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Original Research Report

Couples' Sleep and Psychological Distress: A Dyadic Perspective

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Abstract

Objectives: Research on aging has increasingly recognized sleep as a key determinant of physical and psychological well-being. The existing literature, however, considers sleep solely at the individual-level. This study constructed dyadic sleep measures and demonstrated their capacity to predict individual-level sleep and psychological distress.

Methods: This study analyzed 2 waves (2009 and 2013) of older couples' same-day time diary data from the Panel Study of Income Dynamics' Supplement on Disability and Use of Time. Dyadic sleep measures included: (a) bedtime differences, (b) wake-up time differences, (c) a categorical indicator of couple's sleeping routines, and (d) a categorical indicator of couple's waking routines.

Results: The measures indicated substantial discordance in the sleep habits of older couples. Results from multilevel regressions showed that waking patterns predicted individual-level sleep durations. Dyadic sleep measures, particularly sleeping patterns, independently predicted the respondents' psychological distress; controlling for sociodemographic characteristics, marital quality, and individual-level sleep measures. Patterns were more pronounced in the weekend measures.

Discussion: Sleep is a dyadic interpersonal process. This study demonstrated that dyadic sleep is a key aspect for older adults' sleep that cannot be reduced to individual-level sleep. Future studies and surveys should incorporate instruments to measure sleep at the couple-level.

Keywords: Couple-level measures—Dyad—Marriage—Mental Health—Sleep

Sleep health is an influential factor for having a healthy life in old age. Poor sleep has enormous consequences for the elderly. There is a large volume of research showing that inadequate sleep and poor sleep quality can increase the risks for depression (Lavretsky, Levin, Oxman, & Irwin, 2008; Leggett, Burgard, & Zivin, 2016), chronic diseases (Foley, Ancoli-Israel, Britz, & Walsh, 2004; Schwartz et al., 1999), and mortality (Dew et al., 2003). While previous studies demonstrate how critical sleep is for the elderly, our understanding of sleep in older adults is limited to the individual-level. In contrast to the common-sense belief that sleep is an "asocial" activity (Taylor, 1993), recent quantitative and qualitative studies of young adults have shown that sleep is shaped by complex social negotiation processes (e.g., Hislop & Arber, 2003; Venn, Arber, Meadows, & Hislop, 2008). Conceptualizing sleep as a negotiated social process is particularly important because the majority of older adults live and sleep with their partners, in spite of the increasing diversity of living arrangements among elderly couples over the past few decades (Manning & Brown, 2011). By focusing on individual-level sleep outcomes, previous studies have overlooked a fundamental aspect of sleep among older adults.

This study aims to address this gap in the literature, both methodologically and theoretically. In the following sections, I first offer a theoretical framework to understand

how and why older couples' sleep habits are fundamental to individual-level sleep outcomes and mental health. Next, I review existing sleep measures and argue that none of these adequately captures couple-level sleep patterns. Finally, I explain how to construct couple-level sleep measures using the same-day time diaries of couples, from the Panel Study of Income Dynamics' Disability and Use of Time Supplement (PSID-DUST). The results from this study offer one of the first systemic studies of older adults' sleep from the dyadic perspective.

Couples' Sleep Habits as a Fundamental Aspect of Sleep

This study draws on theories from family studies, the life-course perspective, and the stress process to argue that couple-level sleep (defined here as couples' sleeping and waking patterns that result from implicit and explicit negotiation between the couple) is fundamental to understand the sleep of older adults. Couple-level sleep can determine individual-level sleep and make an independent contribution to psychological well-being during old age.

There are strong theoretical reasons to believe that couple-level sleep affects individual-level sleep and mental health. First, having a different sleep schedule from one's spouse is in itself a stressor (Pearlin, 1989, 2010) because it affects their capabilities to perform their usual and desired activities (Pearlin, 2010). Life-course transitions in old age such as retirement, the decline of economic well-being, or changes in living arrangements can change older couples' daily life and sleep schedules (Finkel, Andel, & Pedersen, 2016). Older adults who go to bed earlier than their spouses may be disrupted when their spouses turn the light on, watch TV, or engage in noisy activities. Similarly, older adults' sleep may be disrupted by the activities of spouses who wake up earlier in the morning. Furthermore, stress from discordance in sleep may proliferate over time (Pearlin, Schieman, Fazio, & Meersman, 2005) and can cause conflicts in marital relationships (Rosenblatt, 2006). While some qualitative works indicate that many couples attempt to resolve problems such as discordance in sleep (Hislop & Arber, 2003; Meadows, Arber, Venn, & Hislop, 2008), the process of searching for a solution may lead to additional conflicts. Couples with discordant sleep schedules, therefore, may be exposed to high levels of stress. High levels of stress can impair sleep and lead to mental health problems (Akerstedt, 2006; Lorant, Deliège, Eaton, Robert, Philippot, & Ansseau, 2003). Thus, couple-level sleep can affect individual sleep and mental health outcomes through a series of stress processes (Pearlin, 1989; Pearlin, Schieman, Fazio, & Meersman, 2005).

