

**DAILY INFLUENCES ON EVERYDAY MEMORY, WELL-BEING,
AND AFFECT AMONG DYADIC CAREGIVERS AND CARE
RECIPIENTS WITH MILD COGNITIVE IMPAIRMENT**

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS	iii
LIST OF TABLES	vi
LIST OF FIGURES	vii
LIST OF SYMBOLS AND ABBREVIATIONS	ix
SUMMARY	x
CHAPTER 1. Introduction	1
1.1 Mild Cognitive Impairment	2
1.2 ADLs and IADLs in MCI	3
1.3 Caregiving in MCI	4
1.3.1 Aspects of MCI Caregiving: Affect, Stress, Burden and Coping	5
1.3.2 Spousal Dyads	8
1.4 Sleep	13
1.4.1 MCI Sleep Disturbance	14
1.4.2 Caregiver Sleep	15
1.5 Overview of the Proposed Study	15
1.5.1 Research Aims	17
1.5.2 Hypotheses	18
CHAPTER 2. Method	19
2.1 Participants	19
2.1.1 Cognitive Empowerment Program	21
2.2 Measures	21
2.2.1 Primary Outcomes	21
2.2.2 Additional Outcomes	24
2.3 Procedure	26
2.3.1 Pre-test Session	26
2.3.2 The Diary	27
CHAPTER 3. Results	29
3.1 Hypothesis 1: Care Partner Memory Failures	31
3.1.1 H1 _{concurrent}	32
3.1.2 H1 _{lagged}	37
3.2 Hypothesis 2: Care Partner Depressive Affect	43
3.2.1 H2 _{concurrent}	43
3.2.2 H2 _{lagged}	51
3.3 Hypothesis 3: Caregiver Burden	57
3.3.1 H3 _{concurrent}	58
3.3.2 H3 _{lagged}	62

CHAPTER 4. Discussion	65
4.1 Limitations and Future Directions	69
APPENDIX A. CARE PARTNER DIARY	73
APPENDIX B. CARE RECIPIENT DIARY	89
APPENDIX C. ADDITIONAL BASELINE DATA	100
APPENDIX D. SUMMARY DIARY DATA	102
REFERENCES	125

LIST OF TABLES

Table 1	Care Partner and Care Recipient Demographics at Baseline	20
Table 2	Hypothesis 1 Concurrent Model Comparison	34
Table 3	Hypothesis 1 Concurrent Model E Summary	34
Table 4	Hypothesis 1 Lagged Model Comparison	39
Table 5	Hypothesis 1 Final Lagged Model G Summary	39
Table 6	Hypothesis 2 Concurrent Model Comparison	44
Table 7	Hypothesis 2 Concurrent Model E Summary	45
Table 8	Hypothesis 2 Lagged Model Comparison	52
Table 9	Hypothesis 2 Lagged Model E Summary	53
Table 10	Hypothesis 3 Concurrent Model Comparison	59
Table 11	Hypothesis 3 Concurrent Model G Summary	59
Table 12	Hypothesis 3 Lagged Model Comparison	63
Table 13	Hypothesis 3 Lagged Model F Summary	63
Table 14	Memory Functioning Questionnaire Subset Scores at Baseline	100
Table 15	Mutuality Scores at Baseline	100
Table 16	RMBPC Scores at Baseline	101
Table 17	Daily Inventory of Stressful Events (DISE) at Baseline	101
Table 18	Sleep Disorders Inventory (SDI) at Baseline	101
Table 19	Aggregate Diary Data	102
Table 20	Correlation of CR and CP Variables	124
Table 21	Correlation of CP Variables	124

LIST OF FIGURES

Figure 1	3-Way Interaction of CP Sleep Quality, RMBPC, and CR Sleep Quality	36
Figure 2	3-Way Interaction of CP Lagged and Concurrent Sleep Quality and Stress	41
Figure 3	2-Way Interaction of RMBPC and Mutuality	47
Figure 4	2-Way Interaction of RMBPC and CR Depressive Affect	48
Figure 5	2-Way Interaction of CR Depressive Affect and Mutuality	49
Figure 6	2-Way Interaction of CR Stress and Mutuality	50
Figure 7	3-Way Interaction of CP Lagged Sleep, CR Stress, and Mutuality	55
Figure 8	2-Way Interaction of Mutuality and CR GDS	56
Figure 9	Interaction of CP GDS and CR Memory	61
Figure 10	Care Recipient Sleep Quality Across Days	103
Figure 11	Care Recipient Sleep Quality by Day	104
Figure 12	Caregiver Sleep Quality Across Days	105
Figure 13	Caregiver Sleep Quality by Day	106
Figure 14	Caregiver Burden Difficulty Across Days	107
Figure 15	Caregiver Burden Difficulty by Day	108
Figure 16	Time Spent Caregiving Across Days	109
Figure 17	Mutuality Across Days	110
Figure 18	RMBPC Scores Across Days	111
Figure 19	Memory Blips Reported Across Days	112
Figure 20	Caregiver Memory Ratings Across Days	113
Figure 21	Caregiver Memory Ratings by Day	114

Figure 22	Care Recipient Memory Ratings Across Days	115
Figure 23	Care Recipient Memory Ratings by Day	116
Figure 24	DISE for CRs and CPs Across Days	117
Figure 25	Caregiver Global Stress Ratings Across Days	118
Figure 26	Caregiver Stress Ratings by Day	119
Figure 27	Care Recipient Stress Ratings Across Days	120
Figure 28	Care Recipient Stress Ratings by Day	121
Figure 29	Caregiver Depressive Affect Across Days	122
Figure 30	Care Recipient Depressive Affect Across Days	123

LIST OF SYMBOLS AND ABBREVIATIONS

ADL	Activities of Daily Living
aMCI	Amnesic Mild Cognitive Impairment
CBI-R	Cambridge Behavioural Inventory
CC	Collaborative Cognition
CEP	Cognitive Empowerment Program
CP	Abbreviation for care partner, also referred to as caregivers
CR	Abbreviation for care recipient
DISE	Daily Inventory of Stressful Events
GDS	Geriatric Depression Scale
IADL	Instrumental Activities of Daily Living
MFQ	Memory Functioning Questionnaire
MCI	Mild Cognitive Impairment
RMBPC	Revised Memory and Behavior Problems Checklist
SDI	Sleep Disorders Inventory
TICS	Telephone Interview for Cognitive Status
ZBI	Zarit Burden Interview

SUMMARY

Multifaceted approaches to understanding daily fluctuations that affect memory and well-being among spousal dyads, where one member has diagnosed mild cognitive impairment (MCI) and the other serves as a care partner, is a relatively unexplored area of research. This study took a novel and exploratory approach to understanding the interconnectedness of different influences on spousal dyads' daily fluctuations in memory, caregiver burden, stress, sleep, affect, relationship mutuality, and collaborative cognition from the perspective of the care partner and the care recipient. Using a nightly diary, 27 dyads (participants with MCI and their spousal care partners) filled out an online form for 14 consecutive nights. The diary forms included self-report and informant reports about daily stress, sleep quality, caregiver burden, depressive affect, memory, dyadic interactions, and collaboration. Using multilevel modeling, I investigated how daily fluctuations in these variables among both members of the dyad were associated with memory failures, depressive affect, and caregiver burden outcomes within days and from one day to the next. I anticipated higher reported daily stress, lower quality sleep, higher depressive affect, collaborative cognition, negative dyadic interactions, poorer sleep quality and lower daily memory ratings to negatively influence care partners' daily caregiver burden, depressive affect, and reported memory failures within days and from one day to the next. Results were promising with respect to protective effects of mutuality and collaborative cognition whereas poorer-than-average sleep quality showed significant lagged sleep debt effects on aspects of daily cognition and depressive affect. Problematic behaviors related to cognitive impairment in the care recipients was also associated with

poorer memory outcomes for caregivers. The present study was successful in implementing a novel study design and demonstrated the value of multidimensional investigations using repeated measures with both members of caring dyads dealing with MCI.

CHAPTER 1. INTRODUCTION

The cognitive aging process is not uniform. Changes in cognition occur within and across individuals at different rates and for different cognitive processes (e.g., Hertzog, 2008). Some aspects of cognition show performance declines more generally within the population around a certain age, whereas others may not decline at all (see Nyberg et al., 1996; Schaie & Zanjani, 2006). Cognitive changes that occur throughout the aging process for some individuals can also fall outside of what are considered normal compared to others of the same age and level of education. These changes can be observed in individual's daily functioning based on one's ability to complete everyday *activities of daily living* (ADLs) - which are basic functions performed to maintain oneself such as feeding, toileting, grooming and bathing -- as well as *instrumental activities of daily living* (IADLs) (e.g., Hindmarch et al., 1998; Katz, 1983). IADLs describe activities that allow individuals to live independently, such as cooking, cleaning, managing finances and more, but are not considered essential basic functions of living and can be considerably more complex than ADLs (Lawton & Brody, 1969; Gold, 2012; Guo & Sapra, 2021). Understanding how cognitively demanding everyday activities interplay with dyadic and individuals' daily memory, affect, interactions, responsibilities, stress, and well-being are central to the current study.

Diagnosable cognitive impairment can vary from mild, as in the case of Mild Cognitive Impairment (MCI), to severe, such as dementia. For the purposes of this dissertation, I focus on MCI, a diagnosis that is typically characterized by individuals who have impaired cognition in one or more domains but do not have dementia (e.g., Petersen

et al., 1999) and how it affects daily remembering and aspects of well-being among spousal care partners. Moreover, caregiving has been defined as an intrinsic aspect of relationships that involve caring for the well-being of another (Pearlin et al., 1990). Caregiving can entail both affective, or emotional components of care, as well as the behavioral, or more practical aspects of care. While there can be many reasons for the establishment of a caregiving relationship, the current study focused on the dynamic of caring between older couples where one of the members of the dyad has been diagnosed with MCI. The transition into a caregiving role for a loved one with MCI often involves increased care responsibilities as well as changes in the relationship (e.g., Beatie et al., 2021; Pearlin et al., 1990; Pearlin & Aneshensel, 1994). To better understand this transition, a clear understanding of the nature of MCI is needed.

1.1 Mild Cognitive Impairment

A diagnosis of MCI involves the following: subjective cognitive complaint, preserved functional activities of daily living (ADLs), objective impairment in one or more cognitive domains, and the absence of dementia (e.g., Petersen et al., 1999; Morris, 2012). MCI is not necessarily a transitional state between normal cognition and dementia (Grundman et al., 2004), although many people who are diagnosed with MCI do go on to develop dementia. MCI is also considered an umbrella term for a heterogeneous set of conditions (e.g., Lopez et al., 2006; Nordlund et al., 2005; Roberts et al., 2012; Overton et al., 2019). Approximately 6% of the US population between 70-89 are diagnosed with some form of MCI each year with the likelihood being higher for men and those with lower levels of education compared to women (Overton et al., 2019; Roberts et al., 2012). Within the MCI diagnoses there are four identified subtypes based on type of impairments and

number of affected domains. The types of impairment are classified as amnesic (aMCI: memory impairment) and non-amnesic (other cognitive impairment), as well as single domain or multiple domains of impairment (Petersen et al., 2004; Winblad et al., 2004). For the purpose of this study, literature reviewed focuses on amnesic MCI (aMCI) as the sample was drawn from a group of people primarily diagnosed with aMCI with either single or multiple domains of impairment.

The progression from MCI to dementia ranges from 5-17% annually according to various studies (e.g., Boyle et al., 2006; Cloutier et al., 2021; Ganguli et al., 2004; Manly et al., 2008; Palmer et al., 2008; Petersen et al., 1999; Petersen et al., 2001), and the conversion to Alzheimer's Disease (AD) may be higher for those with aMCI (e.g., Albert et al., 2011; Da et al., 2014; Gauthier et al., 2006; Manly et al., 2008; Morris et al., 2001). However, some studies have found that up to 50% of people diagnosed with MCI who are followed longitudinally do not progress past MCI or even revert back to a cognitively normal state. Prevalence rates of MCI vary widely (between approximately 5-30%) depending on criteria used, the type of study, and subtype factors (e.g., Langa & Levine, 2014; Overton et al., 2019; Ward et al., 2012).

1.2 ADLs and IADLs in MCI

Although persons with MCI should not struggle performing ADLs, they may have difficulties with complex IADLs such as medication and financial management. Indeed, studies have shown that compared to healthy controls, persons with MCI perform worse on IADL tasks, but better than people with AD (Gold, 2012; Jekel et al., 2015; Lara-Ruiz et al., 2019; Reppermund et al., 2013). This is not necessarily surprising given that the

ability to function independently and maintain generally preserved cognitive function are part of the differential diagnosis between MCI and dementia (e.g., Petersen, 2004; Gauthier et al., 2006; Sperling et al., 2011). Further, recent work by Cloutier and colleagues (2021) found that complex IADL performance may remain stable for years but then declines rapidly for people who progress past MCI into early AD. These authors noted, however, that more subtle, gradual IADL declines may be present many years before an AD progression and advocate for continued research in this area. Of particular importance for the proposed study is how these changes in IADL functioning may affect the care partner of the person with MCI. Given that spousal couples' lives are inextricably linked, changes in daily living and cognitive function within one partner impacts the lived experiences of both spouses (e.g., Hoppmann & Gerstorf, 2016). This may be even more relevant in the context of caring for a spouse with cognitive impairment.

1.3 Caregiving in MCI

The burden and impact of supporting individuals with MCI at present are under-researched (e.g., Betts Adams, 2006; Connors et al., 2019; McIlvane et al., 2008; Werner, 2012). However, we do know that the transition to a caregiving role for a loved one with a diagnosis of MCI, a condition that is both heterogeneous and has an uncertain path forward, tends to involve increased responsibilities and emotional components that may contribute to MCI caregiving burden (Beatie et al., 2021; Garand et al., 2005; McIlvane et al., 2008; Roberto et al., 2013). Caregiver burden can encompass emotional, psychological, social, financial, physical, and mental health components that may be associated with the caregiving role (e.g., Clare, 2002; Lara-Ruiz et al., 2019; Paradise et al., 2015; Zarit et al., 1986). Generally, factors related to dementia caregiving burden are grouped into three

domains: care recipient characteristics, caregiver characteristics, and the caregiving context (e.g., Burns & Rabins, 2000; Clyburn et al., 2000). Notably, conceptualization of caregiver burden in MCI has often been based on dementia caregiving, including the scales used to measure it, based on this author's review of the literature (e.g., Betts Adams, 2006; Lara-Ruiz et al., 2019). The transition into a caregiving role, also termed a *caregiving career*, for a loved one with MCI involves several changes to the nature of the relationship and increased care responsibilities (e.g., Beatie et al., 2021; Pearlin et al., 1990; Pearlin & Aneshensel, 1994).

1.3.1 Aspects of MCI Caregiving: Affect, Stress, Burden and Coping

Previous work, although limited, has found that spousal MCI caregiving can involve significant burden among caregivers (e.g., Carlozzi et al., 2018; Garand et al., 2005; Joling et al., 2010; Ryan et al., 2012). A review of MCI caregiving studies found caregiver burden was conceptualized differently across studies as subjective stress, emotional and physical strain, subjective burden, or objective burden (Werner, 2012). All of these conceptualizations pointed to the multidimensional nature of the stresses involved with MCI caregiving, such as physical health problems, perceived task or emotional load increase, feelings of partner loss or loneliness, and dealing with subjective stress. Additionally, spouses may even attempt to increase collaboration on daily goals and tasks as a way of compensating for their partner's impairments, which can be an additional source of distress and loneliness (Brennan & Shaver, 1995; Hoppmann & Gerstorf, 2016). In a study comparing caregivers of MCI and informants of non-impaired participants, Paradise and colleagues (2015) found that more than 35% of the MCI caregivers in their study had clinically significant burden as measured by the Zarit Burden Interview (ZBI:

Zarit et al., 1980) compared to 17% of the non-caregiver controls. Further analyses revealed that only behavioral problems as measured by the revised Cambridge Behavioural Inventory (CBI-R: Wear et al., 2008) and not depression or lowered cognition of the persons with MCI were most strongly associated with this burden. The behavioral items measured by the CBI-R include items pertaining to the care recipients' self-care, motivation, sleep, and everyday skills.

Bruce and colleagues (2008) also found that increased caregiver burden was related to both the cognitive and emotional symptoms reported by the participants with MCI as well as informant reports about these symptoms in the care recipient. In their study of MCI caregivers, Springate and Tremont (2013) reported that caregiver burden and depression was associated with increased problematic behaviors and ADL impairment in the care recipient. Other factors that have been shown to be related to increased caregiver burden include high dependence on caregivers by the person with MCI (e.g., Frank et al., 2006) and anosognosia, or the lack of awareness of one's symptoms (Kelleher et al., 2016). Interestingly, Kelleher et al. (2016) reported that anosognosia was associated with lower depressive affect and anxiety in the MCI care recipients. Similarly, Blieszner and Roberto (2010) found that care partners' depressive symptomology was poorer when caregivers had less knowledge about dementia, higher perceived burden, were more bothered by MCI impairments, had poorer personal health, less social support, and used more coping strategies. Together, these findings suggest that it is important to not just consider the level of cognitive ability of the care recipient when evaluating caregiver experience, but also the associated behaviors that may be related to MCI. The present study was designed to evaluate the multifaceted affective, health, behavioral, relational, and psychological

experience of both the caregiver and care recipient with MCI. The next section will cover facets of this type of dyadic experience that are of primary interest to this study.

1.3.1.1 Stress and Coping

Caregiving for someone with cognitive impairment can be quite stressful, especially in the context of informal family caregiving. Affection, responsibility, and care can become unbalanced as the person with MCI becomes more impaired. This may lead to changes in the relationship as the primary roles tip more heavily toward the caregiver (Pearlin et al., 1990). Pearlin and colleagues' (1990) caregiving stress process model identifies different components relevant to stress experienced by AD caregivers. This model elucidates the complex nature of caregiving for someone with memory impairment and is helpful to better conceptualize the impact on caregivers.

1.3.1.2 Stress Process Model

According to the stress process model, stressors are defined as conditions, experiences, and activities that are problematic for caregivers that fatigue, defeat, dampen their efforts, and threaten them in some way (Pearlin et al., 1990). The stress process model also takes into account the caregiver's background demographics, characteristics, history of caregiving, and resource access. Additionally, the model defines primary stressors – the demands of caring encompassing the subjective and/or objective needs and limitations of the care recipient -- as well as their magnitude. This includes cognitive status, magnitude of the workload on the part of the caregiver, caregiver fatigue, and emotional deprivation or loss in intimacy, social activities, goal setting, and more. According to the model, secondary stressors are generally the result of primary stressors and are composed of role

and psychological strains – namely caregiving and family conflict, financial strain, social restriction, self-esteem, perceived caregiving mastery and competence, and loss of self-identity. Coping is one mediator identified in the stress process model and includes situational management, finding meaning from the situation to reduce threat, and stress management. The second mediator is social support which acts to buffer secondary stressors via caregiver confidants and instrumental support from others to support the act of providing care. The caregiving stress process model has been referenced throughout the literature as a basis for understanding the complex nature of caregivers' stress load as a major contributing component of caregiver burden.

1.3.2 Spousal Dyads

Spousal caring dyads are often different than other caregiving relationships due to the underlying long term relationship component that was (likely) in place well before the presence of cognitive impairment in one of the partners. Spouses have long histories together as well as highly interconnected experiences in older adulthood via shared environments, daily experiences, and collaborative problem solving, and impact one another's affect, mental health, and well-being (e.g., Bookwala & Schulz, 1996; Butterworth & Rodgers, 2006; Carstensen, 1992; Carstensen et al., 1995; Gerstorf et al., 2013; Hoppmann et al., 2011; Hoppmann & Gerstorf, 2013; Hoppmann & Gerstorf, 2016; Lang, 2001; Savla et al., 2011; Repetti et al., 2011). According to socioemotional selectivity theory, spousal dyad affect becomes intricately linked over time through shared experiences and derived meaning from the relationship (Carstensen et al., 1995). This theory also suggests that well-being in one spouse is tied to the well-being of the other.

However, the nature of spousal couples' relationship dynamics is made even more complex during the transition to cognitive impairment and the experiences that take place therein.

1.3.2.1 Collaborative Cognition

Collaborative cognition is also of primary interest in this study. Collaborative cognition is defined as the interactive approach by couples to remember and approach everyday goals and tasks, whereas distributed cognition is merely the division of remembering among group members (Staudinger & Baltes, 1996; Barnier et al., 2008; Harris et al., 2019; Rogoff, 1998). The literature has used terms such as integrative problem-solving, collaborative cognition, distributed cognition, dyadic interactions, unbalanced responsibilities, and shared problem solving to describe different components of remembering involving more than a single individual, sometimes referred to as transactive memory (Wegner, 1987; Barnier et al., 2008). Within the present study, I refer to remembering that is shared among couples as *collaborative cognition*.

Older adult couples have shown enhanced collaborative recall performance when communication was positive or encouraged recall persistence, whereas negative communication during the recall process resulted in less collaborative remembering but did not impact recall performance (Harris et al., 2019). Additionally, shared remembering may more generally enhance remembering among spouses (e.g., Margrett & Marsiske, 2002; Brennan & Enns, 2015). The terms and contexts vary but the central tenet remains that task accomplishment requires remembering in some capacity that is shared among partners. Within the context of everyday living in spousal dyads, collaborative cognition

can range from things such as recalling shared memories together to remembering shared tasks or being responsible for remembering something *for* your partner.

Remembering for a spouse with MCI may involve being responsible for initiating or executing an intention or action that was at one time the sole responsibility of the care recipient. Importantly, this may result in increased responsibility on the part of the caregiver and could be a contributing factor to daily caregiver burden as well as increased memory errors. Generally, older adults perform relatively well on real-world memory tasks including prospective remembering, which involves the retrieval of a future intended action (e.g., Einstein & McDaniel, 1990; Henry et al., 2004; Schnitzspahn et al., 2018). Prospective remembering describes many cognitively demanding tasks that are part of daily life. This study specifically sought to understand how collaborative cognition among cognitively impaired spousal dyads impacts daily experienced caregiver burden, everyday remembering, and stress based on the distribution of cognitive responsibilities.

1.3.2.2 Well-Being, Affect, and Stress

Affect between spouses is also often interrelated. For example, negative affect or daily stress experienced by one partner can influence stress reactivity in the other, sometimes referred to as spousal coregulation (Larson & Almeida, 1999; Repetti et al., 2011; Ferrer & Helm, 2013). Additionally, synchrony on indicators of well-being via depressive symptomology, perceived health, and meaning and purpose in life rating trajectories have been demonstrated and described as a “contagion” effect among couples (Bookwala & Schultz, 1996). For example, older adult spouses were more likely to endorse depressive symptomology if their spouse did as well (Goodman & Shippy, 2002).

Additionally, collaborative problem-solving among couples on joint goal progress was associated with a reduction in negative affect in both partners, and couples who reported more joint goals endorsed using more effective collaborative problem-solving approaches (Hoppman & Gerstorf, 2013). Additionally, spouses who indicated high marital satisfaction demonstrated daily coupling of stress reactivity biomarkers, and a stress buffering effect was found among couples who reported higher spousal support (Liu et al., 2013).

Moreover, Berg et al. (2011) found that among spousal couples dealing with an ongoing health condition in one partner, collaborative coping (communicative problem solving by both partners to address a stressor) on shared stressors was associated with higher negative affect among both spouses. This is a clear example of another way in which stressors and stress reactivity among spouses may be shared. Higher depressive affect has also been found among spouses with higher caregiver burden and family conflict ratings (e.g., Bookwala, 2014; Clyburn et al., 2000; Joling et al., 2010). Moreover, among middle and older adult spousal couples, depressive affect has been linked to a spouse becoming or remaining ill over time, but was moderated by resiliency factors such as feelings of mastery and self-esteem (Bookwala, 2014; Pinquart & Sörensen, 2007). Within the present study context, the interconnectedness of couples' daily affect, stress, and shared experiences were examined relative to memory and affective well-being outcomes in the care partner.

1.3.2.3 Individual and Within-Couple Variability

Savla et al. (2011) conducted a weeklong diary study with spousal MCI caregivers investigating daily stress, strain, spousal interactions, daily activities, well-being, sleep,

and behavioral issues. They found that daily pleasant spousal interactions were associated with higher daily reported positive affect within-persons. They also found that on days when negative spousal interactions occurred, caregivers reported increased negative affect. Care recipient behavioral problems reported by the caregivers were associated with daily negative affect in the caregiver and were coupled with caregivers' salivary cortisol indicators of increased stress compared to days without this pattern. These findings point to a myriad of factors that may influence caregivers' experienced stress including engagement in activities, spousal interactions, and impaired behaviors both between and within individuals in dyads. The present study extended these findings by collecting specific daily memory and caregiver burden measures which were not included in the investigation by Savla et al. (2011) in addition to collecting data from both dyad members and expanding the diary collection to a two-week measurement period.

Similarly, other daily diary studies found that on days when healthy older adults experienced interpersonal stressors, they reported more memory failures that same day and the next day (Neupert et al., 2006; Neupert et al., 2008). Another diary study found that when stressors involved a close friend or family member, mastery beliefs reduced cognitively healthy middle aged adults' stress reactivity, whereas older adults' stress reactivity was not modulated by mastery beliefs (Neupert et al., 2007). In another study, spousal dementia caregivers who reported higher caregiver burden simultaneously reported lower marital satisfaction (Fitzpatrick & Vacha-Hasse, 2010). Additionally, one study found that longitudinal mental health rating differences within couples were associated with lower mental health, health issues, and lower marriage satisfaction (Gerstorf et al., 2013). Taken together, stress, marital satisfaction, depressive affect, physical and mental

health, and caregiver burden impact individual's and spousal dyads' daily lived experiences in meaningful ways. The current study sought to extend these findings by including measures of caregiver burden, stress, depressive affect, collaborative cognition, dyadic interactions, and more for both members of spousal dyads over a period of two weeks to further investigate these relationships over time.

1.4 Sleep

The impact of sleep on different aspects of cognition and well-being has been a lasting area of interest in psychology (e.g., Bergmann, 2000; Feinberg & Evarts, 1969; Scullin, 2013; Yaffe et al., 2014). The sleep dysregulation model posits that mental health symptoms are often exacerbated by sleep disturbances which in turn may impair circadian rhythms and emotional regulation (Palagini et al., 2019). Sleep duration and sleep quality indicators show decreases with increasing age on measures such as sleep fragmentation (the number of times adults wake up during the night), sleep disturbances, and the number and quality of deep restorative slow-wave sleep (SWS) stages (Bliwise et al., 2009; Bliwise, 2013; Espiritu, 2008; Mander et al., 2017; Ohayon et al., 2004; for a review see Scullin & Bliwise, 2015). Moreover, self-reported night-to-night sleep quality and within-person average sleep duration deviations have been associated with day-to-day cognitive performance as well as depressive affect across a range of tasks in middle aged and older adults (Baglioni et al., 2010; Gamaldo et al., 2010; Regestein et al., 2004; Roane et al., 2014; Smith et al., 2015). However, middle aged and older adults seem to be less sensitive to poor night-to-next-day sleep on cognitive performance compared to younger adults (e.g., Duffy et al., 2009; Nesthus et al., 1998; Stenuit & Kerkhofs, 2005). Poor sleep quality and inactivity have also been linked to lower cognitive performance among healthy older adults

(e.g., Nakakubo et al., 2017). Moreover, in a daily diary study, self-reported leisure exercise in older adults was associated with fewer memory failures within persons across days and from one day to the next day (Whitbourne et al., 2008). Given the importance of sleep in both cognitive and emotional function, it is critical to try to understand how couple's sleep patterns may influence one another's sleep quality, affect, stress, and memory performance in everyday life.

1.4.1 MCI Sleep Disturbance

Sleep disturbance among people with MCI has been more generally associated with increased depressive affect, poorer cognitive performance and worse physical health (for a review see Naismith & Mowszowski, 2018). Moreover, older adults with MCI show decreased SWS and greater sleep disturbance, impacting their alertness during the day compared to healthy older adults (Pistacchi et al., 2014; Gorgoni et al., 2016; Naismith & Mowszowski, 2018; Palmer et al., 2018). Given that persons with MCI generally tend to experience greater sleep disturbance and that many spousal caregivers share a bed, it is likely that the sleep of a person with MCI will directly impact the functioning of the caregiver. A recent systematic review (Köhler et al., 2016) found that individuals with MCI across studies and MCI subtypes displayed sleep disturbance prevalence rates, including sleep disorders, ranging from 7.9-49%. Another study found that among non-amnesic MCI patients who completed two weeks of daily diaries and actigraphy sleep monitoring, sleep fragmentation via the time spent awake after falling asleep and the number of times people awoke was associated with reduced attention and executive functioning measures (Naismith et al., 2010).

1.4.2 Caregiver Sleep

Among caregivers, sleep disturbance is highly prevalent and often accompanies caregiver burden, depression, and impaired physical health (McCurry & Terri, 1996; McCurry et al., 2007; Byun et al., 2016; Liu et al., 2017). Additionally, caregivers report struggling with energy and tiredness throughout the day while simultaneously experiencing sleep disturbances and trouble falling asleep, which are often associated with the care recipient (Hughes et al., 2020). In a weeklong diary study with concurrent objective sleep measurement, informal dementia caregivers' self-reported sleep quality ratings and next day fatigue were worse and showed increased variability in night-to-night sleep patterns compared to non-caregivers (Rowe et al., 2008). Additionally, actigraphy sleep measures from dementia caregivers reveal that depressive symptomology is associated with poorer sleep quality and that older caregivers with lower self-rated health reported spending more time in bed but not more time asleep (Beaudreau et al., 2008). Finally, in a study with informal caregivers, more hours per week spent caregiving was associated with higher self-reported sleep disturbance and lower quality of life ratings (Ravyts & Dzierzewski, 2020). Sleep disturbance is present among both memory impaired care recipients and their caregivers. However, the interactive effect of sleep on daily cognitive, affective, stress, and caregiver burden outcomes across spousal partners remains to be investigated. The present study set the stage for answering these questions with a once daily measurement over a two-week period.

1.5 Overview of the Proposed Study

This dissertation study investigated spousal dyads – one with MCI and one identified as a caregiver - using a two-week daily diary form to collect self- and informant reports on a wide range of variables that may impact daily memory and well-being in one or both members of the dyad. Both members of the dyad had their own version of the form, with the care partners' form being longer and more extensive to include informant reports about the care recipient (Ready et al., 2004ab). Both versions of the diary included measures that captured subjective memory, perceived stress, memory failures, sleep quality, sleep quantity, depressive affect, daily activity, collaborative cognition, and dyadic interactions. In addition, the care partner diary also asked for caregiver burden ratings, coping behaviors, and informant ratings of sleep quality, sleep quantity, stress, memory, problematic behaviors, and observed memory failures.

