***	0.1742 ***
Education *(Some High School)*	High School Graduate	-0.0406	-0.0268	-0.0599	-0.0075	-0.0465
	At Least Some College	-0.0820	-0.1861 *	-0.1322 *	0.1295 *	0.0685
	Employed	0.1291 **	0.1827 ***	-0.1271 **	-0.0444	-0.0880 *
Marital Status *(Single)*	Married	-0.0692	0.1185 *	-0.0278	-0.0919	-0.0614
	Divorced/Separated	-0.1513 *	0.0115	0.0058	0.0032	0.0666
	Widowed	-0.1314 *	0.0956	0.1743 *	-0.1588 *	-0.1081
	Children in Household	0.0268	0.0030	-0.1023 ***	0.0327	0.0301
	Disabled	0.2968 ***	0.2598 ***	0.1663 ***	0.5985 ***	0.6496 ***
	Healthy Diet	0.0963 *	0.1400 ***	0.0612	0.0433	0.0351
	Exercised	-0.3705 ***	-0.2429 ***	-0.0547	-0.0551	-0.1026 *
General Health *(Excellent)*	Very Good	0.6577 ***	0.6336 ***	0.7328 ***	0.3337 ***	0.2906 ***
	Good	1.1345 ***	0.8716 ***	1.1732 ***	0.4872 ***	0.4642 ***
	Fair	1.2816 ***	0.9257 ***	1.5496 ***	0.9405 ***	0.9810 ***
	Poor	1.1140 ***	0.6955 ***	1.7258 ***	1.2603 ***	1.4984 ***
Routine Doctor Visit *(< 1 Yr)*	1-2 Years Ago	-0.1726 **	-0.1767 ***	-0.5277 ***	0.0649	0.0717
	2-5 Years Ago	-0.1456 *	-0.2627 ***	-0.7575 ***	0.1642 *	0.1565 *
	> 5 Years Ago	-0.3614 ***	-0.3425 ***	-1.1048 ***	0.1192 *	0.1224 *
Social Emotional Support *(Always)*	Usually	-0.1036 *	-0.0881 *	-0.0404	0.6631 ***	0.6009 ***
	Sometimes	-0.1122 *	-0.1353 *	-0.0012	1.1071 ***	1.0821 ***
	Rarely	0.0162	-0.0269	0.1151	1.3811 ***	1.5161 ***
	Never	-0.1224	-0.1770 *	-0.1626 *	0.5697 ***	0.6985 ***
	Constant	-1.7728 ***	-0.0274	-2.6603 ***	-1.7180 ***	
Cutpoints[1]	1 Day “Not Good”					1.6199 ***
	8 Days “Not Good”					2.8813 ***
	15 Days “Not Good”					3.6247 ***
	22 Days “Not Good”					4.0381 ***