Second, sleep discordance deviates from the cultural norm of the "ideological code of American family" (Smith, 1993). In the United States and most Western societies, practices within the family remain quite traditional (Gross, 2005).The dominant cultural norm expects that not only do married couples sleep together, but husbands and wives synchronize their sleep schedules. Maintaining a concordant sleep schedule is an important social interaction process that sustains older adults' family identities (Burke, 1991). When there is a deviation from this norm, it suggests an older adult's inability to be a good husband or a good wife (McLeod, 2015). Therefore, discordant sleep among couples can negatively impact older adults' self-mastery and lead to a disconfirmation of their family identities and roles. Anxiety, negative emotions, psychological distress, and/or depression are often observed among individuals who have lower levels of self-mastery and who experience identity disconfirmation (Stets & Harrod, 2004). Thus, by being a behavior that "deviates" from cultural norm, discordance in couples' sleep can affect mental health and affects individual-level sleep.

Thus, because existing population studies of older adults only consider sleep measures at the individual-level, empirical research on older adults can be strengthened by considering sleep from a dyadic perspective.

Existing Measures of Sleep and Their Limitations

Since the 1980s, surveys have included questions that aim specifically at providing better measures of the sleep outcomes of older adults. These questions address sleep quality and sleep duration and patterns. The 1981 Established Populations for Epidemiologic Studies of the Elderly (EPESE) contained a set of questions relating to symptoms of insomnia. The survey included questions that asked older adults about the frequency with which they experienced "difficulty falling asleep," "waking up during the night," "trouble falling back to sleep after waking up during the night," and "feeling rested in the morning." Many subsequent nationally representative studies of older adults adopted similar questions about sleep quality. The Health and Retirement Study (HRS) after the 2002 wave, the 2010–2011 wave of the National Social Life, Health, and Aging Project (NSHAP), and the recent National Health and Aging Trend Study (NHATS) all have similar questions about insomnia symptoms. These questions are particularly useful for screening problem sleep in the general population of older adults. The questions capture key components of the clinical definitions of insomnia that are in the *Diagnostic and Statistical Manual of Mental Disorders* and *International Classification of Diseases* (Chen, Waite, Kurina, et al., 2015).

Aside from questions of insomnia symptoms, the EPESE provided information about sleep duration among older adults by asking "how many hours do you usually sleep at night?" This single item question has been adopted by the consumption and activities supplement of the HRS, NSHAP, and NHATS' sleep module. All of the sleep outcomes that have been described thus far are measured by questionnaires. More recently, the second wave of NSHAP adopted innovative actigraphy in a subsample of older

adults that included randomly selecting one-third of the respondents in the core survey (Lauderdale et al., 2014). The actigraphy offered a direct assessment of sleep by recording and analyzing the activity levels of the older adults. Researchers can obtain parameters that measure sleep in older adults that may not be easy to obtain through survey questions, such as actual sleep duration, wake times after sleep onset (i.e., total minutes awake during the sleep period), and sleep latency (i.e., how much time it takes an individual to fall asleep).

Despite these efforts in measuring sleep in the general population of older adults, all existing studies *conceptualize* and *measure* sleep as a purely individual behavior. This approach overlooks the critical fact that, for many married older adults, sleep is also a negotiated social process (Meadows, 2005). A few recent studies have considered couples' sleep from a dyadic perspective (Troxel, 2010). These studies found that attachment styles affect sleep concordance and sleep concordance can be a predictor of the marital relationship (Gunn, Buysse, Hasler, Begley, & Troxel, 2015; Hasler & Troxel, 2010). These studies, however, are based on small, nonrepresentative, convenient samples, and are focused on younger adults. None of these studies provide a theoretical background to conceptualize dyadic sleep as another aspect of sleep that is fundamental for individual sleep and individual well-being. Additional studies are needed that focus on the general population of older adults and develop dyadic sleep measures that reflect the dyadic aspect of sleep.

