# Social support, social strain, sleep quality, and actigraphic sleep characteristics: evidence from a national survey of US adults

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## ARTICLE INFO

## ABSTRACT

*Objective:* To determine the associations between average family and friend social support and strain over 10 years and sleep quality, sleep efficiency, total sleep time, and night-to-night total sleep time variability.
*Participants:* Non-institutionalized English-speaking US adults aged 34–81 who participated in the MacArthur Study on Aging: Midlife in the United States.
*Measurements:* Sleep quality was assessed by the Pittsburgh Sleep Quality Index and by a 7-day daily diary. Sleep efficiency, total sleep time, and night-to-night total sleep time variability were assessed by actigraphy (MiniMitter 64).
*Results:* Social support, but not social strain, was significantly associated with both self-reported measures of quality (social support $\beta = -1.239, P = .019$ for global Pittsburgh Sleep Quality Index scores; social support $\beta = -0.248, P = .016$ for diary assessed quality). Lower scores on both quality measures indicate better sleep. In contrast, social strain, but not social support, was significantly associated with sleep efficiency (social strain $\beta = -3.780, P = .007$). Social strain, but not social support, was significantly associated with night-to-night sleep variability (social strain $\beta = 0.421, P = .034$); however, the overall model was not significant. Neither social support nor social strain was significantly associated with total sleep time.
*Conclusion:* Social support was significant for self-reported sleep, whereas only social strain was significantly associated with objective sleep parameters. Future research on social relationships and sleep should analyze both positive and negative aspects of relationships in tandem because effects appear to differ based on outcome.

## Introduction

The consequences of poor sleep are increasingly understood to affect health, from mortality risk to cardiovascular disease, obesity, diabetes, and many others (see Czeisler[1] [2015] for a summary).[1–5] The significance of sleep to health begs the question: What contributes to poor sleep? The determinants of sleep can be found at different levels of analysis, from the genetic to the social. This article operates at the social psychological level to understand how social support and social strain from family and friends may impact both subjective and objective sleep characteristics. The sleep literature at the social psychological level tends to consider 3 aspects of social relationships: social support, loneliness, and social strain, which are operationally defined as *perceptions* of the supportive, lacking (in connection), or strained aspects of the individual's social network.

The first aspect is social support. Seminal work by Cassel and Cobb in the 1970s established social support as a significant protective

factor for a variety of health outcomes.[6–8] These protective effects appear to hold for many aspects of sleep; conversely, a lack of social support is predictive of poor sleep. Low social support is associated with increased odds of shorter self-reported sleep duration, whether duration is operationalized as ≤6 hours, ≤7 hours, or perceived days of insufficient sleep per week.[9–11] When sleep was assessed by actigraphy, however, different results were obtained: emotional support was not predictive of total sleep time (TST) (or sleep quality) but was predictive of lesser wake after sleep onset.[12] Despite some differences between subjective and objective sleep outcomes for TST, it appears that supportive social relationships generally have a positive effect on sleep.

Supportive social relationships are thus highly desirable. When people want social connectedness and yet have their wishes frustrated, the result is conceptualized as loneliness. Loneliness, the second aspect of social relationships, is defined as a *perception* of a lack of social connection. Loneliness contributes to poor sleep efficiency (SE), poor daytime function, and sleep fragmentation but not sleep duration.[13–15] The mechanism by which loneliness affects sleep may include "feelings of vulnerability and unconscious vigilance for

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social threat, implicit cognitions that are antithetical to relaxation and sound sleep."[16 (p4)]

However, as desirable as relationships may be, relationships can themselves be a source of strain. Thus, a third approach builds on the social support literature to include the negative aspects of social relationships. It is important to note that the presence of strain does not necessarily imply the absence of support, for there is evidence to suggest that social support and strain are independent.[17,18] Because a lack of social support is not the same as the presence of strain, analysis of support alone would yield a partial understanding of the effect of social relationships on sleep. To date, however, few articles on sleep have included social strain.[19,20] This appears to be an oversight because the literature indicates that the effects of the negative aspects of social relationships on well-being generally tend to be either as powerful or even more so than the positive aspects of social relationships.[21] If this proposition holds for sleep, then negative aspects of social relationships may have a greater effect on sleep parameters.

This third line of research typically analyzes support and strain together. It consistently finds that negative aspects of relationships influence sleep. High levels of family strain and low levels of family support produce the highest odds of reporting weekly/daily sleep problems.[19] Interpersonal distress is correlated with sleep and arousal.[22] Aversive social ties correlate with poorer self-reported sleep quality, and supportive ties correlate with better sleep quality, with depression as a significant mediator.[20]

Strides have thus been made toward a fuller understanding of how social relationships affect self-reported sleep. However, it is well-known that self-reported and objectively measured sleep outcomes often yield different results, which suggests that they may be distinct phenomena deserving separate analysis.[23–25] In addition, some aspects of self-reported sleep such as global sleep quality and sleep problems do not have straightforward objective analogues. Thus, the literature has left open to investigation whether social support and strain are associated with *objectively* measured sleep parameters such as TST, SE, and night-to-night variability in TST, a parameter of increasing interest due to its association with depressive symptoms and subjective well-being.[26,27] Furthermore, it is unknown whether social support or strain will have the larger effect on objective sleep parameters and if results differ with self-reported sleep. A study employing both objective and subjective sleep outcomes may provide a clearer picture of the effects of social relationships on sleep.

