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Objective and Subjective Socioeconomic Gradients Exist for Sleep Quality, Sleep Latency, Sleep Duration, Weekend Oversleep, and Daytime Sleepiness in Adults

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Abstract

Socioeconomic gradients exist for multiple health outcomes. Lower objective socioeconomic position (SEP), whether measured by income, education, or occupation, is associated with inadequate sleep. Less is known about whether one's perceived ranking of their social status, or subjective SEP, affects sleep. This study examined whether a subjective socioeconomic gradient exists for sleep while controlling for objective SEP. Participants ($N = 177$; age, $M = 45.3$ years, $SD = 6.3$ years) completed the Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale, MacArthur Ladder, and other self-report measures to assess sleep and objective SEP. Subjective SEP trumped objective SEP as a better predictor of sleep duration, daytime sleepiness, and weekend oversleep. These findings highlight the need to expand our framework to better understand the mechanisms underlying socioeconomic gradients and sleep.

It is well established that a socioeconomic gradient exists for multiple health outcomes, even after adjusting for known risk factors. Adults of lower socioeconomic position (SEP) report more frequent acute and chronic physical (e.g., insomnia) and mental problems (e.g., depression), as well as poorer quality of life, compared to adults of higher SEP (Adler et al., 1994; Adler, Epel, Castellazzo, & Ickovics, 2000; Adler & Ostrove, 1999; Cohen et al., 2008; Gellis et al., 2005; Moore, Adler, Williams, & Jackson, 2002; Operario, Adler, & Williams, 2004; Ostrove, Adler, Kuppermann, & Washington, 2000; Schnittker & McLeod, 2005). Sleep has been posited to be a potential mechanism explaining how SEP may "get under the skin" to affect health (Hill, Burdette, & Hale, 2009; Moore et al., 2002; Van Cauter & Spiegel, 1999).

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Inadequate sleep adversely influences multiple physiological processes important in health outcomes, including immune functioning, glucose intolerance, diabetes, metabolic syndrome, obesity, and cardiovascular disease (Ayas et al., 2004; Spiegel, Leproult & Van Cauter, 1999; Steptoe, Peacey, & Wardle, 2006).

Objective measures of SEP, including lower income, education, and occupation status, have been linked to a greater subjective need for sleep (Ursin, Bjorvatn, & Holsten, 2005), greater difficulty initiating and maintaining sleep (Gellis et al., 2005; Hall, Bromberger, & Matthews, 1999; Lauderdale et al., 2006), considerably more accumulated sleep debt (Hall et al., 1999; Ursin et al., 2005), as well as both long (≥ 9 hr) and short (≥ 6 hr) sleep durations (Krueger & Friedman, 2009; Stamatakis, Kaplan, & Roberts, 2007; Stranges et al., 2008; Ursin et al., 2005), even after controlling for important covariates (e.g., gender, age, marital status, and smoking). Objective SEP broadly encompasses contextual factors related to access to tangible resources (Operario et al., 2004). Through absolute social (e.g., education status) and economic indicators (e.g., asset:debt ratio), access to material goods and services (e.g., fresh food and health care) is positively associated with social and health outcomes (Adler & Ostrove, 1999). Despite compelling evidence linking *objective* SEP and sleep, relatively little is known about the relationship between *subjective* SEP and sleep.

Subjective measures of SEP are based on individuals' perceptions of their own rank in the socioeconomic hierarchy in comparison to others. Subjective SEP is thought to more accurately capture subtle aspects of social status as it taps into psychosocial processes influenced by one's social context (Operario et al., 2004). Health disparities may stem from discordant social comparison, irrespective of one's objective SEP (cf. Adler et al., 1994; Singh-Manoux, Adler, & Marmot, 2003; Singh-Manoux, Marmot, & Adler, 2005; Wilkinson, 1999). In fact, subjective SEP has been found to better predict current physical and mental health, as well as changes in health status, over and above objective SEP (Singh-Manoux et al., 2003). A subjective SEP gradient exists for a range of health outcomes, including poorer psychological functioning (depression, negative affect, pessimism, reported stress, and general health ratings; Adler et al., 2000; Operario et al., 2004; Ostrove et al., 2000; Singh-Manoux et al., 2003), impaired physiological functioning (resting heart rate, body mass index, waist circumference, cortisol levels, vulnerability to upper respiratory infection, diabetes, and metabolic syndrome; Adler et al., 2000; Cohen et al., 2008; Manuck, Phillips, Gianaros, Flory, & Muldoon, 2010; Phillips, Neumann, Flory, Muldoon, & Manuck, 2007; Singh-Manoux et al., 2003; Wright & Steptoe, 2005), and even mortality (Kopp, Skrabski, Kawachi, & Adler, 2005; Singh-Manoux et al., 2003). It is interesting to note that inadequate sleep has been suggested as a potential culprit in the aetiology and maintenance of many of these conditions (Ayas et al., 2004; Spiegel et al., 1999; Steptoe et al., 2006).

Few studies have examined the relation between subjective SEP and sleep. Lower subjective SEP has been associated with prolonged sleep duration (Patel, Malhotra, Gottlieb, White, & Hu, 2006), longer sleep latency (Adler et al., 2000), and poorer sleep quality (Goodin, McGuire, & Smith, 2010). There is preliminary evidence that this association exists after controlling for objective SEP and negative affect (Adler et al., 2000), and may be moderated by ethnicity (Goodin et al., 2010). However, findings are limited to samples of middle-aged women and college students. To convincingly establish an association between subjective SEP and sleep, this finding merits replications with a sample of healthy adults, extensions to multiple sleep domains, and analyses controlling for objective SEP.