Constructing Dyadic Sleep Measures

This study improves previous measures in several ways. First, couples' actual differences in terms of bedtimes and wake-up times are measured, instead of the degree of concordance. This change allows for a better interpretation of the effect the discordant sleep had on individual sleep outcomes and mental health. Second, an "actor-and-partner" approach is adopted to construct dyadic sleep measures by distinguishing between the behavior of the focal older adult, "the actor," and that of the focal older adults' spouse, "the partner." If a couple has 30 min of discordance in their bedtimes, this may indicate two situations: the husband goes to sleep earlier than his wife, or the wife goes to sleep earlier than her husband. Measures that simply consider the differences in sleep schedules cannot reflect such a pattern. The actor-and-partner approach resolves the issue by recoding the focal older adult as the actor and considering his or her sleeping time in relation to the spouse. For example, if the husband goes to sleep 30 min earlier than his wife, I will code "actor goes to sleep earlier" when the husband is the actor and code "actor goes to sleep late" when the wife is the actor. In this way, patterns of bedtime routines and waking routines from the eyes of the focal older adult can be examined to better understand the complexity of the dynamics of sleep patterns among older couples.

Method

Data

This study has focused on couples in the 2009 and 2013 waves from the Panel Study of Income Dynamics' (PSID) Supplement on Disability and Use of Time (DUST). The PSID is a national representative sample of approximately 5,000 families in the United States. Interviews were conducted annually from 1968 to 1997 and biannually after that. The PSID added the DUST Supplement to collect detailed information of time usage among older adults in 2009. Unmarried cohabitating couples were excluded. The second wave of DUST was conducted in 2013 with older adults, including those who were cohabitating, married, and unmarried.

Each wave of DUST used telephone interviews to collect time diaries. The diary collected information on all activities, such as start time, end time, and duration during a 24-h period. Each respondent was asked to complete two diaries, one for weekdays and one for weekends. The 2009 DUST identified 755 individuals and the 2013 DUST had 1,776 individuals who completed at least one diary. For the purposes of this study, the sample was limited to older couples who had two completed diaries for a total of four diaries. Single and cohabitating older adults were eliminated for the 2013 data. These processes led to 718 individuals (359 couples) in the 2009 DUST and 908 individuals (454 couples) in the 2013 DUST.

Although there was a subgroup of older adults who were in both waves of DUST, this study relied on cross-sectional samples for several reasons. A longitudinal analysis of two waves of data does not provide additional insight into the dyadic sleep, since time diaries only reflected couples' current sleep practices. Even with a longitudinal analysis that combined 2009 and 2013 waves, there are no longitudinal measures of couples' sleep practices over the 4 years. Interpreting longitudinal results of dyadic sleep measures based on two time points can be difficult. As such, a longitudinal analysis does not capture the effects of changes in sleep practices among the couples, nor the effects of long-term exposure to discordant sleep. The longitudinal sample included less than 250 couples with completed couple-level time diaries, making it difficult to detect an effect. For these two reasons, this study focused on cross-sectional analysis.

Dyadic Sleep Measures

Four dyadic sleep measures were constructed using couples' same-day time diary data. The first measure was the husband-wife differences for bedtimes. Following the same logic, I created another measure of the husband-wife differences for the wake-up times. I created two other categorical variables that accounted for the order and time differences of bedtime and waking patterns using the previously mentioned actor-and-partner approach. The bedtime routine variable was coded as follows: the couple sleeping at about

the same time (i.e., the difference in bedtimes is less than 20 min), the actor sleeping 20 min later, the actor sleeping 1 h later, the partner sleeping 20 min later, and the partner sleeping 1 h later. The variable for the wake-up time routine was coded similarly. These four measures were calculated separately for the weekends and weekdays.

Measure of Psychological Distress

Starting in 2005, the PSID added the Kessler 6 (K6) psychological stress scale to the main survey. K6 is a validated measure of nonspecific psychological distress and has been incorporated into many large-scale surveys, including the Behavioral Risk Factor Surveillance System and the National Health Interview Survey (Kessler et al., 2002; Reeves et al., 2011). The K6 scale was constructed by adding up the answers to the six items. The scores ranged from 6 to 30, with the higher scores indicating higher levels of psychological distress.

