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Examining Social Capital in Relation to Sleep Duration, Insomnia, and Daytime Sleepiness

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Abstract

Objective—Sleep, which plays an important role in health and well-being, is socially patterned such that certain demographic groups have worse sleep health than others. One possible mechanism driving sleep disparities is social capital. The current study examines the association between social capital and self-reported sleep variables (e.g., duration, insomnia symptoms, and daytime sleepiness) among a sample of 1,007 participants from the Sleep Health and Activity, Diet and Environment Study (SHADES).

Methods—Logistic regressions were used to estimate whether the sleep variables were associated with social capital measures. All models control for age, sex, race/ethnicity (Non-Hispanic White, Black/African-American, Hispanic/Latino, Asian, and multicultural/other), income, and education (less than high school, high school graduate, some college, and college graduate).

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Results—Lower likelihood of membership in groups was seen for long sleepers (>9hrs, p-value<.05) and beliefs that neighbors rarely/never help each other was more likely among short sleepers (5-6hrs, p-value<.05), relative to 7-8 hour sleepers. A decreased sense of belonging was seen among short sleepers (5-6hrs, p-value<.05). Decreased likelihood of trust was reported by those with moderate-severe insomnia (p-value<.05). Similarly, neighborhood improvement efforts were less likely among individuals with moderate-to-severe insomnia (p-value<.05).

Conclusions—Results of our study show that short and long sleep duration, as well as insomnia, were inversely related to measures of social capital, such as group memberships and a sense of neighborhood belonging. Future research may explore the directionality of the relationship between social capital and sleep and perhaps consider future interventions to improve low social capital and/or poor sleep in community samples.

Keywords

Social environment; community; insomnia; public health

INTRODUCTION

Sleep plays an important role in health and well-being.[1-3] Poor sleep health (e.g., sleep duration for less than or equal to 6 hours of sleep or poor sleep quality) is associated with poor mental health, anxiety, and depression;[4,5] higher risk of hypertension and cardiovascular disease;[6-8] and greater mortality risk.[9,10] Unfortunately, worse sleep health has been shown to be more common among individuals from low socioeconomic status (SES, low income and education) compared to other groups.[11-15] This paper contributes to a growing body of research on neighborhood-level characteristics and their relationship to sleep.[16-19] Specifically, we examine social capital, a social network concept referring to the quality of connections among individuals in a community,[20-23] and its relationship to several dimensions of sleep health, including sleep duration, insomnia, and daytime sleepiness.

Previous research has examined a range of neighborhood factors and their association to sleep. Research has shown high risk for sleep apnea among children living in communities that have low average SES.[18,19] After adjustment for SES, research has found favorable neighborhood factors (lower neighborhood disorder and higher safety and social cohesion) are associated with higher objectively measured sleep duration,[16] and undesirable neighborhood factors (higher neighborhood disorder and lower safety and social cohesion) are associated with shorter sleep duration.[17] Similarly, research has found, controlling for SES, low social cohesion is associated with shorter sleep duration.[24] Also, research has found an association between unfavorable neighborhood factors (crime, noise, and cleanliness) and poor physical health is partially mediated by sleep quality.[25] Although previous literature has demonstrated an association between sleep and neighborhood factors, previous studies have not fully addressed the directionality of the relationships among specific social capital components and sleep health dimensions. Further, this growing body of literature to suggest neighborhood factors matter for sleep outcomes,[16-19] little attention has been paid to social capital.[17,26,27] Although our research is cross-sectional in nature, we examine the relationships among specific social capital and sleep health dimensions.

Social capital refers to the nature and quality of social relationships and connections among individuals in a neighborhood or social network. Also, in addition to the nature of these relationships, social capital has to also do with the resources a person may receive by virtue of their social connections. Social network variables such as social capital are important to consider as evidence shows that health behaviors such as alcohol consumption, smoking,[29,30] and sleep duration,[31] are remarkably homogenous among groups of socially connected individuals.[28] Previous research has found low social capital is associated with depression[32,33] and mortality risk,[34] whereas high social capital is associated with physiological well-being.[35] Research has also shown that, after controlling for SES, social capital is associated with self-reported health.[36] With regards to sleep, one study was identified that examined social capital among community-dwelling Japanese individuals, finding poor social capital is associated with insufficient sleep duration.[37]

The Social-Ecological Model of Sleep Health[9,38] posits that poor sleep health is driven by social-contextual factors that underpin health broadly and sleep health specifically. Obtaining a better understanding of relationships between sleep health and social capital may allow for a deeper understanding of the social-environmental causes and/or consequences of poor sleep health. As such, the goal of this paper is to examine discrete measures of social capital and their relationship to a range of sleep health parameters (sleep duration, insomnia, and daytime sleepiness).

Social capital is operationalized in terms of the following dimensions: 1) participation in social or community organization(s) (i.e., the number of formal social groups, such as clubs, a person belongs to), 2) neighborhood helping behavior (i.e., the degree to which neighbors help each other), 3) neighborhood belonging (i.e., the degree to which individuals feel like their neighborhood makes them feel welcome and that they belong), 4) neighborhood trust (i.e., the degree to which neighbors trust each other), and 5) neighborhood improvement (i.e., the degree to which neighbors work together to improve the neighborhood).[23,39,40] Based on previous findings that demonstrate an inverse association between sleep duration and social capital,[37] we extend these findings to hypothesize an inverse association between social capital and three dimensions of sleep health, including: duration, insomnia, and sleepiness. Consistent with prior research examining neighborhood factors,[16,17,24,37] we propose to control for SES so as to focus on the association between social capital and sleep health. Using cross-sectional data from the Sleep Health and Activity, Diet and Environment Study (SHADES) survey of adults, we examine following hypothesized associations:

Hypothesis 1 (H1): Participation in social or community organizations is inversely associated with sleep duration (short and long), insomnia symptoms, and daytime sleepiness.

Hypothesis 2 (H2): Helping behavior is inversely associated with sleep duration (short and long), insomnia symptoms, and daytime sleepiness.

Hypothesis 3 (H3): Neighborhood belonging is inversely associated with sleep duration (short and long), insomnia symptoms, and daytime sleepiness.