The aim of this study was to identify whether a subjective socioeconomic gradient exists for sleep, beyond objective socioeconomic indicators. The first objective was to replicate past research demonstrating socioeconomic gradients for sleep for both objective and subjective SEP in a sample of healthy, middle-aged adults. The second objective was to examine whether subjective SEP was an independent predictor of sleep, after adjusting for objective SEP. Based on the existing literature, it was posited that (a) lower SEP would be associated with more inadequate sleep (i.e., poorer sleep quality, longer sleep latency, shorter sleep duration, greater weekend oversleep, and daytime sleepiness), and (b) the association with subjective SEP would remain even after controlling for objective SEP.

METHOD

Participants

Participants took part in the larger Healthy Heart Project, a longitudinal study conducted at Concordia University, Montreal, Quebec. The Healthy Heart Project investigates risk factors and precursors to cardiovascular disease during childhood. Children and their parents were recruited using flyers posted throughout the community (e.g., bus stop and library) and bookmarks distributed by teachers in classrooms approved by local school boards.

Participants included 177 healthy adult parents aged 30 to 65 years living with their children. Exclusionary criteria included self-reported use of medication with cardiovascular effects, serious psychopathology, or significant medical conditions. All participants provided informed consent prior to the start of the study, and were compensated for their participation time. This study was approved by the Concordia University Research Ethics Board (No. UH2005-077-4).

Sleep

Sleep quality—The Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) is a 19-item, self-rated questionnaire to measure sleep quality and patterns over the past month. Items are used to derive seven clinically based subscales (sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, daytime dysfunction, and use of sleeping medication). Subscales (each weighted equally from 0–3) are summed to obtain the Global PSQI score (ranges from 0–21), with higher scores indicating considerable sleep disturbance.

Sleep latency—Sleep latency was measured using the sleep latency subscale from the PSQI, with higher scores indicating longer sleep latency (Buysse et al., 1989). Participants reported how long (in minutes) it typically took them to fall asleep during the past month.

Sleep duration—Participants provided their typical sleep and wake times for weekdays in response to the following question: "During the past month, what time do you usually *go to bed/wake up* on weekdays?" Sleep duration for weekdays was calculated as the difference between sleep and wake time. Although sleep duration for weekends was also reported, previous research suggests individuals oversleep during weekends 30 to 120+ min due to work and social schedules (Monk, Buysse, Rose, Hall, & Kupfer, 2000; National Sleep Foundation [NSF], 2008); thus, only sleep duration for weekdays was included, as it is more representative of typical sleep patterns.

Weekend oversleep—Weekend oversleep reflects a behavioral attempt to recover accumulated sleep loss that is needed to maintain a sense of feeling rested (Ursin et al., 2005). To assess the regularity of participants' sleep schedules, weekend oversleep was calculated as the difference between weekend and weekday total sleep duration.

Daytime sleepiness—The Epworth Sleepiness Scale (Johns, 1991) is an eight-item standardized scale to measure daytime sleepiness in adults. On a scale from 0 (*never*) to 3 (*high chance*), participants rated how likely they were to doze off in different daily situations (e.g., watching TV or sitting and reading). Items are summed to yield the total daytime sleepiness score (ranges from 0–24), with scores ≥ 10 reflective of excessive daytime sleepiness.

SEP

Objective SEP—Objective SEP was based on self-reported household income (< $10,000–$200,000 and over), highest level of schooling achieved (no formal schooling to doctorate), and employment status (employed vs. unemployed).

Subjective SEP—The MacArthur Scale of Subjective Social Status (Adler et al., 2000) was used to assess subjective SEP. The scale consists of a 10-rung ladder drawing (parallel to a visual analogue scale) on which participants rank themselves relative to others in their community ("place in society"). Participants place an "X" on the rung that best represents themselves in response to the following description:

> Think of this ladder representing where people stand in our society. At the top of the ladder are the people who are the best off, those who have the most money, most education, and best jobs. At the bottom are the people who are the worst off, those who have the least money, least education, and worst jobs or no jobs.

The participants' endorsed ranking reflects their perceived social standing in comparison to others within their society.

Post Hoc Measures

Mental health—Self-rated mental health was assessed by the five-item general mental health (psychological distress and well-being) scale of the Medical Outcomes Study 36-item Short-Form Health Survey (Ware & Sherbourne, 1992). Participants rated how often their general mood or affect during the past month included complaints related to anxiety, depression, loss of control, and psychological well-being. Response options range from "all of the time" to "none of the time"; lower scores suggest poorer mental health.

Perceived stress—The Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983) is a 10-item, self-report scale that measures the degree to which situations in one's life are appraised as stressful. Participants rate the frequency of stressful situations and feelings of stress over the past month (e.g., "How often have you been upset because of something that happened unexpectedly?"). Response options range from "never" to "very often"; higher scores indicate participants find their lives more unpredictable, uncontrollable, and overloaded.

Statistical Analyses

Data were double-entered, verified, and analyzed with Statistical Package for the Social Sciences 16.0 software (SPSS, Inc., Chicago, IL). Data were checked for assumptions of normality, linearity, and homogeneity of variance. All variables were maintained as continuous to maximize statistical power. Correlational analyses and collinearity diagnostics indicated potential multicollinearity (i.e., increases in standard errors of beta coefficients or limiting size of R^2; Myers, 1990) among objective SEP measures; thus, separate analyses were conducted for household income and education. The general linear model was used to univariately test each demographic covariate (age, gender, ethnicity, and employment status) and subjective and objective SEP measure singularly for every sleep measure (Global PSQI, sleep latency, sleep duration, weekend oversleep, and daytime sleepiness). Second, while controlling for the standard demographic covariates and objective SEP (education *or* household income), subjective SEP was modeled to predict sleep. Thus, each sleep outcome measure had two paired models (1 model with education and 1 model with income). Post hoc exploratory models were tested to consider whether mental health or perceived stress significantly contributed to the models.