The spousal MCI caregiver experience is currently under-researched and is impacted by daily occurrences and facets of daily life such as sleep, stress, affect, dyadic interactions, and spousal coregulation. At present, there is very little comprehensive data available on within-day individual differences analyses that examine a myriad of aspects of spousal daily living on memory failures and well-being within the context of MCI caregiving. The current study's exploration of daily self and informant reports of stress, sleep quality and quantity, depressive affect, dyadic interactions, activity, caregiver burden, collaborative cognition, and daily remembering will provide insight on older adult spousal dyads lived everyday cognitive, physical, interactive, and affective experiences. I believe the present study is novel, has unique and impactful outcomes, and an approach that expands the knowledge base on complex caregiving dyads' everyday lived experiences.

The present study is novel in several important ways. Firstly, the method of data collection captures 14 consecutive days of data at the within-person and within-dyad levels across days. To this author's knowledge, no other study has used such extensive repeated measures with both dyad members. This type of intensive repeated measures within-persons and within-dyads over a two-week period provides insight into variability in everyday memory and functioning within-persons and within-dyads across days and from one day to the next. Secondly, other studies on persons with MCI or MCI caregivers' memory, sleep, and/or stress have only collected data from one member of the dyad and often do not include crossover effects from one partner to the other based on information over the course of each day or from one day to the next whereas the current study includes both. Finally, the present study is also unique in the array of measures included together to capture more holistic insights about potential daily influences on older adults' daily memory outcomes, aspects of well-being and MCI caregiver burden.

1.5.1 Research Aims

The current study sought to explore how daily sleep quality and quantity, depressive affect, and experienced stress in MCI care recipient-caregiver dyads were associated with daily memory failures, collaborative cognition, dyadic interactions, and well-being outcomes including caregiver burden, stress, and depressive affect in the caregiver within days and from one day to the next. I was specifically interested in investigating the interconnectedness of aspects of daily cognition, well-being, relationship dynamics, stress, and sleep as repeated measures with the outcomes specified as daily care partner (1) reported memory failures, (2) depressive affect, and (3) caregiver burden within and across individuals in these dyads within and across days. Using quantitative methods, I

investigated how daily fluctuations among these variables influenced memory, caregiver burden, and depressive affect outcomes among care partners based on caregivers' and care recipients' daily reports. I was also interested in lagged effects, or potential day to next-day effects of care partner and care recipient sleep quality, and care partner stress on caregiver memory, caregiver burden and depression outcomes.

1.5.2 Hypotheses

I specified my hypotheses based on my interest in care partners' (1) everyday remembering, (2) affective well-being, and (3) caregiver burden outcomes as a consequence of their daily MCI caregiving role. My first hypothesis was that higher care partner stress, higher caregiver burden, more reported collaborative cognition, poorer care partner sleep quality, and poorer care recipient sleep quality would be associated with increased memory failures in the care partner within days and from one day to the next. My second hypothesis examined dyadic affective well-being with the outcome specified as depressive affect in the care partner. I expected that higher care recipient stress and depressive affect, lower care partner sleep quality, negative dyadic interaction ratings, and the presence of problematic behaviors in the care recipient would be associated with higher depressive affect in the care partner within days and from one day to the next. My third hypothesis was that higher daily stress and depressive affect in the care partner, poorer care partner sleep quality, lower care recipient memory ratings, and lower dyadic interaction ratings would be associated with higher caregiver burden within days and from one day to the next.

CHAPTER 2. METHOD

2.1 Participants

Twenty-seven dyads ($N=54$ persons) were enrolled in this study. Participants in this study were recruited from the Cognitive Empowerment Program (CEP; described in more detail below). Each dyad consisted of one CEP member diagnosed with MCI ($N=27$), and their (spousal or romantic) care partner ($N=27$). Participation in this study was completely voluntary and there was no compensation for participation as per CEP policy. Eligibility to enroll in the study required that both members of the dyad consented and participated at the same time. The average length of time the dyads were in a relationship together was 41 years ($SD=16.32$). Two dyads were composed of co-habiting long-term romantic partners (one same sex couple), and the rest were married. The sample was primarily composed of Caucasian people with the exception of one Black care partner, one Black care recipient, and three care recipients who identified as “other” - one of which identified as Hispanic or Latin American.

CEP members, hereafter referred to as care recipients (CRs), were between 51-90 years old ($M=74.6$, $SD= 8.26$, 10 females). The average care recipient Telephone Interview for Cognitive Status (TICS; Brandt et al., 1988) score was a 29.81 ($SD= 4.96$) out of 41 possible points. Compared to others their age, care recipients all rated their vision as “fair” or better (on a 5-point scale from poor to excellent), and all but one care recipient rated their hearing as “fair” or better as well as their self-rated health. For self-rated memory compared to others, seven participants indicated theirs was “poor”, 10 rated theirs as “fair”, seven rated theirs as “average”, two rated theirs as “good”, and one indicated it was

“excellent.” The data for this study was collected between April of 2021 and March of 2022.

Caregivers, also referred to as care partners (CPs), ranged between the ages of 51-90 ($M= 71.4$, $SD=8.35$, 18 females). The average TICS score for CPs was 36.19 ($SD= 2.96$). Generally, scores below 31 (out of 41 total points) indicates the presence of cognitive impairment. One CP had a TICS score of 30 and two had a TICS score of 31, indicating *possible* cognitive impairment. There are several possible reasons why these two CPs scored at or below the MCI cut-off other than impaired cognition; namely, stereotype threat, phone call quality, hearing ability, and/or environmental distractions while completing the assessment. Nevertheless, TICS scores were used as a covariate in all multilevel modeling to account for cognitive status and to maintain all possible participant data given the small sample size. Care partners self-rated health, vision, and memory at baseline were all reported as being “fair” or better. There was only one CP who reported their hearing as “poor” and another who reported their health as “poor” whereas 26 reported theirs as “fair” or better. See Table 1 for a summary of demographic information for CPs and CRs.

Table 1. Care Partner and Care Recipient Demographics at Baseline

	CPs	CRs
Mean Age	71.4 (8.35)	74.6 (8.26)
Gender	18 Female	10 Female
Mean Education	17.10 (2.14)	16.62 (2.62)
Mean TICS Score	36.19 (2.96)	29.81 (4.96)
Mean Medications	3.56 (2.14)	4.92 (2.22)
Mean Conditions	4 (3)	5 (3)

Percent Caucasian	96.3%	85.19%
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Numbers in parentheses indicate the standard deviation of the mean. Mean Medications refers to the average total number of prescription medications participants indicated they were presently taking. Mean conditions refers to the average number of current health conditions participants reported. Percent Caucasian refers to the percent of participants in each group who identified as Caucasian.

2.1.1 Cognitive Empowerment Program

The Cognitive Empowerment Program (CEP) is a joint venture between Emory University's Brain Health Center and the Georgia Institute of Technology. The CEP is a research center and therapeutic program for people with MCI located in Emory University's Brain Health Center. Individuals must be diagnosed with MCI by the Emory Cognitive Neurology Clinic or the Alzheimer's Disease Research Center at Emory and are then referred to the CEP where they undergo a battery of cognitive and psychological testing at baseline, six months, and at 12 months when they exit the program. Participants in this study enrolled in the CEP between January of 2020 and August of 2021. The CEP also works with the families of members who have been diagnosed with MCI. Typically, care partners are spousal partners of an enrolled member. Occasionally, they are other family members such as adult children or non-spousal significant others. Designated care partners undergo a small battery of testing, but it is considerably smaller than that of their care recipients. For this study, only dyads composed of spousal (or romantic other) care partners were eligible to participate. Only assessments used in the dissertation analyses will be described below.

2.2 Measures

2.2.1 Primary Outcomes

2.2.1.1 Nightly Diary Forms

Nightly diary forms were completed by each member of the dyad for 14 consecutive days. The diary was based on previous work from my laboratory (e.g., Pearman et al., 2020; Pearman et al., *in preparation*), but has been edited and expanded to enable self and partner ratings regarding key constructs including: collaborative cognition, sleep quality, sleep quantity, dyadic interactions, stress, caregiver burden, overall memory ratings, memory failures, and problematic behaviors exhibited by the care recipient. The forms for care recipients and care partners differed slightly - differences are described below. See Appendices A and B for the care partner and care recipient diary forms, respectively. Data from the nightly forms comprised the primary outcomes of interest. Importantly, the questions were all phrased in terms of only the day individuals completed the form.

2.2.1.1.1 Sleep Quality

Participants completed a variety of indicators related to the quality and quantity of their sleep. The primary variable of interest was the quality of participant's sleep, which was indicated on a sliding scale from 0 ("Poor") to 100 ("Very Good").

2.2.1.1.2 Stress

Participants were asked several questions about stress. Participants indicated how much stress they experienced that day using a sliding scale from 0 ("None") to 100 ("Extremely High"). Participants completed part of the Daily Inventory of Stressful Events (DISE) by indicating the presence (yes or no) of seven potential daily stressors with higher scores indicating more stressors (Almeida et al., 2002).

2.2.1.1.3 Depression

Participants completed the four item Geriatric Depression Scale (GDS-4; Molton, 2013) each day. The GDS-4 is comprised of four yes or no questions (e.g., *Are you basically satisfied with your life?*) from the original 30-item GDS (Yesavage et al., 1982), with increasing scores indicating a higher likelihood of depression.

2.2.1.1.4 Dyadic Interaction

Participants completed a subset of six questions from the Mutuality Scale (Archbold et al., 1990), which measures mutuality between partners (e.g., *How often do the two of you laugh together?*), with scores ranging between 0 and 4. Higher scores indicate increased mutuality.

2.2.1.1.5 Caregiver Burden

Only care partners were asked questions about caregiver burden. Care partners also answered three questions about if helping to care for their partner was difficult, enjoyable, and rewarding that day on a sliding scale from 0 (“Not at all”) to 100 (“Very”). Additionally, caregivers indicated the amount of time spent caring for their partner that day in 30-minute to one-hour increments from 30 minutes or less to six or more hours using a drop-down menu. Care partners were asked a subset of seven questions from the Revised Memory and Behavior Problems Checklist (RMBPC; Teri et al., 1992), which is a list of potential problematic behaviors sometimes exhibited by people with memory impairment (e.g., *Asking the same question over and over again*). Care partners indicated whether or

not the issue occurred that day (“Yes” or “No”) and how much it bothered them on a 5-point likert scale (*Reaction*, 0 = “Not at all” to 4 = “Extremely”).

2.2.1.1.6 Collaborative Cognition

All respondents indicated “Yes” or “No” to whether they collaborated with their partner that day and provided a brief description. The descriptions were used to verify whether a “yes” response indicated that some form of collaborative cognition occurred.

2.2.1.1.7 Global Memory

Participants were asked to rate their own memory that day using a sliding scale (0= “Poor” to 100= “Excellent”).

2.2.1.1.8 Memory Blips

All participants indicated whether or not they experienced any problems remembering something today (“Yes”, “No” or “Unsure” response options). If care recipients did not indicate memory issues or were unsure if they experienced one, the survey ended. If respondents indicated that they experienced a problem remembering something that day the survey used branching logic to ascertain more information about the memory problem(s). These memory problems or memory failures were referred to as “blip(s)” on the diary form. Subsequent questions included a brief description of the blip and the circumstances in which it occurred. These same questions repeated for up to five subsequent blips.

2.2.2 Additional Outcomes

2.2.2.1 Baseline Measures

Baseline measures of cognition, memory function, dyadic interaction, caregiver burden, stress, sleep disorders, and depressive affect were collected as part of the pre-test session or were requested from the CEP. These measures are presented to better characterize the participants at or near baseline. Each of these measures has been implicated as impacting memory function, spousal interaction, well-being, and/or caregiver burden. Baseline measures were collected during a brief phone interview to gather basic demographics information such as age, education, and self-reported health. The phone interview also included the TICS (Brandt et al., 1988), a widely used measure of cognitive functioning. Other baseline measures collected during the first session included the Memory Functioning Questionnaire (MFQ), a reliable subjective memory questionnaire that includes questions about the type and frequency of memory failures as well as mnemonics and external aid use on a 7-point scale with higher scores indicating higher frequency (Gilewski et al., 1990); the DISE; and the Mutuality Scale. Care partners also completed the RMBPC. Summaries of these measures are presented in Appendix C. Depressive symptoms as measured by the GDS, PROMIS Sleep Disturbance Scale (Buysse et al., 2010), STOP-Bang (Chung et al., 2016), Sleep Disorders Inventory (SDI: Tractenberg et al., 2003), date of MCI diagnosis, and the date of entry into the CEP program were requested. Of the requested data, I was able to access date of CEP program enrollment and the Sleep Disorders Inventory (SDI) scores. The other measures were either changed between CEP cohorts and/or were not collected for more than 5 dyads (GDS, PROMIS Sleep Disturbance Scale, and the STOP-Bang) or the data were not made available to me (date of diagnosis). Participants in this study were enrolled in the CEP between January of

2020 and August of 2021. For reference, the data for this study was collected between April of 2021 and March of 2022. The SDI had care partners rate symptoms related to the presence of sleep disorders in their care recipient during the last two weeks on a 5-point likert scale for frequency (from 0- not present to 4- every night) and severity on a 4-point likert scale (0- not present to 3- marked). Care partners also provided caregiver distress ratings that queried how emotionally distressing this behavior was on a 6-point likert scale (0- not present to 5- very severely/extremely). Means and standard deviations are reported in Appendix C.

The goal of this study was to take a unique and multifaceted approach to better understand potential patterns among daily affect, sleep, cognition, stress, and caregiver burden impacts on remembering and well-being factors with a particular emphasis on the care partners' outcomes.

2.3 Procedure

2.3.1 Pre-test Session

After indicating interest in participation and verifying eligibility, participants completed a single pre-testing session. The pre-test session was comprised of the aforementioned phone interview with each member of the dyad as well as an online survey portion. The phone interview began by walking the participants through how to load the online portion of the session via email as needed. Participants then completed the virtual consent form with a member of the research team before proceeding with the phone interview. After participants consented to participate in the study, basic demographic information was collected, followed by the TICS for each participant over the phone.

Participants were then directed to complete the rest of the session online. The online portion had both members of the dyad individually complete the MFQ, Mutuality Scale, and the DISE. Care partners also completed the RMBPC. After the pre-test session was completed, participants were first debriefed on how to access and complete the diary each night. Participants were also briefly walked through the diary form. Participants were then contacted again before the start date of their two-week diary period via telephone and/or email based on their preference. The purpose of the check-in was to (a) serve as a reminder of participation (b) verify participation and (c) answer any questions about the upcoming portion of the study.

2.3.2 *The Diary*

A nightly diary form was completed by each member of the dyad for the same 14 consecutive day period. Participants were given the option of completing either an online diary through Qualtrics or a printed diary booklet. None of the participants opted to complete the study using a paper version. Each member of the dyad was emailed a unique link each day at the end of the day (approximately five o'clock in the evening) to fill out their own diary form. Participants were instructed to fill out their responses independently and only on the specified day of the email. Participants were also contacted between filling out their first and second night of diaries to answer questions, review how to load or fill out any sections of the diary and verify interest in continuing the study. Participant diary data was monitored regularly throughout collection. If participants missed a day, they were instructed to skip that day's entry and complete the next diary entry with the new link. Research personnel contacted participants who missed more than one day's worth of

diaries in a row or as needed. At the end of the 14-day period participants were emailed a debrief and thanked for their participation.

CHAPTER 3. RESULTS

The primary outcome variables of interest in accordance with my hypotheses were (1) the number of reported caregiver daily memory failures, (2) caregiver depressive affect, and (3) caregiver burden - based on CP and CR diary ratings of stress, depressive affect, subjective memory, collaborative cognition, dyadic interactions, caregiver burden, sleep quality, and problematic behaviors exhibited by the care recipient. The measures collected at baseline were analyzed across care partners and care recipients to describe individuals' characteristics, dyadic interaction ratings, problematic behaviors exhibited by the care recipient, stress, and more (see Appendix C). The (daily) repeated measures summary statistics, correlations, and aggregated analyses grouped by person and day are presented in Appendix D.

The use of multilevel modeling was justified based on the inherently nested structure of the data (days nested within persons) as well as the research questions (Snijders & Bosker, 2012). The first goal of data analysis was to identify directional associations among the variables relative to the specified outcomes (caregiver memory blips, caregiver depressive affect, and caregiver burden) for each hypothesis. The second goal of data analysis was to better understand how the array of different daily-life factors were associated with caregiver outcomes by comparing multilevel models to identify the best-fitting model.

Analyses were performed using the lme4 package (Bates et al., 2015) for mixed effects linear modeling in R (R Core Team, 2020). Model predictors at level 1 (day) were all person mean centered (i.e., mean-centered across days within individuals) from the

diary forms, with the exception of collaborative cognition, which was a binary variable. Typical covariates (age, education, and TICS score) were included for CPs in all of the multilevel analyses at level 2 (persons) to help better isolate the effects of interest. I investigated the outcomes for each hypothesis using a series of (concurrent) day analyses, as well as a series of day to next-day (lagged) models using an additive approach. All available diary data were used in the analyses given the limited sample size, and missing data were assumed to be missing at random. For each hypothesis, I began by running a random intercept-only model to establish the intraclass correlation coefficient (ICC). The ICC in the empty model represents the amount of variance in the dependent variable that is due to person-to-person (level 2) variation and falls between 0-1. Higher ICC values indicate higher correlations within an individuals' data across days (level 1), and higher variation from one person to the next (c.f., Snijders & Bosker, 2012). ICCs for all models were not close enough to zero to justify the use of fixed intercepts.

The intercepts were allowed to randomly vary for all models. By allowing the intercepts to randomly vary, individuals (level 2) had different intercepts which reflects different mean levels of the dependent variable for each individual. Then, TICS, age, and education were added as covariates to the intercept-only model for all three hypotheses. The models were run with fixed slopes and all subsequent models contained random intercepts and fixed slopes for all predictors (i.e., slopes were invariant across individuals). Full models included the pre-specified covariates as well as the predictors of interest. These models provided information about the magnitude, direction, and statistical significance of each variable's relationship to the outcome of interest while holding the other variables constant. The full models were then expanded to investigate potential interactions among

variables which provided insight on whether and how the relationship among various predictor variables worked together to impact the association with the outcome of interest. All of the models used maximum likelihood estimation for the purpose of model comparison. Final concurrent and lagged models for each hypothesis were selected based on model fit criteria and model specifications through model comparison. For all three hypotheses model comparisons along with the selected final best fitting concurrent and lagged models as well as their significant findings are presented below. These multilevel models were run in R using the default lme4 settings unless otherwise specified.

3.1 Hypothesis 1: Care Partner Memory Failures

My first hypothesis was that higher care partner stress, higher caregiver burden, reported collaborative cognition, poorer care partner sleep quality, and poorer care recipient sleep quality would be associated with a higher likelihood of more memory failures in the care partner within days and from one day to the next. I used the daily CP global stress rating (*how much stress did you experience today?*) to represent care partner stress, RMBPC to represent caregiver burden, collaborative cognition (CC) reported by the caregivers as a binary (1= “yes”, 0= “no”) variable, and the global CR and CP sleep quality ratings (*how would you rate the quality of your sleep last night*) as model predictors. To test my first hypothesis, I ran a series of concurrent ($H1_{concurrent}$) and lagged ($H1_{lagged}$) multilevel models, generally represented by the Equation 1 below (where i represents a given observation at level 1, within j individual at level 2):

$$\text{Level 1: CP Memory Blips}_{ij} = \beta_{0j} + \beta_{1j}(\text{CP Stress}_{ij}) + \beta_{2j}(\text{RMBPC}_{ij}) + \beta_{3j}(\text{Collaborative Cognition}_{ij}) + \beta_{4j}(\text{CR Sleep Quality}_{ij}) + \beta_{5j}(\text{CP Sleep Quality}_{ij}) + \varepsilon_{ij}$$

$$\begin{aligned} \text{Level 2: } \beta_{0j} &= \gamma_{00} + \gamma_{01}(\text{TICS}) + \gamma_{02}(\text{Age}) + \gamma_{03}(\text{Education}) + U_{0j} \\ \beta_{1j} &= \gamma_{10} \\ \beta_{2j} &= \gamma_{20} \\ \beta_{3j} &= \gamma_{30} \\ \beta_{4j} &= \gamma_{40} \\ \beta_{5j} &= \gamma_{50} \end{aligned} \tag{1}$$

3.1.1 *HI_{concurrent}*

In the concurrent analyses, I used daily CP stress, RMBPC, collaborative cognition, CR sleep quality, and CP sleep quality as level 1 model predictors of same-day care partner memory failures. Concurrent (or same day) sleep quality was represented by diary data that was collected at the same time as the rest of that day's data for each participant. The diary was worded so that individuals answered the sleep quality prompt for each day based on "last night". The concurrent models represent the daily relationship from individuals' sleep that led into the rest of that day's diary data (e.g., stress, memory, dyadic interactions, etc.). In other words, concurrent models represent individuals' self-reports over an approximate 24-hour period of time for each diary beginning with their sleep the night prior all the way through when they filled out the diary at the end of each day of the study. For example, Monday's diary responses contained an individuals' sleep ratings based on when they went to bed on Sunday night until they woke up on Monday morning. Moreover, reported memory blips in Monday's diary would have occurred throughout the day Monday until participants completed the diary at the end of the day Monday.

After a full model containing all the predictors of interest as well as age, education, and TICS as covariates, I performed exploratory analyses that included the addition of several two and three-way interactions at level 1. Model E was selected as the final concurrent model. It included a significant three-way interaction between CP sleep quality, CR sleep quality, and RMBPC and was more parsimonious compared to other exploratory models with similar fit statistics (see Table 2 for model comparison). A summary of fixed and random effects for Model E are presented in Table 3 below. The conditional pseudo- R^2 (Nakagawa & Schielzeth, 2012) was .52 indicating that the amount of information accounted for by the fixed and random effects in the model is 52%. There was also an increase in the conditional or total pseudo- R^2 from the marginal pseudo- R^2 (.22).

Age was significantly negatively associated with memory blips, such that when all other variables were held constant, we expect the average number of memory blips reported to decrease by .02 for every one-year increase in caregiver age ($t=-2.09$, $p=.05$). Additionally, the fixed effect of RMBPC was significantly associated with an increased number of memory blips reported on a daily basis such that per one unit increase in problematic behaviors related to cognitive impairment exhibited by the care recipient (RMBPC score) we expect a .08 increase ($t= 2.57$, $p=.01$) in the number of caregivers reported blips that same day, holding all other variables constant. Collaborative cognition was also significantly associated with an increased number of memory blips within days for caregivers. Holding all other variables constant, on days when collaborative cognition was reported we expect that reported memory blips increased by .18 units ($t=2.82$, $p=.01$). Finally, the three-way interaction of RMBPC with CP and CR sleep quality was significantly associated with memory blips ($B= -0.00$, $t=2.32$, $p=.02$).

Table 2. Hypothesis 1 Concurrent Model Comparison

Model (Predictors)	ICC	<i>n</i> parameters	AIC	BIC	-2LL	Chi-Square (df)	P-val
A: (Intercept-only)	0.36	3	515.29	526.81	509.29	--	--
B: (Model A + TICS + Age + Edu)	0.25	6	510.19	533.23	498.19	A: 11.10 (3)	< 0.05*
C: (Model B+ CP Stress + RMBPC + CC + CR Sleep + CP Sleep)	0.39	11	443.45	484.55	421.45	B: 76.74 (5)	< 0.05*
D: (Model C + CP Sleep*CP Stress)	0.39	12	443.37	488.21	419.37	C: 2.08 (1)	0.15
E: (Model C + CP Sleep*CR Sleep*RMBPC)	0.38	15	443.71	499.76	413.71	D: 5.66 (3)	0.13
F: (Model D + CP Sleep*CR Sleep*RMBPC)	0.38	16	444.51	504.30	412.51	E: 1.20 (1)	0.27
G: (Model F + CP Stress*RMBPC)	0.38	17	445.16	508.68	411.16	F: 1.35 (1)	0.23

CC = collaborative cognition, -2LL= -2*log likelihood; *= significant for p-values $\leq .05$

Table 3. Hypothesis 1 Concurrent Model E Summary

Fixed Effects	Estimate (<i>B</i>)	S.E.	T-Val	DF	P-value
Intercept	-0.30	1.44	-0.21	25.78	0.84
TICS	0.04	0.03	1.67	25.46	0.11
Education	0.02	0.03	0.56	26.14	0.58
Age	-0.02	0.01	-2.09	25.84	0.05*
CP Stress	0.00	0.00	0.46	281.45	0.65
RMBPC	0.08	0.03	2.57	282.09	0.01*
Collaborative Cognition	0.18	0.06	2.82	305.77	0.01*
CP Sleep Quality	0.00	0.00	1.81	281.89	0.07
CR Sleep Quality	0.00	0.00	1.38	282.70	0.17
CP Sleep Quality*CR Sleep Quality	0.00	0.00	0.87	286.28	0.39
RMBPC*CP Sleep Quality	0.00	0.00	0.80	292.40	0.42
RMBPC*CR Sleep Quality	0.00	0.00	0.47	291.73	0.64
RMBPC*CR Sleep Quality*CP Sleep Quality	-0.00	0.00	-2.32	289.95	0.02*
Random Effects					
Parameter	Variance	SD			
Intercept	0.11	0.34			
Residual	0.18	0.43			
Model Information	Pseudo- <i>R</i> ² Fixed	Pseudo- <i>R</i> ² Total			
ICC= 0.38	0.22	0.52			

*= significant for p-values $\leq .05$, Pseudo-*R*² Fixed represents the marginal *R*² (amount of information accounted for by the fixed effects in the model) and Pseudo-*R*² Total represents the conditional *R*² (the amount of information accounted for by the fixed and random effects in the model).

A simple slopes analysis was run to decompose the three-way interaction of RMBPC, CR Sleep, and CP Sleep. Sleep quality among dyads was associated with the care recipient behavioral outcomes (RMBPC) and reported care partner memory blips within-

days, $F(1,289.95) = 5.37, p=.02$. A plot of the three-way interaction is shown below in Figure 1. From left to right on the graph, when RMBPC scores were one standard deviation below individuals' average across days and care recipients reported sleep quality was one standard deviation above their mean, care partner sleep quality showed a strong positive relationship with reported memory blips. Similarly, on days when RMBPC scores were around an individuals' average across days, and care recipients' reported sleep quality was approximately between their means and one standard deviation above their means, care partner sleep quality showed a positive relationship with reported memory blips. Finally, on days when RMBPC scores were one standard deviation above individuals' average across days, and care recipients reported sleep quality was one standard deviation below their mean, care partner sleep quality showed a strong positive relationship with reported memory blips.

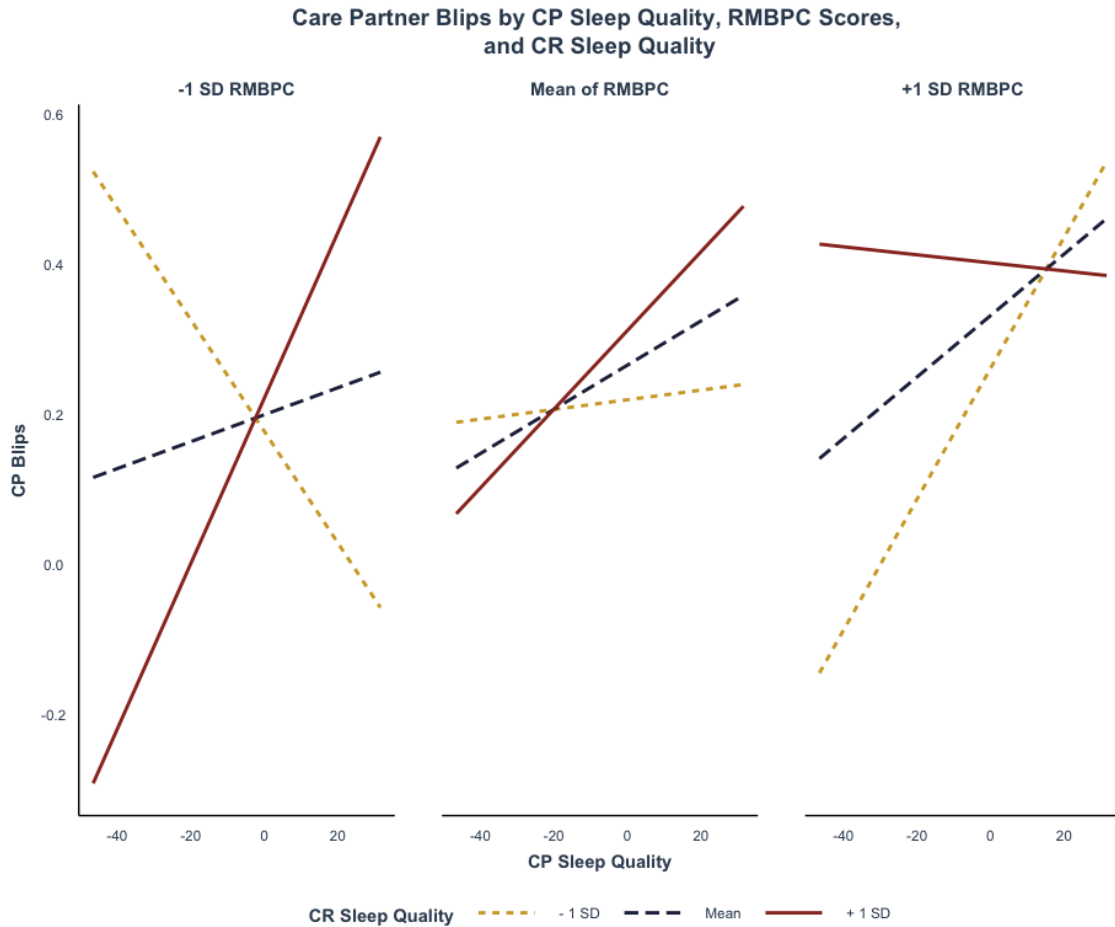


Figure 1. 3-Way Interaction of CP Sleep Quality, RMBPC, and CR Sleep Quality

3.1.1.1 Summary

I hypothesized that higher care partner stress, higher caregiver burden, reported collaborative cognition, poorer care partner sleep quality, and poorer care recipient sleep quality would be associated with a higher likelihood of more memory failures in the care partner within days. I did not find a significant directional association between care partner stress and memory blips but did investigate models that explored stress in a variety of ways (e.g., Models C, D, F, G). Care partner sleep quality was positively associated with memory blips regardless of their care recipient's sleep quality. Meaning, that on days when

caregivers reported higher sleep quality there was an association with increased memory blip reports that same day. However, the strength of the relationship between care partner sleep quality and memory blips was stronger when RMBPC scores were one standard deviation below their means and care recipient sleep quality was one standard deviation above their means. The association between CP sleep quality and memory blips was also stronger when RMBPC scores were above their means and care recipient sleep quality was one standard deviation below their means. In the first instance, care recipients getting better quality sleep on days with lower caregiver burden may have resulted in care partners either having the ability to take on a higher cognitive load to compensate for their partner or having more time for themselves – including the opportunity to commit and report memory blips. In the second instance, on days when RMBPC scores were high (more problematic behaviors occurred throughout the day), and care recipient sleep quality was low, care partners may have reported a higher number of memory blips as a consequence of increased caregiver burden, including having to take on additional daily responsibility for their partners. Age, RMBPC, and collaborative cognition were also significantly associated with memory blips over and above the three-way interaction of CP and CR sleep quality with RMBPC scores across days.