Hypothesis 4 (H4): Neighborhood trust is inversely associated with sleep duration (short and long), insomnia symptoms, and daytime sleepiness.

Hypothesis 5 (H5): Neighborhood improvement is inversely associated with sleep duration (short and long), insomnia symptoms, and daytime sleepiness.

METHODS

Data Source

We analyzed data from the Sleep and Healthy Activity, Diet, Environment, and Socialization (SHADES) study. SHADES was a community-level study of adults (N=1007) age 22-60 in the Philadelphia area, including Philadelphia County and the neighboring Delaware, Montgomery, Bucks, and Chester Counties. Respondents were recruited through advertisements posted in various public spaces and community centers. The study included a survey that was completed online or in person between January 2013 and October 2014. There was only one assessment and no follow-ups, and consisted of a number of items assessing sleep, health, behavior, and environmental factors. Because all online surveys were validated and all in-person surveys ensured completion, there was no missing data.

Measures

Sleep duration was measured using one of the sleep questions from the National Health and Nutrition Examination Survey (NHANES): [41,42] "How much sleep do you usually get at night on weekdays or workdays?" Responses were recorded in whole numbers and categorized as very short (≤4 hours), short (5-6 hours), recommended duration (7-8 hours) and long (≥9 hours), as is consistent with previous studies. [8,43-45]

Insomnia symptoms were measured using the Insomnia Severity Index (ISI).[46] Accordingly, ISI scores range from 0 to 28, with higher scores indicating greater severity of insomnia symptoms. Recommended cutoffs include 0 to 7 for no insomnia, 8 to 14 for mild insomnia, 15 to 21 for moderate insomnia and 22 to 28 for severe insomnia. Due to the low frequency of severe insomnia, the final two categories were collapsed into a moderate-severe category. The ISI is routinely used as an outcome measure for insomnia research [47] and is well-validated for research.[48]

Daytime sleepiness was measured using the Epworth Sleepiness Scale (ESS). This 8-item instrument is routinely used in research[49,50] and is well-validated.[51] Participants were asked to indicate the likelihood that they would be unable to maintain wakefulness in a variety of situations, including sitting and reading, watching TV, and sitting inactive in a public place, etc. Responses are summed and scores can range from 0 to 24. Recommended cutoffs for sleepiness include 0 to 9 for mild sleepiness and 10 or higher for severe daytime sleepiness. [51]

Social capital was measured using variables consistent with prior research.[32,52,53] Social capital domains assessed included group memberships, neighborhood helping behavior, and neighborhood belonging, trust, and improvement. Group memberships were assessed with the questions "how many local groups or organizations in your neighborhood do you currently participate in such as social, political, religious, school-related, or athletic organizations?" Responses were categorized as 0, 1, or ≥2 or more memberships. Neighborhood helping behavior was assessed with the question, "Please rate how likely

people in your neighborhood are willing to help their neighbors with routine activities such as picking up their trash cans, or helping to shovel snow. Would you say that most people in your neighborhood are always, often, sometimes, rarely, or never willing to help their neighbors?" Responses were coded as "Never," "Rarely," "Sometimes," "Often," and "Always." Due to cell sizes at the extremes, responses were collapsed to "Never/Rarely," "Sometimes," and "Often/Always." Neighborhood belonging and trust were assessed by asking participants to agree or disagree with the following statements: "I feel that I belong and am a part of my neighborhood," and "Most people in my neighborhood can be trusted." These were coded as "Agree" vs "Disagree." Finally, neighborhood improvement was assessed by asking participants, "Have people in your neighborhood ever worked together to improve the neighborhood? For example, through a neighborhood watch, creating a community garden, building a community playground, or participating in a block party." Responses were categorized as "Yes" or "No." For purposes of analysis, the discreet measures of social capital are maintained in the current study (e.g., group memberships).

Covariates included age, sex, race/ethnicity (Non-Hispanic White, Black/African-American, Hispanic/Latino, Asian, and multicultural/other), education (less than high school, high school graduate, some college, and college graduate), and income. These were chosen because previous studies have shown them to be related to sleep duration and quality,[54-56] and social functioning.[57,58]

Statistical Analyses

Analysis of variance (ANOVA) was conducted to examine differences in demographic factors by social capital. A series of binomial and multinomial logistic regression models for sleep variables and each of the five social connectedness variables were assessed. In each case, the social capital variable was the outcome and the sleep variable was the predictor. In addition to separate models for each sleep variable (adjusted for covariates), combined models included all sleep variables simultaneously. The reason for including this combined model is that many of the sleep variables overlap with each other and, therefore, associations may be due to the overlapping issue of "poor sleep" and not the specific sleep aspect assessed (i.e., sleep duration, insomnia symptoms, or sleepiness). Therefore, a combined model examines whether any individual sleep variable explains variance in the social capital variables that is unique, after controlling for the other sleep variables. In this way, we can examine whether there is a relationship with insomnia that is distinct the other sleep variables. The 95% confidence intervals (CIs) were computed. Analyses were performed using STATA software version 14 (StataCorp, College Station, TX, USA). All statistical tests were two-tailed. Statistical significance was set at the $P < 0.05$ level.

RESULTS

Characteristics of the Sample

Among participants, average age was 34.0 years (s.d. = 9.4 years) and the sample was 50.9% male. Participants were 58.1% non-Hispanic white, 55.9% reported a college degree, and 18.6% reported income of $75,000 or higher. Among participants, recommended duration (7-8 hours) was reported by 47.7%. Approximately one third of participants reported no

insomnia symptoms (34.8%). Daytime sleepiness scores averaged 7.8 (sd = 4.7). See Table 1 for a detailed summary of the study sample and sleep variables.

Participation in Social or Community Groups

In the separate models, very short (≤4 hours) and long sleepers (>9 hours) were respectively approximately half as likely as 7-8 hour sleepers to report membership in a social or community organization. In the combined model, only the relationship between long sleep and membership in social or community organizations was significant, so that long sleepers were half as likely as 7-8 hour sleepers to report participation in one social or community organization. No statistically significant association was identified for short sleep duration, insomnia, or sleepiness (no support for H1, see Table 2).

