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Authors

Liu, Yin
Johnson, Florence
Lei, Lianlian
et al.

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Characteristics and Predictors of Sleep Among Spousal Care Dyads Living With Chronic Conditions

Yin Liu, PhD,[1], **Yeonsu Song, PhD, RN,[2],** **Florence U. Johnson, MSN, MHA,[3]** **Lianlian Lei, PhD,[4],** **Seung-won Emily Choi, PhD,[5]** **Toni C. Antonucci, PhD,[6],** and **Sheria G. Robinson-Lane, PhD, RN[3],*,**

[1]Department of Human Development and Family Studies, Utah State University, Logan, Utah, USA. [2]School of Nursing, University of California Los Angeles, California, Los Angeles, USA. [3]Department of Systems, Populations, and Leadership, School of Nursing, University of Michigan, Ann Arbor, Michigan, USA. [4]Department of Psychiatry, Michigan Medicine, University of Michigan, Ann Arbor, Michigan, USA. [5]Department of Sociology, Anthropology, and Social Work, Texas Tech University, Lubbock, Texas, USA. [6]Department of Psychology, University of Michigan, Ann Arbor, Michigan, USA.

*Address correspondence to: Sheria G. Robinson-Lane, PhD, RN, Department of Systems, Populations, and Leadership, School of Nursing, University of Michigan, 400 N Ingalls, Rm 4341, Ann Arbor, MI 48109, USA. E-mail: grices@umich.edu

Abstract

Objectives: Poor sleep is common among older adults with chronic health conditions and their spousal caregivers. However, dyadic sleep patterns among spouses are underexplored within the literature. This study examines dyadic sleep characteristics and associated contextual factors among spousal care dyads.

Methods: Participants included 462 older adult spousal care dyads from the 2015 National Health and Aging Trends Study and National Study of Caregiving (mean ages of care recipients/caregivers = 79 and 76 years, respectively; 22% of dyads were living with dementia). Self-reported sleep included frequency of (a) trouble falling back asleep among dyads, (b) care-related sleep disturbances among caregivers, and (c) trouble initiating sleep among care recipients. Predictors included between-dyad characteristics such as whether respondents had dementia, care burden and support, relationship quality, neighborhood cohesion, and within-dyad characteristics such as demographics, depression, and positive affect. We conducted multilevel dyadic analysis and actor–partner interdependence modeling.

Results: Sleep was correlated more among dyads living with dementia than those with other chronic conditions. Care dyads had poorer sleep if caregivers reported higher care burden; however, better relationship quality marginally ameliorated the association. Depressive symptoms had a partner effect on poorer sleep among care dyads, whereas positive emotions and older age only had an actor effect on better sleep for care recipients and spousal caregivers. Neighborhood cohesion, care support, and other demographic characteristics were not associated with dyadic sleep outcomes.

Discussion: Addressing both care recipient- and caregiver-related factors may improve sleep health for both members of the care dyad living with chronic conditions.

Keywords: Alzheimer's disease, Caregiving, Depression, Health outcomes, Marriage

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Poor sleep, characterized by difficulty falling asleep, multiple awakenings during sleep, and early morning awakenings, is common among older adults with

chronic health conditions ([Bonanni et al., 2005](); [Moran et al., 2005](); [Tractenberg et al., 2006]()). Unsurprisingly, poor sleep is also a common health issue among family

caregivers—particularly spouses providing dementia care who also bedshare (Liu et al., 2021; Peng et al., 2019). Spousal caregivers may awaken during the night due to caregiving tasks or dementia-related behaviors (Creese et al., 2008; Gibson et al., 2014; Song et al., 2018), which may make it difficult to return to sleep and/or lead to early morning awakenings—core symptoms of clinical insomnia disorder. Insomnia in spousal caregivers may result in higher care burden and acceleration of age-related normative changes in overall physical functioning and sleep health (Pinquart & Sörensen, 2011; Robinson et al., 2005). Ultimately, poor sleep among family caregivers can negatively affect ability to provide care, which may lead to early institutionalization for care recipients (Gaugler et al., 2009; Yaffe et al., 2002). Spousal dyad sleep health is an important target symptom requiring attention.

Various factors contribute to poor sleep within care dyads. However, the literature has primarily emphasized factors and outcomes at the individual level. The social–ecological model of sleep describes factors affecting poor sleep at three levels: individual, social, and societal (Grandner, 2020). The individual level is embedded within the social level and includes dyadic relationships (see Figure 1). In addition to known individual-level factors such as health conditions (e.g., dementia), older age, being female, minoritized race/ethnicity, and lower socioeconomic status (Grandner et al., 2016), dyadic-level characteristics, such as relationship quality and care burden, can affect sleep for care recipients and caregivers (Troxel et al., 2007). Care burden and relationship quality both have strong theoretical and empirical historical basis in family caregiving research.