3.1.2 *HI_{lagged}*

In the lagged models for hypothesis 1, I included the same predictors as in the concurrent model except I used the previous days' care recipient and care partner sleep quality ratings as model predictors to investigate day to next-day relationships. I went through the same additive process for model comparison and exploration including the use of lagged and concurrent sleep quality ratings together for CPs and CRs. The lagged sleep

variables represent sleep that occurred *two nights prior* (but the diary before the “current” diary day). For example, the lagged sleep variable used in these models would be from Sunday night in association with memory blips, stress, RMBPC score, and collaborative cognition that occurred on Tuesday. Tuesday’s diary represents sleep information that occurred Monday night and would be considered “concurrent” sleep data, whereas the lagged sleep variables used Monday’s diary data, which represents sleep from Sunday night into Monday morning when participants woke up. The idea behind including lagged and concurrent sleep was to see if the effects of poorer than average (sleep debt) or higher than average sleep (sleep reserve) for an individual from one night would impact the next night’s sleep as well as the other variables of interest two days later.

Through model comparison, Model G was selected as the final lagged model as it was the most parsimonious and included a significant three-way interaction compared to the other models that contained some combination of significant individual or two-way interactions that were significant. See Table 4 below for lagged model comparisons and Table 5 for a summary of the fixed and random effects for Model G. The conditional pseudo- R^2 (.61) of Model E indicates that the amount of information accounted for by the fixed and random effects in the model is 61%. There was also an increase in the conditional (or total) pseudo- R^2 from the marginal pseudo- R^2 (.20). None of the individual predictors in the model were significant, although concurrent caregiver sleep, collaborative cognition, and RMBPC were all trending toward significance. However, the three-way interaction of lagged caregiver sleep, concurrent caregiver sleep, and concurrent caregiver stress was significantly associated with concurrent memory blips $F(1,244.89) = 3.92, p=.05$.

Table 4. Hypothesis 1 Lagged Model Comparison

Model (Predictors)	ICC	<i>n</i> parameters	AIC	BIC	-2LL	Chi-Square (df)	p-val
A: (Intercept-only)	0.36	3	515.29	526.81	509.29	--	--
B: (Model A + TICS + Age + Edu)	0.25	6	510.19	533.23	498.19	A: 11.10 (3)	< 0.05*
C: (Model B + CRLSQ + CPLSQ + CP Stress + RMBPC + CC)	0.50	11	339.31	377.86	317.31	B:180.88 (5)	< 0.05*
D: (Model B + CRLSQ + CPLSQ + CP Stress + CRSQL*CPLSQ*CP Stress	0.51	14	341.86	390.94	313.76	C: 3.44 (3)	0.33
E: (Model C + CR Sleep*CRLSQ + CRSQL*CPLSQ + CR Sleep*CPLSQ)	0.51	15	329.50	382.08	299.50	D: 14.36 (1)	< 0.05*
F: (Model C + CP Stress*RMBPC*CRLSQ + CP Stress*CPLSQ)	0.52	16	345.24	401.33	313.24	E: 0.00 (1)	1.00
G: (Model C + CPLSQ*CP Sleep*CP Stress)	0.51	17	341.51	401.10	307.51	F: 5.73 (1)	< 0.05*
H: (Model B + CP Stress + RMBPC + CC + CP Sleep + CR Sleep + CPLSQ*CRLSQ*RMBPC)	0.49	17	341.97	401.56	307.97	G: 0.00 (0)	1.00

CRLSQ = care recipient lagged sleep quality, CPLSQ= care partner lagged sleep quality, CC= collaborative cognition, -2LL= -2*log likelihood; *= significant for p-values $\leq .05$

Table 5. Hypothesis 1 Final Lagged Model G Summary

Fixed Effects	Estimate (<i>B</i>)	S.E.	T-Val	DF	p-value
Intercept	-0.13	1.70	-0.08	25.37	0.94
TICS	0.04	0.03	1.32	25.00	0.20
Age	-0.02	0.01	-1.84	25.36	0.08
Education	0.02	0.04	0.48	25.19	0.64
CPLSQ	-0.00	0.00	-1.76	223.48	0.08
CP Sleep Quality	0.00	0.00	1.76	220.79	0.08
CP Stress	-0.00	0.00	-1.07	219.80	0.29
RMBPC	0.06	0.03	1.83	217.38	0.07
CRLSQ	0.00	0.00	0.83	218.10	0.41
CR Sleep Quality	0.00	0.00	1.48	218.55	0.14
Collaborative Cognition	0.13	0.07	1.87	237.61	0.06
CPLSQ*CR Sleep Quality	-0.00	0.00	-1.17	223.11	0.24
CPLSQ*CP Stress	-0.00	0.00	-1.49	222.25	0.14
CP Sleep Quality* CP Stress	0.00	0.00	0.96	232.94	0.34
CPLSQ*CP Sleep Quality*CP Stress	-0.00	0.00	-1.98	244.89	0.05*
Random Effects					
Parameter	Variance	SD			
Intercept	0.16	0.40			
Residual	0.16	0.40			
Model Information	Pseudo- <i>R</i> ² Fixed	Pseudo- <i>R</i> ² Total			
ICC= 0.51	0.20	0.61			

*= significant for p-values $\leq .05$. Pseudo- R^2 Fixed represents the marginal R^2 (amount of information accounted for by the fixed effects in the model) and Pseudo- R^2 Total represents the conditional R^2 (the amount of information accounted for by the fixed and random effects in the model).

Simple slopes analyses helped to further decompose the three-way interaction of concurrent caregiver sleep, lagged caregiver sleep, and concurrent caregiver stress. There was a strong positive (slope) relationship between increasing memory blips committed by care partners and concurrent sleep on days when a) global stress ratings were one standard deviation higher than each person's mean, b) the prior night's sleep quality was one standard deviation below individuals' mean sleep quality or better, and c) lagged sleep quality from two nights prior was one standard deviation below individuals' mean sleep quality score ($B=0.01$, $t=1.76$, $p=.03$). Figure 2 below shows the three-way interaction.

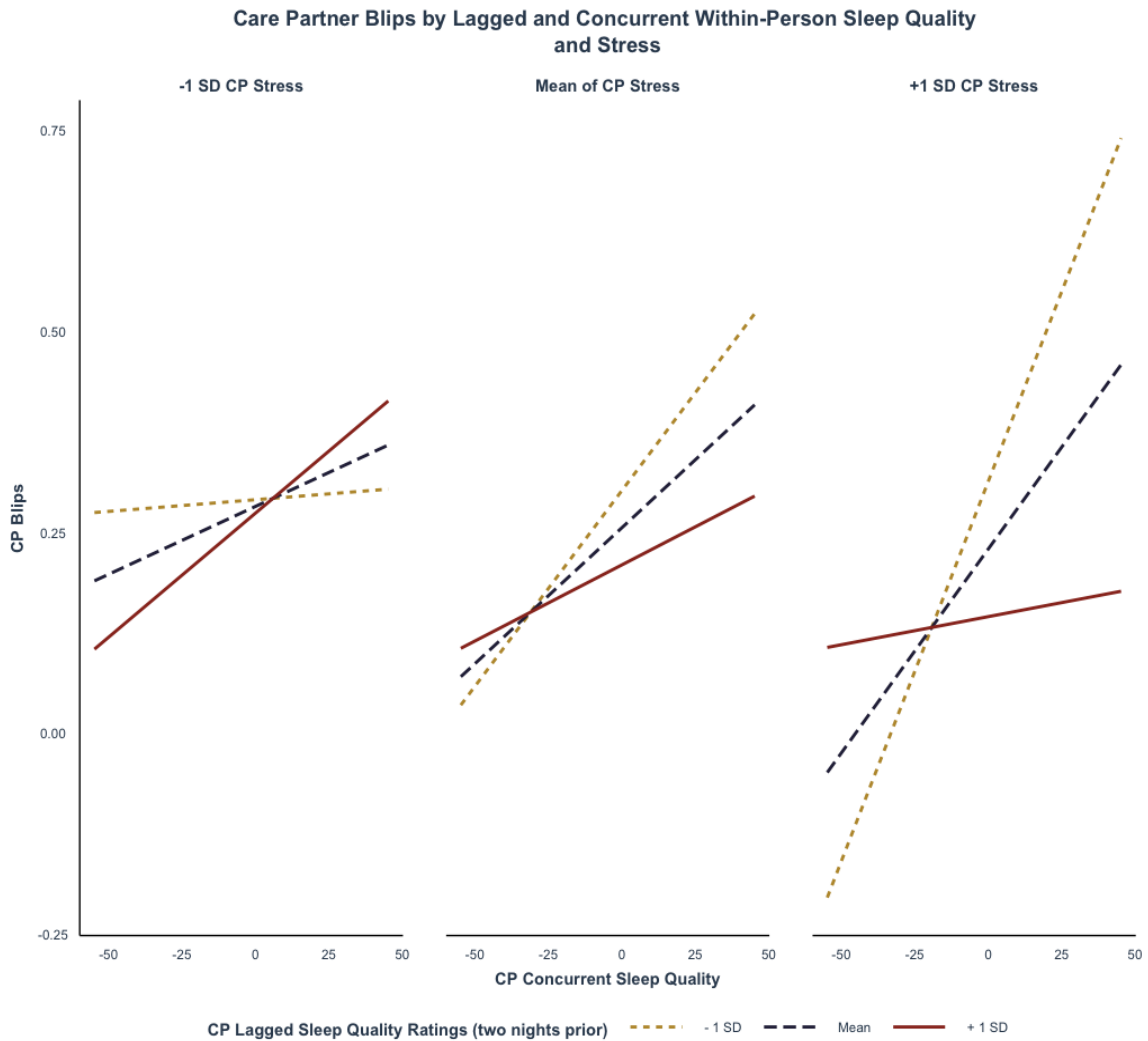


Figure 2. 3-Way Interaction of CP Lagged and Concurrent Sleep Quality and Stress

3.1.2.1 Summary

The lagged analyses indicate unique effects within caregivers with respect to sleep and stress from one night to the next as well as from one night to two days later. Several model predictors were trending toward significance, but the results of the three-way interactions suggests that caregivers may experience a sleep debt from two nights prior that was exacerbated by stress and was invariant to average or even high quality sleep the next

night. There appeared to be a lagged sleep effect such that lower than average sleep quality from two nights prior matters more for committing memory blips two days later than sleep quality leading into days when stress was higher than normal for care partners. In other words, there was a delayed sleep debt effect wherein the prior night's sleep quality was not protective against individuals reporting memory blips when stress was high the next day. This may be due to lasting residual effects from low quality sleep deficits from two nights prior. High quality lagged sleep (from two night's prior) also was not protective of same-day stress impacts on reported memory blips two days later.

Additionally, concurrent and lagged caregiver sleep, collaborative cognition, and RMBPC were all trending toward significance as individual model predictors, which points to potential additional relationships that may be important to consider over and above the interaction effects but were not captured by the present data. Collaborative cognition in spousal caregiving has intricate ties to caregiver burden and well-being depending on the emotional and action-dependent outcome of the interaction (e.g., whether the interaction was positive and constructive and how much work is required by the caregiver). These factors and the shared burden of daily remembering responsibilities and/or informal caregiving may be intertwined with daily affect, stress, burden, and sleep. Moreover, the extant literature has demonstrated that sleep quality and stress contribute to variability in cognitive performance (e.g., Naismith et al., 2010; Neupert et al., 2006; Neupert et al., 2008). However, until now, a multidimensional investigation that included sleep, stress, and caregiver burden as predictors of memory performance (or memory failures) has not been demonstrated, so these trends may reflect meaningful associations with memory blips but were underpowered in the present investigation.

3.2 Hypothesis 2: Care Partner Depressive Affect

My second hypothesis stated that higher depressive affect in the care partner would be associated with higher care recipient stress and depressive affect, lower care partner sleep quality, negative dyadic interaction ratings, and the presence of problematic behaviors in care recipients within days and from one day to the next. To test my hypothesis, I used daily depressive affect (GDS-4) in the care partner as the specified outcome using concurrent day ($H2_{concurrent}$) and lagged day to next-day ($H2_{lagged}$) multilevel models. Care recipient depressive affect was represented by GDS-4 scores and dyadic interactions were represented by mutuality scores in the models. My second hypothesis is generally represented by Equation 2 below.

$$\begin{aligned} \text{Level 1: CP Depressive Affect}_{ij} &= \beta_{0j} + \beta_{1j}(\text{CR Stress}_{ij}) + \beta_{2j}(\text{CR Depressive} \\ &\quad \text{Affect}_{ij}) + \beta_{3j}(\text{CP Sleep Quality}_{ij}) + \beta_{4j}(\text{Mutuality}_{ij}) + \beta_{5j}(\text{RMBPC}_{ij}) \\ &\quad + \varepsilon_{ij} \\ \text{Level 2: } \beta_{0j} &= \gamma_{00} + \gamma_{01}(\text{TICS}) + \gamma_{02}(\text{Age}) + \gamma_{03}(\text{Education}) + U_{0j} \\ \beta_{1j} &= \gamma_{10} \\ \beta_{2j} &= \gamma_{20} \\ \beta_{3j} &= \gamma_{30} \\ \beta_{4j} &= \gamma_{40} \\ \beta_{5j} &= \gamma_{50} \end{aligned} \tag{2}$$

3.2.1 $H2_{concurrent}$

In the concurrent analyses, I used care recipient stress, care recipient GDS-4, care partner sleep quality, mutuality, and RMBPC scores as level 1 predictors of daily caregiver depressive affect (GDS-4). After running a full model containing all of the level 1 variables of interest and the covariates at level 2, I ran a series of exploratory models that included

two and three-way interactions to investigate interactions among the variables. See Table 6 for model comparison. Model E was selected as the final concurrent model as it showed significant improvement in model fit from the full model (without any interactions) and was more parsimonious compared to similar models. For a summary of the fixed and random effects for Model E see Table 7. The conditional pseudo- R^2 (.86) was higher than the marginal pseudo- R^2 (.04) and indicates that the model accounts for a large amount of information in the data.

There were several significant model predictors. Mutuality was significantly negatively associated with caregiver GDS scores such that when all other variables were held constant, for every one-point increase in mutuality scores we expect that caregiver GDS scores decrease by .23 points ($t=-3.86, p=.00$). Additionally, the interactions of: care recipient GDS and mutuality ($B=0.38, t= 3.27, p< .00$), mutuality and RMBPC scores ($B=-0.16, t= -2.23, p=.03$), care recipient stress and mutuality ($B=-0.01, t= -2.00, p=.05$), and care recipient GDS and RMBPC ($B=0.11, t= 2.76, p= .01$) were all significant.

Table 6. Hypothesis 2 Concurrent Model Comparison

Model (Predictors)	ICC	<i>n</i> parameters	AIC	BIC	-2LL	Chi-Square (df)	p-val
A: (Intercept-only)	0.76	3	266.84	278.36	260.84	--	--
B: (Model A + TICS + Age + Edu)	0.76	6	272.46	295.50	260.45	A: 0.38 (3)	0.94
C: (Model B + CR Stress + CR GDS + CP Sleep + Mutuality + RMBPC)	0.84	11	165.91	206.76	143.91	B: 116.54 (5)	< 0.05*
D: (Model C + Mutuality*CR GDS + Mutuality*RMBPC + Mutuality*CP Sleep)	0.85	14	158.43	210.43	130.43	C: 13.47 (3)	< 0.05*
E: (Model C + Mutuality*RMBPC*CR GDS + CR Stress*Mutuality)	0.85	16	150.03	209.44	118.03	D: 12.41 (2)	< 0.05*
F: (Model C + Mutuality*CR GDS + Mutuality*RMBPC*CP Sleep + CR Stress*Mutuality)	0.85	17	159.56	222.69	125.56	E: 0.00 (1)	1.00

-2LL= -2*log likelihood; *= significant for p-values $\leq .05$.

Table 7. Hypothesis 2 Concurrent Model E Summary

Fixed Effects	Estimate (B)	S.E.	T-Val	DF	p-value
Intercept	1.38	2.35	0.59	26.89	0.56
TICS	-0.02	0.04	-0.39	26.86	0.70
Age	-0.01	0.02	-0.39	26.96	0.70
Education	-0.01	0.05	-0.21	26.82	0.83
CP Stress	0.00	0.00	0.85	275.90	0.40
CR GDS	0.04	0.03	1.37	275.89	0.17
CP Sleep Quality	0.00	0.00	0.02	276.89	0.98
Mutuality	-0.23	0.06	-3.86	276.08	0.00*
RMBPC	0.01	0.02	0.45	276.00	0.66
Mutuality*RMBPC	-0.16	0.07	-2.23	277.81	0.03*
CR GDS*Mutuality	0.38	0.12	3.27	276.67	0.00*
CR GDS*RMBPC	0.11	0.04	2.76	276.65	0.01*
CR Stress*Mutuality	-0.01	0.00	-2.00	276.61	0.05*
CR GDS*Mutuality*RMBPC	0.10	0.11	0.92	276.49	0.36
Random Effects					
Parameter	Variance	SD			
Intercept	0.35	0.59			
Residual	0.06	0.24			
Model Information	Pseudo- R^2 Fixed	Pseudo- R^2 Total			
ICC= 0.85	0.04	0.86			

*= significant for p-values $\leq .05$. Pseudo- R^2 Fixed represents the marginal R^2 (amount of information accounted for by the fixed effects in the model) and Pseudo- R^2 Total represents the conditional R^2 (the amount of information accounted for by the fixed and random effects in the model).

Simple slopes analyses were performed to decompose the significant two-way interactions. Mutuality was associated with care recipient behavioral outcomes that impact caregiver burden (RMBPC scores) and reported care partner depressive affect at the level of day $F(1,277.81) = 4.97, p = 0.03$. On days when mutuality was more than one standard deviation below an individual's mean across days, increasing RMBPC scores were associated with increased CP depressive affect. The relationship flipped when mutuality was more than one standard deviation above average, such that there was a negative relationship with low RMBPC scores and CP depressive affect (they both decreased when mutuality was high) as shown in Figure 3. RMBPC was also significantly positively associated with care partner depressive affect when care recipient depressive affect was

approximately one standard deviation above individuals mean depressive affect within-days $F(1,276.65)=7.62, p=.01$. Effectively, when there were more problematic behaviors in the care recipient throughout the day and care recipients reported higher depressive affect, care partners did too. Additionally, daily care recipient depressive affect was significantly associated with mutuality among dyads and care partner depressive affect across days $F(1,276.67) =10.68, p=.001$. When mutuality was one standard deviation or higher than daily averages for care partners, there was a significant positive relationship among care recipient depressive affect and care partner depressive affect. In other words, on days when mutuality was higher than average, higher depressive affect among care recipients was associated with higher care partner depressive affect scores that same day. Finally, care recipient daily stress ratings were also significantly positively associated with care partner depressive affect when daily mutuality was one standard deviation below individuals' means $F(1,276.61) =3.99, p=.04$. Plots of each interaction are included below, respectively in Figure 3, Figure 4, Figure 5, and Figure 6.

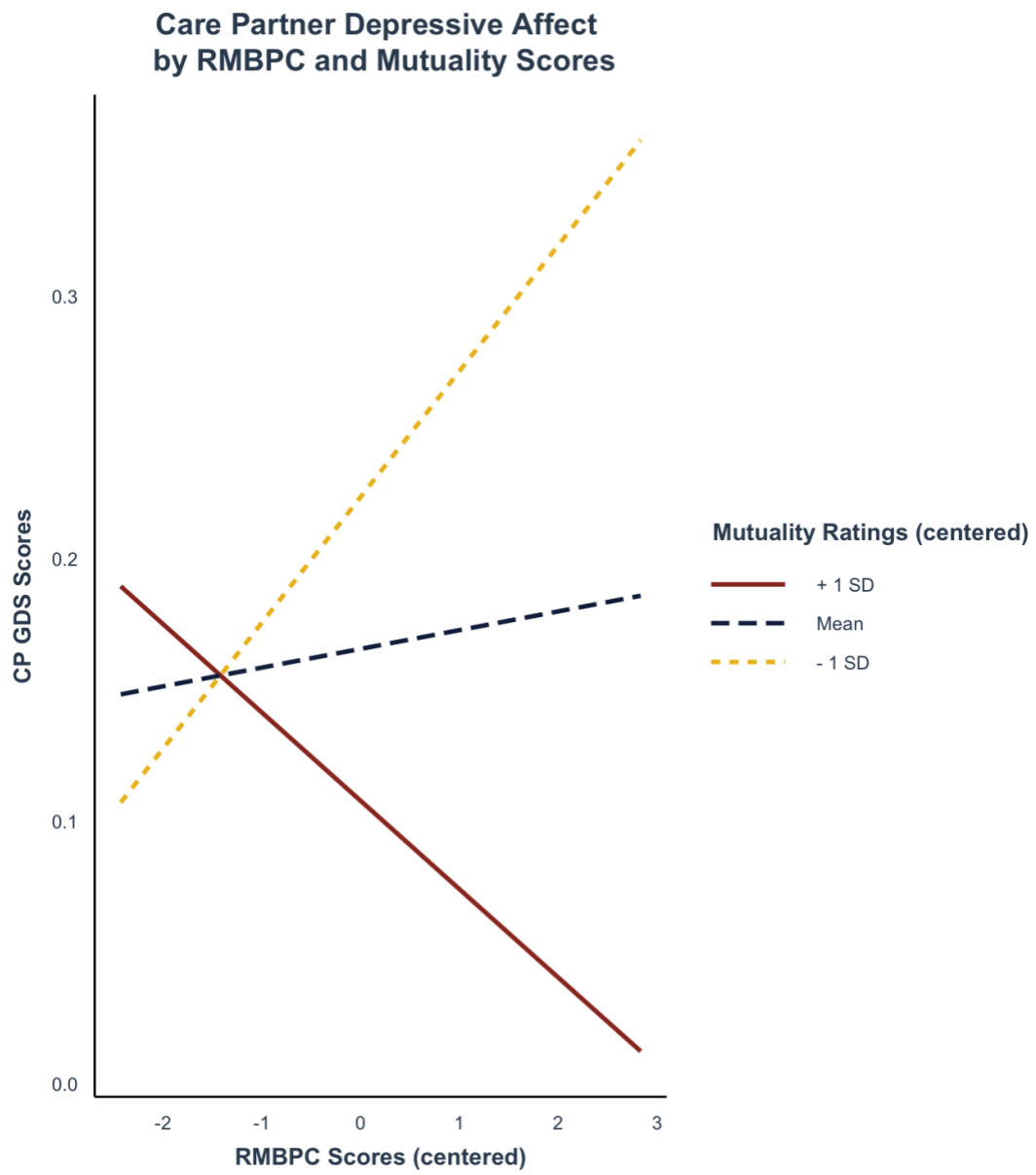


Figure 3. 2-Way Interaction of RMBPC and Mutuality

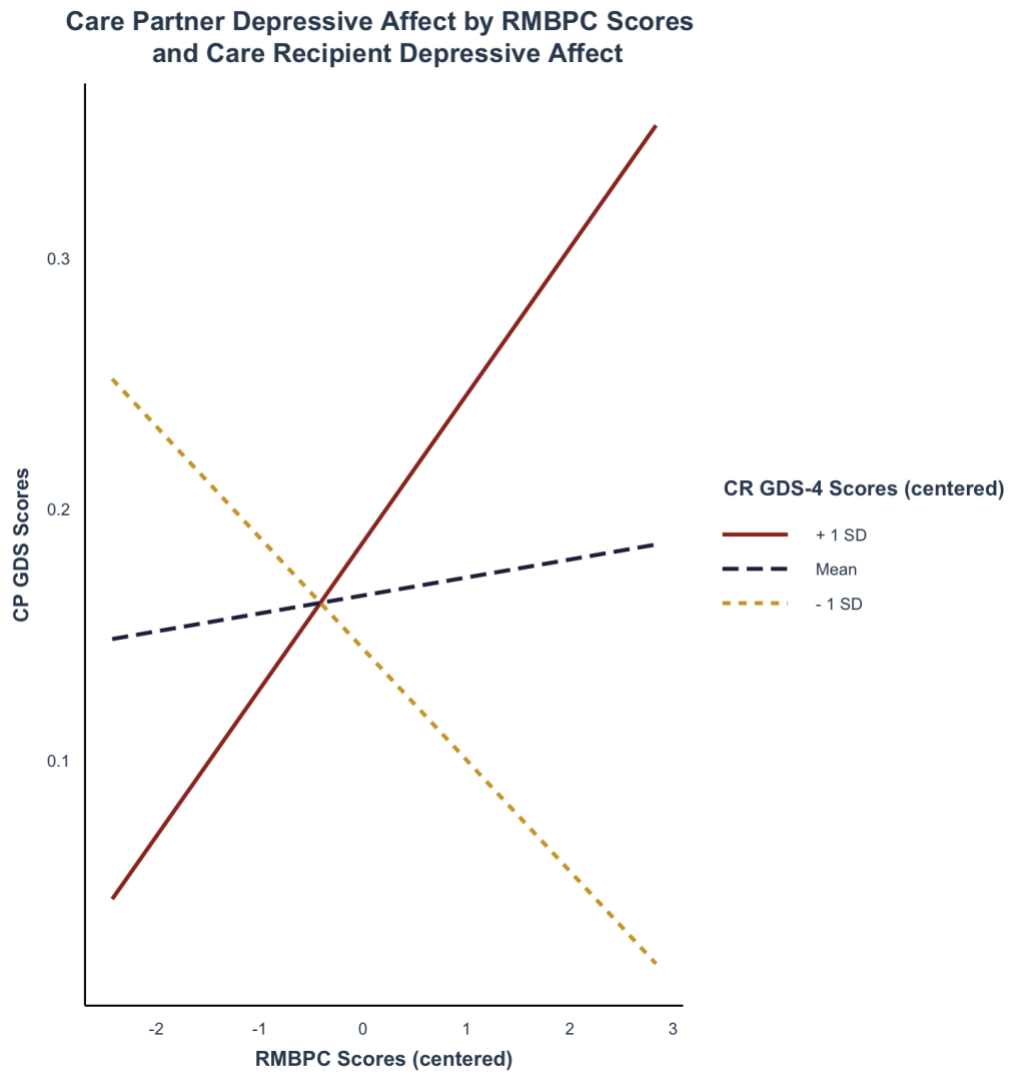


Figure 4. 2-Way Interaction of RMBPC and CR Depressive Affect

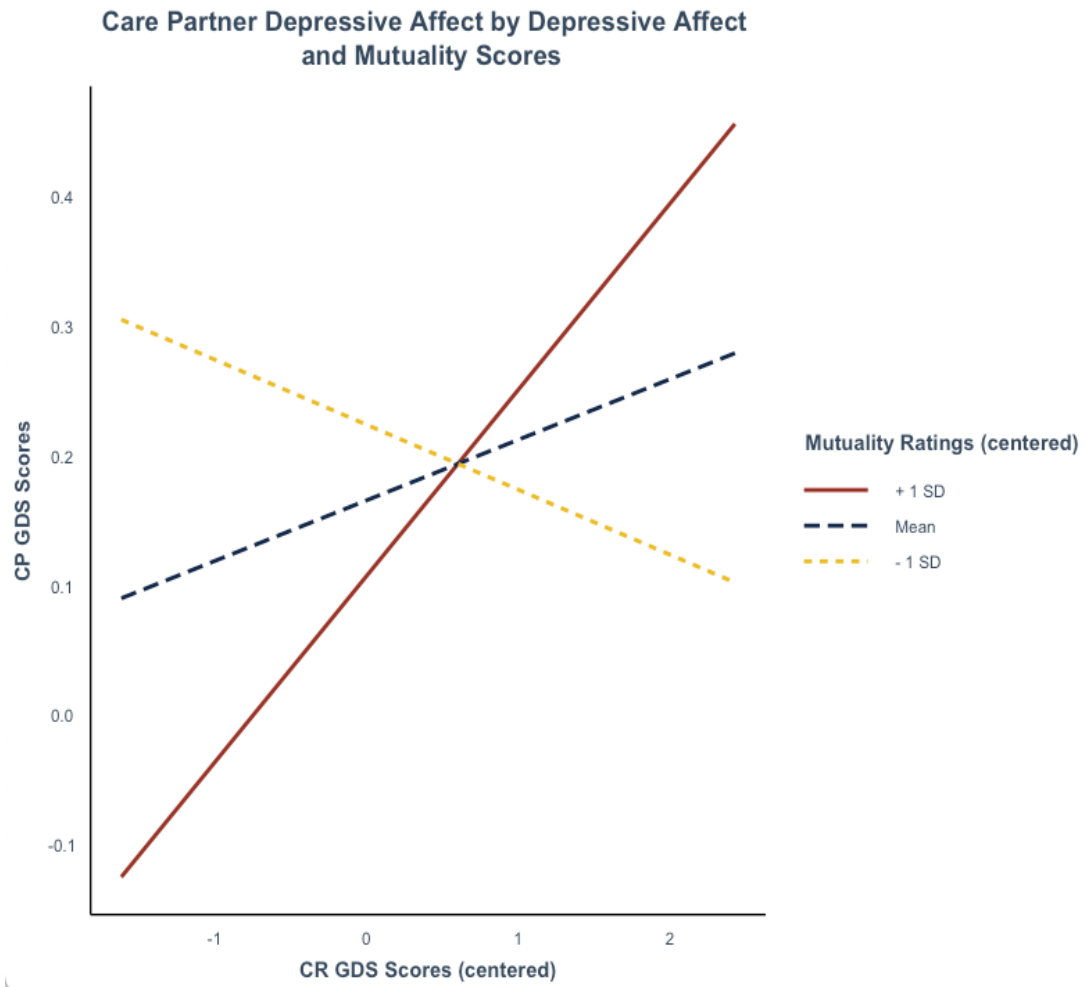


Figure 5. 2-Way Interaction of CR Depressive Affect and Mutuality

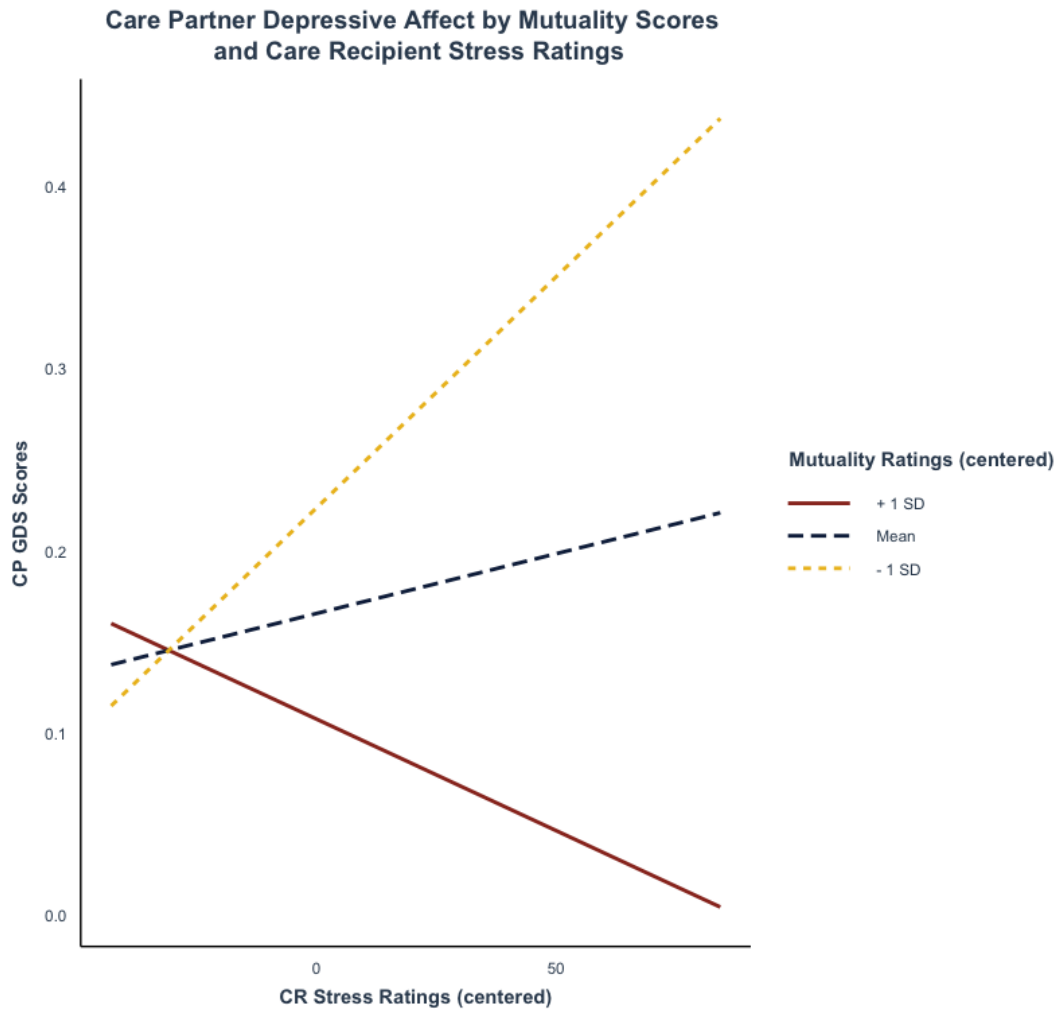


Figure 6. 2-Way Interaction of CR Stress and Mutuality

3.2.1.1 Summary

My second hypothesis stated that higher depressive affect in the care partner would be associated with higher care recipient stress and depressive affect, lower care partner sleep quality, negative dyadic interaction ratings, and the presence of problematic behaviors in care recipients within days for the concurrent analyses. Based on the results, my hypothesis was largely supported with the exception of sleep quality, which was not

significantly associated with care partner depressive affect in the series of models explored in this hypothesis. However, I expected that higher care recipient stress and depressive affect, as a consequence of emotional contagion, would be associated with increased caregiver depressive affect within days and from one day to the next. Mutuality emerged as a significant explanatory variable on its own as an independent model predictor and as a moderating factor among daily care recipient RMBPC scores, depressive affect, and stress scores in relation to caregiver depressive affect. These findings help support my hypothesis by providing evidence substantiating the important role that relationship dynamics hold with respect to emotional contagion and affective coupling among partners within days. Additionally, these results provide clarity on the complexities associated with MCI caregivers' affective well-being within the context of daily couples' mutuality, depression, caregiver burden based on problematic behaviors related to cognitive impairment, and stress rather than isolated analyses of problematic behaviors, caregiver burden ratings, or the impact of care recipients' depressive affect on caregiver depression.