RESULTS

Participants were predominantly middle-aged, Caucasian women, who were married, employed, and had completed an undergraduate degree or higher (see Table 1). The majority of participants were born in Canada (65%) and had lived in Montreal for 31 years (SD = 15.81). Sleep characteristics are presented in Table 2. Participants reported average wake and bedtimes (NSF, 2009), and were employed during regular hours (2% were shift workers). The majority of participants (63%) overslept on weekends by nearly 50 min. Almost one-half of the sample had significant sleep disturbances (PSQI scores ≥ 5), and 20% endorsed excessive daytime sleepiness.

Consistent with past research, subjective SEP was significantly correlated with household income ($r = .50$, $p < .01$) and years of education ($r = .26$, $p < .01$; Adler et al., 2000). Household income and education were also correlated ($r = .37$, $p < .01$). Subjective SEP, household income, and years of education did not differ by employment status (all ps $> .20$).

Gender was the only significant covariate; age, employment status, and ethnicity did not significantly contribute to any of the models. Gender was only significant for sleep duration —men slept 30 min less than women (see Table 3). Models were tested including all demographic covariates (age, gender, employment status, and ethnicity); results were consistent with those including gender alone. Thus, only the models including gender as a covariate are presented. The regression models are presented in Tables 3 and 4.

Hypothesis Testing

In the univariate models, each variable was entered singularly to predict sleep. Household income significantly predicted every sleep measure (sleep quality, sleep latency, sleep duration, weekend oversleep, and daytime sleepiness; average $\eta^2 = .05$). Education significantly predicted only sleep quality and sleep latency (average $\eta^2 = .02$). Subjective SEP significantly predicted every sleep measure, except sleep latency (average $\eta^2 = .04$). The significant models were all in the hypothesized direction; higher SEP was associated with better sleep quality, shorter sleep latency, longer sleep duration, shorter weekend oversleep, and less daytime sleepiness.

In the paired models, subjective SEP and objective SEP (education *or* income) were entered simultaneously, including gender as a covariate, to predict sleep. Subjective SEP better predicted sleep duration and daytime sleepiness than objective SEP, regardless of whether education or income was included in the model (sleep duration: average $\eta^2 = .04$; daytime sleepiness: average $\eta^2 = .05$). Subjective SEP better predicted weekend oversleep ($\eta^2 = .03$), but only with education in the model. Objective SEP better predicted sleep latency than subjective SEP, for both education and income (average $\eta^2 = .03$). Objective SEP better predicted sleep quality ($\eta^2 = .03$), but only with household income in the model. When education was modeled with subjective SEP, both objective and subjective SEP significantly predicated sleep quality (average $\eta^2 = .02$). These models were also tested including age, employment status, and ethnicity as additional covariates; results did not differ, and are not shown. The results partially support the hypothesis that subjective SEP would emerge as a better predictor of sleep problems, after controlling for objective SEP.

Post Hoc Exploratory Analyses

To facilitate comparison with earlier studies, self-rated mental health and perceived stress were included as covariates. Thus, in the post hoc models, subjective SEP and objective SEP (education *or* income) were entered simultaneously, including gender, mental health, and stress as covariates. After controlling for mental health and stress, all of the models were largely identical to the paired models, except for sleep quality (subjective SEP was no longer significant) and sleep latency (income was no longer significant).

DISCUSSION

The aim of this study was to identify whether a subjective socioeconomic gradient exists for sleep in adults. There was clear evidence of a subjective socioeconomic gradient such that individuals ranking themselves lower in comparison to others in their community reported poorer global sleep quality, shorter sleep duration, longer weekend oversleep, and greater daytime sleepiness; no gradient was observed for sleep latency. Further, after controlling for objective SEP, subjective SEP was a stronger predictor of sleep duration, weekend oversleep (education only), and daytime sleepiness. Adults who perceived themselves of lower social standing were more likely to rate their overall sleep quality as “fairly poor,” slept roughly 20 min less during weekdays, overslept on weekends by almost 1 hr, were twice as likely to fall asleep during daily sedentary situations, and endorsed greater sleep disturbances (subscales of PSQI; results not shown), compared to adults who perceived themselves of higher social standing, irrespective of objective SEP. Consistent with past research, an objective socioeconomic gradient was observed for all sleep measures with income, and for global sleep quality and sleep latency with education.

Sleep duration and daytime sleepiness evidenced clear gradients with subjective SEP, over and above objective SEP. The relation between subjective SEP and sleep duration was consistent with previous findings by Patel and colleagues (2006). They found that women of lower SEP were 5 times more likely to sleep ≥9 hr, compared to women of higher SEP. However, only prolonged sleep duration (≥7 hr) was analyzed among this highly homogenous sample of female registered nurses. Thus, it is possible that comparable results would have been observed if the full range of sleep duration (e.g., “short/normal” sleepers) and males had been included. Typically, optimal sleep duration (7–8 hr per night; Ferrara & DeGennaro, 2001) is reported among individuals with high levels of income, education, and occupational status (Krueger & Friedman, 2009; Stranges et al., 2008). This coincides with the Yerkes–Dodson principle (U-shaped pattern) that those with optimal sleep duration (neither too short nor too long) have decreased susceptibility to adverse health consequences (Ayas et al., 2004; Spiegel et al., 1999; Steptoe et al., 2006; Ursin et al., 2005). Together, these findings suggest that low subjective SEP is associated with both short (this study) and long sleep duration (Patel et al., 2006).