For instance, the stress process model posits that care burden is associated with compromised well-being in caregivers (Pearlin et al., 1990); however, some coping strategies

caregivers use to manage care burden can negatively affect care recipients' health and well-being—including dementia progression (Tschanz et al., 2013). Interestingly, cognitive and functional decline among care recipients with dementia has also been associated with dyadic closeness (Norton et al., 2009), and caregivers who report poorer relationship quality are at greatest risk of care burden (Lea Steadman et al., 2007). Although relationship quality and care burden are important for dyadic well-being, few studies have examined these relationships dyadically—particularly how they may affect sleep.

Additionally, these individual-, social-, and dyadic-level factors are further embedded within the societal level, which includes neighborhood characteristics and the care support environment. Neighborhood cohesion influences sleep by creating support networks, trust, and community spirit, increasing perceived safety, and reinforcement of local social norms (e.g., not staying up late at night; Alhasan et al., 2020; Billings et al., 2020). Care support and social engagement (i.e., service use, emotional support) are also associated with better sleep among caregivers (Lee et al., 2007; Liang et al., 2020).

It is unclear how these individual, dyadic, social, and societal factors may influence dyadic sleep patterns. The few studies that have explored spousal sleep patterns dyadically have had small sample sizes or targeted couples in clinical settings (Chen, 2017; Elsey et al., 2019; Gunn et al., 2015, 2021; Hasler & Troxel, 2010). By using a national sample to examine the dyadic sleep patterns between older adults with chronic health conditions and their family caregivers, a better understanding of the factors related to poor sleep in both members of spousal care dyads may be developed along with targeted interventions designed to improve family sleep health.

The Current Study

This study aimed to examine the dyadic sleep patterns of older adults with chronic health conditions and their spousal caregivers, and to explore the contextual factors that may influence dyadic sleep outcomes. Based on the known differences in the caregiving demands and caregiver distress between general caregiving versus dementia caregiving populations (Pinquart & Sörensen, 2007), we hypothesized that sleep would be more correlated among care dyads living with dementia than those with other chronic conditions (*H1*). Based on prior findings about how care burden can affect care dyads' well-being, we hypothesized that care dyads would have poorer sleep if the caregiver reported higher care burden (*H2.1*). As sleep disturbance is more prevalent in dementia, we also hypothesized that care dyads living with dementia would have poorer sleep than those with other chronic conditions (*H2.2*). In addition, based on the social–ecological model of sleep, we hypothesized that care dyads living in a less cohesive neighborhood, having caregivers reporting lower care support
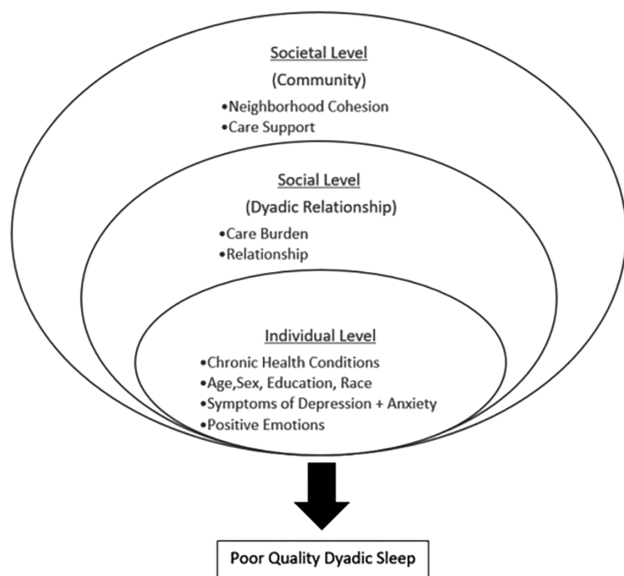

Figure 1. Conceptual model of dyadic sleep and contextual factors.

and poorer relationship quality, would have poorer sleep (*H2.3*). Further, based on prior findings about how relationship quality relates to varying levels of well-being among care dyads, we hypothesized that better relationship quality would moderate the effect of high care burden on poor sleep among care dyads regardless of chronic conditions (*H3*). Finally, we examined how within-dyad and individual characteristics may affect dyadic sleep outcomes based on the actor–partner interdependence models (APIM).