Helping Neighbors

In the separate models, very short sleepers (≤4 hours) and short (5-6 hours) sleepers were approximately 1.5 times more likely to report rarely or never helping their neighbors, compared to 7-8 hour sleepers. In addition, individuals with moderate-severe insomnia and daytime sleepiness were also about 1.5 times more likely to report rarely or never helping their neighbors. In the combined model, only short sleep (5-6 hours) was significant, so that short sleepers were approximately 1.5 times more likely to report rarely never helping behavior (no support for H2, see Table 3).

Sense of Belonging, Neighborhood Trust and Improving the Neighborhood

In separate models, short sleepers (5-6 hours), individuals with moderate-to-severe insomnia and high daytime sleepiness were less likely to report neighborhood belonging than 7-8 hour sleepers. In the combined model, only short sleepers were significantly less likely to report a sense of neighborhood belonging (no support for H3). In separate and combined models, individuals with moderate-to-severe insomnia were less likely to report neighborhood trust (no support for H4). In separate models, short sleepers and individuals reporting moderate-to-severe insomnia were significantly less likely to report neighborhood improvement behaviors. In combined models, individuals with moderate-to-severe insomnia were significantly less likely to report improvement (no support for H5, see Table 4).

DISCUSSION

There is a large and growing body of literature linking social and environmental factors, such as social capital, with individual health outcomes.[36,52,53] While many areas of health have been examined,[32-35] we know less about the relationship between social capital and sleep health. Due to the health disparities in sleep and population health broadly, it is vital to identify barriers to sleep health, such as poor social capital, in order to advance population health for all.[3,59] This paper extends social capital research to examine the relationship between several social capital variables (e.g., group participation, neighborhood belonging) and sleep-related variables, including sleep duration, insomnia and sleepiness. We do so in a cross-sectional study among adults living in Philadelphia and surrounding counties.

Our findings contribute to the growing literature on social capital and sleep health.[16-19] Our results show that long sleepers were less likely to report participation in social or community organizations in both separate and combined models, but not short sleepers. This is a novel contribution to the literature, as Win and colleagues found an association between short sleep duration and poor social capital,[37] and Pabayo and colleagues found an association between a similar construct, social fragmentation, and short sleep duration.[24] Then, consistent with the work from Win and Pabayo, our results found short sleepers were less likely to report helping behaviors and less likely to report a sense of belonging in their community, in both separate and combined models.

With regards to sleep duration, there is an argued U-shaped relationship whereby short sleep (less than 7 hours) is associated with health risks, as is long sleep (greater than 9 hours).[60] While the health detriment associated with short sleeping is well-documented,[6,7,9,56] there is less consensus regarding long sleep and its health detriment.[2,61] Our results show long sleepers are less likely to report social capital (e.g., group memberships) compared to those sleeping 7 to 8 hours, which is a finding that buttresses the U-shaped curve argument that long sleep is associated with adverse outcomes. However, one argument to explain the association between long sleep and poor social capital in this study could be that long sleep may be due to conditions such as anxiety or depression, which would lower one's capacity and motivation for group interaction and its social capital benefits. On the other hand, it may be that long sleepers have less total available time in a 24-hour cycle for socializing thereby limiting their ability to fully engage in their social network.

While other studies examined sleep duration and quality as it relates to social capital, cohesion, and neighborhood-related factors,[17,24,27,37] few have examined daytime sleepiness and insomnia as they relate to social capital. Results from our study found insomnia was significantly, inversely associated with neighborhood trust and improvement behavior in combined models. This is a novel finding, as previous work found a significant relationship between social cohesion and sleep duration and sleep quality, but not insomnia.[17,24,27,37] Further, daytime sleepiness, although a predictor in separate models of low neighborhood helping behavior and low neighborhood belonging, was not a significant predictor of either social capital measure in combined models.

It is interesting to note the different patterns of directionality observed in separate models compared to patterns observed in combined models predicting sleep health dimensions and social capital factors. For instance, daytime sleepiness was a significant predictor of social capital in separate models but not in combined models. Our aim in analyzing sleep health variables together in combined models was to examine whether any specific sleep-related variable demonstrated an association that was unique and not otherwise explained by the others. In this way, the lack of significant association for sleepiness in combined models suggests that the variance explained by sleepiness generally overlaps with that explained by other sleep variables.

Although not all associations between sleep and social capital components were significant in both separate and combined models, there is a general trend toward a relationship between poor sleep health (e.g., short or long sleep, moderate-to-severe insomnia) and poor

social capital (e.g., fewer group memberships, less neighborhood helping behavior, belonging, trust, and improvement). It could be that certain dimensions of poor sleep health (e.g., short sleep) have specific implications for aspects of social behavior, but not others. Combining sleep health dimensions (e.g., duration and insomnia) into a single scale may be one opportunity for future research.

In addition, future research might explore the causal direction between sleep duration, insomnia, and sleepiness and social capital in longitudinal research to examine how sleep health and social capital evolve over time. It would also be insightful to examine the impact of improvements to social capital and their implications for sleep health, or conversely, improvements to social capital and their benefit for sleep health.

In sum, social capital may be a concept with potential for advancing our understanding of the link between social/environmental factors, sleep, and perhaps also population health. For instance, poor social capital and lower access to resources (e.g., both tangible such as goods or financial assistance and intangible, such as social support) may be a driving force in the link between short or long sleep and undesirable health outcomes.

Limitations

The sleep-reported data in this study are retrospective self-report and possible biases exist in reports of sleep duration, insomnia, and sleepiness. In addition, the data were collected in one geographical location and in predominantly urban and suburban settings. Data collected from alternative locations may yield different results. Also, the cross-sectional nature of the study precludes any causality inferences. It should be noted that the current study collected self-reported sleep, as opposed to actual sleep need. Also, while our paper is the first to our knowledge to offer a comprehensive assessment of various social capital dimensions and sleep health parameters, our data are cross-sectional. Future research is needed to understand the directionality of the relationship between social capital and sleep health. Finally, SES and neighborhood characteristics, such as social cohesion, have been conceptualized in the literature as similar constructs,[18,19] yet research examining specific neighborhood dimensions, such as social fragmentation and social capital, have controlled for aspects of SES in their analyses.[17,24,27,37] Consistent with this approach, our analysis controlled for aspects of SES so as to specifically examine social capital. Thus, our findings may be different if we did not control for SES in our study. Future research may examine the conceptual overlap between specific SES dimensions (e.g., income, education, race) and their relationship to social capital.