3.2.2 *H2_{lagged}*

The lagged model ($H2_{lagged}$) used the same predictor variables in the full model as described above except lagged care partner stress scores and sleep quality replaced the concurrent ratings in a range of exploratory models. CP stress was lagged by one day (previous day to next day) and sleep was lagged in the same way as described in hypothesis one (two nights prior or one “diary” day to the next day’s daily diary ratings). For example, the concurrent variables in a given lagged model would be from Tuesday’s diary with the exception of CP stress and CP Sleep, which would both be from Monday’s diary (but sleep

quality describes sleep that occurred overnight from Sunday until waking on Monday morning).

Model E was selected as the final lagged model as it showed the best fit among similar models but contained a significant 3-way interaction between care recipient stress, mutuality, and lagged care partner sleep quality. See Table 8 for model comparison. Table 9 summarizes the fixed and random effects for Model E. The conditional pseudo- R^2 (.90) of Model E indicates that the model accounts for a large amount of information in the data.

Care recipient depressive affect was positively associated with caregivers' depressive affect that same day. For every one-point increase in care recipient GDS scores, we expect a .09 increase in care partners GDS scores holding all other variables constant ($t=3.03$, $p=.00$). Mutuality was also significantly negatively associated with care partners depressive affect such that for every one-point increase in mutuality scores, we expect a .23 decrease in care partner GDS scores ($t=-4.89$, $p=.00$) holding all other variables constant. Finally, the two-way interaction of CR GDS and mutuality was significant ($B=0.44$, $t=3.67$, $p=.00$) as was the three-way interaction of care recipient stress, care partner lagged sleep quality, and mutuality ($B=0.00$, $t=2.31$, $p=.02$).

Table 8. Hypothesis 2 Lagged Model Comparison

Model (Predictors)	ICC	<i>n</i> parameters	AIC	BIC	-2LL	Chi-Square (df)	p-val
A: (Intercept-only)	0.76	3	266.84	278.36	260.84	--	--
B: (Model A + TICS + Age + Edu)	0.76	6	272.46	295.50	260.45	A: 0.38 (3)	0.94
C: Model B + CR Stress + CPL Stress + CR GDS + CPLSQ + Mutuality + RMBPC)	0.88	12	101.13	143.77	77.13	B: 183.32 (6)	< 0.05*

D: (Model C + Mutuality*CR GDS + Mutuality*RMBPC + CR Stress*RMBPC)	0.89	17	91.88	152.28	57.88	C: 19.25 (5)	< 0.05*
E: (Model C + Mutuality*CR GDS + CPL Stress*Mutuality + CR Stress*CPLSQ*Mutuality)	0.89	18	90.37	154.32	54.37	D: 3.51 (1)	0.06
F: (Model C + Mutuality*CR GDS + Mutuality*RMBPC + CR Stress*RMBPC + CPLSQ*Mutuality + CPLSQ*CR stress + CPLSQ*CR GDS)	0.89	18	97.51	97.51	61.51	E: 0.00 (0)	1.00

CPL Stress = Lagged CP Stress, CPLSQ = lagged CP Sleep Quality, -2LL= -2*log likelihood; *= significant for p-values ≤.05

Table 9. Hypothesis 2 Lagged Model E Summary

Fixed Effects	Estimate (B)	S.E.	T-Val	DF	p-value
Intercept	0.94	2.45	0.38	26.66	0.70
TICS	-0.01	0.04	-0.16	26.62	0.87
Age	-0.00	0.02	-0.27	26.67	0.79
Education	-0.01	0.06	-0.22	26.55	0.83
CR Stress	0.00	0.00	0.21	230.70	0.83
CPL Stress	-0.00	0.00	-0.29	230.72	0.78
CR GDS	0.09	0.03	3.03	230.83	0.00*
CPLSQ	0.00	0.00	1.09	231.07	0.28
Mutuality	-0.32	0.06	-4.89	231.41	0.00*
RMBPC	-0.01	0.02	-0.31	231.00	0.76
CR GDS*Mutuality	0.44	0.12	3.67	232.18	0.00*
CPL Stress* Mutuality	-0.01	0.00	-1.88	231.06	0.06
CR Stress*CPLSQ	0.00	0.00	0.74	231.48	0.46
CR Stress*Mutuality	-0.01	0.00	-1.76	231.21	0.08
CPLSQ*Mutuality	0.01	0.01	0.89	231.52	0.37
CR Stress*CPLSQ*Mutuality	0.00	0.00	2.31	231.47	0.02*
Random Effects					
Parameter	Variance	SD			
Intercept	0.38	0.62			
Residual	0.04	0.21			
Model Information	Pseudo- R^2 Fixed	Pseudo- R^2 Total			
ICC= 0.85	0.03	0.90			

*= significant for p-values ≤.05. Pseudo- R^2 Fixed represents the marginal R^2 (amount of information accounted for by the fixed effects in the model) and Pseudo- R^2 Total represents the conditional R^2 (the amount of information accounted for by the fixed and random effects in the model).

Simple slopes analyses were run to further decompose the significant interactions present in the final lagged model (E). For the significant three-way interaction, when care

partner's lagged sleep quality (two nights prior) was approximately one standard deviation below an individual's mean and next day (two days later but one diary later) mutuality was approximately one standard deviation below an individual's mean, there was a positive significant association between that day's care recipient stress and care partner depressive affect (yellow line far left graph) $F(1,231.47) = 5.33, p = .02$. Similarly, when lagged care partner sleep was one standard deviation below an individual's average and mutuality was approximately one standard deviation above an individual's mean, there was a significant negative association between same-day CR stress and CP depressive affect (yellow line, far right graph). Essentially, when care partners had a sleep debt from poor lagged sleep quality two nights prior, the relationship between same-day care recipient stress and caregiver depressive affect co-occurred in that they both increased when mutuality was lower than normal – a potential contagion effect. However, when care partners had a (lagged) sleep debt from two nights prior and two days later mutuality was higher than average, care partner depressive affect was not reflective of higher care recipient stress. That is to say that good relationship mutuality moderated the effect of one partner's stress increasing the others depressive affect when lagged sleep quality was accounted for. A plot of the three-way interaction is shown below in Figure 7.



Figure 7. 3-Way Interaction of CP Lagged Sleep, CR Stress, and Mutuality

For the two-way interaction of care recipient depressive affect and mutuality, on days when mutuality was approximately an individual's mean or higher, there was a significant positive association (slope) between care recipient depressive affect and caregiver depressive affect $F(1,232.18)=13.46, p=.00$. Essentially, on days when mutuality for couples was about average or higher, higher care partner and care recipient depressive affect co-occurred within-days. A plot of the two-way interaction is presented below in Figure 8.

**Care Partner Depressive Affect by Dyadic Mutuality Scores
and Care Recipient Depressive Affect**

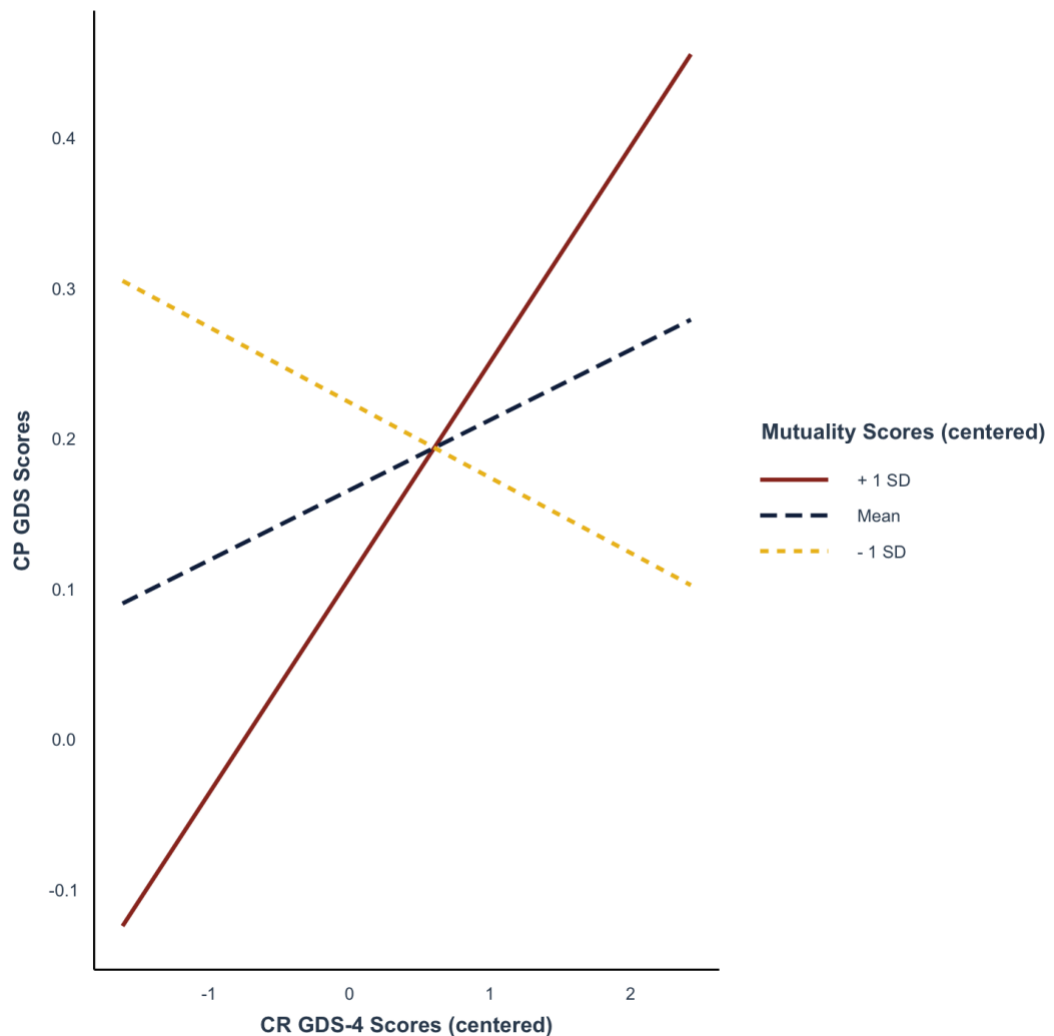


Figure 8. 2-Way Interaction of Mutuality and CR GDS

3.2.2.1 Summary

My second hypothesis stated that higher depressive affect in the care partner would be associated with higher care recipient stress and depressive affect, lower care partner sleep quality, negative dyadic interaction ratings, and the presence of problematic behaviors in care recipients from one day to the next for the lagged analyses. When lagged care partner sleep and stress were accounted for in the multilevel models my predictions

were largely supported with the exception of RMBPC scores. Care recipient depressive affect was significant over and above interactive effects which points to the importance of depressive affect contagion among these dyads. The effect of mutuality was also a pervasive effect over and above its role in the significant two and three-way interactions. Mutuality seems to act as a buffer for negative affect and stress contagion from one partner to the other. Additionally, sleep debt was implicated as a potential vulnerability for care partners. Low quality sleep may build-up, creating a hangover or debt within individuals, and impacts contagion effects with respect to the negative effects of care recipient stress on care partner depression two days later. Perhaps what was most interesting was the three-way interaction of poor lagged sleep with poor compared to high mutuality and stress. On days when care partners had a sleep debt and mutuality was lower than average two days later, as CR stress increased so did CP GDS, but that relationship flipped when mutuality was high. So even with a sleep debt, mutuality acted as a moderator so that the impact of CR stress on CP GDS flips – and CPs were less bothered by CR stress (even with a sleep debt) if mutuality was higher than average.

3.3 Hypothesis 3: Caregiver Burden

My third hypothesis was that higher daily stress and depressive affect in the care partner, low care partner sleep quality, lower care recipient memory ratings, and lower dyadic interaction ratings would be associated with higher caregiver burden within days ($H3_{concurrent}$) and from one day to the next ($H3_{lagged}$). Predictors included the same covariates at level 2 used in previous two hypotheses, as well as care partner stress, care partner depressive affect, care partner sleep quality, care recipient memory ratings, and dyadic interaction ratings as model predictors at level 1. Care recipient memory was

represented as person mean centered daily global memory rating. The caregiver burden outcome was represented by responses to the diary prompt: *Helping to care for my partner with Mild Cognitive Impairment was difficult today* on a 0-100 sliding scale. Equation 3 below generally represents the full model for hypothesis three.

$$\begin{aligned}
 \text{Level 1: Caregiver Burden}_{ij} &= \beta_{0j} + \beta_{1j}(\text{CP Stress}_{ij}) + \beta_{2j}(\text{CP Depressive} \\
 &\quad \text{Affect}_{ij}) + \beta_{3j}(\text{CP Sleep Quality}_{ij}) + \beta_{4j}(\text{CR Global Memory}_{ij}) + \\
 &\quad \beta_{5j}(\text{Mutuality}_{ij}) + \varepsilon_{ij} \\
 \text{Level 2: } \beta_{0j} &= \gamma_{00} + \gamma_{01}(\text{TICS}) + \gamma_{02}(\text{Age}) + \gamma_{03}(\text{Education}) + U_{0j} \\
 \beta_{1j} &= \gamma_{10} \\
 \beta_{2j} &= \gamma_{20} \\
 \beta_{3j} &= \gamma_{30} \\
 \beta_{4j} &= \gamma_{40} \\
 \beta_{5j} &= \gamma_{50}
 \end{aligned} \tag{3}$$

3.3.1 *H3concurrent*

Model G was selected as the final model (see Table 10 for model comparison). Model G was similar to other comparable models but accounted for more information in the data and contained a three-way interaction that revealed a significant two-way interaction. A summary of fixed and random effects for Model G are presented below in Table 11. The conditional pseudo- R^2 (.53) of Model E indicates that the amount of information accounted for in the data by the model is 52%, a significant increase from the marginal pseudo- R^2 (.16).

Care partner stress was significantly associated with caregiver burden difficulty as expected. When all other variables were held constant, for every one unit increase in daily stress rating, we expect a .30 increase in caregiver burden difficulty ratings ($t=5.86, p=.00$). Moreover, daily mutuality was also significantly associated with same-day caregiver

burden difficulty ratings. Holding all other variables constant, for every one unit increase in mutuality ratings, we expect a decrease of 13.49 points (out of 100) on difficulty of caregiver burden ratings that same day ($t=-3.32, p=.00$). Finally, the two-way interaction of care partner depressive affect and care recipient memory was also significantly associated with care partner's caregiver burden ratings ($B=0.74, t=1.95, p=.05$).

Table 10. Hypothesis 3 Concurrent Model Comparison

Model (Predictors)	ICC	<i>n</i> parameters	AIC	BIC	-2LL	Chi-Square (df)	p-val
A: (Intercept-only)	0.35	3	3046.7	3058.2	3040.7	--	--
B: (Model A + TICS + Age + Edu)	0.32	6	3049.4	3072.5	3037.4	A: 3.22 (3)	0.36
C: (Model B + CP Stress + CP GDS + CP Sleep + CR Memory + Mutuality)	0.42	11	2566.4	2606.9	2544.4	B: 493 (5)	<.05*
D: (Model C + CP GDS*CR Memory)	0.44	12	2565.3	2609.5	2541.3	C: 3.10 (1)	0.08
E: (Model C + CP Sleep* CP Stress)	0.42	12	2567.2	2611.4	2543.2	D: 0.10 (0)	1.00
F: (Model D + CP Stress* CR Memory)	0.43	13	2565.6	2613.5	2539.6	E: 3.34 (1)	0.05*
G: (Model F + Mutuality*CRMemory*CP GDS)	0.44	16	2568.3	2627.3	2536.3	F: 3.26 (3)	0.35

-2LL= -2*log likelihood; *= significant for p-values $\leq .05$.

Table 11. Hypothesis 3 Concurrent Model G Summary

Fixed Effects	Estimate (<i>B</i>)	S.E.	T-Val	DF	p-value
Intercept	-9.75	60.03	-0.16	26.52	0.87
TICS	-0.41	1.06	-0.38	26.16	0.71
Age	0.42	0.38	1.10	26.50	0.28
Education	1.17	1.39	0.84	25.48	0.41
CP Stress	0.30	0.05	5.86	267.45	0.00*
CP GDS	3.78	4.29	0.88	269.41	0.38
Mutuality	-13.49	4.06	-3.32	269.32	0.00*
CR Memory	-0.05	0.08	-0.66	268.28	0.51
CP Sleep Quality	0.03	0.06	0.50	267.16	0.62
Mutuality*CR Memory	0.25	0.35	0.74	269.94	0.46
CP GDS*Mutuality	5.86	11.33	0.52	284.77	0.61
CP GDS*CR Memory	0.74	0.38	1.95	282.90	0.05*
CP Stress*CR Memory	0.01	0.00	1.24	280.19	0.21
CP GDS*Mutuality*CR Memory	0.47	0.45	1.04	273.21	0.30
Random Effects					
Parameter	Variance	SD			
Intercept	200.80	14.17			
Residual	259.10	16.10			

Model Information	Pseudo- R^2 Fixed	Pseudo- R^2 Total
ICC= 0.44	0.16	0.53

*= significant for p-values $\leq .05$, Pseudo- R^2 Fixed represents the marginal R^2 (amount of information accounted for by the fixed effects in the model) and Pseudo- R^2 Total represents the conditional R^2 (the amount of information accounted for by the fixed and random effects in the model).

A simple slopes analysis revealed that when care partner GDS scores were more than one standard deviation below an individual's daily mean there was a significant negative association between care recipient's global memory ratings and care partner's caregiver burden difficulty ratings $F(1,282.90)= 3.81, p= .05$. Essentially, on days when care partners had much lower depressive affect scores than their average, low care recipient global memory scores were associated with increased difficulty of caregiving. A plot of the interaction is shown below in Figure 9.

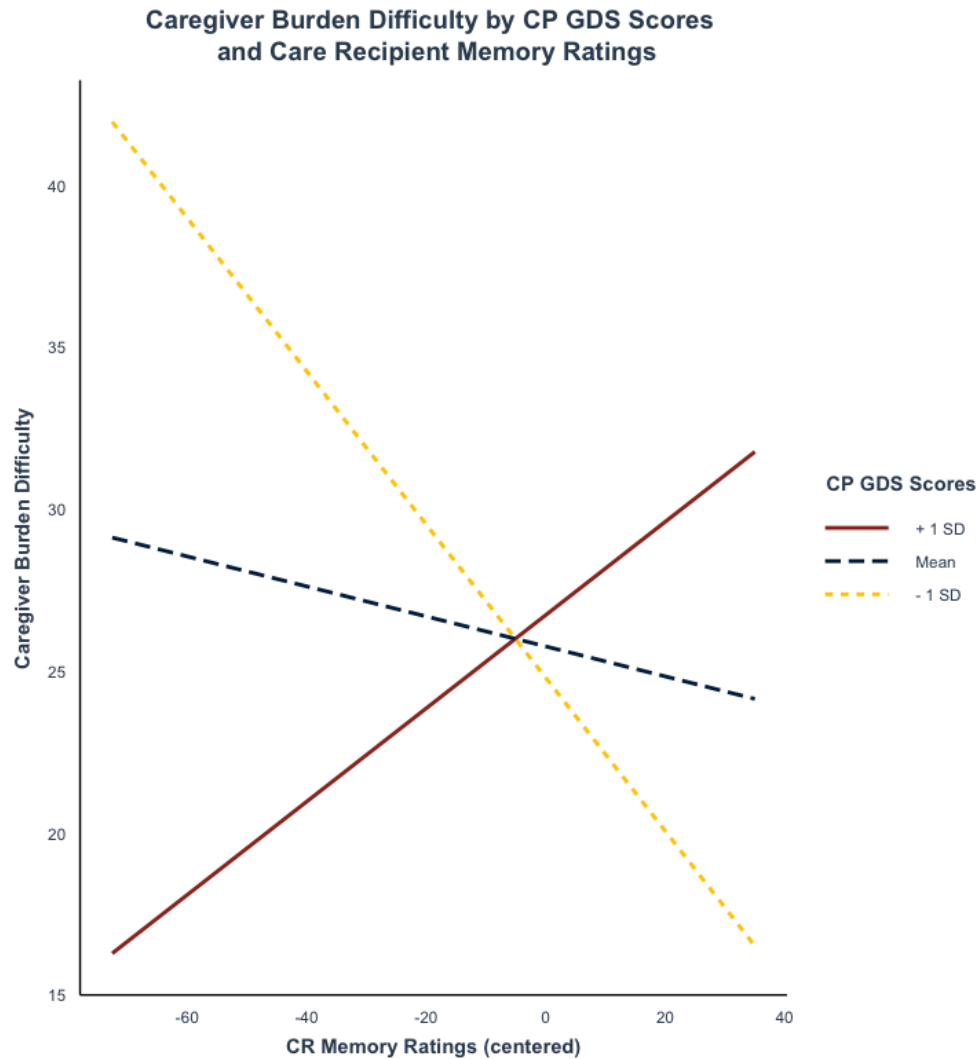


Figure 9. Interaction of CP GDS and CR Memory

3.3.1.1 Summary

My third hypothesis was that higher daily stress and depressive affect in the care partner, poor care partner sleep quality, lower care recipient memory ratings, and lower dyadic interaction ratings would be associated with higher caregiver burden within days. My final concurrent model did not reveal significant effects of care partner sleep on caregiver burden difficulty ratings. However, the final model did show that high daily stress was associated with higher caregiver burden difficulty and that decreases in daily mutuality

were associated with decreases in caregiver burden difficulty that same day. Finally, the interaction of care partner depressive affect and care recipient memory revealed that on days when care partners reported lower than average depressive affect scores, low care recipient global memory scores were associated with increased difficulty of caregiving.

3.3.2 *H3_{lagged}*

Predictors in the lagged models were the same as in the concurrent models except the previous day's care partner sleep quality and stress ratings were used in exploratory models in addition to the concurrent day's ratings to investigate potential day to next-day associations among the variables. Model F was selected as the final model as it explained the highest amount of information in the data and showed similar model fit to comparable models (see Table 12 for model comparison results). A summary of Model F's fixed and random effects are presented in Table 13 below.

The conditional pseudo- R^2 (.49) of Model F indicates that the model accounts for a large amount of information in the data. There was also an increase in the conditional or total pseudo- R^2 from the marginal pseudo- R^2 (.15). In terms of significant lagged model predictors, unsurprisingly, mutuality was negatively associated with caregiver burden difficulty ratings and care partner stress was positively associated with caregiver burden difficulty even accounting for lagged stress and sleep effects. Holding all other variables constant, per one unit increase in mutuality, we expect a 12.55 decrease in caregiver burden difficulty ratings (out of 100) within days ($t=2.63$, $p=.00$). Additionally, per one unit increase in care partner stress scores we expect a .35 increase in caregiver burden difficulty ratings within days while holding all other variables constant ($t=5.62$, $p=.00$). Care partner

GDS was trending toward, but did not reach, significance as an independent model predictor of caregiver burden difficulty.

Table 12. Hypothesis 3 Lagged Model Comparison

Model (Predictors)	ICC	<i>n</i> parameters	AIC	BIC	-2LL	Chi-Square (df)	p-val
A: (Intercept-only)	0.35	3	3046.7	3058.2	3040.7	--	--
B: (Model A + TICS + Age + Edu)	0.32	6	3049.4	3072.5	3037.4	A: 3.22 (3)	0.36
C: (Model B + CPL Stress + CP GDS + CPLSQ+ CR Memory + Mutuality)	0.36	11	2226.8	2265.7	2204.8	B: 832.6 (5)	< 0.05*
D: (Model C + CP Stress)	0.40	12	2200.7	2243.0	2176.7	C: 28.17 (1)	< 0.05*
E: (Model D + CPLSQ*CP Stress)	0.40	13	2201.4	2247.2	2175.4	D: 1.30 (1)	0.25
F: (Model D + CP Stress*CPLSQ)	0.40	13	2201.4	2247.2	2175.4	E:0.00 (0)	1.00

CPL Stress = Lagged CP Stress, CPLSQ = lagged CP Sleep Quality, -2LL= -2*log likelihood; *= significant for p-values ≤0.05

Table 13. Hypothesis 3 Lagged Model F Summary

Fixed Effects	Estimate (<i>B</i>)	S.E.	T-Val	DF	p-value
Intercept	-29.50	58.76	-0.50	28.25	0.62
Age	0.57	0.37	1.54	28.05	0.14
Education	1.16	1.34	0.86	26.13	0.40
TICS	-0.16	1.03	-0.16	27.53	0.87
CPL Stress	-0.08	0.05	-1.51	227.83	0.13
CP GDS	9.09	4.91	1.83	228.67	0.06
CPLSQ	0.05	0.07	0.63	229.57	0.53
CR Global Memory	-0.04	0.08	-0.46	227.07	0.65
Mutuality	-12.55	4.77	-2.63	230.31	0.00*
CP Stress	0.35	0.06	5.62	227.88	0.00*
CPLSQ*CP Stress	0.00	0.00	1.14	228.51	0.25
Random Effects					
Parameter	Variance	SD			
Intercept	181.4	13.47			
Residual	266.9	16.34			
Model Information	Pseudo- <i>R</i> ² Fixed	Pseudo- <i>R</i> ² Total			
ICC= 0.40	0.15	0.49			

*= significant for p-values ≤0.05, Pseudo-*R*² Fixed represents the marginal *R*² (amount of information accounted for by the fixed effects in the model) and Pseudo-*R*² Total represents the conditional *R*² (the amount of information accounted for by the fixed and random effects in the model).

3.3.2.1 Summary

My third hypothesis was that higher daily stress and depressive affect in the care partner, low care partner sleep quality, lower care recipient memory ratings, and lower dyadic interaction ratings would be associated with higher caregiver burden from one day to the next. I expected positive relationships among higher daily stress and depressive affect ratings relative to higher caregiver burden. I also expected negative relationships for within-day care partner sleep quality, lower dyadic interaction ratings, and low care recipient subjective memory ratings relative to higher experienced caregiver burden within days. The lagged models revealed a significant positive relationship among care partner's daily stress ratings and a significant negative relationship among daily mutuality and caregiver burden. No other predictors in the model were significant when lagged sleep and stress were accounted for, which indicates that these relationships may be best understood within the context of within-day variables. Caregiver burden is an exceedingly complex concept and one that is not well understood at present for informal spousal MCI caregiving. Caregiving burden within the context of daily relationship dynamics, sleep, stress, depression, and memory functioning likely involves much more than just subjective ratings of how difficult caregiving was that day. Future analyses should seek to investigate daily caregiver burden from additional lenses that include things like RMBPC, how rewarding caregiving was, and potentially the health of the caregiver. These analyses help elucidate the relationship of within-day and day-to-day associations across an array of predictors relative to caregiver burden with the context of reports from both the caregivers and their care recipients.