*p<0.05, ** p<0.001, ***p<0.0001

Reference groups are listed in *italics* below each category name

Key variables are highlighted

[1] Represent ordered logit Tau cutpoints, not Beta values

Table A.4. Analysis 2: Unweighted Pooled Model with State Effects

Category	Variable	Obese Beta	Overweight or Obese Beta	High Blood Pressure Beta	Mental Health (Dichotomous) Beta	Mental Health (Categorical) Beta
State *(North Carolina)*	DC	-0.5368 *	-0.5058 *	-0.1365	0.3478 *	0.3254 *
	Illinois	0.0519	-0.0545	-0.1350	0.3237 *	0.2045
	Louisiana	0.0218	0.0067	0.2009	-0.0441	-0.0512
Care Recipient Condition *(Alzheimer's)*	Chronic	0.0352	0.0117	0.0730	0.0634	0.0639
	Mobility-Restricting	0.2142	0.1144	0.1480	0.0502	0.0498
	Other	0.0435	0.1158	0.1586	0.0758	0.0266
Care Recipient Age *(< 20)*	20-60	0.0666	0.0506	0.0897	0.0070	0.1829
	61-75	-0.0547	0.0620	0.3274	-0.2268	-0.0484
	> 75	-0.1742	-0.0598	0.4212	-0.1740	0.0392
Relationship *(Caring for Parent)*	Caring for Child	0.0873	0.3020	0.0470	-0.2875	-0.1715
	Caring for Spouse	0.0479	-0.0524	0.1945	0.1953	0.2243
	Caring for Sibling	-0.0796	-0.4338 *	0.2884	0.0992	0.0025
	Caring for Grandparent	0.0439	-0.1825	0.0055	-0.0529	0.0385
	Caring for Non-Relative	-0.0021	-0.1796	0.2480	0.1358	0.1651
	Female Care Recipient	0.0497	0.2250 *	-0.0071	-0.1178	-0.0916
	Cognitive Changes	0.0357	0.0410	0.1208	0.1753	0.1761
Caregiving Activity *(Cognitive)*	ADLs	0.1767	-0.0170	0.1473	-0.4109 *	-0.3733 *
	IADLs	-0.0217	0.0473	0.1236	-0.3010 *	-0.2397
	Mobility	0.2311	0.1388	0.2767	-0.1158	-0.0972
Caregiving Duration *(6mo-1yr)*	1-5 Yrs	0.0163	-0.1676	-0.3648 *	-0.0458	-0.0959
	> 5 Yrs	0.0204	-0.0751	-0.2041	0.1163	0.0555
Hours/Week Caregiving *(< 10)*	10-20	0.2020	0.0934	0.0807	-0.1242	-0.0711
	21-40	-0.0110	-0.0104	0.1083	0.0197	0.1248
	> 40	-0.0951	-0.2090	-0.0112	0.1197	0.2964 *
Caregiving Burden *(No Burden)*	Financial	0.0227	-0.2526	0.2353	0.6359 ***	0.6144 ***
	Social	-0.3004	-0.3556 *	-0.2036	0.6309 **	0.5461 **
	Physical	-0.2801	-0.5340	0.0858	0.8094 *	0.8556 **
	Psychological	-0.0954	-0.1156	0.1575	0.9425 ***	0.8979 ***
Age *(18-29)*	30-45	0.3698	0.1461	0.6704 *	-0.4567 *	-0.3912
	46-65	0.2058	0.0588	1.3144 ***	-0.8961 **	-0.7288 **
	> 65	-0.1539	-0.0604	1.9144 ***	-1.5582 ***	-1.5313 ***
	Female	-0.1131	-0.6893 ***	-0.4041 ***	0.3456 *	0.3057 *
Race *(Non-Hispanic White)*	Non-Hispanic Black	0.6110 ***	0.8603 ***	0.6361 ***	-0.1521	-0.2113
	Hispanic	0.1729	0.5460	0.1633	-0.0419	0.1798
	Other Race	0.1621	-0.0177	-0.1710	0.0934	0.0462
Income *(> $75,000)*	< $20,000	-0.1342	-0.0431	0.2007	0.5896 **	0.5544 **
	$20,000-$75,000	-0.0411	0.1417	-0.0186	0.0914	0.0963
Education *(Some High School)*	High School Graduate	0.0258	-0.0484	-0.2978	0.2493	0.0983
	At Least Some College	0.0048	-0.1902	-0.3088	0.4159	0.2200
	Employed	0.1405	0.2986 *	-0.0414	-0.0292	-0.0739
Marital Status *(Single)*	Married	-0.1609	0.0704	0.0432	-0.0443	0.0666
	Divorced/Separated	-0.1184	0.1981	0.0243	-0.0856	0.1042
	Widowed	-0.3572	0.2763	0.2454	-0.0381	0.0539
	Children in Household	0.0351	-0.0677	-0.1083	0.0460	0.0467

Category	Variable	Obese Beta	Overweight or Obese Beta	High Blood Pressure Beta	Mental Health (Dichotomous) Beta	Mental Health (Categorical) Beta
	Disabled	0.3573 *	0.2580 *	-0.0201	0.6583 ***	0.6207 ***
	Healthy Diet	0.1465	0.0950	-0.0587	-0.0840	-0.0970
	Exercised	-0.4344 ***	-0.4365 **	-0.2573 *	0.1006	0.0463
General Health *(Excellent)*	Very Good	0.7247 ***	0.6216 ***	0.8445 ***	0.7549 ***	0.7257 ***
	Good	1.1212 ***	0.7995 ***	1.2835 ***	0.7849 ***	0.7986 ***
	Fair	1.2754 ***	1.2555 ***	1.7461 ***	1.0588 ***	1.1584 ***
	Poor	0.9793 **	0.7109 *	1.7921 ***	1.3422 ***	1.6609 ***
Routine Doctor Visit *(< 1 Yr)*	1-2 Years Ago	-0.2008	0.0661	-0.4948 **	0.1405	0.1137
	2-5 Years Ago	-0.0859	-0.2885	-0.6893 **	0.1725	0.1640
	> 5 Years Ago	-0.5013 *	-0.4207 *	-0.9107 ***	0.2102	0.1883
Social Emotional Support *(Always)*	Usually	0.1561	0.1615	0.2168	0.5846 ***	0.5072 ***
	Sometimes	-0.0072	-0.1282	0.2633	0.9845 ***	0.9539 ***
	Rarely	0.0697	-0.0090	0.2802	1.5832 ***	1.6126 ***
	Never	-0.4526	-0.5107 *	-0.2826	0.9439 **	1.1629 ***
	Constant	-1.5511 *	0.6765	-2.5231 ***	-2.0899 **	
Cutpoints[1]	1 Day "Not Good"					2.1853 ***
	8 Days "Not Good"					3.5573 ***
	15 Days "Not Good"					4.2214 ***
	22 Days "Not Good"					4.6422 ***