Implications and Future Directions

Results from the current study offer several directions for future research. We detected an association between long sleep and several social capital. These patterns may be further explored in future research, as the previous evidence suggests an association between short sleep and poor social capital, research in the future may examine longitudinal patterns of sleep health and social capital to understand the directionality of the association between these constructs.

Public health approaches may be considered for methods, such as engaging community health workers or community events that specifically aim to improve social capital building events and messaging, so as to increase social capital among individuals who reside in communities at risk for poor social capital and poor sleep health or consider community-based methods for improving sleep health as a method for improving social capital. Also, as sleep is a behavior that is linked to a suite of health outcomes, including chronic conditions, such as diabetes, hypertension, and mortality risk,[6,9,44] it may be interesting to examine how improving social capital may improve sleep and consequently, chronic disease management. Finally, future research may combine social network analysis (e.g., examining connections among individuals) with measures of social capital to examine how these factors interact and bear consequence for sleep and health.

Conclusion

Our study offers preliminary evidence for the link between social capital and several self-reported sleep variables. Specifically, we find preliminary evidence to suggest poor sleep health (e.g., short and long sleep duration and insomnia) is associated with poor social capital (e.g., less participation in social or community organizations, lower helping behavior and less neighborhood trust, belonging, and improvement). The importance of social network factors, such as social capital, for health has been demonstrated in other domains, including smoking and alcohol consumption.[29,30] Social capital may be a social network factor that helps advance our understanding of the link between neighborhoods, sleep, and population health.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

REFERENCES

1. Hirshkowitz M, Whiton K, Albert SM, et al. National Sleep Foundation's sleep time duration recommendations: methodology and results summary. Sleep Health J Natl Sleep Found. 2015;1(1): 40–43. doi:10.1016/j.sleh.2014.12.010
2. Watson NF, Badr MS, Belenky G, et al. Joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society on the recommended amount of sleep for a healthy adult: Methodology and discussion. Sleep. 2015;38(8):1161–1183. doi:10.5665/sleep.4886 [PubMed: 26194576]
3. St-Onge M-P, Grandner MA, Brown D, et al. Sleep duration and quality: Impact on lifestyle behaviors and cardiometabolic health: A scientific statement from the American Heart Association. Circulation. 2016;134(18):e367–e386. doi:10.1161/CIR.0000000000000444 [PubMed: 27647451]
4. Hyyppä MT, Kronholm E, Mattlar CE. Mental well-being of good sleepers in a random population sample. Br J Med Psychol. 1991;64(Pt 1):25–34. [PubMed: 2043502]
5. Calkins AW, Hearon BA, Capozzoli MC, Otto MW. Psychosocial predictors of sleep dysfunction: the role of anxiety sensitivity, dysfunctional beliefs, and neuroticism. Behav Sleep Med. 2013;11(2): 133–143. [PubMed: 23136825]
6. Buxton OM, Marcelli E. Short and long sleep are positively associated with obesity, diabetes, hypertension, and cardiovascular disease among adults in the United States. Soc Sci Med. 2010;71(5):1027–1036. [PubMed: 20621406]
7. Gangwisch JE, Heymsfield SB, Boden-Albala B, et al. Short sleep duration as a risk factor for hypertension. Hypertension. 2006;47(5):833–839. [PubMed: 16585410]

8. Zizi F, Jean-Louis G, Brown CD, Ogedegbe G, Boutin-Foster C, McFarlane SI. Sleep duration and the risk of diabetes mellitus: epidemiologic evidence and pathophysiologic insights. Curr Diab Rep. 2010;10(1):43–47. [PubMed: 20425066]
9. Grandner MA, Hale L, Moore M, Patel NP. Mortality associated with short sleep duration: The evidence, the possible mechanisms, and the future. Sleep Med Rev. 2010;14(3):191–203. doi: 10.1016/j.smrv.2009.07.006 [PubMed: 19932976]
10. Patel SR, Ayas NT, Malhotra MR, et al. A prospective study of sleep duration and mortality risk in women. Sleep. 2004;27(3):440–444. [PubMed: 15164896]
11. Hale L, Peppard PE, Young T. Does the demography of sleep contribute to health disparities. Sleep Disord Their Impact Public Health. 2007:1–17.
12. Jackson CL, Hu FB, Redline S, Williams DR, Mattei J, Kawachi I. Racial/ethnic disparities in short sleep duration by occupation: The contribution of immigrant status. Soc Sci Med. 2014;118:71–79. [PubMed: 25108693]
13. Nunes J, Jean-Louis G, Zizi F, et al. Sleep duration among black and white Americans: results of the National Health Interview Survey. J Natl Med Assoc. 2008;100(3):317–322. [PubMed: 18390025]
14. Grandner MA, Williams NJ, Knutson KL, Roberts D, Jean-Louis G. Sleep disparity, race/ethnicity, and socioeconomic position. Sleep Med. 2016;18:7–18. [PubMed: 26431755]
15. Pandey A, Donat M, Mahmud S, Brimah P, Zizi F, Jean-Louis G. Risk of obstructive sleep apnea and anxiety among blacks with metabolic syndrome. Chest. 2011;140(4_MeetingAbstracts):796A–796A. doi:10.1378/chest.1113865
16. Johnson DA, Simonelli G, Moore K, et al. The Neighborhood Social Environment and Objective Measures of Sleep in the Multi-Ethnic Study of Atherosclerosis. Sleep. 9 2016.
17. Desantis AS, Diez Roux AV, Moore K, Baron KG, Mujahid MS, Nieto FJ. Associations of neighborhood characteristics with sleep timing and quality: the Multi-Ethnic Study Of Atherosclerosis. Sleep. 2013;36(10):1543–1551. doi:10.5665/sleep.3054 [PubMed: 24082314]
18. Brouillette RT, Horwood L, Constantin E, Brown K, Ross NA. Childhood sleep apnea and neighborhood disadvantage. J Pediatr. 2011;158(5):789–795.e1. doi:10.1016/j.jpeds.2010.10.036 [PubMed: 21146181]
19. Spilsbury JC, Storfer-Isser A, Kirchner HL, et al. Neighborhood disadvantage as a risk factor for pediatric obstructive sleep apnea. J Pediatr. 2006;149(3):342–347. doi:10.1016/j.jpeds.2006.04.061 [PubMed: 16939744]
20. Bourdieu P La Distinction: Critique Sociale Du Jugement. Vol 12 Editions de minuit; 1979.
21. Burt RS. A note on social capital and network content. Soc Netw. 1997;19(4):355–373.
22. Coleman JS. Social capital in the creation of human capital. Am J Sociol. 1988;94:S95–S120.
23. Hawe P, Shiell A. Social capital and health promotion: a review. Soc Sci Med. 2000;51 (6):871–885. doi:10.1016/S0277-9536(00)00067-8 [PubMed: 10972431]
24. Pabayo R, Molnar BE, Street N, Kawachi I. The relationship between social fragmentation and sleep among adolescents living in Boston, Massachusetts. J Public Health. 2014;36(4):587–598. doi:10.1093/pubmed/fdu001
25. Hale L, Hill TD, Burdette AM. Does sleep quality mediate the association between neighborhood disorder and self-rated physical health? Prev Med. 2010;51(3-4):275–278. doi:10.1016/j.ypmed. 2010.06.017 [PubMed: 20600254]
26. Faubel R, Lopez-Garcia E, Guallar-Castillón P, et al. Sleep duration and health-related quality of life among older adults: a population-based cohort in Spain. Sleep. 2009;32(8):1059. [PubMed: 19725257]
27. Johnson AL, Jung L, Song Y, Brown KC, Weaver MT, Richards KC. Sleep deprivation and error in nurses who work the night shift. J Nurs Adm. 2014;44(1): 17–22. doi:10.1097/NNA. 0000000000000016 [PubMed: 24316614]
28. McPherson M, Smith-Lovin L, Cook JM. Birds of a feather: Homophily in social networks. Annu Rev Sociol. 2001;27:415–444.
29. Christakis NA, Fowler JH. The collective dynamics of smoking in a large social network. N Engl J Med. 2008;358(21):2249–2258. [PubMed: 18499567]