CHAPTER 4. DISCUSSION

This study took a novel approach to understanding MCI caregiver outcomes within the context of daily life and the caregiving context by collecting daily self-reports over a two-week period of time from caregivers and care recipients with MCI. The study design itself was unique as previous research typically only collected data from one member of caring dyads, not both. Additionally, prior studies have focused on only one or two aspects of daily living. Whereas this study collected data on a much wider range of data on potential daily influences *together* that have been implicated as impacting caregiver memory blips, depressive affect, and caregiver burden. Finally, the present study was also unique by examining data collected across days and lagged day to next-day effects within-individuals and within and across dyads. The design of the study alone constitutes a unique contribution to the field of dyadic MCI caregiving and the results are extremely promising. Even with a small sample size there were many interesting and significant effects.

Overall, mutuality emerged as an important explanatory variable for caregiver depression and caregiver burden outcomes in the concurrent and day to next-day analyses for hypotheses two and three which examined care partner depressive affect and caregiver burden. Understanding partner and relationship dynamics within the context of informal spousal (or romantic partner) caregiving is important and becomes even more essential to consider for everyday well-being in the context of MCI as relationship dynamics evolve when one partner transitions to an informal caregiving role. In this investigation, mutuality emerged as a buffer between potentially negative impacts of care recipient's RMBPC, depressive affect, and global stress. Understanding the impact of mutuality during and

throughout the caregiver transition provides an opportunity to target ways to improve caregiver outcomes. The findings from this study suggest that bolstering mutuality in caring dyads may be a good target for MCI caregiving interventions that focus on caregiver well-being and cognition (e.g., Harris et al., 2019). Further, informal MCI caregivers may convert to formal caregivers if their care recipient's cognitive status or health declines in the future. In particular, for individuals with aMCI diagnoses, this is a very real potential reality for their significant others and as such points to the importance of protecting the well-being of memory impaired individuals as well as their caregivers.

Additionally, caregiver burden as measured by RMBPC scores and caregiver burden difficulty ratings showed a variety of interesting results. The findings suggest that on days when RMBPC scores were low and care recipients got better quality sleep the night before, care partners were more likely to commit memory blips. The increasing possibility of committing more memory blips could be due to care partners having more time for themselves because their caregiving burden was low, and partners were high functioning – so care partners had more opportunities to commit and report their own memory blips. This effect could also be due to care partners having more time or energy to commit to filling out the diary. However, on days when RMBPC scores were high and care recipient sleep quality was low, care partners may have reported a higher number of memory blips due to increased daily cognitive load as a consequence of compensating for and/or caregiving for their partners. This finding suggests that sleep quality is not necessarily protective against memory blips for caregivers. In addition, on days when care partners reported lower than average depressive affect scores, low care recipient global memory scores were also associated with increased difficulty of caregiving which is in line with previous findings

(e.g., Brennan & Shaver, 1995; Hoppmann & Gerstorf, 2016; Savla et al., 2011; Springate & Tremont, 2013).

Further, on days when care partners had low depressive affect scores, low care recipient global memory ratings were associated with increased difficulty of caregiving. Models that included lagged sleep and stress also suggest that higher care partner daily stress ratings were associated with higher caregiver burden difficulty ratings and that higher mutuality was associated with lower caregiver burden ratings within-days. Further, on days when problematic behaviors related to cognitive impairment (RMBPC scores) were higher and when the previous night's sleep was poorer than average for care recipients, caregivers were more likely to report blips even when their sleep quality was reportedly good. The relationship with higher sleep quality and blips for care partners also held true when RMBPC scores were lower than average and sleep was higher than average for care recipients. Perhaps the interplay of poor care recipient sleep, which in turn may be related to problematic behaviors upon waking, negatively impacts care partner's daily cognition, specifically in terms of committing memory errors.

An alternative explanation may be that when the opposite is true, and care recipients report a good night's sleep and low RMBPC scores, care partners have more time to commit memory errors throughout that day as a consequence of lower caregiver burden. These findings are not surprising but do bridge the divide between the literature on caregiving and emotional contagion and coregulation among couples. This study expanded the array of variables that have been used together to investigate caregiver burden from a more holistic view. Typically, caregiver burden in MCI caregivers has been investigated on a much smaller scale, both in diary length, and in the number and type of associated

factors measured. This study presented a unique opportunity to examine MCI caregiving as a multifaceted concept within the context of individual's daily self and informant reports between care partners and care recipients.

Additionally, the models on care partner depression were fascinating. When care partners had a lagged sleep debt from two nights prior, but two days later mutuality was higher than average, care partner depressive affect was not reflective of higher care recipient stress. High relationship mutuality moderated the effect of care recipient's stress increasing their caregiver's depressive affect when lagged sleep quality was accounted for. But, on days when care recipients exhibited more problematic behaviors throughout the day and reported higher depressive affect, care partners did too. Additionally, when mutuality was one standard deviation higher than daily averages for care partners, care recipient depressive affect and care partner depressive affect were positively associated. Daily caregiver stress was also positively associated with care partner depressive affect. The results support previous findings on contagion and coregulation among spouses for negative daily depression and stress ratings (Bookwala & Schultz, 1996; Carstensen et al., 1995; Larson & Almeida, 1999; Repetti et al., 2011; Ferrer & Helm, 2013) but extend them by including a wider variety of everyday influences and using concurrent and lagged analyses.

Until now, there has been limited comprehensive work on MCI caregiver daily affect, cognition, and burden, particularly within the context of reports from both the caregiver and the care recipient. Other studies from our lab (e.g., Hertzog et al., 2021; Pearman et al., 2020; Lustig et al., 2020, Pearman et al., *in preparation*) have provided insight into the internal, dyadic, and contextually relevant aspects of caring for someone

with and/or personally experiencing everyday memory problems among older adults. Within the context of the literature, the present study sets the stage for better understanding the complex nature of caregiver (1) memory, (2) depression, and (3) caregiver burden outcomes for spousal MCI care partners based on daily fluctuations in sleep quality, caregiver burden, stress, multiple aspects of cognition, and dyadic interactions within and across days.

4.1 Limitations and Future Directions

The present study involves several important considerations. First, this study was run with a small sample. So, while there was enough data to run multilevel analyses because of the repeated measures it was not a high-powered study. The data for this study was collected as part of a grant awarded from the CEP and at the time data collection began the CEP had somewhere between 60-80 total members in the program. Participants in the program are encouraged to participate in ongoing research opportunities and are often happy to do so. For example, participants in this study shared that they were excited that their participation in this study might help other families in the future who are affected by an MCI diagnosis. Whereas the data from this study are extremely promising and provide hope for the future of multidimensional dyadic caregiving research, the sample was small and should be replicated with more participants. Moreover, future investigations that build on this study should consider alternative time periods of data collection. For example, a longitudinal burst measurement study design could capture two-week daily diary data several times throughout the year. Measurement periods could then be aligned with different life or diagnostic events to get at stability or changes within and across individuals and dyads. Finally, future investigations based on this study could also benefit from data

collection that occurs multiple times throughout the day to better get at within-day timescale fluctuations.

Furthermore, the sample used in this study was also not necessarily representative of the population of older adults or older adult spousal caregivers. The sample was drawn exclusively from the CEP and not the greater Atlanta community. Whereas the CEP does a lot of work to help people with diagnosed MCI and their care partners – people who are part of the program receive a number of services, education, and access to resources to help with their current (and future) circumstances – that is not the norm for older adults diagnosed with MCI. Additionally, it is unclear exactly when the care recipients in this study were diagnosed with MCI. In order to be enrolled in the CEP they had to be referred after receiving an MCI diagnosis and some of the participants were nearly at the end of their 12-month period in the program. MCI remains an extremely heterogeneous condition and it is possible that some care recipients could have progressed to a dementia state by the time they participated in this study. Moreover, very little baseline data was available from Emory on the caregivers. Other than the TICS, it is possible that the care partners may have also had their own health issues, including cognitive impairment, that could not be accounted for in the current analyses. Finally, participants in this study were primarily white and well-educated. Future studies of this nature should seek to include minority as well as hard to reach populations of older adults to be able to better generalize the findings.

On a different note, memory blips are exceedingly difficult to measure. Asking individuals to report (and remember) what they forgot in general is challenging. With the understanding that this data may not reflect the true number of memory blips that occurred for caregivers each day, even on this scale, the findings are interesting and may speak to

what and how individuals operate in their everyday lives. The average reported memory blip was less than 1 each day for care recipients and care partners – but individuals reported as many as 4 in a day. I believe that the skew in the data may better represent the scale to which even cognitively healthy older adults experience memory failures in their everyday lives – whether small or large. Additionally, the use of memory failure counts at the level of day has been used previously as a dependent variable in similar types of multilevel modeling investigations (e.g., Whitbourne et al., 2008). Future investigations should consider qualitatively analyzing days when more than one blip was reported to provide more insight on what a “poor memory” day for caregivers and care recipients might look like.

Finally, the use of the GDS-4 in the diary was out of convenience but may not have been the best representation of depressive affect. The diary was designed to be as easy and efficient to answer as possible, while still collecting thorough and meaningful information. The GDS-4 is an extremely succinct measure of depression, but it is not a typical sad or blue scale like the original GDS. The GDS-4 may actually be a better indicator of mental wellness and/or worry about the future than a strict measure of depression more generally or depressive affect. Future studies should consider how to best measure depressive affect which may involve using other established scales or consider using selected binary questions that directly query participants if they feel sad, blue, worried, or depressed. For the purpose of this study, the GDS-4 was sufficient.

The present investigation presents novel outcomes that meaningfully contribute to the literature on caregiving dyads’ everyday experiences. Sleep debt and the delayed effects of poor sleep quality among caregivers are one area for future research to focus on.

Caregivers were more vulnerable to negative daily influences when they had a sleep debt from poor quality sleep two nights prior – even when their most recent night’s sleep quality was self-rated as high. Additionally, future interventions should target caring dyads’ self-regulation, communication, collaborative cognition, stress management, and coping strategies to increase dyadic mutuality and reduce negative spousal coregulation. Interventions of this nature may be helpful for both members of the dyad, and caregivers in particular, with respect to daily cognition, depressive affect and caregiver burden.

APPENDIX A. CARE PARTNER DIARY

Please complete this daily diary form once per day at the end of the day. Please respond only about things that happened today.

We would like for each person to fill out their own form. This is the form for the **Care Partner**.

If you have any questions about completing this form, please email or call:

Alysha Naran: anaran6@gatech.edu, (678) 767-2168

Emily Lustig: elustig@gatech.edu, (404) 692-3355

Thank you!

End of Block: Directions

Start of Block: SLEEP

The next questions ask about your SLEEP last night.

What time did you go to sleep last night?

▼ 7:30 PM ... I don't remember

What time did you wake up this morning?

▼ Before 5:00 AM ... 11:00 AM or Later

Approximately how many hours of sleep did you get last night?

0 – 12+ hours (checkbox options)

How would you rate the quality of your sleep last night?

0= Poor

100= Very Good

0 10 20 30 40 50 60 70 80 90 100



Did you toss and turn last night?

Yes

No

I don't know

Did you wake up in the middle of the night last night?

Yes

No

I don't know

Was your sleep refreshing?

0= Not at all

100= Very Much

0 10 20 30 40 50 60 70 80 90 100



Was your sleep restful?

0= Not at all

100= Very Restful

0 10 20 30 40 50 60 70 80 90 100



How awake did you feel today?

0= Very Tired

100= Very Awake

0 10 20 30 40 50 60 70 80 90 100



How would you rate the quality of your partner's sleep last night?

0= Poor

100= Very Good

0 10 20 30 40 50 60 70 80 90 100

	
--	--

Approximately how many hours of sleep did your partner get last night?

0 hours – 12+ hours (checkbox options)

I don't know

How awake did your partner seem today?

0= Very Tired 100= Very Awake

0 10 20 30 40 50 60 70 80 90 100

	
--	--

End of Block: SLEEP

Start of Block: STRESS

How much stress did you experience today?

0= None 100= Extremely High

0 10 20 30 40 50 60 70 80 90 100

	
--	--

How much stress did your partner experience today?

0= None 100= Extremely High

0 10 20 30 40 50 60 70 80 90 100

	
--	--

Please indicate whether the following happened to you since you filled out yesterday's diary entry and provide a rating of how stressful it was for you.

	Did it occur today?		How stressful was this for you? If it did not occur, please select 0.			
	No	Yes	0 - not at all	2 - not very	3 - somewhat	4 - very
1. Did you have an argument or disagreement with anyone since you filled out yesterday's diary entry?						
2. Since you filled out yesterday's diary entry, did anything happen that you could have argued about but you decided to let pass in order to avoid a disagreement?						
3. Since you filled out yesterday's diary entry, did anything happen at work or school (other than what you have already mentioned) that most people would consider stressful?						
4. Since you filled out yesterday's diary entry, did anything happen at home that most people would consider stressful?						
5. Many people experience discrimination on the basis of such things as race, sex, or age. Did anything like this happen to you since you filled out yesterday's diary entry?						
6. Since you filled out yesterday's diary entry, did anything happen to a close friend or relative (other than what you have already mentioned) that turned out to be stressful for you?						
7. Did anything else happen to you since you filled out yesterday's diary entry that most people would consider stressful?						

End of Block: STRESS

Start of Block: GDS

Please answer the questions below regarding how you feel today:

	Yes	No
Are you basically satisfied with your life?		
Do you feel that your life is empty?		
Are you afraid that something bad will happen to you?		
Do you feel happy most of the time?		

End of Block: GDS

Start of Block: Daily Activity

Did you participate in CEP-related activities today (other than this study)?

Yes

No

Did your partner participate in CEP-related activities today (other than this study)?

Yes

No

Other; explain: _____

How active were you today?

0= Not all

100= Very Active

0 10 20 30 40 50 60 70 80 90 100

	
--	--

How active was your partner today?

0= Not all

100= Very Active

0 10 20 30 40 50 60 70 80 90 100

	
--	--

End of Block: Daily Activity

Start of Block: Cognition: Collaborative, Burden, Self-Ratings, Informant Ratings

Please select the number that best answers each question about your partner today.

	0	1	2	3	4
How often does he or she express feelings of appreciation for you and the things you do?					
How often does he or she help you?					
How much love do you feel for him or her?					
How often do the two of you laugh together?					
How much emotional support does he or she give to you?					
To what extent do you enjoy the time the two of you spend together?					

Please answer the following questions about your experience with your partner today.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
Helping to care for my partner caused me emotional distress today					
Helping to care for my partner was stressful today					
It was upsetting to see my partner declining					
I felt like we communicated effectively today					

Helping to care for my partner with Mild Cognitive Impairment was difficult today

0= Not at all 100= Very Difficult

0 10 20 30 40 50 60 70 80 90 100



Helping to care for my partner with Mild Cognitive Impairment was enjoyable today
 0= Not at all 100= Very Difficult

0 10 20 30 40 50 60 70 80 90 100



Helping to care for my partner with Mild Cognitive Impairment was rewarding today
 0= Not at all 100= Very

0 10 20 30 40 50 60 70 80 90 100



How much time did you spend caring for your partner today?

▼ 30 minutes or less ... 6+ hours

On the whole, please rate today in terms of your feelings, thoughts, and actions.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I met unexpected obstacles or challenges today.					
I experienced stress today					
I experienced a memory challenge today					

Please indicate the extent to which you agree or disagree with each statement **TODAY**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
There was little I could do to change the important things in my life.					
What happened in my life was beyond my control.					
I try to take care of little problems before they become big problems.					

The following is a list of problems patients sometimes have. Please indicate if any of these problems have occurred today. If so, please indicate how much this bothered or upset you when it happened. If it did not happen today select no and "0". Use the following scale for your reaction.

	Did it occur today?		Reaction (how much it bothered you)				
	No	Yes	0 - not at all	1 - a little	2 - moderately	3 - very much	4 - extremely
Asking the same question over and over							
Losing or misplacing things							
Starting, but not finishing, things							
Doing things that embarrass you							
Waking you or other family members up at night							
Appearing anxious or worried							
Appearing sad or depressed							

Did you and your partner collaborate to remember anything together today? What we mean is did you and your partner remembering anything together or have your own roles to jointly accomplish something.

For example, "I remembered to make the list and bring it to the grocery store and my partner was responsible for double checking the list and items before we left the store."

Another example would be something like, "I reminded my partner about the first names of the new neighbors and my partner reminded me about a doctor's appointment I had this morning."

Yes

No

Display This Question:

If Did you and your partner collaborate to remember anything together today? What we mean is did you... = Yes

Please briefly describe how you and your partner collaborated to get something done today. Was it done together? Did each of you have a separate role or responsibility?

Think about your own remembering today. On a scale from 0-100, today I would rate my own memory as:

0= Poor

100= Excellent

0 10 20 30 40 50 60 70 80 90 100



Think about your approach to remembering today. Consider whether or not you used anything to help yourself remember something - this could range from effectively using a calendar or list to creating an association or setting a goal to accomplish something.

On a scale from 0-100, I would rate my approach to remembering today as:

0= Not intentional

100= Highly intentional

0 10 20 30 40 50 60 70 80 90 100



Think about your partner's remembering today. On a scale from 0-100, today I would rate my partner's memory as:

0= Poor

100= Excellent

0 10 20 30 40 50 60 70 80 90 100

	
--	--

Think about your partner's approach to remembering today. Consider whether or not your partner used anything to help themselves remember - this could range from effectively using a calendar or list to creating an association or setting a goal to accomplish something.

On a scale from 0-100, I would rate my partner's approach to remembering today as:
0= Not intentional 100= Highly intentional

0 10 20 30 40 50 60 70 80 90 100

	
--	--

Did you help your partner remember something today?

Yes, please explain in a sentence or two: _____

No

I'm not sure, please explain: _____

Did you remember something for your partner today?

Yes, please explain in a sentence or two: _____

No

Did you experience any problems remembering something today? This could be anything you forgot from a relatively major event to a minor nuisance.

Yes

No

Unsure

End of Block: Cognition: Collaborative, Burden, Self-Ratings, Informant Ratings

Start of Block: Memory Blip #1

Display This Question:

If Did you experience any problems remembering something today? = Yes

In the following sections, you will have an opportunity to tell us about each memory blip you experienced today (up to 5 blips). Please only describe one blip or experienced issue in each section.

Display This Question:

If Did you experience any problems remembering something today? = Yes

Please describe one memory problem today with a sentence or two.

Display This Question:

If Did you experience any problems remembering something today? = Yes

Did you use any of the following strategies or memory techniques to try to help yourself remember (please select all that apply to this situation):

- ☐ To-Do List
 - ☐ Reminder Note/Wrote it down
 - ☐ Appointment book or Calendar
 - ☐ A medication organizer/pill organizer
 - ☐ Asked someone else remind you
 - ☐ Had someone else remind you
 - ☐ Leave things in familiar places
 - ☐ A digital reminder alarm/alert
 - ☐ Followed a routine
 - ☐ Tried to pay close attention to what you were doing
 - ☐ Tried bringing the information to mind multiple times
 - ☐ Set a goal to remember
 - ☐ Visualization techniques
 - ☐ Created an association
 - ☐ Mindfulness
 - ☐ I just relied on my mind/brain
 - ☐ Other, explain: _____
 - ☐ None of the above
-

Display This Question:

If Did you experience any problems remembering something today? = Yes

How stressful was this incident for you?

Not at all

Mildly

Moderately

Extremely

Display This Question:

If Did you experience any problems remembering something today? = Yes

Was this incident due to a disruption in your routine?

Yes

No

Display This Question:

If Did you experience any problems remembering something today? = Yes

How important was this memory blip?

Not at all

Mildly

Moderately

Extremely

Display This Question:

If Did you experience any problems remembering something today? = Yes

What did you do to adjust for this blip?

Display This Question:

If Did you experience any problems remembering something today? = Yes

Did you experience a second memory blip today?

Yes

No

End of Block: Memory Blip #1 – Repeats for up to 5 total blips.

End of Block: Memory Blip 5

Start of Block: Report of Partner's Memory Blip

Next, we will ask you to report any memory blips experienced by your partner today.

Did your partner experience any memory blips today? These can either be things you observed or that your partner told you about.

Yes

No

Unsure

I don't remember

Display This Question:

If Did your partner experience any memory blips today? These can either be things you observed or th... = Yes

Please select **the most important** memory blip by your partner that you can remember and describe it below:

Display This Question:

If Did your partner experience any memory blips today? These can either be things you observed or th... = Yes

What happened that made you realize that your partner had a memory blip?

Display This Question:

If Did your partner experience any memory blips today? These can either be things you observed or th... = Yes

To your knowledge, did your partner use any of the following strategies or memory techniques to try to help remember what was forgotten? (Please select all that apply to this situation):

- ☐ To-Do List
- ☐ Reminder Note/Wrote it down
- ☐ Appointment book or Calendar
- ☐ A medication organizer/pill organizer
- ☐ Relied on someone else to remind them
- ☐ Leave things in familiar places
- ☐ A digital reminder alarm/alert
- ☐ Followed a routine
- ☐ Tried to pay close attention to what you were doing
- ☐ Tried bringing the information to mind multiple times
- ☐ Set a goal to remember
- ☐ Visualization techniques
- ☐ Created an association
- ☐ Mindfulness
- ☐ I don't know
- ☐ Other, explain: _____
- ☐ None of the above

Display This Question:

If Did your partner experience any memory blips today? These can either be things you observed or th... = Yes

How stressful was this blip for your partner?

Not at all

Mildly

Moderately

Extremely

Display This Question:

If Did your partner experience any memory blips today? These can either be things you observed or th... = Yes

How stressful was this blip for you personally when it occurred?

Not at all

Mildly

Moderately

Extremely

Display This Question:

If Did your partner experience any memory blips today? These can either be things you observed or th... = Yes

What happened as a result of the blip?

Display This Question:

If Did your partner experience any memory blips today? These can either be things you observed or th... = Yes

Did you have to do anything to help your partner during this blip?

Yes

No

Display This Question:

If Did you have to do anything to help your partner during this blip? = Yes

Please describe what you did to help your partner below:

End of Block: Report of Partner's Memory Blip, End of Survey

APPENDIX B. CARE RECIPIENT DIARY

Please complete this daily diary form once per day at the end of the day. Please respond only about things that happened today.

We would like for each person to fill out their own form. This is the form for the **CEP Member**.

If you have any questions about completing this form, please email or call:
Alysha Naran: anaran6@gatech.edu, (678) 767-2168

Emily Lustig: elustig@gatech.edu, (404) 692-3355

Thank you!

End of Block: Directions

Start of Block: SLEEP

The next questions ask about your SLEEP last night.

What time did you go to sleep last night?

▼ 7:30 PM ... I don't remember

What time did you wake up this morning?

▼ Before 5:00 AM ... 11:00 AM or Later

Approximately how many hours of sleep did you get last night?

0 hours – 12+ hours (checkbox options)

How would you rate the quality of your sleep last night?

0= Poor

100= Very Good

0 10 20 30 40 50 60 70 80 90 100



Did you toss and turn last night?

Yes

No

I don't know

Did you wake up in the middle of the night last night?

Yes

No

I don't know

Was your sleep refreshing?

0= Not at all

100= Very Much

0 10 20 30 40 50 60 70 80 90 100



Was your sleep restful?

0= Not at all

100= Very Restful

0 10 20 30 40 50 60 70 80 90 100



How awake did you feel today?

0= Very Tired

100= Very Awake

0 10 20 30 40 50 60 70 80 90 100



How would you rate the quality of your partner's sleep last night?

0= Poor

100= Very Good

0 10 20 30 40 50 60 70 80 90 100

	
--	--

Approximately how many hours of sleep did your partner get last night?

0 hours – 12+ hours (checkbox options)

I don't know

How awake did your partner seem today?

0= Very Tired 100= Very Awake

0 10 20 30 40 50 60 70 80 90 100

	
--	--

End of Block: SLEEP

Start of Block: STRESS

How much stress did you experience today?

0= None 100= Extremely High

0 10 20 30 40 50 60 70 80 90 100

	
--	--

How much stress did your partner experience today?

0= None 100= Extremely High

0 10 20 30 40 50 60 70 80 90 100

	
--	--

Please indicate whether the following happened to you since you filled out yesterday's diary entry and provide a rating of how stressful it was for you.

	Did it occur today?		How stressful was this for you? If it did not occur, please select 0.			
	No	Yes	0 - not at all	2 - not very	3 - somewhat	4 - very
1. Did you have an argument or disagreement with anyone since you filled out yesterday's diary entry?						
2. Since you filled out yesterday's diary entry, did anything happen that you could have argued about but you decided to let pass in order to avoid a disagreement?						
3. Since you filled out yesterday's diary entry, did anything happen at work or school (other than what you have already mentioned) that most people would consider stressful?						
4. Since you filled out yesterday's diary entry, did anything happen at home that most people would consider stressful?						
5. Many people experience discrimination on the basis of such things as race, sex, or age. Did anything like this happen to you since you filled out yesterday's diary entry?						
6. Since you filled out yesterday's diary entry, did anything happen to a close friend or relative (other than what you have already mentioned) that turned out to be stressful for you?						
7. Did anything else happen to you since you filled out yesterday's diary entry that most people would consider stressful?						

End of Block: STRESS

Start of Block: GDS

Please answer the questions below regarding how you feel today:

	Yes	No
Are you basically satisfied with your life?		
Do you feel that your life is empty?		
Are you afraid that something bad will happen to you?		
Do you feel happy most of the time?		

End of Block: GDS

Start of Block: Cognition: Collaborative, Burden, Self-Ratings, Informant Ratings

Did you participate in CEP-related activities today (other than this study)?

Yes

No

Did your partner participate in CEP-related activities today (other than this study)?

Yes

No

Other; explain: _____

How active were you today?

0= Not all

100= Very Active

0 10 20 30 40 50 60 70 80 90 100

	
--	--

How active was your partner today?

0= Not all

100= Very Active

0 10 20 30 40 50 60 70 80 90 100

	
--	--

End of Block: Daily Activity

Start of Block: Cognition: Collaborative, Burden, Self-Ratings, Informant Ratings

Please select the number that best answers each question about your partner today.

	0	1	2	3	4
How often does he or she express feelings of appreciation for you and the things you do?					
How often does he or she help you?					
How much love do you feel for him or her?					
How often do the two of you laugh together?					
How much emotional support does he or she give to you?					
To what extent do you enjoy the time the two of you spend together?					

On the whole, please rate today in terms of your feelings, thoughts, and actions.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I met unexpected obstacles or challenges today.					
I experienced stress today					
I experienced a memory challenge today					

Please indicate the extent to which you agree or disagree with each statement **TODAY**.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
There was little I could do to change the important things in my life.					
What happened in my life was beyond my control.					
I try to take care of little problems before they become big problems.					

Did you and your partner collaborate to remember anything together today? What we mean is did you and your partner remembering anything together or have your own roles to jointly accomplish something.

For example, "I remembered to make the list and bring it to the grocery store and my partner was responsible for double checking the list and items before we left the store."

Another example would be something like, "I reminded my partner about the first names of the new neighbors and my partner reminded me about a doctor's appointment I had this morning."

Yes

No

Display This Question:

If Did you and your partner collaborate to remember anything together today? What we mean is did you... = Yes

Please briefly describe how you and your partner collaborated to get something done today. Was it done together? Did each of you have a separate role or responsibility?

Think about your own remembering today. On a scale from 0-100, today I would rate my own memory as:

0= Poor

100= Excellent

0 10 20 30 40 50 60 70 80 90 100



Think about your approach to remembering today. Consider whether or not you used anything to help yourself remember something - this could range from effectively using a calendar or list to creating an association or setting a goal to accomplish something.

On a scale from 0-100, I would rate my approach to remembering today as:

0= Not intentional

100= Highly intentional

0 10 20 30 40 50 60 70 80 90 100



Think about your partner's remembering today. On a scale from 0-100, today I would rate my partner's memory as:

0= Poor

100= Excellent

0 10 20 30 40 50 60 70 80 90 100



Think about your partner's approach to remembering today. Consider whether or not your partner used anything to help themselves remember - this could range from effectively using a calendar or list to creating an association or setting a goal to accomplish something.

On a scale from 0-100, I would rate my partner's approach to remembering today as:

0= Not intentional

100= Highly intentional

0 10 20 30 40 50 60 70 80 90 100



Did you help your partner remember something today?

Yes, please explain in a sentence or two: _____

No

I'm not sure, please explain: _____

Did your partner help you remember something today?

Yes, please explain in a sentence or two: _____

No

Did you experience any problems remembering something today?

Yes

No

Unsure

End of Block: Cognition: Collaborative, Burden, Self-Ratings, Informant Ratings

Start of Block: Memory Blip #1

Display This Question:

If Did you experience any problems remembering something today? = Yes

In the following sections, you will have an opportunity to tell us about each memory blip you experienced today (up to 5 blips). Please only describe one blip or experienced issue in each section.

Display This Question:

If Did you experience any problems remembering something today? = Yes

Please describe one memory problem today with a sentence or two.

Display This Question:

If Did you experience any problems remembering something today? = Yes

Did you use any of the following strategies or memory techniques to try to help yourself remember (please select all that apply to this situation):

- ☐ To-Do List
- ☐ Reminder Note/Wrote it down
- ☐ Appointment book or Calendar
- ☐ A medication organizer/pill organizer
- ☐ Asked someone else remind you
- ☐ Had someone else remind you
- ☐ Leave things in familiar places
- ☐ A digital reminder alarm/alert
- ☐ Followed a routine
- ☐ Tried to pay close attention to what you were doing
- ☐ Tried bringing the information to mind multiple times
- ☐ Set a goal to remember
- ☐ Visualization techniques
- ☐ Created an association
- ☐ Mindfulness
- ☐ I just relied on my mind/brain
- ☐ Other, explain: _____
- ☐ None of the above

Display This Question:

If Did you experience any problems remembering something today? = Yes

How stressful was this incident for you?

Not at all

Mildly

Moderately

Extremely

Display This Question:

If Did you experience any problems remembering something today? = Yes

Was this incident due to a disruption in your routine?

Yes

No

Display This Question:

If Did you experience any problems remembering something today? = Yes

How important was this memory blip?

Not at all

Mildly

Moderately

Extremely

Display This Question:

If Did you experience any problems remembering something today? = Yes

What did you do to adjust for this blip?

Display This Question:

If Did you experience any problems remembering something today? = Yes

Did you experience a second memory blip today?