Control Variables

I evaluated the extent to which dyadic sleep measures predicted psychological distress after controlling for individual- and couple-level characteristics that might confound the associations. First, the validity of dyadic sleep as a key dimension of sleep depends on its ability to predict psychological distress independent of individual-level sleep measures. I controlled for two individual-level sleep outcomes: sleep duration and sleep quality rating. The sleep durations of the respondents were derived from time diaries. All respondents were also asked to rate their quality of sleep on the previous night: "Would you say it was excellent, very good, good, fair, or poor?" I recoded the answers so that "excellent" equaled five and "poor" equaled one. Second, many previous studies have suggested that marital quality affects individual sleep (Chen, Waite, & Lauderdale, 2015) and the bedtimes and waking routines of couples. To address this issue, a set of six questions that aimed to assess the marital quality of older adults were included in both waves of DUST. I followed the strategy by Carr, Cornman, and Freedman (2016) and created an overall measure of marital quality. The differences in the couples' employment could affect their bedtimes and wake-up time routines, particularly during weekdays. Therefore, I accounted for the couples' working routines using the information reported in the time diaries. I created a three-category variable: neither worked for pay, both worked for pay, or one worked for pay. This variable was based on whether the respondents reported any paid activity in their time diaries for weekdays and weekends, irrespective of the duration. Another key confounder to be considered was the functional limitation. DUST measured the presence of disability in old age using six items developed for the U.S. Census (Weathers, 2005). The respondents were asked if they had serious difficulty with the following actions: seeing, even when wearing glasses; concentrating; remembering or making decisions; walking or climbing stairs; dressing or bathing; and doing errands alone. I created a dichotomous indicator for the presence of any disability. All regressions controlled for the respondents' age, gender, race and ethnicity, education, income-to-poverty ratio, marital duration, retirement status, and self-rated health.

Analytical Strategy

Since the spouses of all respondents were also in the DUST surveys, a two-level random intercept multilevel model was used to account for the nested nature of the data. This model gives each household a different intercept to account for the fact that data from members of the same household are not independent. A random coefficient model can also account for the nested nature of the data; however, it increases computational difficulty as, in this case, the observation per second-level unit is low. Because the theoretical framework provides no clear rationale for adding a random coefficient for each household, the random intercept model is sufficient. The first-level unit was individual and the second-level unit related to family. All regressions included the full set of control variables. With respect to the missing data, only a small proportion of the respondents had missing values for any one variable. Multiple imputations were used to recover the missing values. I also followed the user guides (Freedman & Cornman, 2012, 2015) and applied the family unit weight for all regressions.

Results

Descriptive Analysis

Table 1 shows the descriptive statistics of older adults in the 2009 and 2013 samples, separately. Even after limiting the 2013 DUST sample to married couples, the two waves of DUST did not differ much in terms of social and demographic characteristics. Table 2 shows the weighted descriptive statistics of four dyadic sleep measures in both waves of the survey. Differences in the wake-up times were larger than those for the bedtimes; however, there are substantial variations. Approximately one-third to one-fourth of the older couples slept about the time as their partners (i.e., within 20 min), but only about 15% of older adults woke up at the same times, suggesting a higher degree of concordance for bedtimes than for wake-up times among couples. The patterns of the couples' sleep schedules and routines were similar for both weekends and weekdays and for the two waves of the surveys.

Regression Analysis

Table 3 shows the relationship between dyadic sleep measures and individual-level sleep outcomes, including all control variables. Differences in bedtimes and bedtime routines were not associated with sleep duration or with

Table 1. Weighted Means (*SD* in Parentheses) and Percentage for Social and Demographic Variables of Older Adults in the 2009 DUST and 2013 DUST

	2009 DUST	2013 DUST
Age		
Mean (*SD*)	66.91 (9.21)	68.81 (7.07)
Male	0.50	0.50
Race and ethnicity		
White	0.88	0.88
Black	0.04	0.05
Hispanic	0.05	0.06
Others	0.02	0.01
Education		
No high school	0.11	0.27
High school	0.44	0.32
Some college	0.25	0.21
College or above	0.20	0.20
Income-to-poverty ratio	6.41 (5.73)	6.23 (5.26)
Martial quality	3.22 (0.55)	3.16 (0.55)
Marital duration	35.82 (20.09)	41.49 (21.90)
Disability	0.40	0.44
Self-rated health		
Excellent	0.18	0.14
Very good	0.32	0.38
Good	0.34	0.32
Fair	0.11	0.12
Poor	0.05	0.04
Sleep duration	7.51 (1.86)	7.55 (1.89)
Sleep quality rating	2.49 (1.04)	2.58 (1.00)
Retirement status	0.45	0.58
Couples' work status		
Both working for pay	0.14	0.06
One working for pay	0.28	0.30
Neither working for pay	0.58	0.64
K6 psychological distress scale	8.20 (3.17)	7.71 (2.75)
Sample size	718	908