30. Rosenquist JN, Murabito J, Fowler JH, Christakis NA. The spread of alcohol consumption behavior in a large social network. Ann Intern Med. 2010;152(7):426. [PubMed: 20368648]
31. Mednick SC, Christakis NA, Fowler JH. The spread of sleep loss influences drug use in adolescent social networks. PloS One. 2010;5(3):e9775. [PubMed: 20333306]
32. Economou M, Madianos M, Peppou LE, Souliotis K, Patelakis A, Stefanis C. Cognitive social capital and mental illness during economic crisis: A nationwide population-based study in Greece. Soc Sci Med. 2014;100:141–147. doi:10.1016/j.socscimed.2013.11.006 [PubMed: 24444849]
33. Landstedt E, Almquist YB, Eriksson M, Hammarström A. Disentangling the directions of associations between structural social capital and mental health: Longitudinal analyses of gender, civic engagement and depressive symptoms. Soc Sci Med. 2016;163:135–143. doi:10.1016/j.socscimed.2016.07.005 [PubMed: 27423294]
34. Kawachi I, Kennedy BP, Lochner K, Prothrow-Stith D. Social capital, income inequality, and mortality. Am J Public Health. 1997;87(9):1491–1498. [PubMed: 9314802]
35. Lindström M, Giordano GN. The 2008 financial crisis: Changes in social capital and its association with psychological wellbeing in the United Kingdom – A panel study. Soc Sci Med. 2016;153:71–80. doi:10.1016/j.socscimed.2016.02.008 [PubMed: 26889949]
36. Kawachi I, Kennedy B, Glass R. Social capital and self-rated health: a contextual analysis. Am J Public Health. 1999;89(8):1187–1193. [PubMed: 10432904]
37. Win T, Yamazaki T, Kanda K, Tajima K, Sokejima S. Neighborhood social capital and sleep duration: a population based cross-sectional study in a rural Japanese town. BMC Public Health. 2018;18. doi:10.1186/s12889-018-5204-4
38. Grandner MA. Sleep, health, and society. Sleep Med Clin. 2017;12(1):1–22. [PubMed: 28159089]
39. Chen D, Yang T-C. The pathways from perceived discrimination to self-rated health: An investigation of the roles of distrust, social capital, and health behaviors. Soc Sci Med. 2014;104:64–73. doi:10.1016/j.socscimed.2013.12.021 [PubMed: 24581063]
40. De Clercq B, Pfoertner T-K, Elgar FJ, Hublet A, Maes L. Social capital and adolescent smoking in schools and communities: A cross-classified multilevel analysis. Soc Sci Med. 2014;119:81–87. doi:10.1016/j.socscimed.2014.08.018 [PubMed: 25150654]
41. Centers for Disease Control and Prevention. National Health and Nutrition Examination Survey Phone Follow-up Dietary Interviewer Procedures Manual.; 2008.
42. National Center for Health Statistics. Analytic and reporting guidelines: the national health and nutrition examination survey (NHANES). Hyattsville MD Cent Dis Control Prev. 2006.
43. Gangwisch JE, Malaspina D, Boden-Albala B, Heymsfield SB. Inadequate sleep as a risk factor for obesity: analyses of the NHANES I. SLEEP. 2005;28(10):1289. [PubMed: 16295214]
44. Grandner MA, Chakravorty S, Perlis ML, Oliver L, Gurubhagavatula I. Habitual sleep duration associated with self-reported and objectively determined cardiometabolic risk factors. Sleep Med. 2014;15(1):42–50. [PubMed: 24333222]
45. Jean-Louis G, Williams NJ, Sarpong D, et al. Associations between inadequate sleep and obesity in the US adult population: analysis of the national health interview survey (1977-2009). BMC Public Health. 2014;14(1):1. [PubMed: 24383435]
46. Bastien CH, Vallières A, Morin CM. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. Sleep Med. 2001;2(4):297–307. [PubMed: 11438246]
47. Morin CM, Belleville G, Bélanger L, Ivers H. The Insomnia Severity Index: psychometric indicators to detect insomnia cases and evaluate treatment response. Sleep. 2011;34(5):601–608. [PubMed: 21532953]
48. Chaudhary NS, Kampman KM, Kranzler HR, Grandner MA, Debbarma S, Chakravorty S. Insomnia in alcohol dependent subjects is associated with greater psychosocial problem severity. Addict Behav. 2015;50:165–172. [PubMed: 26151580]
49. Buysse DJ, Hall ML, Strollo PJ, et al. Relationships between the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), and clinical/polysomnographic measures in a community sample. J Clin Sleep Med JCSM Off Publ Am Acad Sleep Med. 2008;4(6):563–571.
50. Gradisar M, Gardner G, Dohnt H. Recent worldwide sleep patterns and problems during adolescence: a review and meta-analysis of age, region, and sleep. Sleep Med. 2011;12(2):110–118. [PubMed: 21257344]