Method

Data and Study Population

This cross-sectional study used data from the 2015 National Health and Aging Trends Study (NHATS) and National Study of Caregiving (NSOC), national surveys of older adults and their caregivers in the United States (Freedman et al., 2019; Kasper & Freedman, 2020). The NHATS aims to collect data to reduce disability, maximize functioning and other health outcomes, and enhance the quality of life among older adults (Freedman & Kasper, 2019). Participants were eligible for NHATS if they were Medicare beneficiaries aged 65 and older and lived in the contiguous United States. Participants were asked to answer questions regarding their physical and cognitive capacity, health, and well-being. A proxy respondent (generally a family caregiver) was interviewed when participants were unable to do so because of dementia or other serious illness.

The NSOC is a supplement of NHATS that surveys caregivers of NHATS participants who received assistance with self-care, mobility, household activities, transportation, or medical care from at least one unpaid family caregiver. The NSOC collects detailed information regarding activities for which help was provided, duration and intensity of help, support services, effects on caregivers, and health and well-being of caregivers. Of the 8,334 NHATS respondents in 2015, 1,458 had at least one caregiver complete the NSOC, with a total of 2,204 caregivers interviewed. Only NHATS respondents and their spousal caregivers who lived in the same household in the community setting were included in this study. The final analytic sample consisted of 462 spousal care dyads.

Measures

Dyadic sleep outcomes
Both older adults with chronic conditions and their caregivers answered a single-item question related to frequency of trouble falling back asleep ("In the last month, on nights when you woke up before you wanted to get up, how often did you have trouble falling back asleep?") Responses were provided using a 5-point Likert scale, ranging from 1 (*every night*) to 5 (*never*), with higher scores suggesting

less frequent trouble and better sleep. In addition, we created a composite variable of *insomnia symptoms* by combining the above single-item sleep question with two additional sleep items rated by each member of the dyads. They included frequency of trouble initiating sleep among care recipients ("In the last month, how often did it take more than 30 min to fall asleep?") and frequency of interrupted sleep due to providing care to a spouse ("In the last month, how often did helping the patient cause your sleep to be interrupted?"). Responses to these questions used the same 5-point Likert scale, ranging from 1 (*every night*) to 5 (*never*), with higher scores suggesting fewer insomnia symptoms and better sleep. We calculated the average scores based on the two sleep items for care recipients ($\alpha = 0.68$) and caregivers ($\alpha = 0.21$). The scores proxied the level of insomnia symptoms, with higher scores suggesting less severe symptoms and better sleep.

Dementia and chronic health conditions
Care recipients were deemed to have probable dementia if they met any of the following criteria: (a) having ≤ 1.5 standard deviations (*SD*s) below mean in at least two domains of cognitive tests: memory (e.g., immediate and delayed 10-word recall), orientation (e.g., date, month, year, and day of the week, naming the President and Vice President), and executive function (e.g., clock drawing test), (b) having a score of 2 or higher on the AD8 Dementia Screening Interview (Galvin et al., 2005) administered to proxy respondents, or (c) having self- or proxy report of a diagnosis of dementia or Alzheimer's disease (Kasper et al., 2013). Other chronic conditions were self- or proxy-reported, including physician-diagnosed conditions and/or serious difficulty hearing and seeing.

Predictors of between-dyad characteristics
We examined four contextual factors reported by either care recipients or the caregivers, including caregiving burden, neighborhood cohesion, care support, and relationship quality.

Four items measured *care burden* ($\alpha = 0.67$) evaluating if (1) *caregivers were exhausted when going to bed at night*, (2) *caregivers had more things to do than they could handle*, (3) *caregivers did not have time for themselves*, and (4) *as soon as a routine gets going, the patient's needs change*. Caregivers responded on a 3-point Likert scale ranging from 1 = *very* to 3 = *not so much*. We reverse-coded each item and calculated the scale score as the mean, with higher scores suggesting greater caregiving burden.

Three items measured neighborhood cohesion ($\alpha = 0.73$), evaluating how community members (1) *know each other very well*, (2) *are willing to help each other*, and (3) *can be trusted*. Care recipient self- or proxy-reported on a 3-point Likert scale ranging from 1 = *agree a lot* to 3 = *do not agree*. We reverse-coded each item and calculated the scale score as the mean, with higher scores suggesting better neighborhood cohesion.