Table 2. Weighted Means (*SD* in Parentheses) and Percentage of Dyadic Sleep Measures in the 2009 DUST and 2013 DUST

	2009 DUST	2013 DUST
Weekend dyadic sleep measures		
Bedtime difference (h)	1.02 (1.01)	1.16 (1.14)
Wake-up time difference (h)	1.81 (1.75)	2.00 (1.76)
Bedtime routine		
About the same	0.23	0.20
Actor 20 min late	0.23	0.22
Actor 1 h late	0.16	0.17
Partner 20 min late	0.23	0.22
Partner 1 h late	0.16	0.18
Wake-up time routine		
About the same	0.14	0.11
Actor 20 min late	0.17	0.14
Actor 1 h late	0.26	0.30
Partner 20 min late	0.17	0.14
Partner 1 h late	0.26	0.31
Weekday dyadic sleep measures		
Difference in bedtime (h)	1.02 (1.03)	0.98 (1.05)
Difference in wake-up time (h)	1.76 (1.62)	1.86 (1.85)
Bedtime routine		
About the same	0.24	0.29
Actor 20 min late	0.22	0.21
Actor 1 h late	0.16	0.14
Partner 20 min late	0.22	0.21
Partner 1 h late	0.16	0.15
Wake-up time routine		
About the same	0.16	0.14
Actor 20 min late	0.14	0.15
Actor 1 h late	0.28	0.27
Partner 20 min late	0.14	0.16
Partner 1 h late	0.28	0.28
Sample size	718	908

the ratings of sleep quality in older adults. There was a negative association between the differences in wake-up times and sleep duration. The larger the difference in the wake-up times of the older couples, the shorter their sleep duration. The associations were significant for both waves of the survey and also for the weekend and weekday diaries. Table 3 suggests that there was an association between the actor waking up later and an increase in his or her duration of sleep. The partner's waking up later was associated with a decrease in sleep duration and declines in sleep quality ratings. In summary, the dyadic measures of couples' waking patterns were predictors of individual-level sleep outcomes.

Panel A in Table 4 shows the associations between the dyadic bedtime measures and the psychological distress of older adults. Analysis 1 indicates the association between the differences in bedtimes and psychological distress. Analysis 2 shows the association between bedtime routines and psychological distress. Results from the 2009 DUST suggest that the increase of an hour in the differences in bedtimes was associated with an increase in the K6 psychological distress score. This association was particularly significant for weekends, but only marginally significant for weekdays. When considering the couples' bedtime routines, both actor sleeping 1 h later or partner sleeping 1 h later during weekends were positively associated with the K6 score. The symmetrical effects suggest that the differences in the bedtimes of the older adults were of greater consequence for their mental health than the order in which they went to sleep. Only the weekend bedtime routine, however, was statistically significant. The patterns were similar for the 2013 DUST. There was a significant positive association between the differences in bedtimes and the K6 psychological distress score. Either the actor or the partner sleeping 1 h later during the weekend was associated with an increase in the psychological distress score. The results show that couple-level bedtime measures were significant predictors of psychological distress in older adults after controlling

Table 3. Results From the Multilevel Model Predicting Individual-Level Sleep Measures by Dyadic Sleep Measures