No previous studies have examined the relation of subjective SEP with daytime sleepiness or weekend oversleep. Daytime sleepiness has been increasingly related to adverse health outcomes, poor work performance, and injuries (Dean et al., 2010; Drake et al., 2010; Drake, Roehrs, Richardson, Walsh, & Roth, 2004; Ferrara & DeGennaro, 2001; Pallesen et al., 2007). The cumulative effects of chronic daytime sleepiness have been posited to hinder overall quality of life (Ferrara & DeGennaro, 2001), as much or more than sleep disorders (e.g., sleep apnea), physical and mental disorders (e.g., multiple sclerosis and depression), or even shift work (Dean et al., 2010; Drake et al., 2010; Drake et al., 2004; Ferrara & DeGennaro, 2001; Pallesen et al., 2007).

Weekend oversleep is considered an indicator of irregular sleep schedules, and can arguably be deemed a prevalent form of sleep problems among adults (NSF, 2008). “Catching up” on sleep on the weekends is seen as indirect evidence of sleep deprivation (Crosby, LeBourgeois, & Harsh, 2005), and is associated with impaired daytime functioning (i.e., driving drowsy or reduced work productivity; NSF, 2008; Wolfson & Carskadon, 1998), greater anxiety, depression, and low self-esteem (El-Sheik, Kelly, Buckhalt, & Hinnant, 2010), as well as circadian desynchronization (Dollander, 2002). Thus, daytime sleepiness and weekend oversleep provide additional insight into how sleep schedule, nocturnal sleep, or lack thereof, may influence overall daytime functioning and well-being (Dean et al., 2010; Drake et al., 2010; Drake et al., 2004; Pallesen et al., 2007; Ursin et al., 2005).

Subjective sleep quality was better predicted by objective SEP, when controlling for subjective SEP. This is consistent with the findings of Adler and colleagues (2000), who found a significant, negative correlation between sleep quality with objective SEP (education and income), but not with subjective SEP (ladder). It is also partially consistent with the findings observed by Goodin and colleagues (2010), who found an interaction between ethnicity and subjective SEP such that, among Caucasians, there was no relation between sleep quality and subjective SEP, after controlling for occupational status ("work for pay" vs. "not working for pay"). Among Asian Americans and African Americans only, subjective SEP predicted sleep quality. The consistency of these findings may be partly attributable to sample characteristics and the assessment of sleep quality. Adler et al.'s (2000) study consisted entirely of women; this study was *predominantly* women (80%). Across all three studies, the PSQI was used as an index of sleep quality.

Sleep latency was better predicted by objective SEP, after controlling for subjective SEP. This finding was inconsistent with Adler et al.'s (2000) findings that subjective SEP predicted sleep latency, after controlling for objective SEP and negative affect. Post hoc analyses were conducted to control for similar covariates, including well-being and perceived stress; subjective SEP still did not predict sleep latency. Compared to our participants, the Adler et al. (2000) sample was less educated (high school education: 5.2% vs. 32.2%) and had lower household incomes (median income: $30,000 vs. $65,000). There is evidence to suggest that sleep latency may be attributable to tangible resources related to objective SEP. In fact, exposure to noise from traffic, aircraft, a railway, and the neighborhood is inversely related to income (Gualezzi, 1998). Further, because the body responds to external stimuli, noise is linked with significant increases in sleep latency (Griefahn, Marks, & Robens, 2006), body movement, psychological stress (Stansfeld & Matheson, 2003), as well as adverse effects on the cardiovascular (e.g., increased heart rate; Zhao, Zhang, Selin, & Spear, 1991) and endocrine systems (e.g., increased catecholamines; Evans, Hygge, & Bullinger, 1995).

Subjective SEP may better account for observed socioeconomic gradients with health. Several researchers have demonstrated that subjective SEP is a better predictor of health outcomes than objective SEP, and the relation remains robust even after controlling for objective SEP (Adler & Ostrove, 1999; Operario et al., 2004; Ostrove et al., 2000; Schnittker & McLeod, 2005; Singh-Manoux et al., 2003; Singh-Manoux et al., 2005). Subjective SEP is considered a summative measure of social status that broadly encompasses multiple socioeconomic dimensions (e.g., financial security, material wealth, and prestige; Adler et al., 1994; Adler et al., 2000; Adler & Ostrove, 1999; Schnittker & McLeod, 2005). Subjective SEP may reflect one's perceived sense of worth and their success or failure to meet their educational potential (Cohen et al., 2008; Snibbe, Stewart, & Adler, 2007). Subjective SEP likely captures "cognitive averaging" of traditional, objective SEP indicators that tap at one's perceptions of their environment and social interactions, as well as how they adjust, cope, and recover (Frijda, 1988). Subjective SEP may be a more sensitive assessment of one's evaluation of their status, future prospects, and resources (Singh-Manoux et al., 2003; Singh-Manoux et al., 2005), compared to objective SEP. Negative affect, depression, perceived stress, self-esteem, mastery, optimism, and extraversion have previously been postulated to be confounders in the relation between subjective SEP and health; however, controlling for these variables does not attenuate the association (cf. Cohen et al., 2008; see also Adler et al., 2000). Post hoc exploratory analyses yielded largely consistent results for the associations between subjective SEP and sleep, even after controlling for mental health and perceived stress. Further, there is emerging evidence that subjective SEP itself directly influences biological processes (Gianaros et al., 2007).