Care support was measured by the sum of seven items reported by caregivers (α = 0.54). These dichotomous items asked caregivers *whether caregivers had friends or family to talk about important things in life and helped with their daily activities; helped care for a spouse; and in the last year, had gone to a support group for people who gave care; used any service, received any training or found financial help to help take care of the patient*. We calculated the scale score as the sum, with higher scores suggesting better care support.

Four items measured relationship quality (α = 0.63), asking caregivers (1) *how much they enjoyed being with* the care recipient, how much the care recipient (2) *argued with them*, (3) *appreciated what they did for them*, and (4) *got on their nerves*. Caregivers responded on a 4-point Likert scale, ranging from 1 = *a lot* to 4 = *not at all*, coded with higher scores suggesting better relationship quality.

Predictors of within-dyad characteristics

We examined demographic characteristics, depressive symptoms, and positive emotions assessed for each member of the care dyads.

Demographic characteristics included care recipient and caregiver biological age, sex, education, and whether one was non-Hispanic White or non-Hispanic Black.

Symptoms of depression and anxiety were measured by the Patient Health Questionnaire-4 (Kroenke et al., 2009; α = 0.74 for care recipients and 0.70 for caregivers). It asked the frequency of four symptoms that occurred over the past month (1) *had little interest or pleasure in doing things*, (2) *felt down*, *depressed*, or *hopeless*, (3) *felt nervous, anxious, or on edge*, and (4) *been unable to stop or control worrying*. Responses ranged from *not at all* (= 1) to *nearly every day* (= 4), with higher scores suggesting more severe symptoms.

Positive emotions were measured by four items (α = 0.68 for care recipients and 0.64 for caregivers) asking both care recipients and their spousal caregivers how often they felt cheerful, bored, full of life, and upset over the last month (Freedman et al., 2014). Responses were scored on a 5-point Likert scale, ranging from 1 = *every day* to 5 = *never*. We reverse-coded the positive items and calculated the scale score as the mean, with higher scores suggesting higher positive emotions.

Analytical Strategy

Preliminary descriptive analyses were conducted for demographic characteristics and all study variables for care dyads. To examine *H1*, we fit empty multilevel models (i.e., without any predictors) with dyadic sleep outcomes measured for both care recipients and spousal caregivers living with dementia versus other chronic health conditions to examine intraclass correlations in dyadic sleep (*Model 0*). Then, we added predictors of between-dyad characteristics to the empty model to examine the second hypothesis. Specifically, to examine *H2.1*, we fit models with

care burden as a predictor (*Model 1*); to examine *H2.2*, we added dementia in *Model 1* as an additional predictor (*Model 2*); to examine *H2.3*, we added in *Model 2* the following variables as other predictors: neighborhood cohesion, care support, and relationship quality (*Model 3*). To examine *H3*, we added in *Model 3* the interaction term relationship quality × care burden (*Model 4*).

Further, we explored the actor and partner effects of within-dyad demographic characteristics (i.e., individual age, sex, education, race) and emotional well-being (i.e., individual symptoms of depression and anxiety, and positive emotions) on dyadic sleep outcomes. We implemented the APIM using a multilevel modeling framework in SAS (version 9.4), and Supplementary Figure 1 illustrates the general form of the model. These models allow testing simultaneously the effects of the care recipients' characteristics on their own sleep outcomes and the effect of their characteristics on the caregiver sleep outcomes and vice versa. These models also account for the intercorrelation among care dyads for predictors and outcomes. All models were estimated using maximum likelihood estimation, allowing care recipients to be included even when caregiver information was missing. These individuals contributed information to the analysis of actor effects in the models. Separate models fit each combination of the six predictors and two outcomes resulting in 12 models. For these statistical tests, $p < .05$ was considered statistically significant.

Results

Participant Characteristics

Care recipient and caregiver characteristics are presented in Table 1. Care recipient and caregiver mean ages were 78.59 years (*SD* = 7.22, ranging from 65 to 99) and 75.77 years (*SD* = 8.82, ranging from 43 to 97), respectively. More than half of the care recipients were men. Both care recipients (77%) and caregivers (73%) were predominantly non-Hispanic White. Most dyads (72%) were non-Hispanic White, whereas 17% had both spouses being non-Hispanic Black. Most care recipients and spousal caregivers graduated from high school (19% vs 31%, respectively), followed by those who graduated from college and beyond (12% vs 29%, respectively). Among 462 spousal care dyads, 22% (*n* = 103) lived with dementia. Nine percent of the participants (*n* = 43) had proxy reports on behalf of them; among these proxy reports, 74% (*n* = 32) was because of dementia, and the rest were due to other illnesses or limitations such as cardiovascular problems, diabetes, cancer, speech or hearing impairment, or language barriers. About 93% (*n* = 429) of the care recipients lived in the community, and 7% (*n* = 33) in assisted living or other facilities. About half of the care recipients had trouble falling back asleep (51%), among whom 53% had spouses who were also having trouble falling back