	Weekend		Weekday	
	Sleep duration, coefficient (*SE*)	Sleep rating, coefficient (*SE*)	Sleep duration, coefficient (*SE*)	Sleep rating, coefficient (*SE*)
DUST 2009 (*N* = 718)				
A: Difference in bedtime	−0.07 (0.10)	−0.02 (0.06)	0.15 (0.10)	0.10 (0.07)
B: Bedtime routine (ref = within 20 min)				
Actor 20 min late	−0.33 (0.24)	−0.12 (0.16)	0.11 (0.28)	0.03 (0.17)
Actor 1 h late	−0.57† (0.31)	0.04 (0.18)	−0.19 (0.29)	0.24 (0.19)
Partner 20 min late	0.13 (0.24)	−0.11 (0.16)	0.26 (0.29)	0.02 (0.18)
Partner 1 h late	0.08 (0.27)	−0.33† (0.18)	0.81** (0.30)	0.24 (0.20)
C: Difference in wake-up time	−0.17** (0.06)	0.07* (0.03)	−0.14* (0.08)	−0.02 (0.04)
D: Wake-up time routine (ref = within 20 min)				
Actor 20 min late	−0.36 (0.29)	−0.03 (0.20)	0.41 (0.28)	0.01 (0.21)
Actor 1 h late	0.53* (0.24)	0.21 (0.16)	0.92*** (0.24)	0.06 (0.19)
Partner 20 min late	−0.77* (0.30)	0.04 (0.20)	0.10 (0.27)	0.12 (0.22)
Partner 1 h late	−1.74*** (0.27)	0.22 (0.17)	−1.22*** (0.24)	0.03 (0.19)
DUST 2013 (*N* = 908)				
A: Difference in bedtime	0.06 (0.06)	−0.03 (0.04)	0.01 (0.08)	0.03 (0.04)
B: Bedtime routine (ref = within 20 min)				
Actor 20 min late	−0.06 (0.23)	0.04 (0.14)	0.06 (0.22)	0.10 (0.12)
Actor 1 h late	0.18 (0.24)	0.02 (0.15)	−0.24 (0.28)	0.09 (0.13)
Partner 20 min late	0.19 (0.22)	−0.11 (0.14)	0.29 (0.20)	−0.12 (0.12)
Partner 1 h late	0.14 (0.25)	−0.06 (0.15)	0.41† (0.22)	0.05 (0.13)
C: Difference in wake-up time	−0.08† (0.05)	0.03 (0.02)	−0.11* (0.05)	0.02 (0.02)
D: Wake-up time routine (ref = within 20 min)				
Actor 20 min late	0.53* (0.26)	−0.10 (0.18)	0.19 (0.21)	−0.24 (0.15)
Actor 1 h late	1.20*** (0.25)	−0.16 (0.15)	0.84*** (0.21)	−0.10 (0.13)
Partner 20 min late	0.06 (0.27)	−0.20 (0.17)	−0.28 (0.21)	−0.23 (0.13)†
Partner 1 h late	−0.95*** (0.26)	−0.05 (0.15)	−1.53*** (0.22)	−0.05 (0.12)

Note: All regressions were weighted and controlled for age, gender, education, race and ethnicity, income-to-poverty ratio, self-rated health, presence of disability, marital duration, and martial quality.
†$p < .1$. *$p < .05$. **$p < .01$. ***$p < .001$.

for individual-level sleep measures, marital quality, and a wide range of demographic, health, and social variables.

Panel B in Table 4 shows the regression results from a multilevel model for couple-level wake-up time measures. The patterns were somewhat different from those in Panel A. Wake-up time differences were associated with an increase in the psychological distress score on weekends but not on weekdays. This finding was consistent with the previous observation that the discordant sleep schedules on weekends was of greater consequence than the discordant sleep schedules during weekdays. When considering the waking routines, however, there was no significant association. Panel B in Table 4 suggests that the effects of wake-up measures were not as significant as the bedtime measures. Additional analysis was performed by examining the association between dyadic sleep and psychological distress by gender, revealing no gender difference. This might be, in part, due to the reduction of sample size after stratifying the sample by gender. Future studies are needed to investigate this issue.

Taken together, Tables 3 and 4 show that dyadic sleep measures are able to predict individual sleep duration and mental health. Patterns were consistent for the 2009 DUST and 2013 DUST. These results support the concept that couple-level sleep practice is a key aspect of sleep that cannot be reduced to individual-level variables.

Discussion

The consequences of poor sleep are substantial for older adults. Sleep, however, is both a social and interpersonal process. Previous research of older adults' sleep has focused on the individual-level. Using couples' same-day time diary data from the newly available DUST data, this study constructed four couple-level sleep measures based on older couples' bedtimes and waking habits and demonstrated the power of dyadic sleep measures in predicting individual-level outcomes in the general population of older adults.