51. Johns MW. Daytime sleepiness, snoring, and obstructive sleep apnea: the Epworth Sleepiness Scale. Chest. 1993;103(1):30–36. [PubMed: 8417909]
52. Veenstra G Social capital, SES and health: an individual-level analysis. Soc Sci Med. 2000;50(5): 619–629. doi:10.1016/S0277-9536(99)00307-X [PubMed: 10658843]
53. Cattell V Poor people, poor places, and poor health: the mediating role of social networks and social capital. Soc Sci Med. 2001;52(10):1501–1516. doi:10.1016/S0277-9536(00)00259-8 [PubMed: 11314847]
54. Fang J, Wheaton AG, Keenan NL, Greenlund KJ, Perry GS, Croft JB. Association of sleep duration and hypertension among US adults varies by age and sex. Am J Hypertens. 2011;25(3): 335–341. [PubMed: 22052075]
55. Grandner MA, Petrov ME, Rattanaumpawan P, Jackson N, Platt A, Patel NP. Sleep symptoms, race/ethnicity, and socioeconomic position. J Clin Sleep Med. 2013;9(9):897–905. [PubMed: 23997702]
56. Stamatakis KA, Kaplan GA, Roberts RE. Short sleep duration across income, education, and race/ ethnic groups: population prevalence and growing disparities during 34 years of follow-up. Ann Epidemiol. 2007;17(12):948–955. [PubMed: 17855122]
57. Lynch JW, Kaplan GA, Shema SJ. Cumulative impact of sustained economic hardship on physical, cognitive, psychological, and social functioning. N Engl J Med. 1997;337(26):1889–1895. [PubMed: 9407157]
58. Strawbridge WJ, Wallhagen MI. Self-rated health and mortality over three decades results from a time-dependent covariate analysis. Res Aging. 1999;21(3):402–416.
59. Sarris J, O'Neil A, Coulson CE, Schweitzer I, Berk M. Lifestyle medicine for depression. BMC Psychiatry. 2014;14:107. doi:10.1186/1471-244X-14-107 [PubMed: 24721040]
60. Bliwise DL, Young TB. The Parable of Parabola: What the U-Shaped Curve Can and Cannot Tell Us about Sleep. Sleep. 2007;30(12):1614–1615. doi:10.1093/sleep/30.12.1614 [PubMed: 18246971]
61. Grandner MA, Drummond SPA. Who are the long sleepers? Towards an understanding of the mortality relationship. Sleep Med Rev. 2007;11(5):341–360. doi: 10.1016/j.smrv.2007.03.010 [PubMed: 17625932]

HIGHLIGHTS

- Social capital, or the quality of networks and relationships among people who live and work together, is a strong predictor of health. Yet, little research has examined the relationship between social capital and sleep.
- We examine the relationship between social capital and several dimensions of sleep health, including duration, insomnia, and daytime sleepiness.
- We find a pattern of poor sleep health (e.g., short sleep duration and moderate-to-severe insomnia) associated with poor social capital (e.g., fewer group memberships and sense of neighborhood belonging). Interestingly, we did not find any significant associations between daytime sleepiness and social capital. Social capital may be an important factor for understanding social and environmental determinants of sleep health and population health.

Table 1.

Characteristics of the sample (N =1,007).