*p<0.05, ** p<0.001, ***p<0.0001

Reference groups are listed in *italics* below each category name

Key variables are highlighted

[1] Represent ordered logit Tau cutpoints, not Beta values

Table A.5. State-Based Analysis of Caregiver Status and Obesity

Category	Variable	DC Beta	IL Beta	LA Beta	NC Beta
Caregiver Status	Caregiver	0.2780*	0.2589*	0.1260	0.1194
Age *(18-29)*	Age 30-45	-0.0734	0.3584*	0.3785*	0.2532*
	Age 46-65	0.3541	0.4977*	0.4021**	0.1295
	Age > 65	-0.0536	-0.2258	-0.1295	-0.5207***
	Female	0.4200**	-0.1948*	-0.1380*	-0.0246
Race *(Non-Hispanic White)*	Non-Hispanic Black	1.1166***	0.4393***	0.3863***	0.5818***
	Hispanic	0.7760*	0.2089	0.2163	-0.3090*
	Other Race	0.3711	-0.6816*	-0.2173	0.1391
Income *(> $75,000)*	< $20,000	-0.5105*	0.1761	0.2669*	0.1903*
	$20,000-$75,000	-0.2556	0.2191*	0.1337	0.1673*
Education *(Some High School)*	High School Graduate	-0.0963	-0.0203	-0.1497	0.0395
	At Least Some College	-0.1672	0.0229	-0.2228*	0.0301
	Employed	-0.0281	0.2572*	0.1374*	0.0904
Marital Status *(Single)*	Married	-0.4459*	-0.0820	0.0014	-0.0147
	Divorced/Separated	-0.2377	-0.0822	-0.2024	-0.1119
	Widowed	-0.5107*	-0.0011	-0.0800	-0.1240
	Children in Household	0.1645*	0.0016	0.0474	-0.0168
	Disabled	0.4890**	0.3178**	0.3210***	0.2130**
	Healthy Diet	0.0433	0.1652*	0.0999	0.0600
	Exercised	-0.4064**	-0.4564***	-0.3232***	-0.3528***
General Health *(Excellent)*	Very Good	0.7158***	0.7346***	0.5040***	0.6941***
	Good	1.2503***	1.1439***	0.9072***	1.2722***
	Fair	1.2328***	1.3648***	1.0651***	1.4407***
	Poor	1.2642***	1.3295***	0.8017***	1.2500***
Routine Doctor Visit *(< 1 Yr)*	1-2 Years Ago	-0.0961	-0.2709*	-0.0640	-0.2015*
	2-5 Years Ago	0.0336	-0.1453	-0.1644	-0.1676
	> 5 Years Ago	0.1221	-0.2303	-0.2682*	-0.5884***
Social Emotional Support *(Always)*	Usually	-0.1487	-0.1643*	-0.1245	-0.0472
	Sometimes	0.0121	-0.2900*	-0.0769	-0.0671
	Rarely	0.1241	-0.1531	-0.1900	0.2246*
	Never	0.0765	-0.2084	-0.0015	-0.2158
	Constant	-2.4497***	-1.9496***	-1.4830***	-1.7871***

DC=Washington, DC; IL=Illinois; LA=Louisiana; NC=North Carolina
*p<0.05, ** p<0.001, ***p<0.0001
Reference groups are listed in *italics* below each category name
Key variables are highlighted