The results revealed first, that there are substantial discordances in older couples' bedtimes and wake-up times from the dyadic perspective. The discordances in wake-up times and routines were larger than the discordances in bedtimes. Second, dyadic sleep measures predicted

Table 4. Results From the Multilevel Model Predicting Psychological Distress by Dyadic Sleep Measures Among Older Adults, Controlled for Individual Sleep Outcomes, Martial Quality, Health Outcomes, and Sociodemographic Factors

	2009 DUST (*N* = 718)				2013 DUST (*N* = 908)			
	Weekend		Weekday		Weekend		Weekday	
	Analysis 1, coefficient (*SE*)	Analysis 2, coefficient (*SE*)	Analysis 1, coefficient (*SE*)	Analysis 2, coefficient (*SE*)	Analysis 1, coefficient (*SE*)	Analysis 2, coefficient (*SE*)	Analysis 1, coefficient (*SE*)	Analysis 2, coefficient (*SE*)
Bedtime measures								
Bedtime difference	0.56** (0.20)		0.37† (0.20)		0.80** (0.23)		0.62* (0.25)	
Bedtime routine (ref = within 20 min)								
Actor 20 min late		0.29 (0.40)		0.62 (0.44)		0.16 (0.52)		−0.54 (0.84)
Actor 1 h late		0.84† (0.48)		0.74 (0.48)		1.62** (0.58)		0.17 (0.75)
Partner 20 min late		0.28 (0.40)		0.64 (0.45)		0.16 (0.52)		−0.55 (0.84)
Partner 1 h late		0.78† (0.47)		0.68 (0.48)		1.60** (0.58)		0.16 (0.75)
Wake-up measures								
Wake-up time difference	0.25* (0.11)		0.30† (0.16)		0.28* (0.13)		0.12 (0.14)	
Wake-up time routine (ref = within 20 min)								
Actor 20 min late		−0.10 (0.50)		−0.47 (0.62)		−0.54 (0.84)		0.19 (0.73)
Actor 1 h late		0.41 (0.48)		0.32 (0.58)		0.17 (0.75)		0.44 (0.68)
Partner 20 min late		−0.09 (0.49)		−0.45 (0.61)		−0.55 (0.84)		0.18 (0.73)
Partner 1 h late		0.40 (0.48)		0.34 (0.57)		0.16 (0.75)		0.42 (0.68)

Note: All regressions were weighted and controlled for age, gender, education, race and ethnicity, income-to-poverty ratio, self-rated health, presence of disability, marital duration, and martial quality.
†$p < .1$. * $p < .05$. ** $p < .01$. *** $p < .001$.

individual-level sleep. Finally, this study demonstrated that couple-level sleep measures are able to predict psychological distress after controlling for individual-level sleep outcomes, marital quality, and a wide range of demographic, health, and social variables. Differences in bedtimes were associated with an increase in the psychological distress score and these patterns were more pronounced on the weekends.

These findings contribute to the literature on aging and health in several key ways. First, the findings provide evidence that couples' sleep practices are a fundamental aspect of sleep that cannot be reduced to individual-level sleep outcomes. The results also support the notion of "linked lives" in the life-course perspective (Pearlin, 2010), as dyadic sleep may constrain individual sleep. The social aspect of sleep in older adults serves as the basis for the biological processes of sleep. This concept is consistent with the idea of social gerontology, in which the biological aging process occurs in a social world (Alwin, 2012). Previous medical and behavioral models of sleep in older adults are inadequate and provide only partial understanding of older adults' sleep (e.g., Williams, Kay, Rowe, & McCrae, 2013; Smagula et al., 2015). The findings, therefore, imply that an integrated model of sleep among the elderly is needed that takes into the consideration the fact that biological and neurological aspects of human sleep occur and are affected by social contexts.

In spite of the methodological focus of the current study, the results presented here reveal the complexity of older couples' sleep habits and add to the literature on health concordance among couples (Meyler, Stimpson, & Peek, 2007). Unlike studies on the health behaviors of older couples (Graham & Braun 1999; Stimpson, Masel, Rudkin, & Peek, 2006), this study did not find a large amount of concordance in sleep behaviors. Also, the results from this study broaden the scope of time-use research in old age by proposing an innovative way to analyze couples' same-day time diaries. The availability of older adults' time use data in DUST added greatly to our knowledge of how older adults spent their days and the relationships between their daily activities and their health and well-being (Freedman, Conrad, Cornman, Schwarz, & Stafford, 2014; Freedman, Stafford, Schwarz, & Conrad 2013). Few studies have considered nighttime activities such as sleep. Even fewer have considered such nighttime activities at a dyadic level. This study demonstrates an innovative use of the time-use data that is theoretically informed and significant for policy and intervention.