Sleep has been postulated to be one mechanism by which SEP "gets under the skin" to affect health (Cohen et al., 2008; Hill et al., 2009; Moore et al., 2002; Van Cauter & Spiegel, 1999). Individuals of lower perceived social standing may have greater worry and rumination over concerns of employment and financial security, more maladaptive coping styles to manage stressors, or increased vigilance due to neighborhood disorder that may impede sleep and, in turn, confer greater susceptibility to adverse health consequences (Adler et al., 2000; Buysse et al., 2008; Cohen et al., 2008; Hill et al., 2009; McCall, Turpin, Reboussin, Edinger, & Haponik, 1995; NSF, 2009; Silva et al., 2007). Perseverative cognition, including worry or rumination, may lead to difficulties initiating sleep (i.e., longer sleep latency), maintaining an adequate amount of sleep (i.e., sleep duration), and obtaining enough restorative sleep (i.e., sleep quality) to feel refreshed and energized upon awakening (i.e., daytime sleepiness; cf. Brosschot, Gerin, & Thayer, 2006; Pieper, Brosschot, van der Leeden, & Thayer, 2010; Zoccola, Dickerson, & Lam, 2009). Similarly, perseverative cognition has also been found to contribute to sleep disorders, particularly in insomnia (Morin, Vallières, & Ivers, 2007). Compared to healthy controls, insomniacs have more excessive worrying and longer pre-sleep cognitive activity, which increases physiological arousal and exacerbates a vicious cycle, preventing the initiation and maintenance of restorative sleep (Harvey, 2000; Watts, Coyle, & East, 1994). Inadequate or disturbed sleep leads to adverse modifications in several critical systems in the body, including the immune, cardiovascular, and endocrine systems, which, if prolonged, can result in health damage (Ayas et al., 2004; Hill et al., 2009; Moore et al., 2002; Spiegel et al., 1999; Steptoe et al., 2006; Van Cauter & Spiegel, 1999). Thus, sleep may be in the causal pathway to explain how subjective SEP "gets under the skin" to affect health.

Limitations and Suggestions for Future Research

The first limitation of this study was the cross-sectional design. Findings from this study cannot determine the causal or temporal direction of the relation between SEP and sleep. Although it is possible that subjective SEP may lead to inadequate sleep, there is also the possibility of reverse causality; that is, inadequate sleep may potentially predispose adults to interpret and perceive situations negatively (Blagrove & Akehurst, 2001), which could be attributed to the cascade of indirect consequences related to poor sleep (i.e., daytime sleepiness or reduced work productivity). Second, our findings may have limited generalizability due to greater representation of female participants. However, the community-recruited sample was comparable in terms of age, household income, ethnicity, and employment status to other population-representative samples from Quebec, Canada (Statistics Canada, 2007) and nationally representative sleep studies (NSF, 2008, 2009). Third, sleep was assessed only with self-report measures. Our sleep characteristics (e.g., average sleep duration) were consistent with those previously reported (Adler et al., 2000; NSF, 2009; Ursin et al., 2005). The questionnaires used to assess sleep quality, sleep latency (i.e., PSQI), and daytime sleepiness (i.e., Epworth Sleepiness Scale) are standardized measures with demonstrated reliability and validity in research-based and clinical studies

(Buysse et al., 2008). Moreover, because objective measures fail to capture one's perception of how restorative sleep was for them, some evidence suggests self-report measures are better proxies of sleep complaints than objective sleep measures (Van Egeren, Haynes, Franzen, & Hamilton, 1983; Weaver, Kapur, & Yueh, 2004).

Replications of these findings are warranted. Longitudinal designs, with repeated measures of SEP and sleep, are necessary to delineate the nature and direction of their relation. Inclusion of males and females, throughout their life course, and representing the wide socioeconomic spectrum will better elucidate the relation between SEP and health. Objective and subjective measures of sleep across longer time intervals should be assessed. For example, actigraphy and daily sleep logs completed in the participant's natural home environment will provide objective indicators of sleep schedules and patterns, as well as possible risk factors (e.g., sleep environment). Further, future studies should consider examining the role of environmental (e.g., working constraints), chronobiological (e.g., sleep schedules), behavioral (e.g., sleep hygiene), and psychological (e.g., stress) factors to develop a more comprehensive understanding of sleep patterns across different socioeconomic gradients, especially among vulnerable populations.

CONCLUSION

Taken together, this study demonstrates that a subjective socioeconomic gradient exists for sleep among adults, after controlling for objective SEP. These findings suggest subjective SEP may capture a broader range of socioeconomic influences than traditional, objective indicators of SEP and, thus, yield more robust associations with sleep. Further, they highlight the need to expand existing frameworks to consider sleep as a potential mechanism underlying the association between SEP and health. Finally, these results may have eventual implications for strategies to improve sleep among high-risk populations.

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References

Adler NE, Boyce T, Chesney MA, Cohen S, Folkman S, Kahn RL, Syme SL. Socioeconomic status and health: The challenge of the gradient. American Psychologist. 1994; 49:15–24. [PubMed: 8122813]

Adler NE, Epel ES, Castellazzo G, Ickovics JR. Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy White women. Health Psychology. 2000; 19:586–592. [PubMed: 11129362]

Adler NE, Ostrove JM. Socioeconomic status and health: What we know and what we don't. Annals of the New York Academy of Sciences. 1999; 896:3–15. [PubMed: 10681884]

Ayas NT, White DP, Manson JE, Stampfer MJ, Speizer FE, Malhorta A, Hu FB. A prospective study of sleep duration and mortality risk in women. Sleep. 2004; 27:440–444. [PubMed: 15164896]

Blagrove M, Akehurst L. Personality and the modulation of effects of sleep loss on mood and cognition. Personality and Individual Differences. 2001; 30:819–828.