Table A.6. State-Based Analysis of Caregiver Status and Overweight/Obese BMI

Category	Variable	DC Beta	IL Beta	LA Beta	NC Beta
Caregiver Status	Caregiver	0.3597*	0.0918	0.1808*	0.1700*
Age *(18-29)*	Age 30-45	0.4235*	0.3692*	0.4650***	0.2602*
	Age 46-65	0.7500***	0.5761***	0.5221***	0.2667*
	Age > 65	0.2521	0.1855	0.1847	-0.1668
	Female	-0.5104***	-0.7939***	-0.6742***	-0.5884***
Race *(Non-Hispanic White)*	Non-Hispanic Black	1.0412***	0.6325***	0.5246***	0.7040***
	Hispanic	0.5817*	0.2607	0.0956	0.0334
	Other Race	-0.0915	-0.5152*	-0.1097	0.0632
Income *(> $75,000)*	< $20,000	-0.3239	0.0981	0.2737*	0.0380
	$20,000-$75,000	-0.0137	0.1961*	0.1552*	0.2154**
Education *(Some High School)*	High School Graduate	-0.1372	-0.1285	-0.1013	0.0624
	At Least Some College	-0.2976	-0.2615	-0.2155*	-0.1096
	Employed	0.0215	0.2633**	0.2484**	0.1388*
Marital Status *(Single)*	Married	-0.3035*	0.2470*	0.2573*	0.1664
	Divorced/Separated	-0.0932	0.0615	0.1609	-0.0106
	Widowed	-0.2014	0.2189	0.2564*	0.1021
	Children in Household	0.0407	0.0021	-0.0002	-0.0170
	Disabled	0.2291	0.3031**	0.2766**	0.2262**
	Healthy Diet	0.1229	0.3168***	0.0886	0.0710
	Exercised	-0.0644	-0.1510	-0.2161**	-0.3441***
General Health *(Excellent)*	Very Good	0.7573***	0.5804***	0.5040***	0.6864***
	Good	1.0893***	0.8526***	0.6987***	0.9216***
	Fair	0.9174***	0.8521***	0.8041***	1.0467***
	Poor	0.5055*	1.0887***	0.5694***	0.6618***
Routine Doctor Visit *(< 1 Yr)*	1-2 Years Ago	-0.1850	-0.1088	-0.0794	-0.2455**
	2-5 Years Ago	-0.1174	-0.3340*	-0.2370	-0.2633*
	> 5 Years Ago	-0.2984	-0.2767*	-0.3540*	-0.3935***
Social Emotional Support *(Always)*	Usually	-0.1696	-0.0913	0.0282	-0.1194
	Sometimes	-0.0157	-0.1637	-0.1990*	-0.1132
	Rarely	0.1217	-0.1596	-0.1653	0.0902
	Never	-0.1485	-0.0621	-0.1259	-0.2484*
	Constant	-0.6457	-0.1739	-0.0230	0.1784

DC=Washington, DC; IL=Illinois; LA=Louisiana; NC=North Carolina
*p<0.05, ** p<0.001, ***p<0.0001
Reference groups are listed in *italics* below each category name
Key variables are highlighted