Table 1. Characteristics of Spousal Care Dyads (*N* = 462)

	Care recipient			Caregiver		
	Mean or (Freq)	SD or (%)	Range	Mean or (Freq)	SD or (%)	Range
Age (years)	78.59	7.22	65–99	75.77	8.82	43–97
Female	(196)	(42.42)		(269)	(58.23)	
Race and Hispanic ethnicity						
White, non-Hispanic	(355)	(76.84)		(335)	(72.51)	
Black, non-Hispanic	(85)	(18.40)		(84)	(18.18)	
Other (American Indian, Asian, Native Hawaiian,	(12)	(2.60)		(15)	(3.25)	
Pacific Islander, Other), non-Hispanic						
Hispanic	(9)	(1.95)		(15)	(3.25)	
More than one				(9)	(1.95)	
Don't know and refused	(1)	(0.22)		(4)	(0.87)	
Education levels (recoded)	1.75	1.06	1–4	2.63	1.08	1–4
Grade school (no diploma)	(275)	(59.52)		(82)	(17.75)	
High school graduate (HS diploma or equivalent)	(86)	(18.61)		(141)	(30.52)	
Vocational and some college	(44)	(9.52)		(106)	(22.94)	
College graduate and professional degree	(57)	(12.34)		(133)	(28.79)	
Chronic health conditions						
Probable dementia	(103)	(22.34)		NA		
Possible dementia	(55)	(11.93)		NA		
Other chronic conditions	NA	NA	0–1	NA	NA	0–1
Heart attack	(57)	(12.36)		(81)	(17.69)	
Heart disease	(130)	(28.20)		(62)	(13.57)	
Hypertension	(363)	(78.57)		(288)	(62.75)	
Arthritis	(329)	(71.21)		(248)	(54.03)	
Osteoporosis	(110)	(23.86)		(97)	(21.23)	
Diabetes	(177)	(38.31)		(116)	(25.33)	
Lung disease	(106)	(22.94)		(82)	(17.86)	
Cancer	(77)	(16.67)		(107)	(23.41)	
Hearing impairment (used hearing aid)	(90)	(19.48)		(98)	(21.35)	
Sight impairment (trouble seeing across the street)	(400)	(89.69)		(45)	(9.80)	
Sleep last month						
Trouble falling back asleep	3.51	1.17	1–5	3.40	1.05	1–5
Insomnia symptoms[a]	3.46	1.08	1–5	3.75	0.77	1–5
Care burden[b]	NA	NA	NA	1.59	0.53	1–3
Care support[c] (sum of seven binary indicators)	NA	NA	NA	1.95	1.33	0–6
Neighborhood cohesion[d]	2.38	0.58	1–3	NA	NA	
Relationship quality[e]	NA	NA	NA	3.29	0.51	1–4
Symptoms of depression/anxiety last month[f]	1.63	0.67	1–4	1.56	0.59	1–4
Positive emotions last month[g]	3.77	0.67	1–5	3.79	0.66	1–5

Notes: SD = standard deviation.

[a]Insomnia symptoms were measured by the mean of two items. For care recipients, these items took more than 30 min to fall asleep and the frequency of trouble falling back asleep; for caregivers, these items were interrupted sleep because of caregiving and frequency of trouble falling back asleep.

[b]Care burden was self-reported by caregivers only; response range was 1 = *very much*, 2 = *somewhat*, 3 = *not so much*; the scale score was the mean coded so that higher scores suggested greater burden.

[c]Care support was the sum of seven items (1 = *yes*, 0 = *no*), including whether caregivers have friends or family to talk about important things in your life; help with your daily activities, such as running errands, or helping you with things around the house; help care for care recipient; and in the last year, have gone to a support group for people who give care; used any service that took care of the care recipient so that you could take some time away from helping; received any training to help you take care of the care recipient; found financial help for the care recipient, including helping him/her apply for Medicaid.

[d]Neighborhood cohesion was self-reported by the care recipient only; response range was 1 = *agree a lot*, 2 = *agree a little*, 3 = *do not agree*; each item was reverse-coded and the scale score was the mean coded so that higher scores suggested better cohesion.

[e]Relationship quality item response range was 1 = *a lot*, 2 = *some*, 3 = *a little*, 4 = *not at all*; positive items were reverse-coded and the scale score was the mean coded so that higher scores suggested better quality.