Variable		Total		Participation in Social or Community Organizations				Neighborhood Helping Behavior				Neighborhood Belonging			Neighborhood Trust			Neighborhood Improvement		
		N	%	None %	One %	Two+ %	P-Value	Never %	Sometime %	Often %	P-Value	No %	Yes %	P-Value	Disagree %	Agree %	P-Value	No %	Yes %	P-Value
Age, yrs *	Mean		34.0	33.2	33.5	35.3	**0.006**	35.5	33.2	32.9	**0.000**	32.5	35	**<.0001**	32.5	35	**<.0001**	32.9	34.7	**0.003**
	Standard Deviation		9.4	9.1	8.9	10.0		10.0	9.0	8.9		8.5	9.9		8.5	9.9		8.9	9.7	
Sex	Male	619	50.9%	39.2%	39.4%	36.8%	0.738	35.4%	40.7%	39.8%	0.290	40.0%	37.6%	0.449	44.4%	35.5%	0.449	37.0%	39.5%	0.432
	Female	597	49.1%	60.8%	60.6%	63.3%		64.6%	59.3%	60.2%		60.1%	62.4%		55.6%	64.6%		63.0%	60.5%	
Race/Ethnicity	Non-Hispanic White	251	58.1%	61.9%	63.9%	53.6%	0.113	58.7%	63.0%	55.6%	0.467	59.0%	59.9%	0.512	46.2%	66.5%	0.512	60.4%	59.0%	**0.010**
	Black/African-American	46	10.6%	22.2%	21.3%	31.0%		27.2%	22.6%	25.5%		23.8%	25.9%		36.9%	18.8%		21.1%	27.3%	
	Hispanic/Latino	55	12.7%	5.5%	3.9%	3.9%		4.4%	3.7%	6.2%		5.5%	4.0%		6.4%	3.6%		4.0%	4.9%	
	Asian	54	12.5%	5.5%	6.1%	5.1%		4.4%	5.3%	7.3%		5.3%	5.6%		4.1%	6.2%		8.3%	3.8%	
	Other/Multiracial	26	6.0%	5.0%	4.8%	6.3%		5.4%	5.3%	5.4%		6.5%	4.6%		6.4%	4.9%		6.2%	4.9%	
Education	Less than high school	26	2.6%	3.2%	2.2%	1.8%	0.117	2.2%	2.7%	3.1%	0.798	3.0%	2.3%	0.679	3.2%	2.3%	0.679	1.6%	3.2%	0.157
	High School	106	10.5%	12.5%	8.2%	9.3%		12.2%	9.3%	10.0%		9.7%	11.1%		15.9%	7.7%		9.6%	11.1%	
	Some College	312	31.0%	32.2%	26.4%	32.8%		32.2%	31.0%	29.3%		29.8%	31.8%		38.6%	27.0%		29.0%	32.2%	
	College	563	55.9%	52.2%	63.2%	56.0%		53.5%	57.1%	57.5%		57.6%	54.8%		42.4%	63.0%		59.8%	53.6%	
Income	< $20,000	182	18.1%	18.6%	17.8%	17.5%	0.036	14.1%	19.3%	22.4%	0.002	23.3%	14.7%	<.0001	25.4%	14.4%	<.0001	18.6%	17.9%	0.963
	$20,000-$34,999	232	23.0%	25.2%	22.5%	20.5%		19.7%	25.4%	23.9%		24.1%	22.2%		28.0%	20.3%		22.6%	23.1%	
	$35,000-$49,999	250	24.8%	28.6%	22.1%	21.7%		24.1%	23.5%	27.4%		25.1%	24.5%		24.5%	24.9%		23.7%	25.4%	
	$50,000-$74,999	157	15.6%	12.7%	17.3%	18.4%		18.9%	13.2%	14.3%		15.4%	15.7%		13.5%	16.7%		15.7%	15.5%	
	> $75,000	187	18.6%	15.0%	20.4%	22.0%		23.2%	18.5%	12.0%		12.2%	22.9%		8.7%	23.8%		19.4%	18.1%	
Sleep Duration	Very Short (≤4 hours)	96	9.5%	10.7%	6.1%	10.2%	**0.018**	10.3%	6.4%	13.1%	**0.020**	10.7%	8.8%	0.081	12.4%	8.0%	0.081	8.5%	10.1%	0.439
	Short (5 to 6 hours)	381	37.8%	38.3%	33.3%	40.4%		34.3%	39.4%	40.5%		41.7%	35.3%		43.2%	35.0%		41.0%	36.0%	
	Normal (7 to 8 hours)	480	47.7%	44.4%	57.1%	45.5%		50.5%	50.0%	40.2%		43.2%	50.7%		40.1%	51.7%		45.7%	48.8%	
	Long (>9 hours)	50	5.0%	6.6%	3.5%	3.9%		4.9%	4.2%	6.2%		4.5%	5.3%		4.3%	5.3%		4.8%	5.1%	
Insomnia Symptoms †	None	350	34.8%	34.2%	35.5%	34.9%	0.105	34.9%	36.2%	32.4%	0.112	29.8%	38.1%	**0.010**	27.4%	38.6%	**0.010**	31.7%	36.6%	0.140
	Mild	389	38.6%	36.1%	44.2%	38.3%		41.9%	37.8%	35.1%		39.5%	38.1%		38.9%	38.5%		38.6%	38.7%	
	Moderate	268	26.6%	29.7%	20.4%	26.8%		23.2%	25.9%	32.4%		30.8%	23.8%		33.7%	22.9%		29.8%	24.7%	
Daytime Sleepiness **	Mean		7.8	8.1	7.5	7.7	0.208	7.54	7.74	8.43	0.056	8.4	7.5	**0.002**	8.42	7.46	**0.002**	7.8	7.9	0.960

Variable	Total N	Total %	Participation in Social or Community Organizations: None %	One %	Two+ %	P-Value	Neighborhood Helping Behavior: Never %	Sometime %	Often %	P-Value	Neighborhood Belonging: No %	Yes %	P-Value	Neighborhood Trust: Disagree %	Agree %	P-Value	Neighborhood Improvement: No %	Yes %	P-Value
Standard Deviation		4.7	4.6	4.3	4.7		4.7	4.4	4.8		4.9	4.4		4.8	4.4		4.6	4.6	

*Data displayed in mean, standard deviation.

**Responses collected on a scale from 1 to 7.

†Insomnia was scored as “none” for participants who scored 0 to 7 on the ISI, as “mild” for participants who scored 8 to 14 on the ISI, and “moderate-severe” for participants who scored 15-28

Table 2.

Binomial logistic regression, single and combined models, examining the relationship between sleep (duration, insomnia, and sleepiness) and participation in social or community organizations (0 and 1 or more organizations), adjusting for age, sex, race/ethnicity, education, and income (N =1,007).

		Participation in Social or Community Organizations (Comparison: No Participation)*							
		One Membership				Two+ Memberships			
			C.I.				C.I.		
Variables (Single/Combined Models)		OR	Lower	Upper	P-Value	OR	Lower	Upper	P-Value
Separate Models									
Sleep Duration	Very Short (≤4hrs)	0.5	0.3	1.0	**0.044**	0.9	0.5	1.5	0.712
	Short (5-6hrs)	0.7	0.5	1.0	0.067	1.0	0.7	1.4	0.976
	Recommended duration (7-8hrs)	1.00		Reference			Reference		
	Long (>9hrs)	0.4	0.2	0.9	**0.031**	0.6	0.3	1.2	0.133
Insomnia†	None	1.00		Reference			Reference		
	Mild	1.3	0.9	1.8	0.235	1.1	0.8	1.5	0.624
	Moderate-Severe	0.7	0.5	1.1	0.169	0.9	0.6	1.4	0.751
Sleepiness‡	High	0.8	0.6	1.2	0.320	0.8	0.6	1.1	0.163
Combined Models									
Sleep Duration	Very Short (≤4hrs)	0.5	0.3	1.1	0.101	1.0	0.5	1.7	0.895
	Short (5-6hrs)	0.7	0.5	1.0	0.076	1.0	0.7	1.4	0.957
	Recommended duration (7-8hrs)	1.00		Reference			Reference		
	Long (>9hrs)	0.4	0.2	0.9	**0.031**	0.6	0.3	1.2	0.131
Insomnia†	None	1.00		Reference			Reference		
	Mild	1.4	1.0	2.1	0.086	1.1	0.8	1.6	0.513
	Moderate-Severe	0.9	0.6	1.5	0.778	1.0	0.7	1.6	0.929
Sleepiness‡	High	0.9	0.6	1.3	0.568	0.8	0.6	1.1	0.161

†Insomnia was scored as “none” for participants who scored 0 to 7 on the ISI, as “mild” for participants who scored 8 to 14 on the ISI, and “moderate-severe” for participants who scored 15 to 28.