Brosschot JF, Gerin W, Thayer JF. The perseverative cognition hypothesis: A review of worry, prolonged stress-related physiological activation, and health. Journal of Psychosomatic Research. 2006; 60:113–124. [PubMed: 16439263]

Buysse DJ, Hall ML, Strollo PJ, Kamarck TW, Owens J, Lee L, … Matthews KA. Relationships between the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), and clinical/ polysomnographic measures in a community sample. Journal of Clinical Sleep Medicine. 2008; 4:563–571. [PubMed: 19110886]

Buysse DJ, Reynolds CF III, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. Psychiatry Research. 1989; 28:193–213. [PubMed: 2748771]

Cohen S, Alper CM, Doyle WJ, Adler N, Treanor JJ, Turner RB. Objective and subjective socioeconomic status and susceptibility to the common cold. Health Psychology. 2008; 27:268–274. [PubMed: 18377146]

Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. Journal of Health and Social Behavior. 1983; 24:385–396. [PubMed: 6668417]

Crosby B, LeBourgeois M, Harsh J. Racial differences in reported napping and nocturnal sleep in 2- to 8-year-old children. Pediatrics. 2005; 115:225–232. [PubMed: 15866856]

Dean B, Aguilar D, Shapiro C, Orr WC, Isserma JA, Calimlim B, Rippon G. Impaired health status, daily functioning, and work productivity in adults with excessive sleepiness. Journal of Occupational and Environmental Medicine. 2010; 52:144–149. [PubMed: 20134351]

Dollander M. Etiology of adult insomnia. L'Encephale. 2002; 28:493–502.

Drake CL, Roehrs T, Breslau N, Johnson E, Jefferson C, Scofield H, Roth T. The 10-year risk of verified motor vehicle crashes in relation to physiologic sleepiness. Sleep. 2010; 33:745–752. [PubMed: 20550014]

Drake CL, Roehrs T, Richardson G, Walsh JK, Roth T. Shift work sleep disorder: Prevalence and consequences beyond that of symptomatic day workers. Sleep. 2004; 27:1453–1462. [PubMed: 15683134]

El-Sheik M, Kelly RJ, Buckhalt JA, Hinnant B. Children's sleep and adjustment over time: The role of socioeconomic gradient. Child Development. 2010; 81:870–883. [PubMed: 20573110]

Evans GW, Hygge S, Bullinger M. Chronic noise and psychological stress. Psychological Science. 1995; 6:333–338.

Ferrara M, DeGennaro L. How much sleep do we need? Sleep Medicine Reviews. 2001; 5:155–179. [PubMed: 12531052]

Frijda NH. The laws of emotion. American Psychologist. 1988; 43:349–358. [PubMed: 3389582]

Gellis LA, Lichstein KL, Scarinci IC, Durrence HH, Taylor DJ, Bush AJ, Riedel BW. Socioeconomic status and insomnia. Journal of Abnormal Psychology. 2005; 114:111–118. [PubMed: 15709817]

Gianaros PJ, Horenstein JA, Cohen S, Matthews KA, Brown SM, Flory JD, … Hariri AR. Perigenual anterior cingulate morphology covaries with perceived social standing. Social Cognitive and Affective Neuroscience. 2007; 2:161–173. [PubMed: 18418472]

Goodin BR, McGuire L, Smith MT. Ethnicity moderates the influence of perceived social status on subjective sleep quality. Behavioral Sleep Medicine. 2010; 8:194–206. [PubMed: 20924833]

Griefahn B, Marks A, Robens S. Noise emitted from road, rail and air traffic and their effects on sleep. Journal of Sound and Vibration. 2006; 295:129–140.

Gualezzi JP. Le bruit dans la ville. Rapport au Conseil Economique et Social. [The noise in the city]. Journal Officiel de la République Française (JORF). 1998 Apr.6:46–287.

Hall M, Bromberger J, Matthews K. Socioeconomic status as a correlate of sleep in African-American and Caucasian women. Annals of the New York Academy of Sciences. 1999; 896:427–430. [PubMed: 10681942]

Harvey AG. Pre-sleep cognitive activity: A comparison of sleep-onset insomniacs and good sleepers. British Journal of Clinical Psychology. 2000; 39:275–286. [PubMed: 11033749]

Hill TD, Burdette AM, Hale L. Neighbourhood disorder, sleep quality, and psychological distress: Testing a model of structural amplification. Health Place. 2009; 15:1006–1013. [PubMed: 19447667]

Johns MW. A new method for measuring daytime sleepiness: The Epworth Sleepiness Scale. Sleep. 1991; 14:540–545. [PubMed: 1798888]

Kopp MS, Skrabski A, Kawachi I, Adler NE. Low socioeconomic status of the opposite sex is a risk factor for middle aged mortality. Journal of Epidemiology and Community Health. 2005; 59:675–678. [PubMed: 16020645]

Krueger PM, Friedman EM. Sleep duration in the United States: A cross-sectional population-based study. American Journal of Epidemiology. 2009; 169:1052–1063. [PubMed: 19299406]

Lauderdale DS, Knutson KL, Yan LL, Rathouz PJ, Hulley SB, Sidney S, Liu K. Objectively measured sleep characteristics among early-middle-aged adults: The CARDIA study. American Journal of Epidemiology. 2006; 164:5–16. [PubMed: 16740591]

Manuck SB, Phillips JE, Gianaros PJ, Flory JD, Muldoon MF. Subjective socioeconomic status and presence of the metabolic syndrome in midlife community volunteers. Psychosomatic Medicine. 2010; 72:35–45. [PubMed: 19933505]

McCall WV, Turpin E, Reboussin D, Edinger JD, Haponik EF. Subjective estimates of sleep differ from polysomnographic measurements in obstructive sleep apnea patients. Sleep. 1995; 18:646–650. [PubMed: 8560130]

Monk TH, Buysse DJ, Rose LR, Hall JA, Kupfer DJ. The sleep of healthy people—A diary study. Chronobiology International. 2000; 17:49–60. [PubMed: 10672433]

Moore PJ, Adler NE, Williams DR, Jackson JS. Socioeconomic status and health: The role of sleep. Psychosomatic Medicine. 2002; 64:337–344. [PubMed: 11914451]

Morin CM, Vallières A, Ivers H. Dysfunctional Beliefs and Attitudes About Sleep (DBAS): Validation of a brief version (DBAS–16). Sleep. 2007; 30:1547–1554. [PubMed: 18041487]

Myers, R. Classical and modern regression with applications. 2. Boston, MA: Duxbury; 1990.