Table A.7. State-Based Analysis of Caregiver Status and High Blood Pressure

Category	Variable	DC Beta	IL Beta	LA Beta	NC Beta
Caregiver Status	Caregiver	0.2373	-0.0446	0.0383	-0.0229
Age *(18-29)*	Age 30-45	0.8033*	0.5615*	1.0246***	0.9401***
	Age 46-65	1.8494***	1.3703***	1.7587***	1.8259***
	Age > 65	2.2858***	1.9698***	2.1816***	2.3069***
	Female	-0.1664	-0.3963	-0.2530	-0.2536***
Race *(Non-Hispanic White)*	Non-Hispanic Black	0.4896***	0.4929***	0.5561***	0.5710***
	Hispanic	0.0422	-0.6110*	0.0784	-0.3517*
	Other Race	0.0987	-0.0930	-0.1658	0.0117
Income *(> $75,000)*	< $20,000	0.0896	0.3643*	0.3009*	0.1056
	$20,000-$75,000	0.0829	0.1889*	0.2466**	0.0671
Education *(Some High School)*	High School Graduate	-0.0112	0.0983	-0.2516*	0.0044
	At Least Some College	-0.1422	-0.0318	-0.2773*	-0.0601
	Employed	-0.1015	-0.1238	-0.0538	-0.1811*
Marital Status *(Single)*	Married	-0.1684	-0.0254	-0.0167	0.0215
	Divorced/Separated	-0.0056	0.0154	0.0516	-0.0084
	Widowed	0.2163	0.2980*	0.1697	0.1414
	Children in Household	-0.0921	-0.1386*	-0.1164**	-0.0772*
	Disabled	0.2699*	0.0362	0.2164*	0.1637*
	Healthy Diet	0.1279	0.0317	0.1115	0.0370
	Exercised	-0.0609	-0.0665	-0.0433	-0.0564
General Health *(Excellent)*	Very Good	0.6465***	0.7886***	0.6664***	0.7824***
	Good	0.9643***	1.2437***	1.0530***	1.2960***
	Fair	1.4283***	1.7068***	1.5321***	1.5407***
	Poor	1.4818***	1.9753***	1.6067***	1.7889***
Routine Doctor Visit *(< 1 Yr)*	1-2 Years Ago	-0.4247*	-0.5169***	-0.4908***	-0.5848***
	2-5 Years Ago	-0.6582*	-0.8532***	-0.8633***	-0.6850***
	> 5 Years Ago	-1.6842***	-0.8837***	-1.0988***	-1.1926***
Social Emotional Support *(Always)*	Usually	-0.1653	0.0005	-0.0246	-0.0362
	Sometimes	0.1273	-0.0023	-0.0402	-0.0174
	Rarely	-0.0595	-0.1061	0.1154	0.2568*
	Never	-0.3051	-0.1517	-0.1639	-0.1236
	Constant	-2.8048***	-2.4467***	-2.5405***	-2.8023***

DC=Washington, DC; IL=Illinois; LA=Louisiana; NC=North Carolina
*p<0.05, ** p<0.001, ***p<0.0001
Reference groups are listed in *italics* below each category name
Key variables are highlighted

Table A.8. State-Based Analysis of Caregiver Status and Poor Mental Health (Dichotomous Outcome)

Category	Variable	DC Beta	IL Beta	LA Beta	NC Beta
Caregiver Status	Caregiver	0.5295***	0.3436***	0.2446**	0.1548
Age *(18-29)*	Age 30-45	-0.1780	-0.3992*	-0.1798	-0.1884*
	Age 46-65	-0.5804**	-0.7911***	-0.5166***	-0.6452***
	Age > 65	-1.4935***	-1.4440***	-1.3091***	-1.5672***
	Female	0.3877***	0.5415***	0.4670***	0.6832***
Race *(Non-Hispanic White)*	Non-Hispanic Black	-0.3648*	-0.1287	-0.0264	-0.3687***
	Hispanic	-0.4064	0.1961	0.0395	-0.4783**
	Other Race	0.1222	-0.2018	0.1406	0.0477
Income *(> $75,000)*	< $20,000	0.5802*	0.4567**	0.3027*	0.1160
	$20,000-$75,000	0.1654	0.2396*	0.1216	0.0924
Education *(Some High School)*	High School Graduate	-0.2351	-0.1372	0.0338	-0.0099
	At Least Some College	-0.0570	-0.0345	0.1437	0.1548
	Employed	0.0883	-0.1245	0.0919	-0.1002
Marital Status *(Single)*	Married	-0.1792	-0.1394	-0.0241	-0.0668
	Divorced/Separated	-0.0023	-0.0080	0.1165	-0.0458
	Widowed	-0.1938	-0.1406	-0.1284	-0.1628
	Children in Household	0.0508	0.0537	0.0493	0.0121
	Disabled	0.4899***	0.6240***	0.7776***	0.5044***
	Healthy Diet	0.0788	0.0691	-0.0555	0.0955
	Exercised	-0.1776	-0.0529	-0.0041	-0.0696
General Health *(Excellent)*	Very Good	0.5605***	0.2198*	0.4409***	0.2730**
	Good	0.5374***	0.4030***	0.6497***	0.4360***
	Fair	0.9490***	0.8187***	1.0267***	0.9548***
	Poor	1.4280***	1.4765***	1.3559***	1.1142***
Routine Doctor Visit *(< 1 Yr)*	1-2 Years Ago	-0.0194	-0.0080	-0.0296	0.1857*
	2-5 Years Ago	0.0115	0.1528	0.0106	0.2947*
	> 5 Years Ago	0.1060	-0.1440	0.1342	0.2829*
Social Emotional Support *(Always)*	Usually	0.5739***	0.6684***	0.5582***	0.7445***
	Sometimes	0.9478***	1.1518***	0.9555***	1.2514***
	Rarely	1.3897***	1.1314***	1.2381***	1.6081***
	Never	0.6191*	0.5910**	0.5350***	0.6052***
	Constant	-1.3177***	-1.1612***	-2.1348***	-1.6966***