Yes

No

End of Block: Memory Blip #1 – Repeats for up to 5 total blips.

End of Block: Memory Blip 5

End Survey

APPENDIX C. ADDITIONAL BASELINE DATA

Table 14. Memory Functioning Questionnaire Subset Scores at Baseline

Subset	CP Mean (SD)	CR Mean (SD)
Retrospective Functioning	4.0 (1.0)	3.0 (1.68)
Frequency of Forgetting	5.0 (1.3)	4.0 (0.91)
Seriousness of Forgetting	5.0 (2.0)	4.0 (1.65)
Mnemonics Usage	3.0 (1.57)	3.0 (1.31)

Higher Scores indicate better functioning and less frequent mnemonics use.

Table 15. Mutuality Scores at Baseline

Question	CP Means (SD)	CR Means (SD)
<i>How often do the two of you see eye to eye?</i>	3.22 (0.58)	3.15 (0.72)
<i>How often do you feel physically close to him or her?</i>	3.33 (0.73)	3.56 (0.69)
<i>How often do you enjoy sharing past experiences with him or her?</i>	3.63 (0.56)	3.48 (0.98)
<i>How often does he or she express feelings of appreciation for you and the things you do?</i>	3.52 (0.70)	3.41 (1.01)
<i>How attached are you to him or her?</i>	3.81 (0.39)	3.96 (0.19)
<i>How often does he or she help you?</i>	3.33 (0.68)	3.67 (0.62)
<i>How often do you like to sit and talk to him or her?</i>	3.41 (0.69)	3.56 (0.64)
<i>How much love do you feel for him or her?</i>	3.85 (0.36)	3.96 (0.19)
<i>To what extent do the two of you share the same values?</i>	3.85 (0.36)	3.81 (0.39)
<i>When you really need it, how much does he or she comfort you?</i>	3.44 (0.75)	3.78 (0.51)
<i>How often do the two of you laugh together?</i>	3.44 (0.75)	3.48 (0.94)
<i>How often do you confide in him or her?</i>	3.19 (0.92)	3.33 (0.78)
<i>How much emotional support does he or she give to you?</i>	3.26 (0.81)	3.70 (0.61)
<i>To what extent do you enjoy the time the two of you spend together?</i>	3.59 (0.50)	3.81 (0.48)
<i>How often does he or she express feelings of warmth toward you?</i>	3.52 (0.64)	3.52 (0.08)
<i>How often do you two plan your days together (for instance, review your calendars)?</i>	3.54 (0.58)	3.41 (0.89)
<i>Total</i>	3.49 (0.41)	3.60 (0.47)

Table 16. RMBPC Scores at Baseline

Occurrence in the <u>past week</u>	# Yes (N=27)	Reaction Mean (SD)
<i>Asking the same question over and over</i>	17	1.04 (0.88)
<i>Trouble remembering recent events (i.e., items in newspaper or TV)</i>	16	0.75 (0.74)
<i>Trouble remembering significant past events</i>	13	0.73 (0.76)
<i>Losing or misplacing things</i>	23	1.42 (0.88)
<i>Forgetting what day it is</i>	14	0.46 (0.74)
<i>Starting, but not finishing, things</i>	16	0.91 (1.0)
<i>Difficulty concentrating on a task</i>	16	0.74 (0.81)
<i>Destroying property</i>	0	--
<i>Doing things that embarrass you</i>	4	0.19 (0.51)
<i>Waking you or other family members up at night</i>	7	0.45 (1.0)
<i>Talking loudly and rapidly</i>	2	0.11 (0.32)
<i>Appears anxious or worried</i>	12	0.91 (1.02)
<i>Engaging in behavior that is potentially dangerous to self or others</i>	1	0.11 (0.47)
<i>Threats to hurt oneself</i>	1	0.24 (0.97)
<i>Threats to hurt others</i>	0	--
<i>Aggressive to others verbally</i>	2	0.11 (0.32)
<i>Appears sad or depressed</i>	8	0.77 (1.19)
<i>Expressing feelings or hopelessness or sadness about the future</i>	7	0.73 (1.20)
<i>Crying and tearfulness</i>	6	0.60 (1.09)
<i>Commenting about death of self or others</i>	5	0.48 (1.03)
<i>Talking about feeling lonely</i>	4	0.50 (1.05)
<i>Comments about feeling worthless or being a burden to others</i>	5	0.45 (1.0)
<i>Comments about feeling like a failure or about not having any worthwhile accomplishments in life</i>	1	0.22 (0.94)
<i>Arguing, irritability, and/or complaining</i>	9	1.05 (1.39)
Sample Mean (SD)	7.0 (4.98)	0.67 (0.52)

Table 17. Daily Inventory of Stressful Events (DISE) at Baseline

# of Stressors	# CPs	# CRs
0	8	20
1	10	4
2	6	2
3	2	1
4	0	0
5	0	0
6	1	0
7	0	0
Sample Mean (SD)	1.26 (1.32)	0.41 (0.80)

Table 18. Sleep Disorders Inventory (SDI) at Baseline

Scale	Mean (SD)
Frequency (0-4)	.51 (.47)
Severity (0-3)	.24 (.25)
Caregiver Distress (0-5)	.25 (.74)

APPENDIX D. SUMMARY DIARY DATA

Table 19. Aggregate Diary Data

Diary measure	CP Means (SD)	CP Range	CR Means (SD)	CR Range
<i>Sleep Quality (0-100)</i>	74.70 (20.42)	0 - 100	76.13 (19.79)	2 – 100
<i>Time Slept</i>	<i>Mode: 7-8 hours</i>	2-3 hours, 11-12 hours	<i>Mode: 7-8 hours</i>	2-3 hours, 11-12 hours
<i>Global Stress (0-100)</i>	32.08 (24.96)	0 - 100	27.10 (24.79)	0 – 100
<i>Global Memory (0-100)</i>	83.87 (13.70)	19 - 100	69.87 (17.68)	1 – 100
<i>Memory Blips (0-5)</i>	0.26 (0.58)	0 - 4	0.41 (0.63)	0 – 3
<i>Mutuality Scores (0-4)</i>	3.19 (0.64)	1.33 - 4	3.38 (0.66)	1.5 - 4
<i>GDS-4 (0-4)</i>	0.15 (0.60)	0 - 4	0.43 (0.81)	0 – 4
<i>DISE Total (0-7)</i>	1.26 (1.50)	0 - 6	0.71 (1.25)	0 – 7
<i>Time Spent Caregiving (<30 min- 6+ hours)</i>	3.82*(2.38)	1- 8	--	
<i>Difficulty of Caregiving (0-100)</i>	25.58 (23.46)	0 – 93	--	
<i>Caregiving was Rewarding (0-100)</i>	58.69 (29.32)	0 - 100	--	
<i>RMBPC Score (out of 7)</i>	--	0 - 5	1.79 (1.48)	
<i>Diary Duration (seconds)</i>	1028.54 (2560.25)	170- 45674	1526.29 (4511.47)	135 - 77010
<i>Diaries Filled Out</i>	12.74 (1.43)	9 - 14	12.04 (1.89)	8 - 14
<i>Diary Compliance</i>	91% (344/378)		86% (325/378)	

*Time spent caregiving was a categorical variable, 1= 30 minutes or less, 2= 31 minutes to 1 hour, 3= 1-2 hours, 4= 2-3 hours, 5= 3-4 hours, 6= 4-5 hours, 7= 5-6 hours, 8= 6 or more hours spent caregiving.