[f]Symptoms of depression and anxiety response range was 1 = *not at all*, 2 = *several days*, 3 = *more than half the days*, 4 = *nearly every day*; the scale score was the mean coded so that higher scores suggested more depressive symptoms.

[g]Positive emotion items response range was 1 = *every day*, 2 = *most days*, 3 = *some days*, 4 = *rarely*, or 5 = *never*; positive items were reverse-coded and the scale score was the mean coded so that higher scores suggested better positive affect/mood.

asleep. Slightly more than half of the care recipients also had difficulty initiating sleep (57%), among whom 28% had spouses who were also having disrupted sleep because of providing care.

Hypothesis Testing on Dyadic Sleep and Associated Between-Dyad Factors

For *H1*, the extent of raw intraclass correlations of trouble falling back asleep and insomnia symptoms was larger among care dyads living with dementia (i.e., 0.062 and 0.123, respectively) than those living with other chronic health conditions (i.e., 0.025 and 0.043, respectively). The findings (presented in Table 2) supported *H1* and suggested that care recipient and caregiver sleep was more similar and correlated among dementia care dyads than those living with other chronic conditions.

Main-Effect Associations With Dyadic Sleep

For *H2*, findings from *Models 1–3* in Table 3 suggested that higher care burden was associated with poorer dyadic sleep, in terms of more frequent trouble falling back asleep (β = –0.292, standard error [*SE*] = 0.069, *p* < .001) and more insomnia symptoms (β = –0.334, *SE* = 0.058, *p* < .001) for both care recipients and caregivers within care dyads. However, dementia status and other between-dyad characteristics (i.e., neighborhood cohesion, care support, and relationship quality) did not have any main-effect associations with dyadic sleep outcomes (Models 2 and 3).

For *H3*, the interaction term between relationship quality and care burden in *Model 4* was marginally significant. Specifically, relationship quality marginally moderated the association between caregiving burden and dyadic frequency of trouble falling back asleep (β = –0.232, *SE* = 0.133, *p* = .083). As illustrated in Figure 2, better relationship quality was protective against less frequent trouble falling back asleep among care dyads but only when the care burden was low; when the care burden was high, better relationship quality was associated with more frequent trouble falling back asleep dyadically.

The Actor and Partner Effects of the Within-Dyad Characteristics on Dyadic Sleep

We built multilevel APIM to explore how within-dyad and individual demographic characteristics, symptoms of depression and anxiety, and positive emotions were associated with dyadic sleep outcomes. Models were created sequentially by adding one of the following predictors (measured for both care recipients and the spousal caregivers) into *Model 4*: biological age, sex, education, race, depressive symptoms, and finally, positive affect (Supplementary Figure 1).

Findings from these APIM suggested that biological age had an actor effect (but no partner effect), so that older age was associated with more frequent trouble falling back asleep (β = –0.019, *SE* = 0.006, *p* = .001) as well as having more insomnia symptoms (β = –0.010, *SE* = 0.005, *p* = .036) for individual care recipients and caregivers themselves. Sex, education, or race were not significantly associated with any dyadic sleep outcomes. Further, symptoms of depression and anxiety had both actor and partner effects on the two dyadic sleep outcomes. Specifically, worse symptoms of depression and anxiety were associated with more frequent trouble falling back asleep and more insomnia symptoms for oneself (β = –0.465, *SE* = 0.060, *p* < .001 and β = –0.460, *SE* = 0.050, *p* = .001, respectively) as well as for their spousal caregivers (β = –0.127, *SE* = 0.060, *p* < .001 and β = –0.105, *SE* = 0.050, *p* = .038, respectively). Finally, higher positive emotions had an actor effect (but no partner effect), such that more positive emotion was associated with less frequent trouble falling back asleep (β = 0.211, *SE* = 0.072, *p* = .003) as well as having fewer insomnia symptoms (β = 0.277, *SE* = 0.059, *p* < .001) for care recipients and caregivers themselves.