National Sleep Foundation. 2008 “Sleep in America” poll. Washington, DC: Author; 2008.

National Sleep Foundation. 2009 “Sleep in America” poll. Washington, DC: Author; 2009.

Operario D, Adler NE, Williams DR. Subjective social status: Reliability and predictive utility for global health. Psychology and Health. 2004; 19:237–246.

Ostrove JM, Adler NE, Kuppermann M, Washington AE. Objective and subjective assessments of socioeconomic status and their relationship to self-rated health in an ethnically diverse sample of pregnant women. Health Psychology. 2000; 19:613–618. [PubMed: 11129365]

Pallesen S, Nordhus IH, Omvik S, Sivertsen B, Tell GS, Bjorvatn B. Prevalence and risk factors of subjective sleepiness in the general adult population. Sleep. 2007; 30:619–624. [PubMed: 17552377]

Patel SR, Malhotra A, Gottlieb DJ, White DP, Hu FB. Correlates of long sleep duration. Sleep. 2006; 29:881–889. [PubMed: 16895254]

Phillips J, Neumann S, Flory J, Muldoon M, Manuck S. Subjective SES is related to body composition and physical activity [Abstract]. Psychosomatic Medicine. 2007; 69:A-110.

Pieper S, Brosschot JF, van der Leeden R, Thayer J. Prolonged cardiac effects of momentary assessed stressful events and worry episodes. Psychosomatic Medicine. 2010; 72:570–577. [PubMed: 20410249]

Schnittker J, McLeod JD. The social psychology of health disparities. Annual Review of Sociology. 2005; 31:75–103.

Silva GE, Goodwin JL, Sherrill DL, Arnold JL, Bootzin RR, Smith T, … Quan SF. Relationship between reported and measured sleep times: The Sleep Heart Health Study (SHHS). Journal of Clinical Sleep Medicine. 2007; 3:622–630. [PubMed: 17993045]

Singh-Manoux A, Adler NE, Marmot MG. Subjective social status: Its determinants and its association with measures of ill-health in the Whitehall II study. Social Science and Medicine. 2003; 56:1321–1333. [PubMed: 12600368]

Singh-Manoux A, Marmot MG, Adler NE. Does subjective social status predict health and change in health status better than objective status? Psychosomatic Medicine. 2005; 67:855–861. [PubMed: 16314589]

Snibbe, AC., Stewart, J., Adler, NE. Where do I stand? How people determine their subjective socioeconomic status. 2007. Retrieved from http://www.macses.ucsf.edu/research/psychosocial/subjective.php

Spiegel K, Leproult R, Van Cauter E. Impact of sleep debt on metabolic and endocrine function. Lancet. 1999; 354:1435–1439. [PubMed: 10543671]

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. Annals of Epidemiology. 2007; 17:948–955. [PubMed: 17855122]

Stansfeld SA, Matheson MP. Noise pollution: Non-auditory effects on health. British Medical Bulletin. 2003; 68:243–257. [PubMed: 14757721]

Statistics Canada. Annual income in Canada. Ottawa, Ontario, Canada: Author; 2007. (Catalogue No. 75-202-XWE)

Steptoe A, Peacey V, Wardle J. Sleep duration and health in young adults. Archives of Internal Medicine. 2006; 166:1689–1692. [PubMed: 16983045]

Stranges S, Dorn JM, Shipley MJ, Kandala NB, Trevisan M, Miller MA, … Cappuccio FP. Correlates of short and long sleep duration: A cross-cultural comparison between the United Kingdom and the United States. American Journal of Epidemiology. 2008; 168:1353–1364. [PubMed: 18945686]

Ursin R, Bjorvatn B, Holsten F. Sleep duration, subjective sleep need, and sleep habits of 40- to 45-year-olds in the Hordaland Health Study. Sleep. 2005; 28:1260–1269. [PubMed: 16295211]

Van Cauter E, Spiegel K. Sleep as mediator of relationship between socioeconomic status and health: A hypothesis. Annals of the New York Academy of Sciences. 1999; 896:254–261. [PubMed: 10681902]

Van Egeren L, Haynes SN, Franzen M, Hamilton J. Presleep cognitions and attributions in sleep-onset insomnia. Journal of Behavioral Medicine. 1983; 6:217–232. [PubMed: 6620374]

Ware JE Jr, Sherbourne CD. The MOS 36-Item Short-Form Health Survey (SF–36): I. Conceptual framework and item selection. Medical Care. 1992; 30:473–483. [PubMed: 1593914]

Watts FN, Coyle K, East MP. The contribution of worry to insomnia. British Journal of Clinical Psychology. 1994; 33:211–220. [PubMed: 8038740]

Weaver EM, Kapur V, Yueh B. Polysomnography vs. self-reported measures in patients with sleep apnea. Archives of Otolaryngology–Head & Neck Surgery. 2004; 130:453–458. [PubMed: 15096430]

Wilkinson RG. Health, hierarchy, and social anxiety. Annals of the New York Academy of Sciences. 1999; 896:48–63. [PubMed: 10681887]

Wolfson AR, Carskadon MA. Sleep schedules and daytime functioning in adolescents. Child Development. 1998; 69:875–887. [PubMed: 9768476]

Wright CE, Steptoe A. Subjective socioeconomic position, gender and cortisol responses to waking in an elderly population. Psychoneuroendocrinology. 2005; 30:582–590. [PubMed: 15808928]