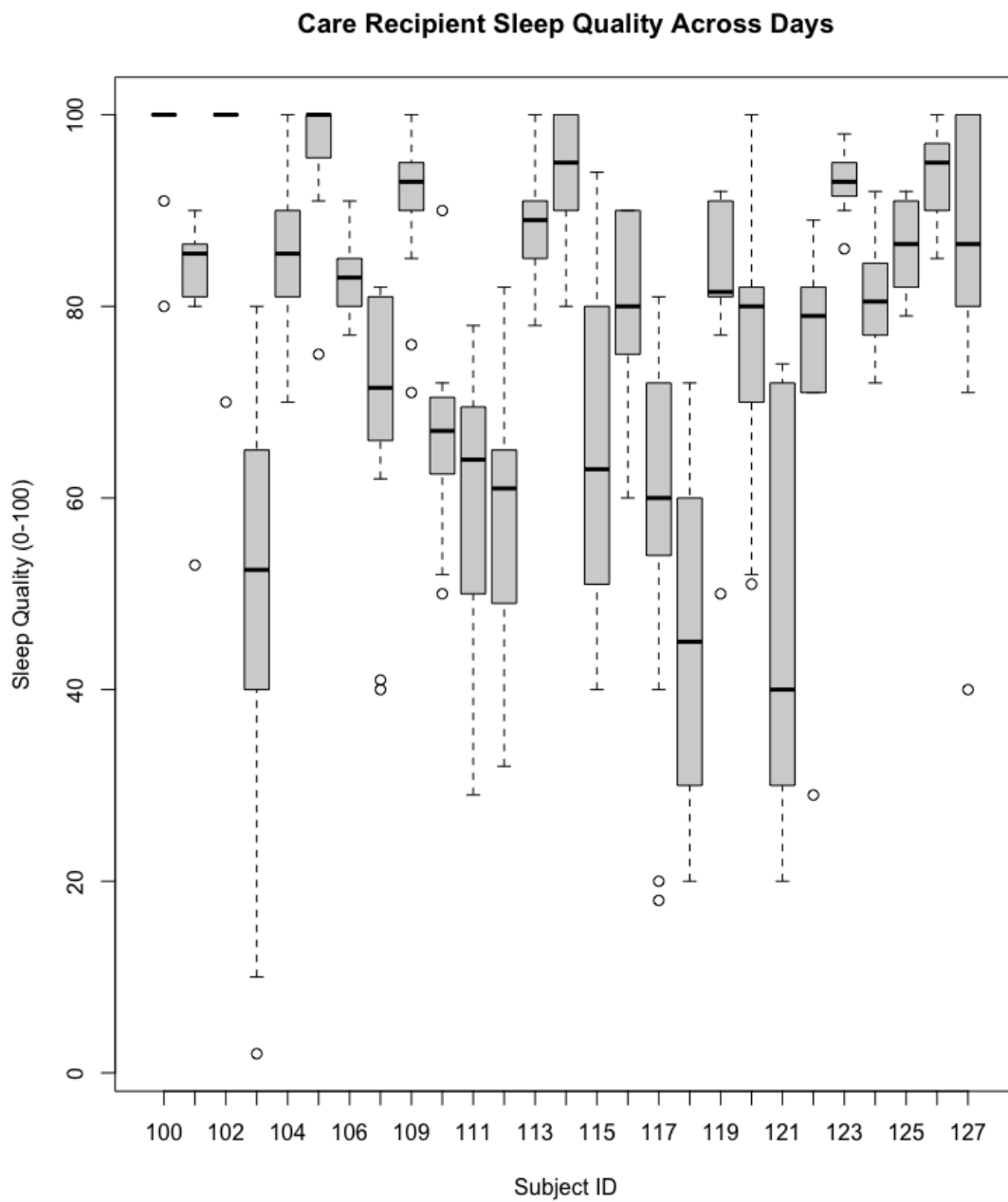


Figure 10. Care Recipient Sleep Quality Across Days

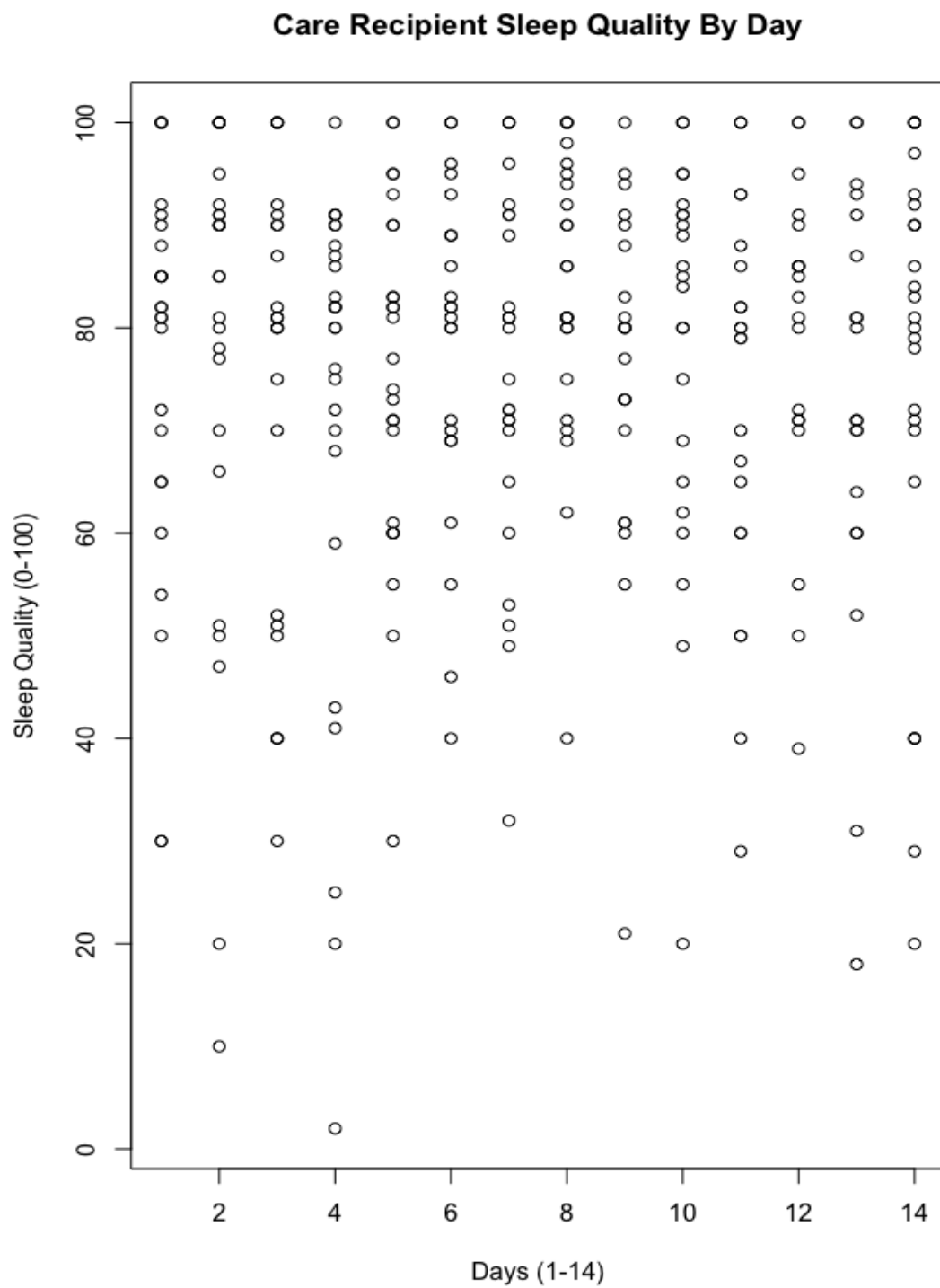


Figure 11. Care Recipient Sleep Quality by Day

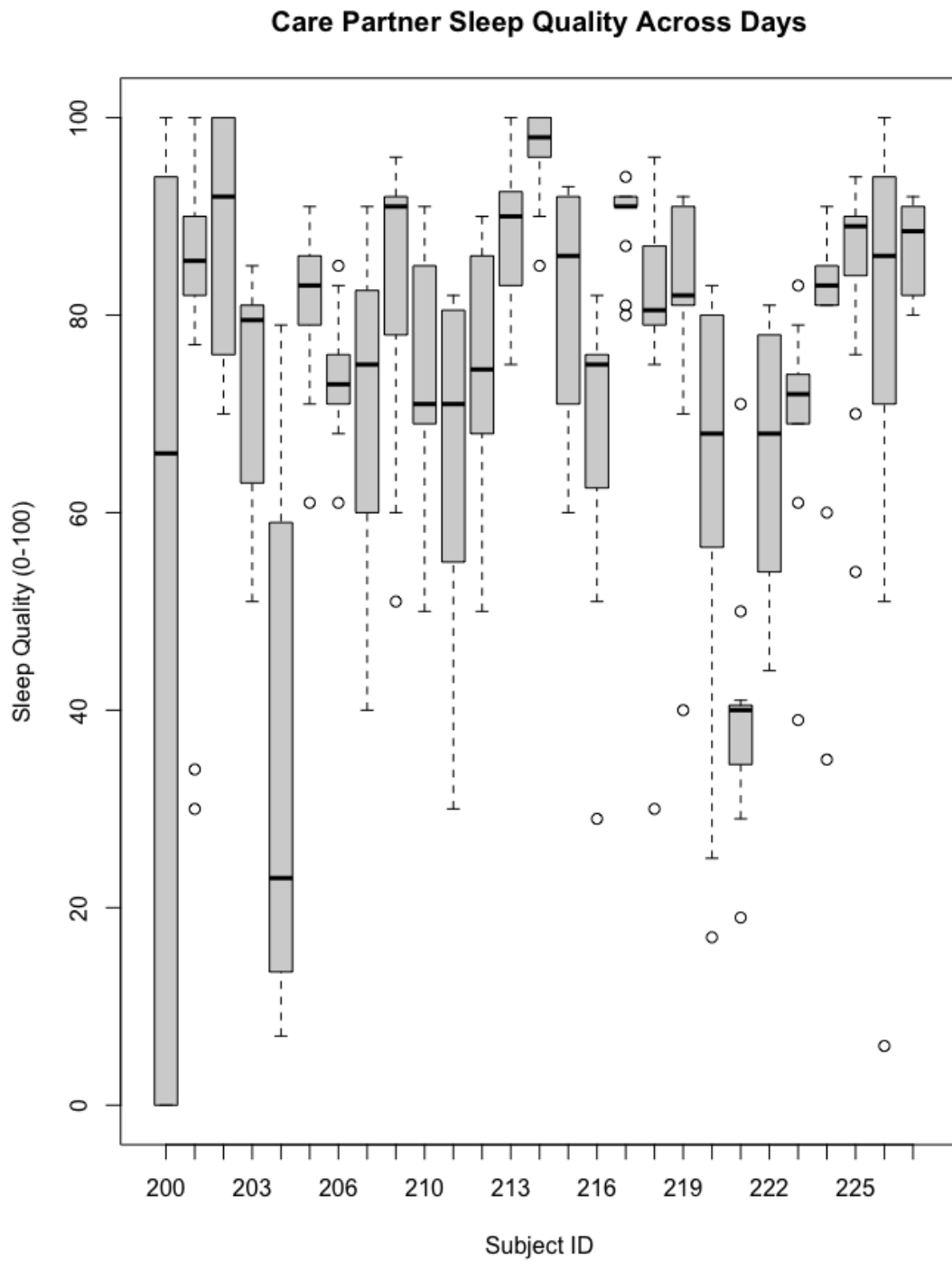


Figure 12. Caregiver Sleep Quality Across Days

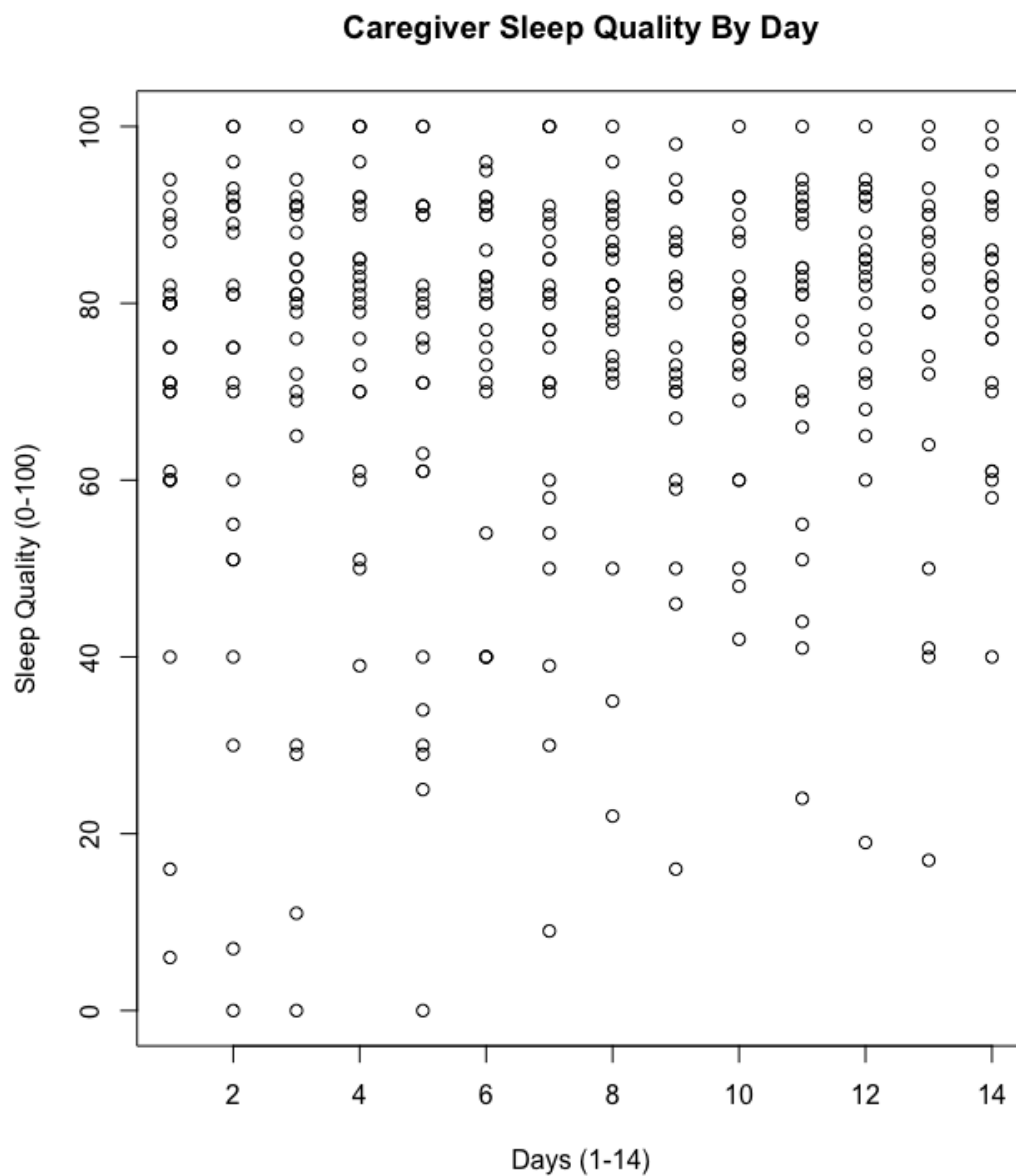


Figure 13. Caregiver Sleep Quality by Day

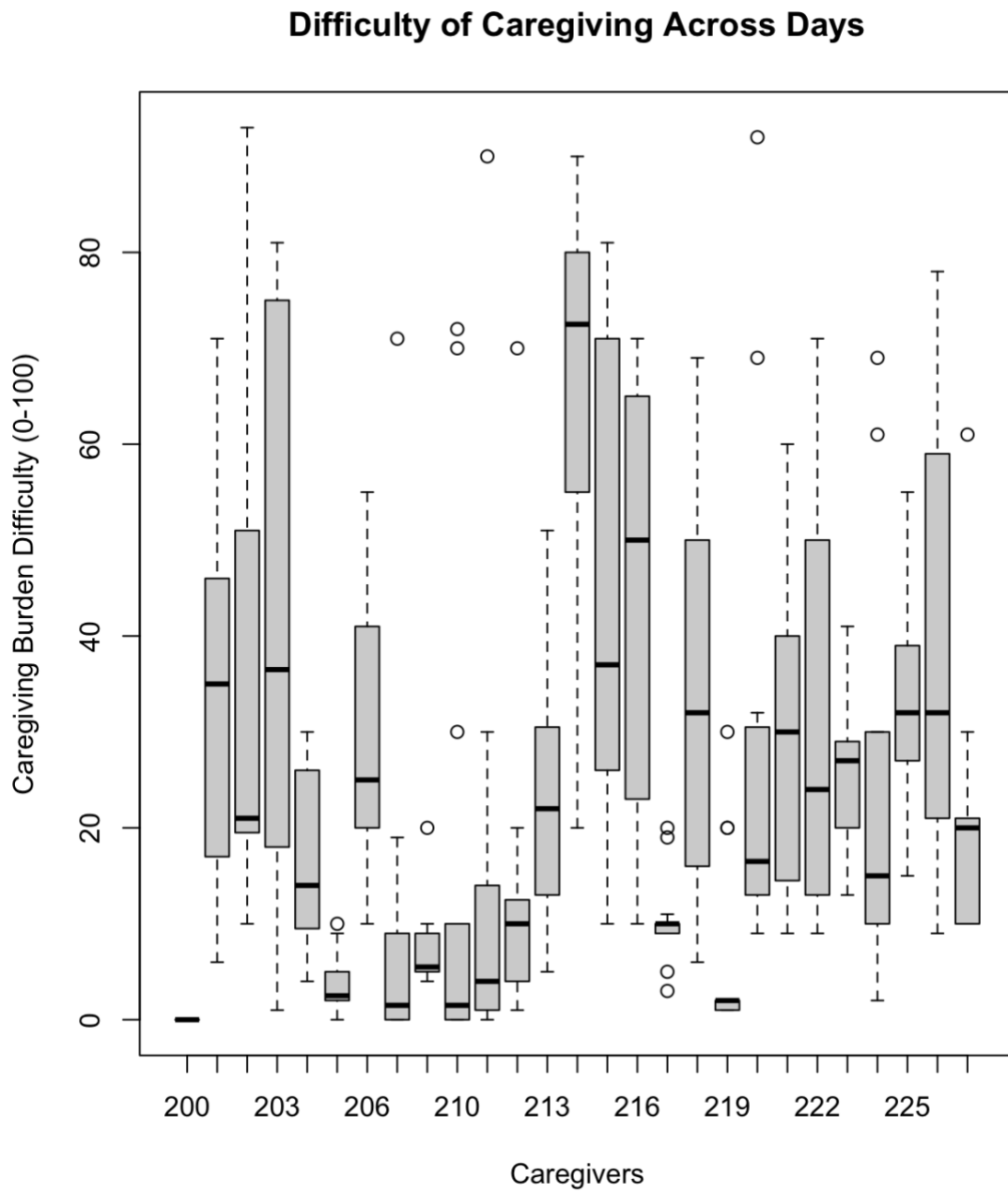


Figure 14. Caregiver Burden Difficulty Across Days

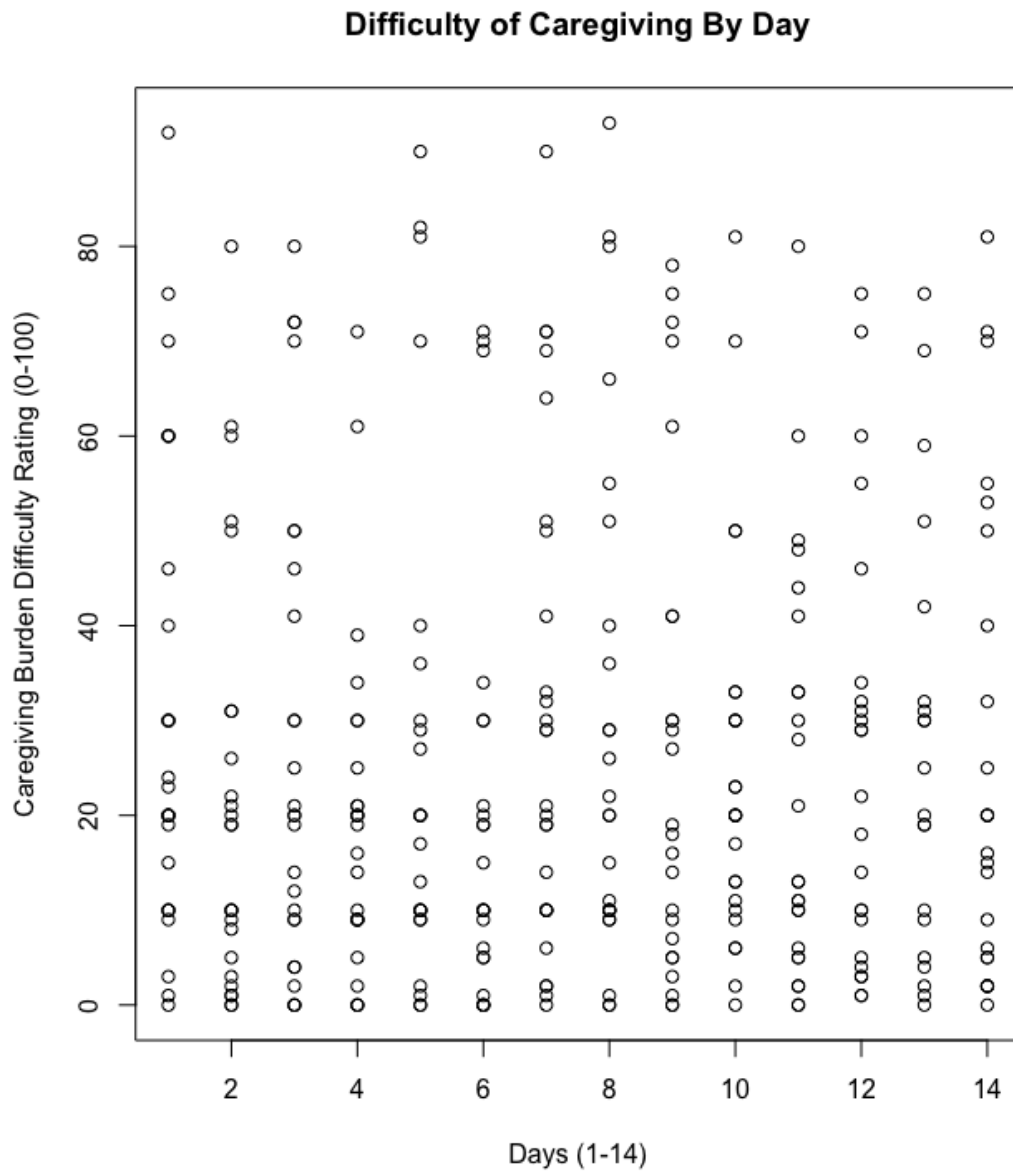


Figure 15. Caregiver Burden Difficulty by Day

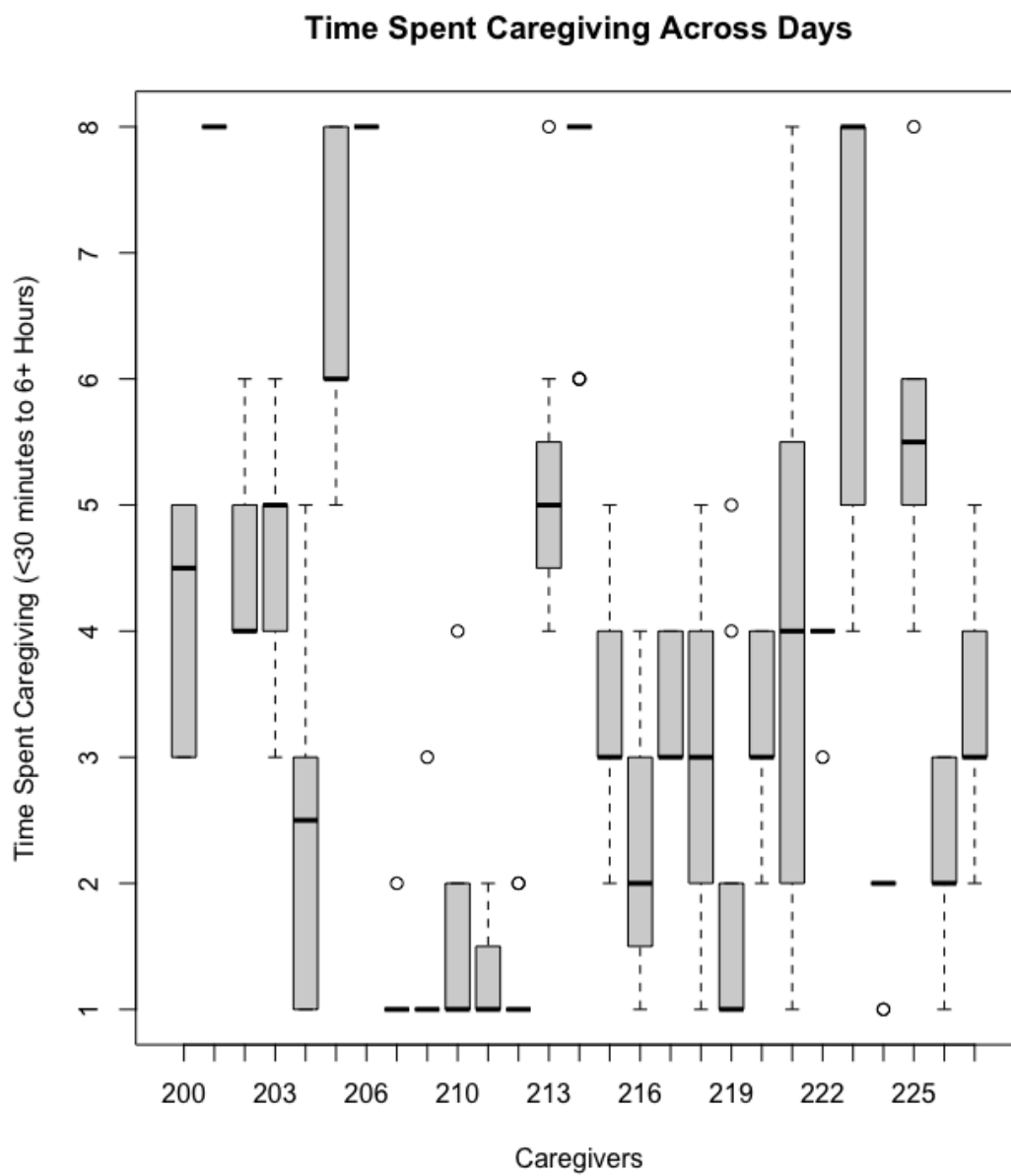


Figure 16. Time Spent Caregiving Across Days

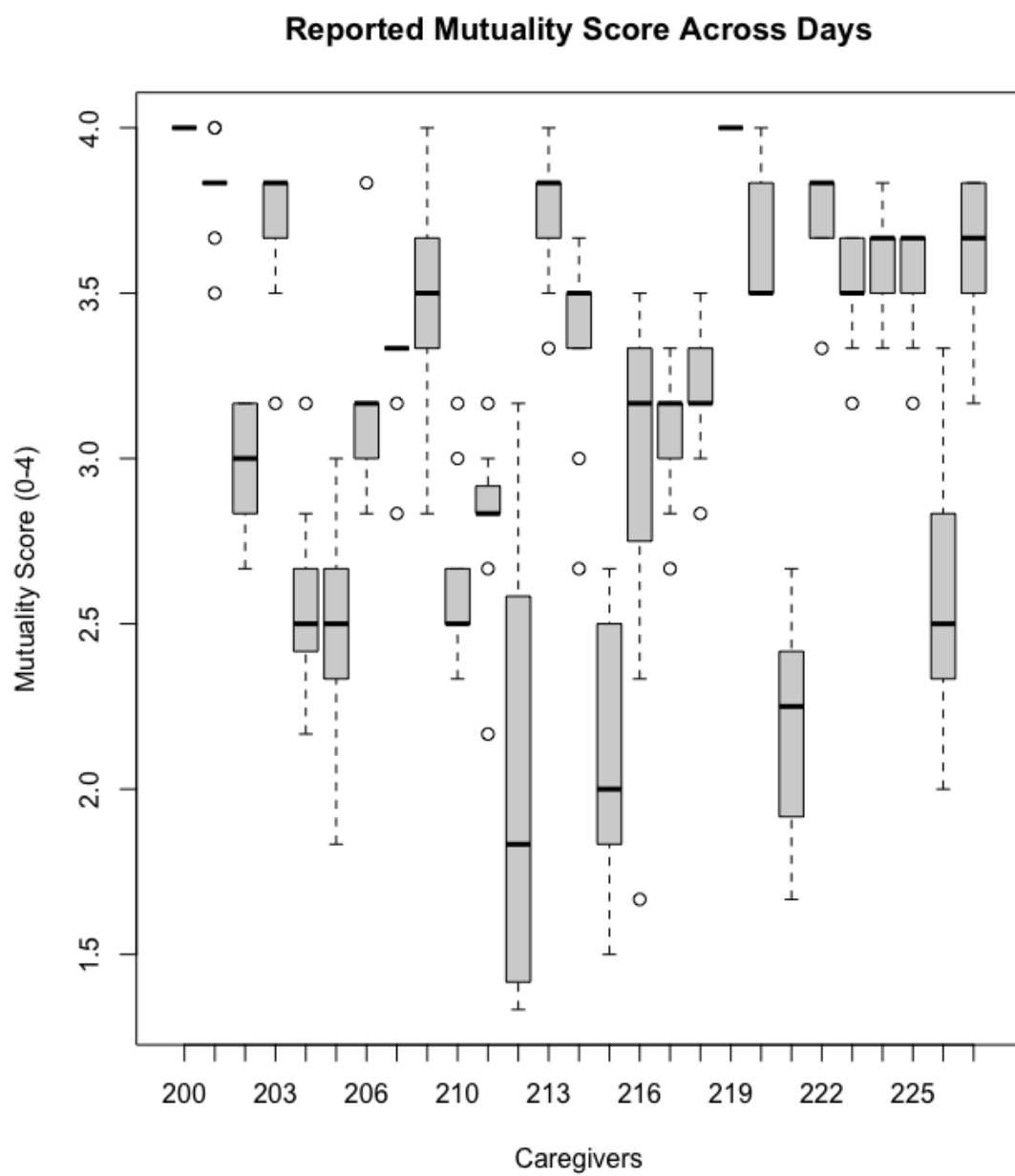


Figure 17. Mutuality Across Days

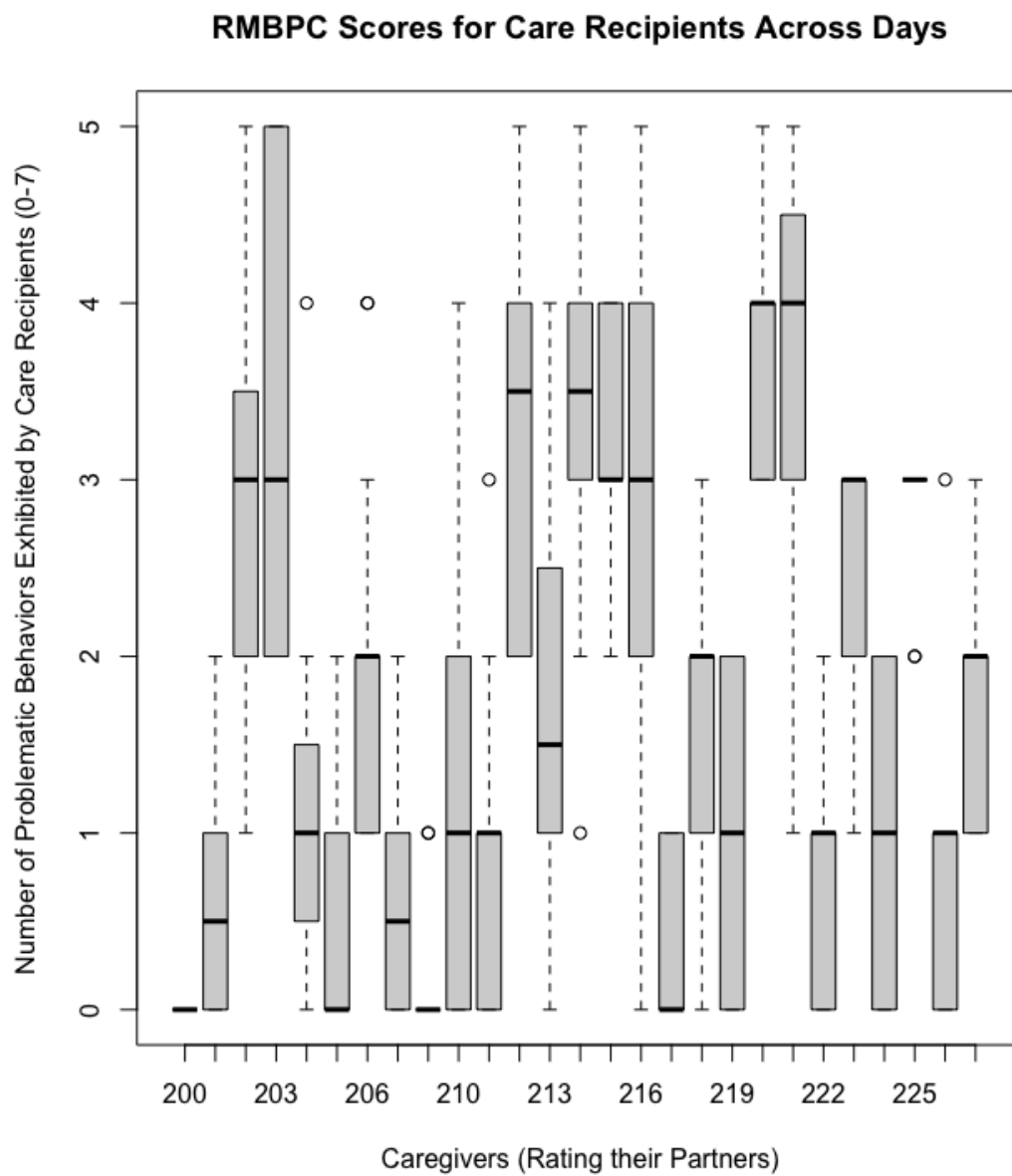


Figure 18. RMBPC Scores Across Days

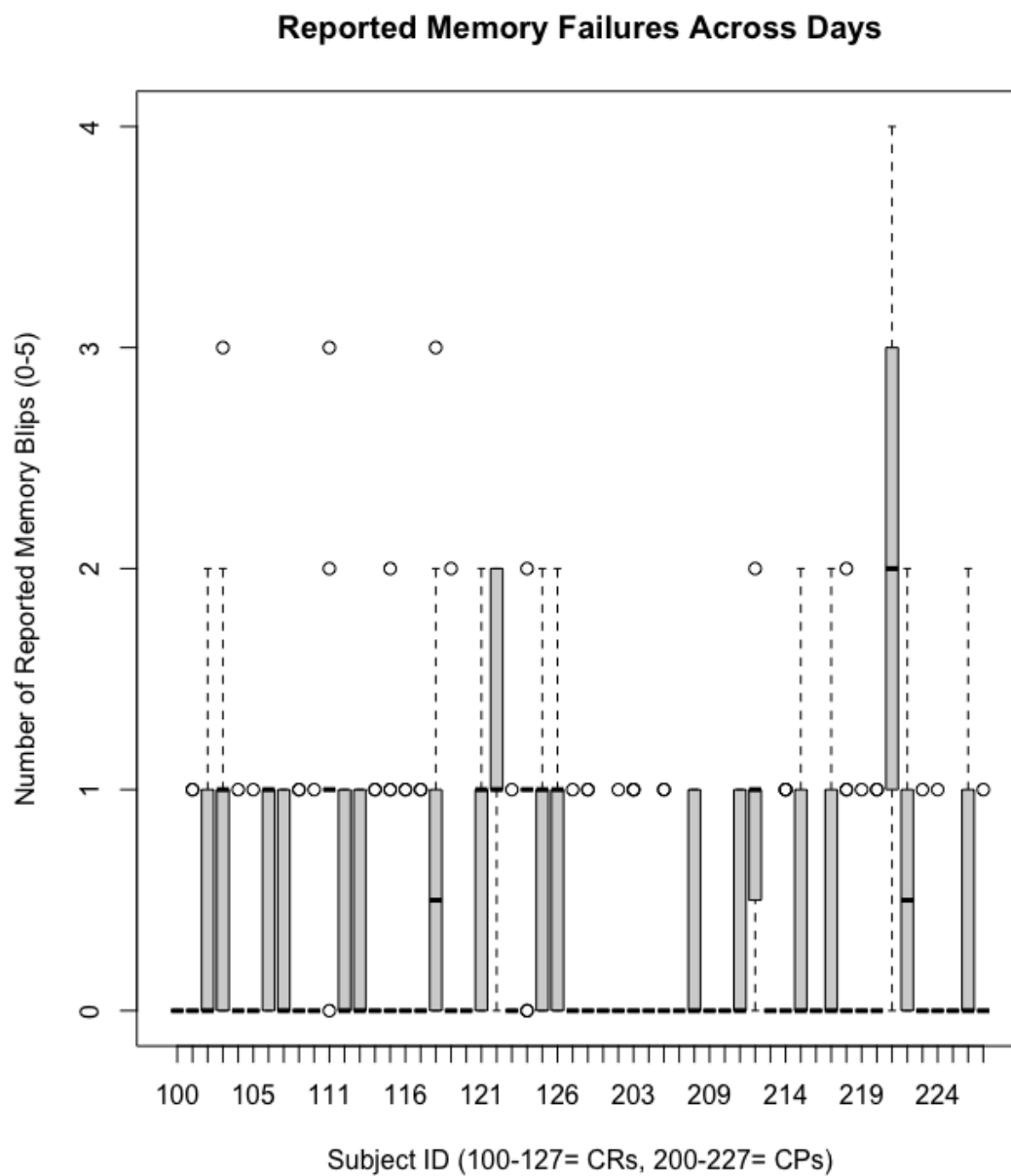


Figure 19. Memory Blips Reported Across Days

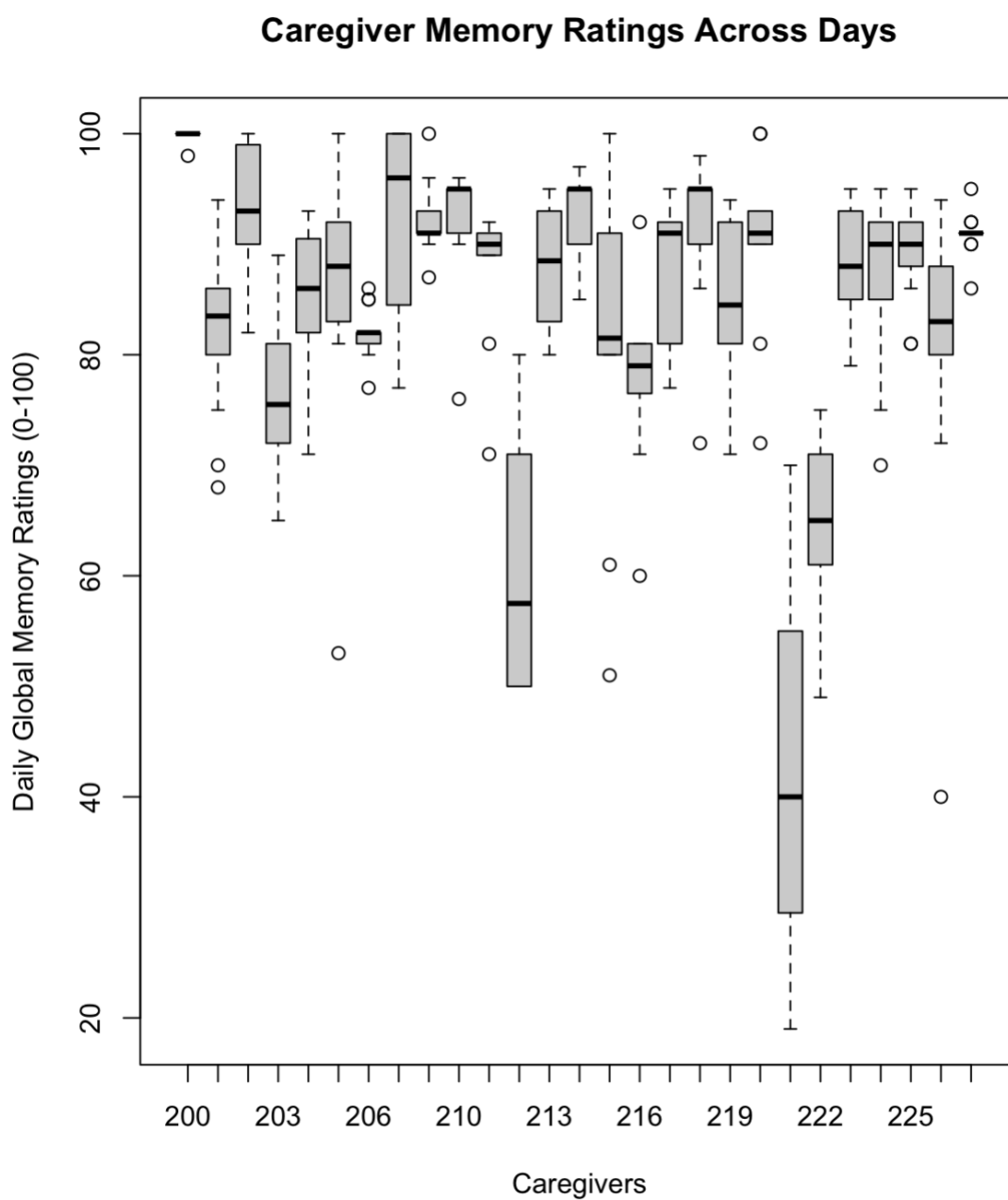


Figure 20. Caregiver Memory Ratings Across Days

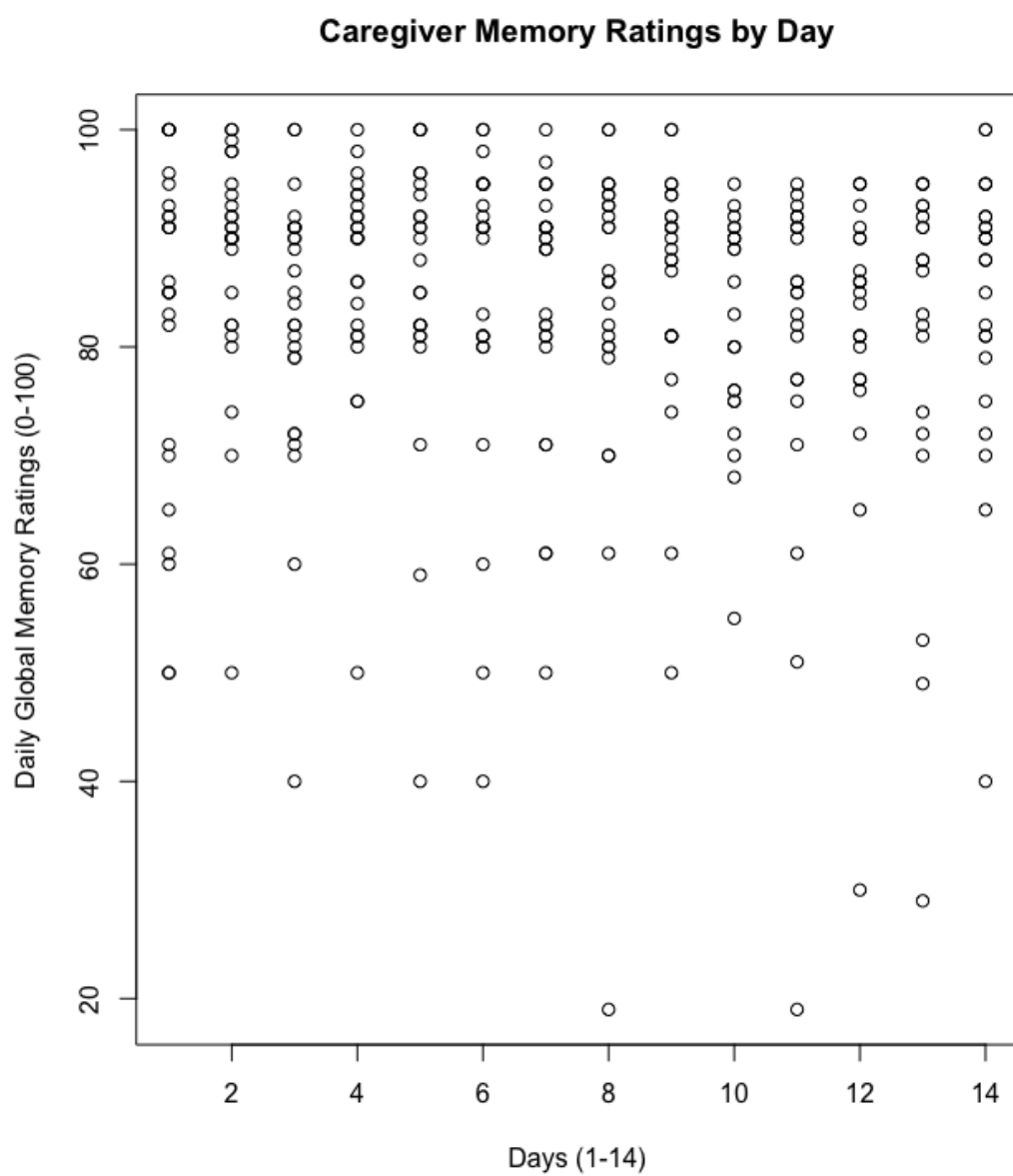


Figure 21. Caregiver Memory Ratings by Day

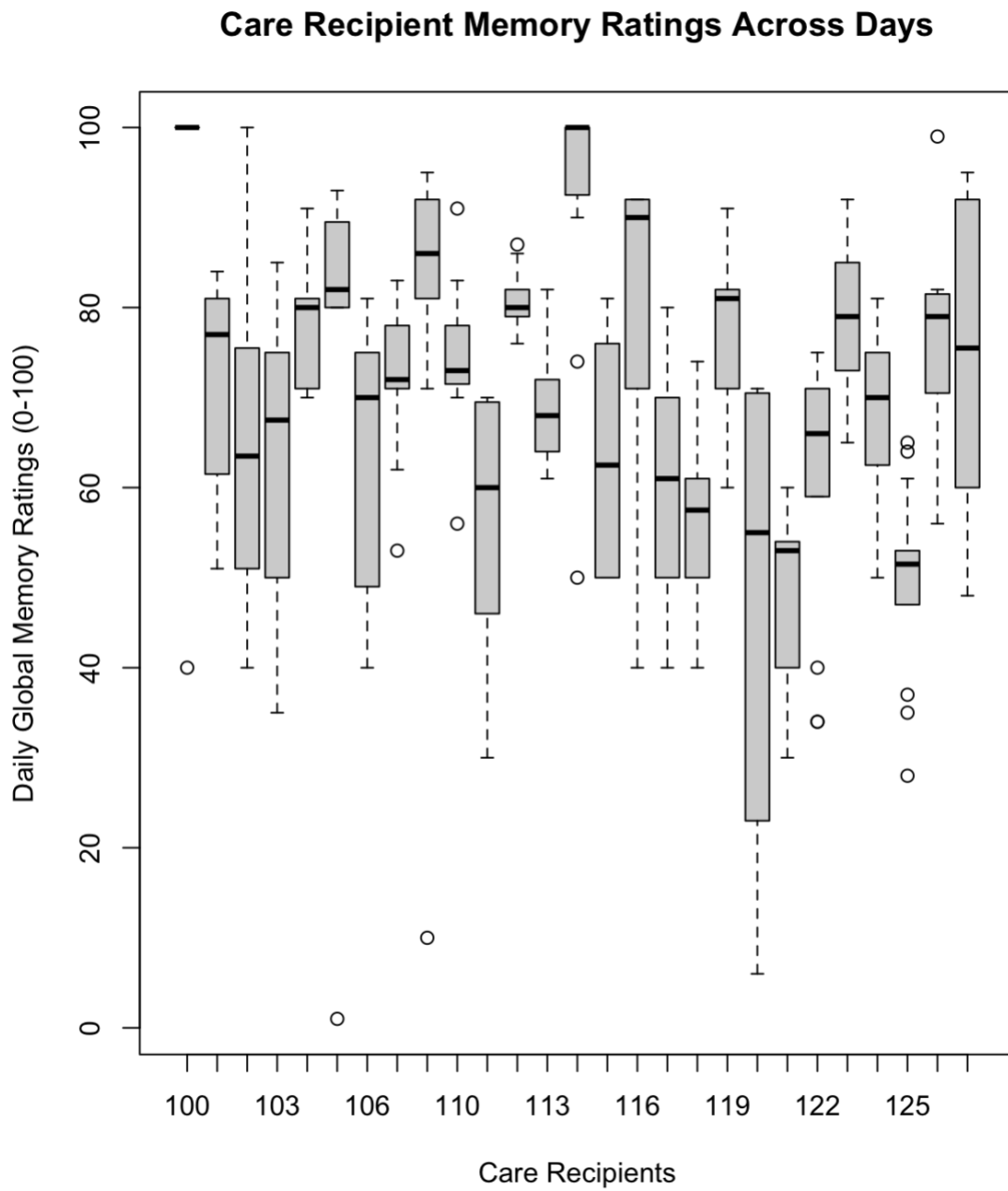


Figure 22. Care Recipient Memory Ratings Across Days

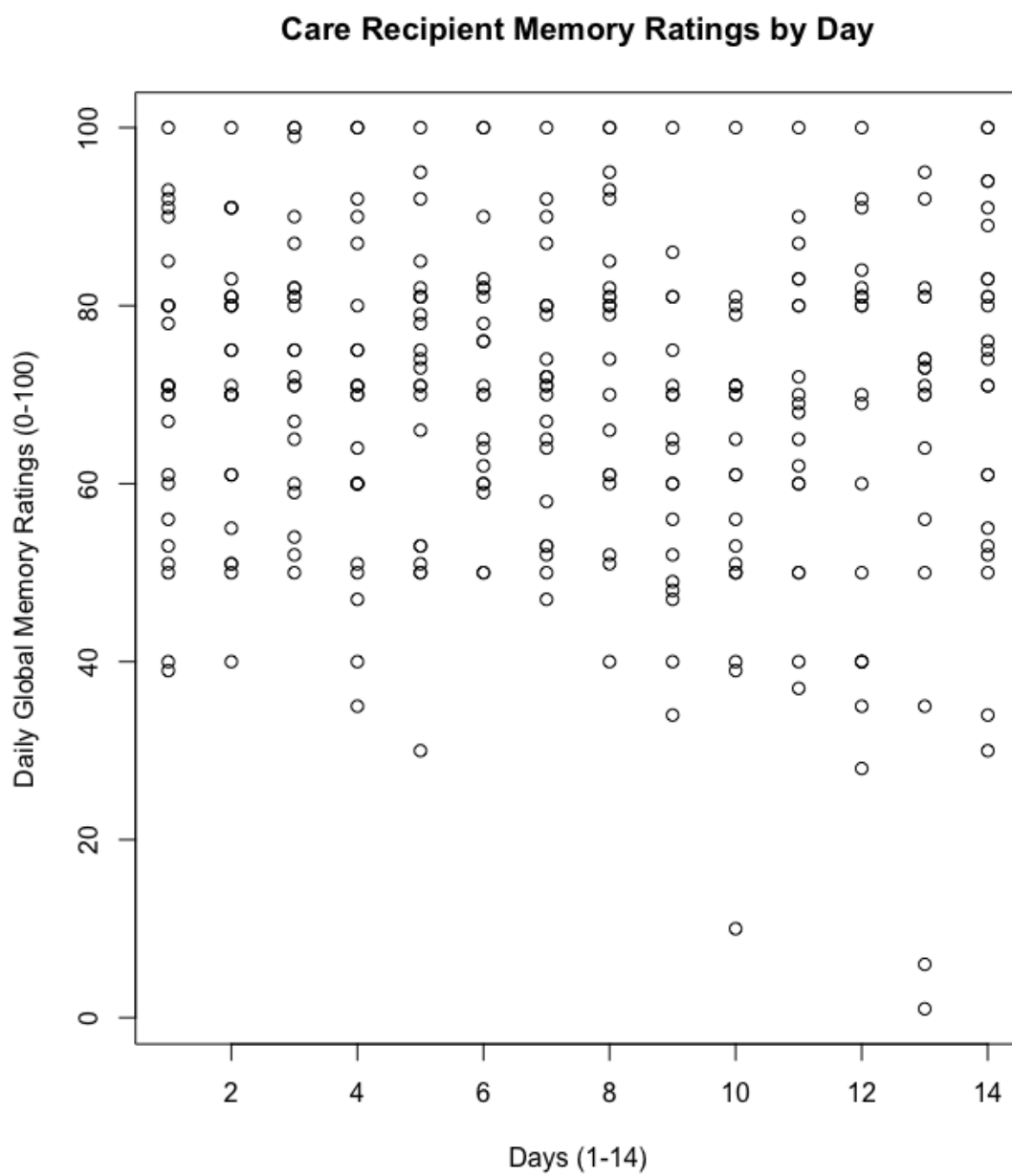


Figure 23. Care Recipient Memory Ratings by Day

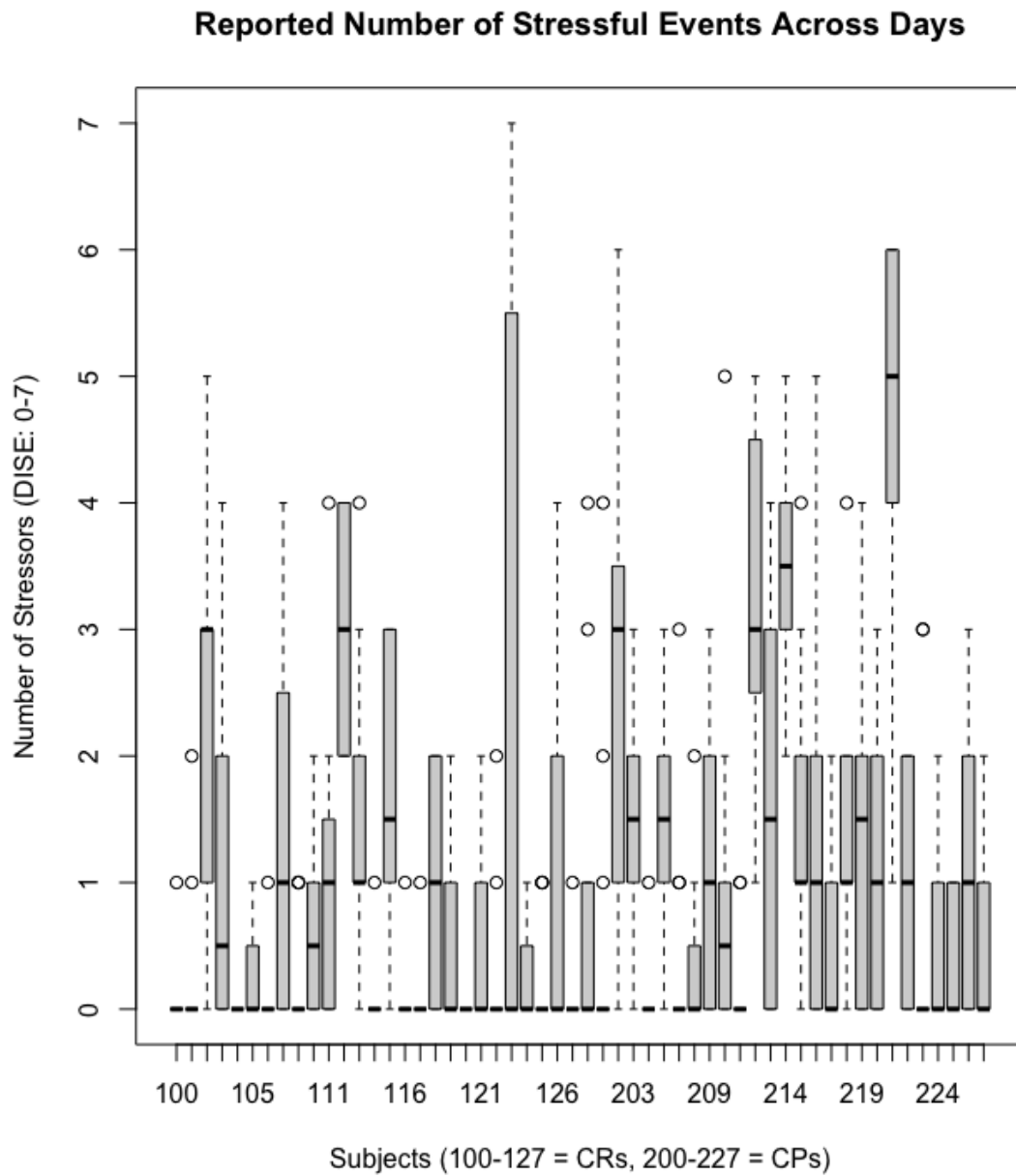


Figure 24. DISE for CRs and CPs Across Days

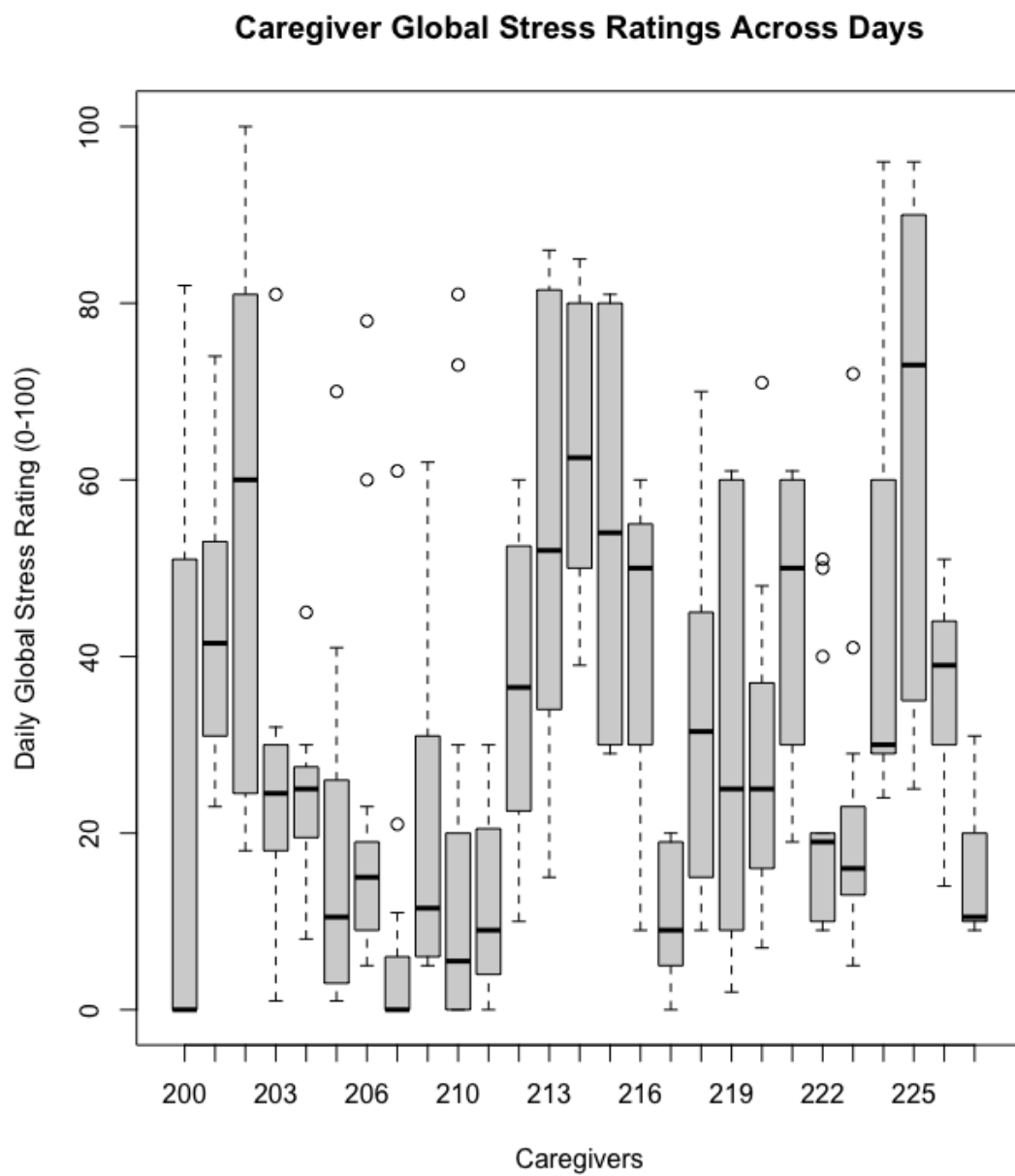


Figure 25. Caregiver Global Stress Ratings Across Days

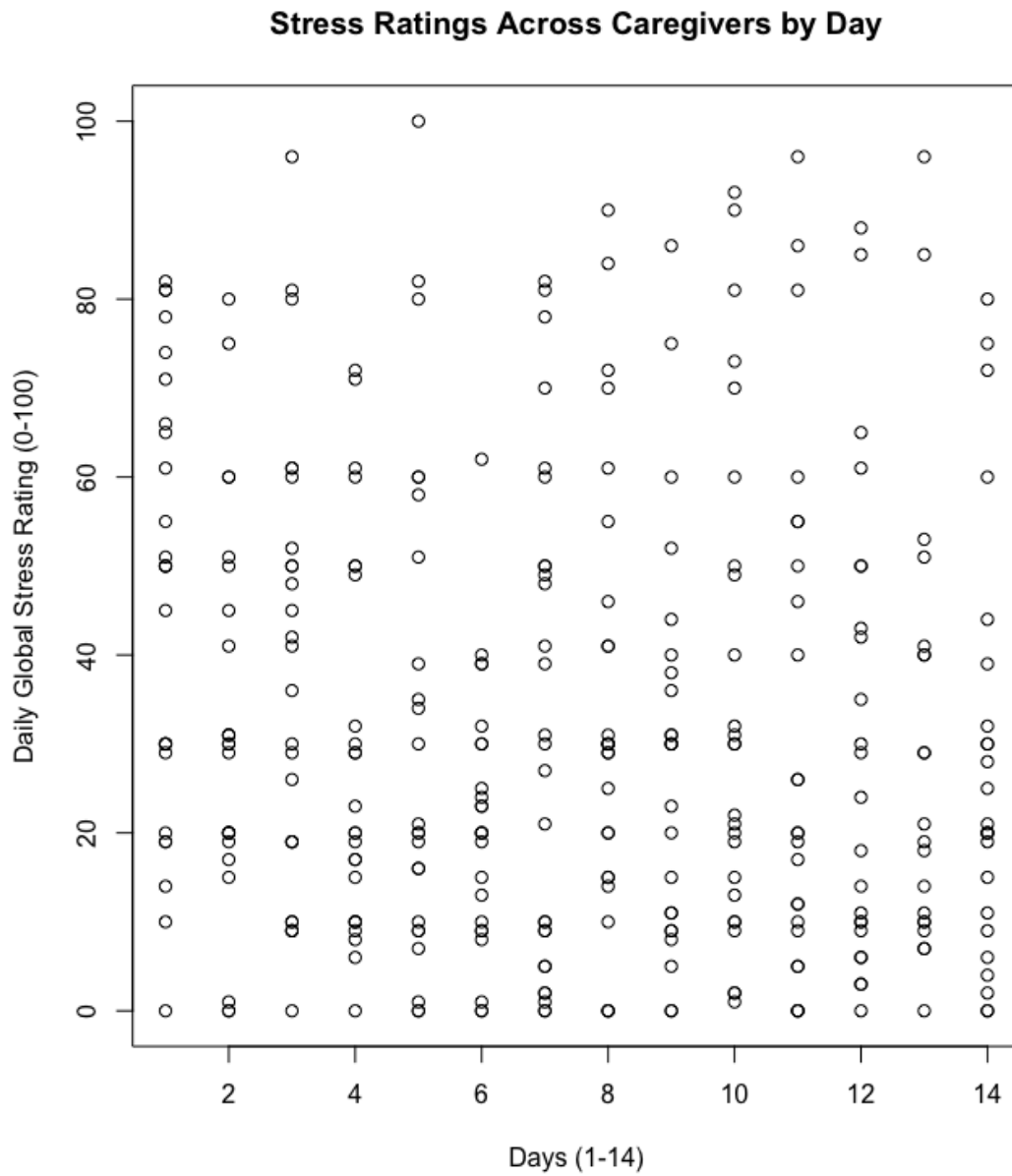


Figure 26. Caregiver Stress Ratings by Day

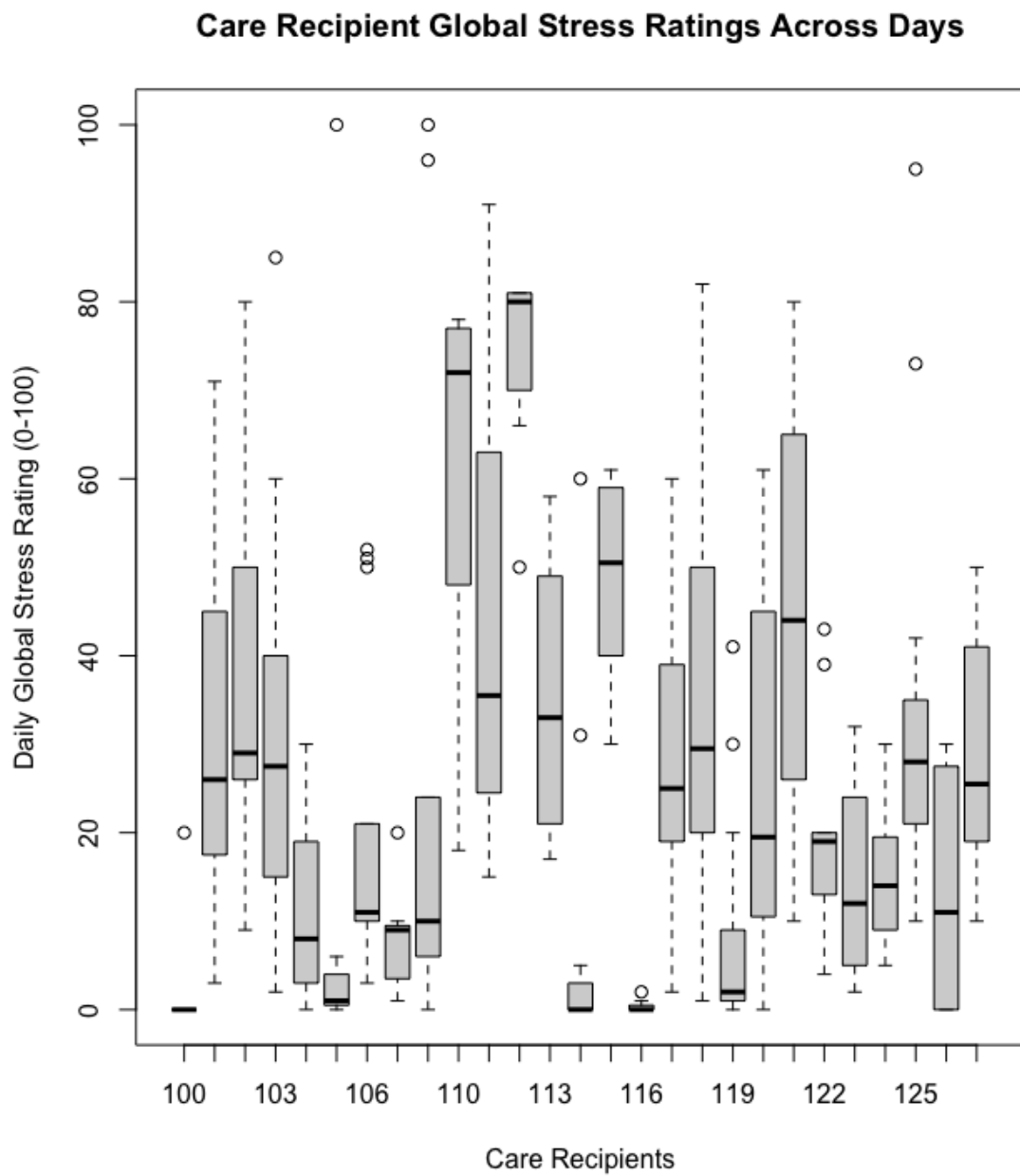


Figure 27. Care Recipient Stress Ratings Across Days

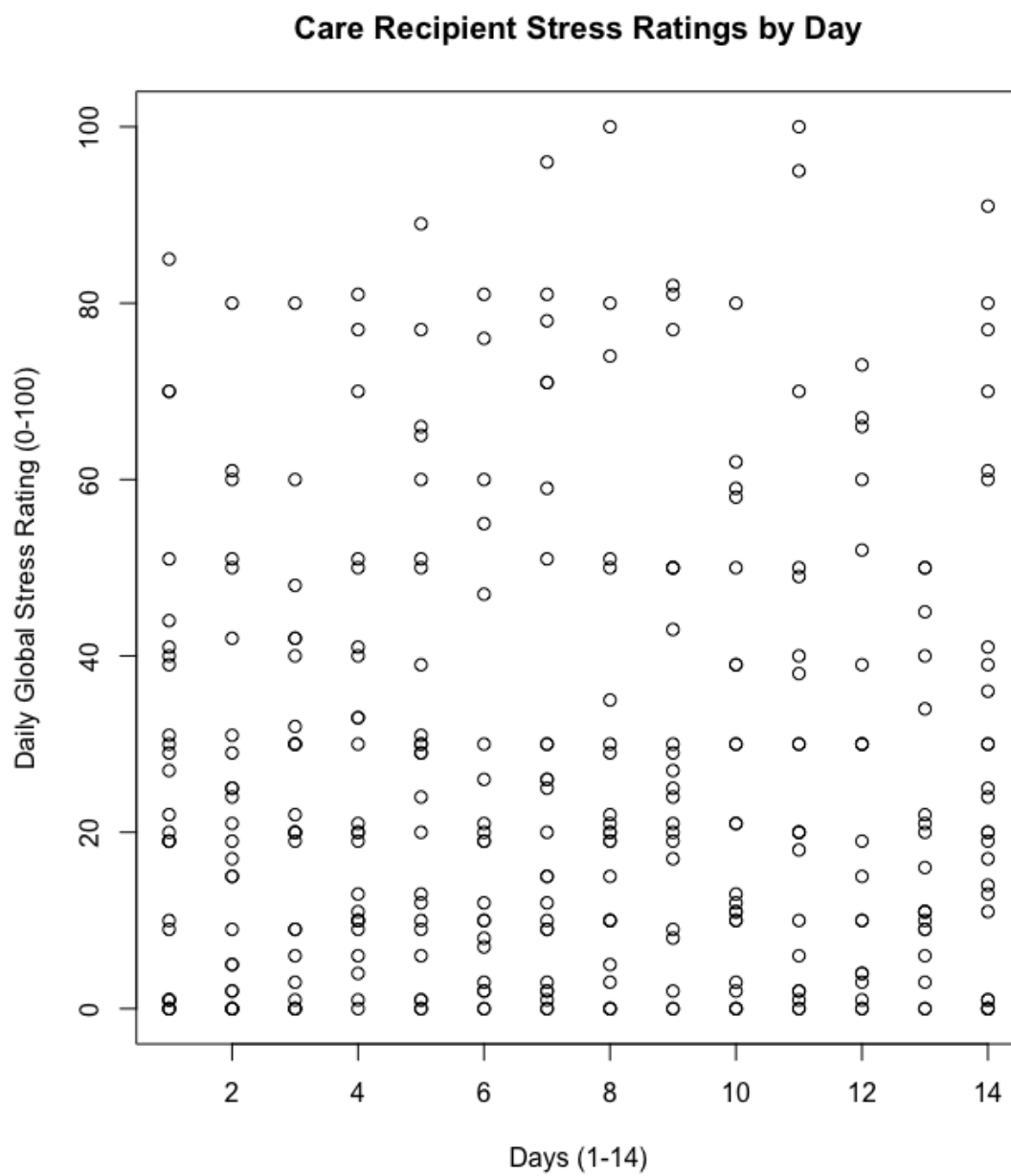


Figure 28. Care Recipient Stress Ratings by Day

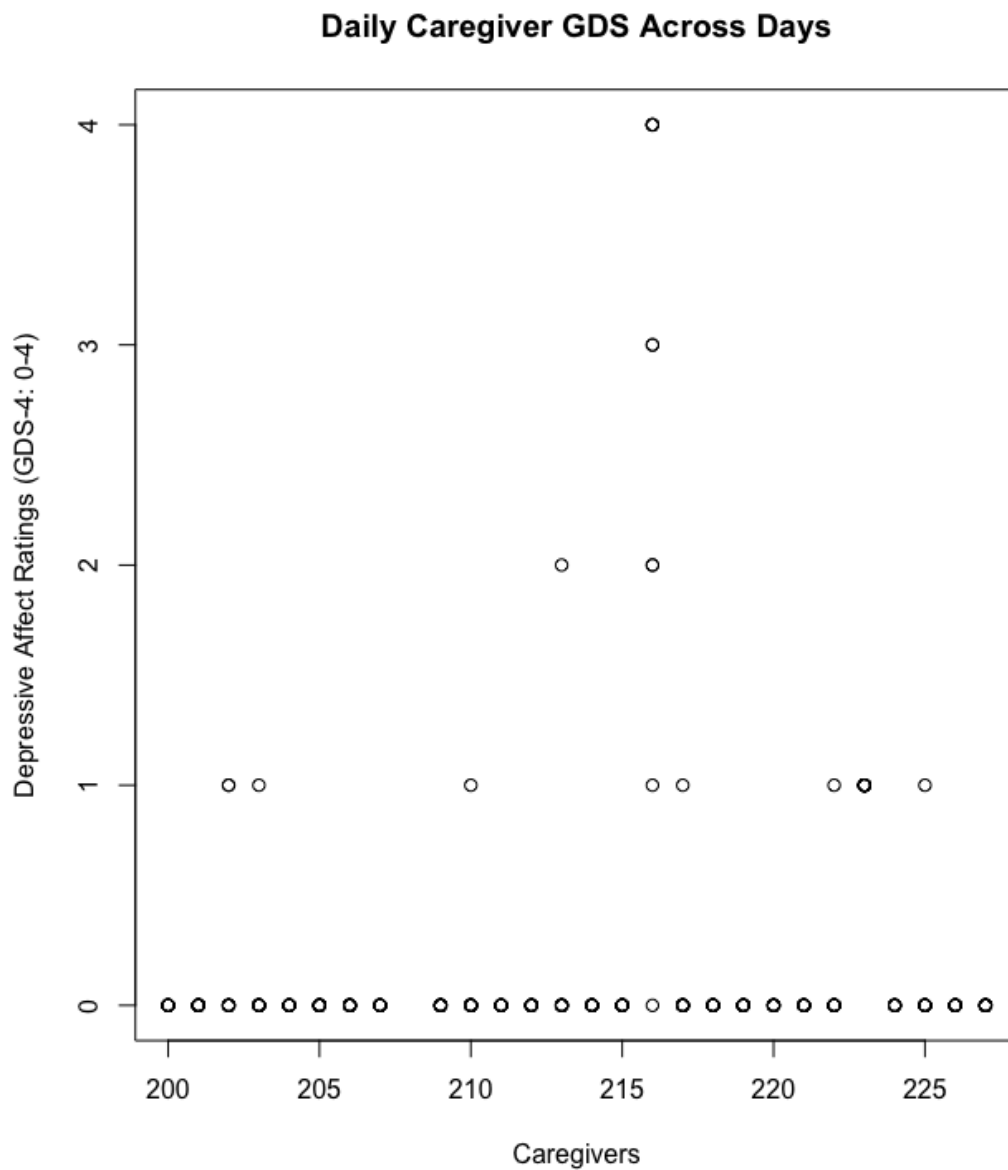


Figure 29. Caregiver Depressive Affect Across Days

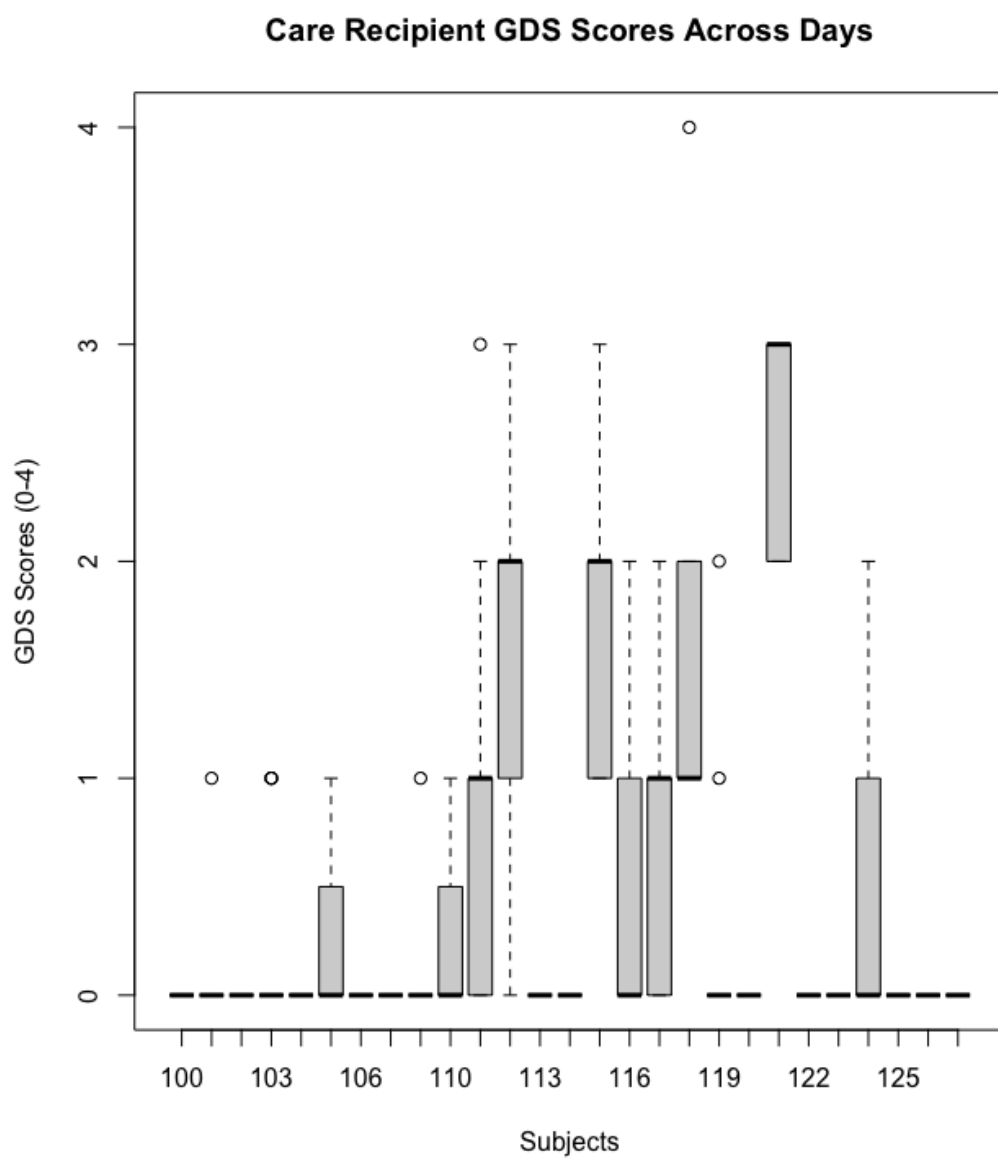


Figure 30. Care Recipient Depressive Affect Across Days

Table 20. Correlation of CR and CP Variables

	CR Sleep	CR Stress	CR Blips	CR Mem	CR GDS	CP Sleep	CP Stress	CP Mutuality	CP Blips	RMBPC	CP Mem	CP DISE	CP GDS	Time CG
CR Sleep	1.000	-0.353	-0.249	0.315	-0.519	0.130	0.087	0.280	-0.244	-0.193	0.267	-0.097	0.088	0.207
CR Stress	-0.353	1.000	0.096	-0.139	0.355	0.026	0.195	-0.387	0.182	0.239	-0.231	0.230	-0.176	-0.089
CR Blips	-0.249	0.096	1.000	-0.205	0.122	-0.041	0.044	-0.021	0.164	0.023	-0.193	-0.022	-0.102	-0.058
CR Mem	0.315	-0.139	-0.205	1.000	-0.201	0.045	-0.057	0.093	-0.084	-0.126	0.231	0.059	0.075	-0.052
CR GDS	-0.519	0.355	0.122	-0.201	1.000	-0.084	0.166	-0.477	0.374	0.251	-0.359	0.295	0.062	-0.144