Discussion

Utilizing a national sample, we examined the critical sleep characteristics of older adults with chronic health conditions and their spousal caregivers. Specifically, we examined the contextual factors of dyadic sleep outcomes at the individual, dyadic, social, and societal levels to inform future evidence-based interventions designed to promote

Table 2. Intraclass Correlation in Dyadic Sleep Outcomes (Model 0 for H1)

	Frequency in trouble falling back asleep	Insomnia symptoms
Dementia care dyads	0.062	0.123
Nondementia care dyads	0.025	0.043
All care dyads	0.034	0.062

Notes: Frequency in trouble falling back asleep was measured by the single item "In the last month, on nights when you woke up before you wanted to get up, how often did you have trouble falling back asleep?" for care recipients and their spousal caregivers. Insomnia symptoms were measured by two items in addition to the aforementioned single item; for care recipients, they were "In the last month, how often did it take more than 30 min to fall asleep?" and "In the last month, on nights when you woke up before you wanted to get up, how often did you have trouble falling back asleep?"; for spousal caregivers, they were "In the last month, how often did it take more than 30 min to fall asleep?" and "In the last month, on nights when you woke up before you wanted to get up, how often did you have trouble falling back asleep?"

Table 3. Dyadic-Level Characteristics and Associations With Dyadic Sleep Outcomes (Models 1–4 for H2–3)

	Model 1	Model 2	Model 3	Model 4
	Est (*SE*)	Est (*SE*)	Est (*SE*)	Est (*SE*)
Frequency of trouble falling back asleep				
Fixed effect				
Intercept	3.918 (0.115)***	3.927 (0.115)***	3.264 (0.335)***	2.026 (0.787)**
Caregiving burden	–0.292 (0.069)***	–0.310 (0.070)***	–0.283 (0.073)***	0.457 (0.432)
Dementia		0.100 (0.090)	0.107 (0.091)	0.093 (0.091)
Neighborhood cohesion			0.085 (0.064)	0.088 (0.064)
Care support			0.021 (0.028)	0.025 (0.028)
Relationship quality			0.114 (0.077)	0.492 (0.231)*
Care burden × relationship quality				–0.232 (0.133)†
Random effect				
Compound symmetry	0.018 (0.057)	0.017 (0.057)	0.017 (0.057)	0.014 (0.057)
Residual	1.203 (0.080)***	1.205 (0.080)***	1.200 (0.080)***	1.200 (0.080)***
–2 log likelihood	2,785.4	2,782.4	2,775.4	2,774.6
AIC; BIC	2,789.4; 2,797.6	2,786.4; 2,794.7	2,779.4; 2,787.6	2,778.6; 2,786.8
Insomnia symptoms				
Fixed effect				
Intercept	4.132 (0.098)***	4.140 (0.098)***	3.693 (0.285)***	3.075 (0.670)***
Caregiving burden	–0.334 (0.058)***	–0.356 (0.060)***	–0.328 (0.062)***	0.042 (0.368)
Dementia		0.122 (0.077)	0.129 (0.077)	0.122 (0.077)
Neighborhood cohesion			0.086 (0.054)	0.087 (0.054)
Care support			–0.006 (0.024)	–0.005 (0.024)
Relationship quality			0.064 (0.065)	0.253 (0.196)
Care burden × relationship quality				–0.116 (0.113)
Random effect				
Compound symmetry	0.025 (0.041)	0.023 (0.041)	0.021 (0.041)	0.021 (0.041)
Residual	0.844 (0.056)***	0.846 (0.056)***	0.848 (0.056)***	0.849 (0.056)***
–2 log likelihood	2,477.5	2,470.8	2,474.6	2,476.1
AIC; BIC	2,481.5; 2,489.7	2,478.0; 2,486.3	2,478.6; 2,486.9	2,480.1; 2,488.4

Notes: All predictors in *Models 1–4* were measured at the dyadic level, reported by either care recipients or spousal caregivers. Caregivers reported caregiving burden, care support, and relationship quality. Dementia diagnosis was based on the care recipients only; care recipients reported neighborhood cohesion. AIC = Akaike information criterion; BIC = Bayesian information criterion; EST = estimate; *SE* = standard error.
*$p < .05$. **$p < .01$. ***$p < .001$. †$p < .08$.

sleep health among care dyads living with chronic health conditions. Our findings suggested that sleep health was more correlated among dementia care dyads than those living with other chronic health conditions. Further, higher care burden was associated with poorer dyadic sleep for all care partners in general. Better relationship quality seemed to benefit dyadic sleep, especially when the care burden was low. Additionally, while older age and higher levels of positive emotions were associated with poorer sleep for oneself, more symptoms of depression and anxiety were associated with poorer sleep for oneself, and one's care partner.