DC=Washington, DC; IL=Illinois; LA=Louisiana; NC=North Carolina
*p<0.05, ** p<0.001, ***p<0.0001
Reference groups are listed in *italics* below each category name
Key variables are highlighted

Table A.9. State-Based Analysis of Caregiver Status and Poor Mental Health Categories (Categorical Outcome)

Category	Variable	DC Beta	IL Beta	LA Beta	NC Beta
Caregiver Status	Caregiver	0.5894***	0.3248***	0.2504**	0.1863*
Age *(18-29)*	Age 30-45	-0.1495	-0.2978*	-0.1526	-0.2063*
	Age 46-65	-0.5274**	-0.6589***	-0.4901***	-0.6307***
	Age > 65	-1.5191***	-1.3973***	-1.3457***	-1.6421***
	Female	0.3783***	0.5071***	0.4249***	0.6178***
Race *(Non-Hispanic White)*	Non-Hispanic Black	-0.3538*	-0.0774	-0.1075	-0.3903***
	Hispanic	-0.3503	0.1605	0.0213	-0.4893**
	Other Race	0.0563	-0.2480	0.0974	-0.0112
Income *(> $75,000)*	< $20,000	0.6760**	0.4833***	0.3687**	0.2234*
	$20,000-$75,000	0.1410	0.2459*	0.1510*	0.1319*
	Employed	0.0165	-0.1382	0.0294	-0.1363*
Education *(Some High School)*	High School Graduate	-0.2073	-0.1426	0.0026	-0.0741
	At Least Some College	-0.0133	-0.0720	0.0942	0.0683
Marital Status *(Single)*	Married	-0.2177*	-0.1450	0.0212	0.0033
	Divorced/Separated	-0.0609	0.0090	0.1643	0.0950
	Widowed	-0.3055	-0.1371	-0.0538	-0.0454
	Children in Household	0.0578	0.0553	0.0390	0.0048
	Disabled	0.5600***	0.6606***	0.7832***	0.5814***
	Healthy Diet	0.0690	0.0503	-0.0427	0.0824
	Exercised	-0.2709*	-0.0943	-0.0672	-0.0968
Routine Doctor Visit *(< 1 Yr)*	1-2 Years Ago	-0.0055	-0.0162	-0.0187	0.1943*
	2-5 Years Ago	0.0928	0.1027	0.0017	0.2784*
	> 5 Years Ago	0.0072	-0.0985	0.1534	0.2497*
Social Emotional Support *(Always)*	Usually	0.5065***	0.6060***	0.5096***	0.6742***
	Sometimes	0.9259***	1.1328***	0.9225***	1.2230***
	Rarely	1.7243***	1.4866***	1.2588***	1.6805***
	Never	0.8323**	0.7048***	0.6848***	0.6897***
General Health *(Excellent)*	Very Good	0.5132***	0.1825	0.4376***	0.2063*
	Good	0.5318***	0.3861**	0.6266***	0.4092***
	Fair	1.0089***	0.9003***	1.0764***	0.9664***
	Poor	1.7532***	1.8369***	1.5845***	1.2806***
Cutpoints[1]	1 Day "Not Good"	1.2206**	1.1452***	2.0666***	1.6024***
	8 Days "Not Good"	2.8502***	2.6900***	3.1147***	2.7929***
	15 Days "Not Good"	3.6625***	3.5361***	3.7665***	3.5557***
	22 Days "Not Good"	4.0837***	4.0648***	4.1290***	3.9655***

DC=Washington, DC; IL=Illinois; LA=Louisiana; NC=North Carolina
*p<0.05, ** p<0.001, ***p<0.0001
Reference groups are listed in *italics* below each category name
Key variables are highlighted
[1] Represent ordered logit Tau cutpoints, not Beta values

References

1. Talley RC, Crews JE. Framing the public health of caregiving. *Am J Public Health.* Feb 2007;97(2):224-228.

2. Roche V. The hidden patient: addressing the caregiver. *Am J Med Sci.* Mar 2009;337(3):199-204.

3. AARP. Almost One-Third of U.S. Adult Population Plays Caregiver Role in Households Across America: 65.7 Million Caregivers. 2010; http://www.aarp.org/about-aarp/press-center/info-03-2010/caregiving_survey_release.html. Accessed 13 March 2011.