The findings showed waking patterns to be better predictors of individual sleep while bedtime routines were better for predicting psychological distress. These results suggest that the pathways through which couples' sleep practices affect mental health may not operate primarily through individual sleep outcomes. The findings also imply that the mechanisms through which couple-level sleep practices affect individual sleep and mental health outcomes may be different. Discordance in bedtimes may be more stressful for older adults than discordance in wake-up times. With respect to individual sleep, waking patterns show the effects because this can directly shorten the durations of sleep in older adults by causing them to wake up in the morning. More studies are needed to investigate these processes.

In spite of the strength and innovation of this article, the study has several limitations. DUST provided no information about whether the couples slept in the same bed at night. It is possible that some couples whose bedtimes or wake-up times were different may sleep separately. There are several reasons why the lack of information regarding co-sleeping does not seriously undermine the dyadic sleep measures constructed in this article. First, a recent estimate using nationally representative data from NSHAP shows that nearly 80% of married older adults slept with their spouses (Lauderdale et al., 2014). This study (see Table 2) showed that only 15%–25% of older couples slept or woke up within 20 min of one another. Therefore, these dyadic sleep measures still capture the sleep practices of many co-sleeping older couples.

Second, the dyadic sleep measures not only reflect the interdependence of sleep among couples who sleep in the same bed but also reflect the idea of the interdependence of daily life and schedules in couples who live in the same household. Many studies have found that parents' sleep is influenced by their children's sleep and vice versa (Fuligni, Tsai, Krull, & Gonzales, 2015). In theory, the conceptualization of "dyad" is not limited to sleeping in the same bed. The meaning of the term dyad is closer to that of the social science literature, which emphasizes the interdependent nature of behaviors, health, and well-being among couples who live together (Lewis et al., 2006). Such an idea is further supported by the fact that in this study dyadic sleep measures predicted individual sleep outcomes. Even though I cannot be sure that every couple sleeps in the same bed, the associations suggest that the strong interdependence in couples' sleep is a key factor for health and well-being. I might have been able to observe larger effects between dyadic sleep measures and individual-level outcomes if all the couples slept together. The lack of the information on co-sleeping, therefore, does not invalidate the dyadic sleep measures constructed in this study.

A second limitation is that further investigation is required into the social and psychological processes that link dyadic sleep measures and two key outcomes that have been examined in this study. Also, this study was not focused on providing any explanations of how older adults arrange and negotiate bedtime and wake-up time practices with their spouses. A deep investigation of these issues is beyond the scope of this article. Given the importance of these issues in understanding sleep patterns and their consequences for older adults, future studies are needed to conduct further exploration into the social processes that lead to the concordance and discordance of sleep among older couples and the mechanisms through which dyadic

sleep influences the mental and physical health of the elderly. Lastly, the relationships between the dyadic sleep measures and the outcome variables may be associational rather than causal. It is possible that psychological distress "causes" discordance in couples' bedtime practices. Poor individual sleep may lead to sleeping separately and producing discordance in sleep. Further studies are needed to identify causal relationships to provide evidence about whether interventions that aim to reduce the discordance of sleep among couples may also improve individual sleep and mental health.

Finally, since DUST collected time diaries on one weekday and one weekend day, the design may only provide a 2-day snapshot of sleep in older couples. Future data collection efforts that gather data about couples' sleep over multiple days could add valuable insights regarding dyadic sleep behaviors. Nevertheless, the approach developed in this study remains useful because it offers a fresh perspective on sleep among older adults. When interpreting results from this study, these dyadic measures provide no indication of the duration of the couples' exposure to sleep discordance. The study was not able to distinguish between older adults who had been exposed to discordant sleep on a chronic basis and those who had been exposed to in the short-run. The associations present the effect of exposure to sleep discordance that is averaged across all durations. Future studies that collect couples' sleep habits over a longer period of time could shed light on this issue.

In sum, this study offers a new perspective on older adults' sleep by demonstrating the importance of examining sleep at the couple level. As sleep is increasingly becoming recognized as a key health behavior and a risk factor for older adults, this study reveals dyadic sleep is a key aspect of sleep that cannot be reduced to individual-level sleep. The dyadic approach adopted here is applicable to future research on older adults' sleep, aging and health, and future data collection. These efforts will advance our understanding of older adults' sleep and help to develop better programs to improve sleep health in old age. This study also suggests that a dyadic approach should be considered for programs that aim to improve sleep. With a few exceptions, the current interventions and programs that improve sleep remain only at the individual-level. The results from this study, therefore, call for a reconsideration of older adults' sleep in terms of theories, data collection, and interventions.

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