‡Sleepiness was scored as “high” for participants who scored 10 or higher on the ESS.

Table 3.

Multinomial logistic regression, single and combined models, examining the relationship between sleep (duration, insomnia, and sleepiness) and neighbor helping behavior (often/always, sometimes, and rarely/never), adjusting for age, sex, race/ethnicity, income, and education (N =1,007).

		Neighborhood Helping Behavior (Comparison: Often/Always)*							
		Sometimes				Rarely/Never			
			C.I.		P-		C.I.		P-
Variables (Single/Combined Models)		**OR**	**Lower**	**Upper**	**Value**	**OR**	**Lower**	**Upper**	**Value**
Separate Models									
Sleep Duration	Very Short (≤4hrs)	0.7	0.3	1.2	0.24	1.8	1.0	3.2	**0.039**
	Short (5-6hrs)	1.2	0.9	1.7	0.18	1.6	1.1	2.3	**0.009**
	Recommended duration (7-8hrs)	1.0			Reference				
	Long (>9hrs)	0.8	0.3	1.6	0.537	1.4	0.6	2.9	0.355
Insomnia†	None	1.0			Reference				
	Mild	0.8	0.6	1.2	0.356	0.8	0.6	1.3	0.562
	Moderate-Severe	1.1	0.8	1.6	0.545	1.6	1.0	2.5	**0.026**
Sleepiness‡	High	1.0	1.0	1.0	0.495	1.0	1.0	1.1	**0.023**
Combined Model									
Sleep Duration	Very Short (≤4hrs)	0.6	0.3	1.2	0.160	1.5	0.9	2.8	0.221
	Short (5-6hrs)	1.2	0.9	1.7	0.239	1.6	1.1	2.3	**0.026**
	Recommended duration (7-8hrs)	1.0			Reference				
	Long (>9hrs)	0.8	0.4	1.6	0.531	1.4	0.7	2.9	0.379
Insomnia†	None	1.0			Reference				
	Mild	0.8	0.6	1.2	0.239	0.8	0.5	1.1	0.170
	Moderate-Severe	1.1	0.7	1.8	0.651	1.2	0.7	2.0	0.492
Sleepiness‡	High	1.0	1.0	1.1	0.597	1.0	1.0	1.1	0.158

†Insomnia was scored as “none” for participants who scored 0 to 7 on the ISI, as “mild” for participants who scored 8 to 14 on the ISI, and “moderate-severe” for participants who scored 15 to 28.

‡Sleepiness was scored as “high” for participants who scored 10 or higher on the ESS.

Table 4.

Binomial logistic regression, single and combined models, examining the relationship between sleep (duration, insomnia, and sleepiness) and neighborhood belonging, trust, and improvement adjusting for age, sex, race/ethnicity, education, and income (N =1,007).

		Neighborhood Belonging				Neighborhood Trust				Neighborhood Improvement			
			C.I.				C.I.				C.I.		
Variables (Single/Combined Models)		**OR**	**Lower**	**Upper**	**P-Value**	**OR**	**Lower**	**Upper**	**P-Value**	**OR**	**Lower**	**Upper**	**P-Value**
Single Models													
Sleep Duration	Very Short (≤4hrs)	0.6	0.4	1.0	0.056	0.8	0.5	1.4	0.497	0.9	0.5	1.4	0.528
	Short (5-6hrs)	0.6	0.5	0.9	**0.003**	0.7	0.5	1.0	**0.057**	0.7	0.5	1.0	**0.033**
	Recommended duration (7-8hrs)	1.00		Reference		1.0		Reference		1.00		Reference	
	Long (>9hrs)	1.2	0.6	2.3	0.548	1.1	0.6	2.2	0.730	1.0	0.5	1.9	0.987
Insomnia†	None	1.00		Reference		1.0		Reference		1.00		Reference	
	Mild	1.2	0.6	2.3	0.548	0.7	0.5	1.0	0.090	0.9	0.6	1.2	0.317
	Moderate-Severe	1.2	0.6	2.3	0.548	0.6	0.4	0.9	**0.005**	0.6	0.4	0.9	**0.011**
Sleepiness‡	High	1.2	0.6	2.3	0.548	0.8	0.6	1.1	0.242	0.9	0.7	1.2	0.515
Combined Model													
Sleep Duration	Very Short (≤4hrs)	0.8	0.5	1.3	0.381	1.1	0.6	1.9	0.760	1.1	0.6	1.8	0.853
	Short (5-6hrs)	0.7	0.5	1.0	**0.049**	0.8	0.6	1.2	0.327	0.8	0.6	1.1	0.163
	Recommended duration (7-8hrs)	1.00		Reference		1.0		Reference		1.0		Reference	
	Long (>9hrs)	1.3	0.7	2.4	0.459	1.2	0.6	2.4	0.608	1.1	0.6	2.0	0.868
Insomnia†	None	1.00		Reference		1.0		Reference		1.0		Reference	
	Mild	0.8	0.6	1.1	0.246	0.8	0.6	1.1	0.170	0.9	0.6	1.2	0.504
	Moderate-Severe	0.7	0.5	1.0	0.066	0.6	0.4	0.9	**0.024**	0.7	0.4	1.0	**0.040**
Sleepiness‡	High	0.8	0.6	1.1	0.139	1.0	0.7	1.3	0.755	1.0	0.8	1.4	0.915

*Reference groups include “disagree” for belonging, “disagree” for trust, and “no” for improvement.

†Insomnia was scored as “none” for participants who scored 0 to 7 on the ISI, as “mild” for participants who scored 8 to 14 on the ISI, and “moderate-severe” for participants who scored 15 to 28.

‡Sleepiness was scored as “high” for participants who scored 10 or higher on the ESS.