Dyadic Sleep, and Associated Between- and Within-Dyad Factors

Our findings confirm that the extent of correlation of sleep outcomes within the caregiving dyad was an essential characteristic of dyadic sleep, but may not necessarily be associated with individual sleep outcomes (e.g., dementia status

was not significantly associated with average dyadic sleep). However, higher care burden was associated with poorer dyadic sleep outcomes. Higher caregiver-reported burden suggests increased perceived subjective stress and perhaps more care needs of the care recipient. Future study is necessary to better understand how dyadic spousal interactions affect sleep health.

For example, it is not yet clear why and how symptoms of depression and anxiety had a greater influence on dyadic sleep outcomes than positive emotions and affected spouses' sleep in addition to one's own. Although it is beyond the scope of the current study to examine whether poor sleep also affected worse symptoms of depression and anxiety for dyads, the findings suggest that addressing depression and anxiety symptoms of both the care recipient and their caregiver may improve sleep health among care dyads.

We did not find any main-effect associations, and relationship quality only marginally moderated the care
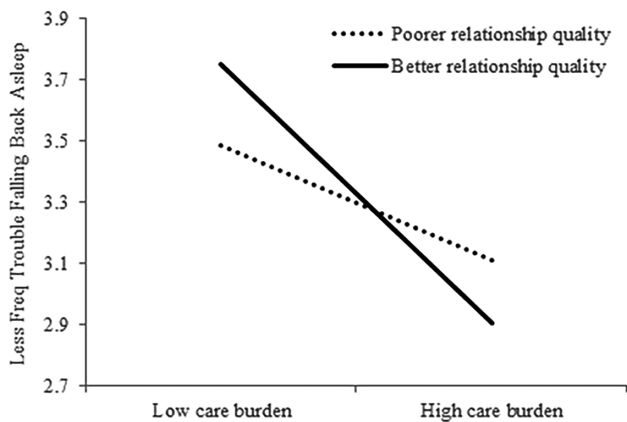
Figure 2. Better relationship quality marginally moderated the care burden–trouble falling back asleep association among care dyads.

burden–sleep association so that a better relationship seemed to be protective against more frequent trouble falling back asleep, especially when the care burden was low; when the care burden was high, however, better relationship quality was associated with poorer dyadic sleep. Better relationship quality may protect caregivers against daily distress in response to the care recipient behavior problems (Chunga et al., 2020) and lower role captivity and overload across time (Bangerter et al., 2019). Though we used standard items to assess relationship quality, this information was only available from caregivers. Future studies evaluating relationship quality from both members of the dyad will help clarify whether perspective-taking and empathy are relevant constructs to consider.

Lastly, we did not find significant relationships between neighborhood cohesion or care support and dyadic sleep. It is known that spousal caregivers tend to be the sole caregivers but are reluctant to seek and accept help and support even when they need it (Fee et al., 2020; Ornstein et al., 2019). It is possible that the measures in the current study emphasized the available social support in the community, whereas prior studies emphasized the neighborhood quality and disadvantage as a stressor (Hale et al., 2013).

Limitations and Conclusion

This study has several limitations. Relying on cross-sectional data, we cannot address the causal relationship between dyadic sleep and the contextual factors examined in the study. Sleep data were collected based on subjective reports and did not capture all aspects of clinical insomnia disorder. Further, the retrospective reporting used for key study questions may have resulted in some recall bias. In addition, while our study only examined spousal care dyads, those in different relationships, such as adult–child caregivers, may have different sleep health behaviors. These interesting patterns of preliminary findings add to the sleep literature and raise important questions about how individual characteristics may affect care partners'

sleep health. Although the study utilized a national sample, several measures had relatively low Cronbach's alpha, and the measure on insomnia symptoms did not fully capture clinical insomnia in this population. Further, we did not apply survey weights in our models. These unweighted findings can inform dyadic sleep characteristics for older adults living with chronic conditions and their caregivers but are not fully representative of the population. Finally, due to health limitations, a small percentage (less than 10%) of care recipients had proxy- rather than self-reports; given that most of the proxy data (74%) was within dyads with dementia, interclass correlation coefficients may be inflated. Due to these limitations, caution should be used in generalizing the findings.

To our knowledge, this is the first study exploring dyadic sleep health among spousal care dyads living with chronic conditions using national survey data from the United States. Sleep is a shared health behavior among older care partners and our findings suggest that care burden and poor relationship quality are relevant contextual factors. Additionally, while positive emotion was only related to one's own better sleep, depressive symptoms were associated with poorer sleep for both oneself and the care partner. Effective caregiver support should address the mental health needs of both members of the care dyad and ultimately the family relationship. An increased focus on families may improve the sustainability of aging in place with a chronic health condition.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

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Conflict of Interest

None declared.

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Author Contributions

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