4. Buchanan R, Huang C. Health-related quality of life among informal caregivers assisting people with multiple sclerosis. *Disabil Rehabil.* May 7 2010.

5. Butterworth P, Pymont C, Rodgers B, Windsor TD, Anstey KJ. Factors that explain the
poorer mental health of caregivers: Results from a community survey of older Australians. *Aust N Z J Psychiatry.* Jul 2010;44(7):616-624.

6. Majerovitz SD. Predictors of burden and depression among nursing home family caregivers. *Aging Ment Health.* May 2007;11(3):323-329.

7. Pinquart M, Sorensen S. Associations of stressors and uplifts of caregiving with caregiver burden and depressive mood: a meta-analysis. *J Gerontol B Psychol Sci Soc Sci.* Mar 2003;58(2):P112-128.

8. Ho SC, Chan A, Woo J, Chong P, Sham A. Impact of caregiving on health and quality of life: a comparative population-based study of caregivers for elderly persons and noncaregivers. *J Gerontol A Biol Sci Med Sci.* Aug 2009;64(8):873-879.

9. Thompson L. *Long-term care: support for family caregivers.* Long-term financing project. Washington DC: Georgetown University Press; 2004.

10. Schulz R, Sherwood PR. Physical and mental health effects of family caregiving. *Am J Nurs.* Sep 2008;108(9 Suppl):23-27; quiz 27.

11. Schulz R, Martire LM. Family caregiving of persons with dementia: prevalence, health effects, and support strategies. *Am J Geriatr Psychiatry.* May-Jun 2004;12(3):240-249.

12. National Family Caregiver Support Program. Administration on Aging. 2011; http://www.aoa.gov/AoARoot/AoA_Programs/HCLTC/Caregiver/index.aspx#resources. Accessed 7 March 2011.

13. Feinberg LF NS, Gray L, Kolb KN. *The State of the States in Family Caregiver Support: A 50-State Study*: Family Caregiver Alliance; November 2004.

14. Associated Press. Cuts to elder care could cost state dollars, lives. *The Sacramento Bee.* January 29, 2011.

15. Herdt T. California seeks to turn back clock on care for the elderly. *Ventura County Star*. February 18, 2011.
16. Federal Legislation: 111th Congress (2009-2010). 2011; http://www.caregiver.org/caregiver/jsp/content_node.jsp?nodeid=2324&chcategory=43&group=Federal+Legislation&subgroup=111th+Congress+%282009-2010%29&from=2009&to=2010. Accessed 8 March 2011.

17. Pear R. Long-Term Care Program Needs Change, Officials Say. *The New York Times*. February 21, 2011;Money & Policy.

18. Zarit SH, Reever KE, Bach-Peterson J. Relatives of the impaired elderly: correlates of feelings of burden. *Gerontologist.* Dec 1980;20(6):649-655.

19. Pearlin LI, Mullan JT, Semple SJ, Skaff MM. Caregiving and the stress process: an overview of concepts and their measures. *Gerontologist.* Oct 1990;30(5):583-594.

20. Chou KR. Caregiver burden: a concept analysis. *J Pediatr Nurs.* Dec 2000;15(6):398-407.

21. Yamaki. *Health of Aging Family Caregivers in Illinois.* Chicago: Institute on Disability and Human Development;2010.

22. Schulz R, Beach SR. Caregiving as a risk factor for mortality: the Caregiver Health Effects Study. *JAMA.* Dec 15 1999;282(23):2215-2219.

23. Burton LC, Zdaniuk B, Schulz R, Jackson S, Hirsch C. Transitions in spousal caregiving. *Gerontologist.* Apr 2003;43(2):230-241.

24. Rospenda KM, Minich LM, Milner LA, Richman JA. Caregiver burden and alcohol use in a community sample. *J Addict Dis.* Jul 2010;29(3):314-324.

25. Tarlow BJ. Positive aspects of caregiving: contributions of the REACH project to the development of new measures for Alzheimer's caregiving. *Res Aging.* 2004;26(4):429-480.

26. Bouldin ED, Winter KH, Andresen EM. Lack of choice in caregiving decision and caregiver risk of stress, North Carolina, 2005. *Prev Chronic Dis.* Mar 2010;7(2):A41.