CP Sleep	0.130	0.026	-0.041	0.045	-0.084	1.000	0.100	0.158	-0.111	-0.068	0.249	-0.011	-0.046	0.131
CP Stress	0.087	0.195	0.044	-0.057	0.166	0.100	1.000	-0.043	0.052	0.413	-0.132	0.476	0.071	0.237
CP Mut	0.280	-0.387	-0.021	0.093	-0.477	0.158	-0.043	1.000	-0.280	-0.214	0.321	-0.266	-0.067	0.194
CP Blips	-0.244	0.182	0.164	-0.084	0.374	-0.111	0.052	-0.280	1.000	0.191	-0.488	0.342	-0.097	-0.071
RMBPC	-0.193	0.239	0.023	-0.126	0.251	-0.068	0.413	-0.214	0.191	1.000	-0.275	0.408	0.207	0.231
CP Mem	0.267	-0.231	-0.193	0.231	-0.359	0.249	-0.132	0.321	-0.488	-0.275	1.000	-0.368	-0.052	0.015
CP DISE	-0.097	0.230	-0.022	0.059	0.295	-0.011	0.476	-0.266	0.342	0.408	-0.368	1.000	0.011	0.090
CP GDS	0.088	-0.176	-0.102	0.075	0.062	-0.046	0.071	-0.067	-0.097	0.207	-0.052	0.011	1.000	-0.012
Time CG	0.207	-0.089	-0.058	-0.052	-0.144	0.131	0.237	0.194	-0.071	0.231	0.015	0.090	-0.012	1.000
CGBD	-0.024	0.066	0.148	-0.102	0.091	0.102	0.496	-0.080	0.021	0.443	-0.094	0.346	0.162	0.287

CR Sleep = CR sleep quality, CR stress = CR global stress, CP Mut= CP mutuality, CR Blips = count of CR blips, CR mem= CR global memory rating, CR GDS= CR GDS-4, CP Sleep = CP sleep quality, CP stress = CP global stress, CPBlips = count of CP blips, CR mem= CR global memory rating, CP DISE= CP DISE Score, CP GDS = CP GDS-4, Time CG= time spent caregiving, CGBD= caregiver burden difficulty ratings

Table 21. Correlation of CP Variables

	CP Sleep	CP Stress	CP Mutuality	CP Blips	RMBPC	CP Mem	CP GDS	TimeCG	CPBD
CP Sleep	1	0.0999	0.1579	-0.1107	-0.0679	0.2492	-0.0463	0.1312	0.1024
CP Stress	0.0999	1	-0.0425	0.0522	0.4128	-0.1322	0.0713	0.2366	0.4963
CP Mut	0.1579	-0.0425	1	-0.2798	-0.2137	0.3214	-0.0668	0.1940	-0.0801
CP Blips	0.1107	0.0522	-0.2798	1	0.1913	-0.4879	-0.0970	-0.0709	0.0210
RMBPC	0.0679	0.4128	-0.2137	0.1913	1	-0.2753	0.2075	0.2311	0.4429
CP Mem	0.2492	-0.1322	0.3215	-0.4879	-0.2753	1	-0.0518	0.0155	-0.0943
CP GDS	0.0463	0.0713	-0.0668	-0.0970	0.2075	-0.0518	1	-0.0117	0.1625
TimeCG	0.1312	0.2366	0.1939	-0.0709	0.2311	0.0155	-0.0117	1	0.2871
CGBD	0.1024	0.4963	-0.0801	0.0210	0.4429	-0.0943	0.1625	0.2871	1

CP Sleep = CP sleep quality, CP stress = CP global stress, CP Mutuality = CP mutuality score, CP Blips = count of CP blips, RMBPC = caregiver ratings of their partners problematic behaviors related to cognitive impairment (RMBPC), CP GDS = CP GDS-4, TimeCG= time spent caregiving, CPBD= caregiver burden difficulty ratings

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