Thus, the questions that motivate this study are: What are the contributions of social support and social strain to sleep quality, efficiency, TST, and night-to-night TST variability? Which has the greater effect on sleep: social support or social strain? It is hypothesized that support should be predictive of higher sleep quality, SE, TST, and lower night-to-night TST variability. Social strain, on the other hand, should be predictive of lower sleep quality, SE, TST, and higher night-to-night TST variability. However, if a comparative claim can be made, strain may have the larger effect, consistent with the literature on well-being.[21] This article thus considers the associations between positive and negative aspects of social relationships and sleep using multiple objective sleep parameters. Furthermore, this article analyzes sleep in a subset of a national probability sample, which is demographically diverse in age, sex, and marital status.

## Participants and methods

Data are drawn from the MacArthur study on Midlife Development in the United States (MIDUS), a national probability sample of noninstitutionalized English-speaking adults in the contiguous United States obtained by random-digit-dialing, aged 34-84 at wave II. Of the several waves, the first and second waves of MIDUS (1994-1995 and 2004-2006) and the Biomarker supplement (2004-

009) are used. Of the 7108 respondents at wave I, 4963 also responded at wave II. A subsample of this population, 1255 respondents, was assessed for the Biomarker supplement; data were collected 5 to 64 months after wave II. A further subsample participated in the sleep study. After exclusion of missing values on covariates and outcome variables, the total number of observations is 236.

The MIDUS study included a subset of twins and siblings. These observations are retained, necessitating the use of cluster robust standard errors. Cluster robust standard errors allow for intraclass correlation and compensate for overly precise estimates in regressions with possibly dependent observations by inflating standard errors and thus widening confidence intervals.[28]

*Outcome variables*

Sleep quality was assessed in 2 ways. The Biomarker supplement to MIDUS included the Pittsburgh Sleep Quality Index (PSQI), a widely used and well-known survey instrument intended to measure sleep quality over the previous month. It consists of 19 items used to form 7 component scores: subjective sleep quality, sleep latency, sleep duration, habitual SE, sleep disturbance, use of sleeping meds, and daytime dysfunction. Scores are coded and summed into a global score with a possible range of 0-21.[29] Lower scores represent better sleep.

Biomarker participants were invited to participate in a subsequent 7-day daily diary and actigraphy study. In the daily diary, respondents rated the overall quality of their sleep the previous night on a scale of 1 (very good) to 5 (very poor). The phenomenon of interest is patterns of sleep quality, and thus, the average of these 7 scores was calculated. Lower scores represent better sleep.

Total sleep time and SE were calculated by data collected from actigraphs, a sensor worn on the wrist of the nondominant arm that allows tracking of movement. The actigraph used in MIDUS was the MiniMitter Actiwatch 64. Actigraphy is particularly informative of sleep patterns because wrist actigraphs are relatively inexpensive and noninvasive and record data that allow for the calculation of TST, wake time, wake bouts, SE, and many other features of sleep that are useful to the researcher. The 7 TST and SE scores from each night were averaged to form an average of TST and SE over 7 nights. To capture variability across the 7 nights, night-to-night TST variability was calculated using mean squared successive differences (MSSD).[26,30] MSSD was calculated by the differences in successive TST squared, summed, and divided by n − 1. This variable was log transformed for normality (log MSSD Shapiro-Wilk $P = .302$). All outcomes were tested for significance of association with each other by Pearson correlation (Table A1).

*Social support and strain*

The primary independent variables of interest are social support and social strain. Social support and strain are constructed variables that are intended to measure, for support, "one's perceived notions of the caring and understanding exhibited by the network," and for strain, "individuals' general perception of the critical, irritating, and unreliable nature of their network."[31 (p7)] There are 3 network domains: family, friend, and spouse. For friends and family, respondents were asked 4 support questions: how much friends or family "care about you," "understand the way you feel," "how much you can rely on them," and "how much you can open up to them"; strain questions asked how often friends or family "make too many demands on you," "criticize you," "let you down when you are counting on them," and "get on your nerves". Spouse support and strain asked similar questions and 2 more in addition: support questions asked how much can the respondent "relax and be yourself around him or her" and how much does one's spouse "appreciate you"; strain questions asked how often does "he or she argue with you" and "make you