27. McKenzie SJ, McLaughlin D, Dobson AJ, Byles JE. Urban-rural comparisons of outcomes for informal carers of elderly people in the community: A systematic review. *Maturitas.* Jul 1 2010.

28. Rozario PA, DeRienzis D. Familism beliefs and psychological distress among African American women caregivers. *Gerontologist.* Dec 2008;48(6):772-780.

29. Heart Disease and Stroke: Objectives. *Healthy People 2020* 2010; http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicid=21. Accessed 8 March 2011.

30. Vitaliano PP, Zhang J, Scanlan JM. Is caregiving hazardous to one's physical health? A meta-analysis. *Psychol Bull.* Nov 2003;129(6):946-972.

31. Fernandez ID, Su H, Winters PC, Liang H. Association of workplace chronic and acute stressors with employee weight status: data from worksites in turmoil. *J Occup Environ Med.* Jan 2010;52 Suppl 1:S34-41.

32. Zhao G, Ford ES, Li C, et al. Serious psychological distress and its associations with body mass index: findings from the 2007 Behavioral Risk Factor Surveillance System. *Int J Public Health.* Jun 2009;54 Suppl 1:30-36.

33. Fredman L, Doros G, Cauley JA, Hillier TA, Hochberg MC. Caregiving, metabolic syndrome indicators, and 1-year decline in walking speed: results of Caregiver-SOF. *J Gerontol A Biol Sci Med Sci.* May 2010;65(5):565-572.

34. Iqbal Kring SI, Brummett BH, Barefoot J, et al. Impact of psychological stress on the associations between apolipoprotein E variants and metabolic traits: findings in an American sample of caregivers and controls. *Psychosom Med.* Jun 2010;72(5):427-433.

35. DeFries EL, McGuire LC, Andresen EM, Brumback BA, Anderson LA. Caregivers of older adults with cognitive impairment. *Prev Chronic Dis.* Apr 2009;6(2):A46.

36. Kim Y, Schulz R. Family caregivers' strains: comparative analysis of cancer caregiving with dementia, diabetes, and frail elderly caregiving. *J Aging Health.* Aug 2008;20(5):483-503.

37. Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2009.

38. Campbell DT, Stanley JC. *Experimental and Quasi-Experimental Designs for Research*. Boston: Houghton Mifflin; 1963.

39. Cook TD, Campbell DT. *Quasi-Experimentation: Design and Analysis Issues for Field Settings*. Boston: Houghton Mifflin; 1979.

40. Rog D. Constructing natural "experiments". In: Wholey JS HH, Newcomer KE, ed. *Handbook of Practical Program Evaluations*. San Francisco: Jossey-Bass; 1994:119-132.

41. Shortell SM, Richardson WC. *Health Program Evaluation*. St. Louis, MO: C. V. Mosby Company; 1978.

42. *Federal Register*. January 23, 2009;74(14):4199-4201.

43. Cameron CA, Trivedi PK. *Microeconometrics: Methods and Applications*. New York: Cambridge University Press; 2005.

44. VA Caregiver Benefits and Services. 2010; http://www.rosalynncarter.org/UserFiles/VA.pdf. Accessed 4 February 2011.

45. Cuts to elder care could cost state dollars, lives. *The Sacramento Bee.* January 29, 2011.

46. Tong C. State must not stop funding adult day-health centers. *The Seattle Times.* January 22, 2009;Editorials/Opinion.

47. Lifespan Respite Care Program (93.072). http://www.federalgrantswire.com/lifespan-respite-care-program.html. Accessed 13 March 2011.

48. Medicare Adult Day Care Services Act (2009). 2011; http://www.caregiver.org/caregiver/jsp/content_node.jsp?nodeid=2324&chcategory=43&chitem=71. Accessed 13 March 2011.

49. Health Care Reform and the CLASS Act. *Focus on Health Reform* 2010; http://www.kff.org/healthreform/upload/8069.pdf. Accessed 4 February 2011.

50. Summary of New Health Reform Law. *Focus on Health Reform* 2010; www.kff.org. Accessed 30 January 2011.

51. Lipson D. *Money Follows the Person Demonstration Grants: Summary of State MFP Program Applications.* Washington, DC: Centers for Medicare and Medicaid Services; August 31, 2007.

52. Money Follows the Person. *Community Services and Long Term Support* 2010; https://www.cms.gov/CommunityServices/20_MFP.asp. Accessed 4 February 2011.