Zhao Y, Zhang S, Selin S, Spear RCA. A dose-response relation for noise induced hypertension. British Journal of Industrial Medicine. 1991; 48:179–184. [PubMed: 2015209]

Zoccola PM, Dickerson SS, Lam S. Rumination predicts longer sleep onset latency after an acute psychosocial stressor. Psychosomatic Medicine. 2009; 71:771–775. [PubMed: 19622710]

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TABLE 1

Participant Demographic Characteristics

Variable	***n***	***%***
Gender		
Female	144	81.4
Ethnicity		
Caucasian	124	70.0
Asian	20	11.0
Black	17	10.0
Latino	9	5.0
Other	7	4.0
Marital status		
Married	118	67.0
Divorced/separated	32	18.1
Single	21	11.9
Widowed	5	2.8
Employment status		
Employed	142	82.1
Unemployed	31	17.9
Education qualifications		
Doctoral degree (Ph.D., M.D.)	15	8.6
Master’s degree	33	18.9
Undergraduate degree	69	39.4
Diploma/certificate	24	13.7
Some college	13	7.4
Some trade/vocational	12	6.8
High school or less	9	5.2

Note. $N = 177$.

TABLE 2

Self-Reported Socioeconomic Position, Sleep, Mental Health, and Stress

Variable	***M***	***SD***
Age (in years)	45.30	6.30
Socioeconomic position		
Household income (in $CAD)	79,914	52,910
Education (in years)	15.71	2.97
Subjective SEP ranking	6.45	1.62
Sleep characteristics		
Sleep quality (PSQI Global score)	4.89	2.88
Sleep latency (in minutes)	16.29	13.70
Weekday sleep duration (in minutes)	457.77	64.83
Weekend oversleep (in minutes)	49.37	66.16
Epworth Sleepiness Scale (daytime score)	6.02	4.08
Mental health		
SF–36 emotional well-being	74.51	16.66
Stress		
Perceived Stress Scale	14.05	6.78

Note. $N = 177$. $CAD = Canadian currency in dollars; SEP = socioeconomic position; PSQI = Pittsburgh Sleep Quality Index; SF–36 = Medical Outcomes Study 36-item Short-Form Health Survey.

TABLE 3

Regression Models: Sleep Duration, Weekend Oversleep, and Daytime Sleepiness

	Sleep Duration				*Weekend Oversleep*				*Daytime Sleepiness*			
Variable	***B***	***95% CI***	***t***	η^2	***B***	***95% CI***	***t***	η^2	***B***	***95% CI***	***t***	η^2
Univariate models												
Gender (male)	**−33.51**	**(−58.01, −9.01)**	**−2.70** *	**0.04**	−20.01	(−45.76, −5.74)	−1.53	0.00	−0.25	(−1.83, 1.33)	−0.31	0.00
Age	0.06	(−1.49, 1.62)	0.08	0.00	−0.69	(−2.27, 0.89)	−0.86	0.00	0.01	(−0.08, 0.11)	0.25	0.00
Ethnicity (Caucasian)	−13.01	(−34.06, 8.03)	−1.22	0.00	21.68	(0.27, 43.11)	1.99	0.01	0.00	(−1.33, 1.33)	0.01	0.00
Employment status (employed)	21.56	(−3.53, 46.66)	1.69	0.01	−8.03	(−34.09, 18.04)	−0.61	0.00	−1.08	(−2.67, 0.51)	−1.33	0.01
Subjective SEP	**8.68**	**(2.89, 14.47)**	**2.96** **	**0.05**	**−8.05**	**(−14.08, −2.02)**	**−2.64** **	**0.04**	**−0.67**	**(−1.04, −0.30)**	**−3.57** **	**0.07**
Household income (in $10k)	**3.22**	**(1.04, 5.41)**	**2.91** **	**0.04**	**−4.04**	**(−6.28, −1.78)**	**−3.54** **	**0.07**	**−0.20**	**(−0.35, −0.06)**	**−2.85** **	**0.05**
Education (in years)	−0.25	(−3.43, 2.94)	−0.16	0.00	−1.29	(−4.61, 2.02)	−0.77	0.00	−0.06	(−0.27, 0.15)	−0.58	0.00
Paired SEP models (covariate: gender)												
Subjective SEP	**7.24**	**(0.57, 13.91)**	**2.14** *	**0.03**	−2.73	(−9.70, 4.24)	−0.77	0.00	**−0.52**	**(−0.95, −0.09)**	**−2.37** *	**0.03**
Household income (in $10k)	1.89	(−0.59, 4.38)	1.50	0.01	**−3.38**	**(−5.99, −0.77)**	**−2.56** **	**0.04**	−0.10	(−0.27, 0.05)	−1.34	0.01
		Adjusted $R^2 = 0.09$, $F = 6.69^{**}$				Adjusted $R^2 = 0.06$, $F = 4.81^{**}$				Adjusted $R^2 = 0.06$, $F = 4.65^{**}$		
Subjective SEP	**9.35**	**(3.38, 15.33)**	**3.09** **	**0.05**	**−7.55**	**(−13.80, −1.29)**	**−2.38** **	**0.03**	**−0.69**	**(−1.06, 0.30)**	**−3.53** *	**0.07**
Education (in years)	−1.48	(−4.69, 1.73)	−0.91	0.01	−0.31	(−3.67, 3.05)	−0.85	0.00	0.30	(−0.18, 0.23)	0.28	0.00
		Adjusted $R^2 = 0.08$, $F = 5.73^{**}$				Adjusted $R^2 = 0.03$, $F = 2.90^{*}$				Adjusted $R^2 = 0.05$, $F = 4.30^{**}$		
Post hoc models (covariates: gender, mental health, & stress)												
Subjective SEP	**7.52**	**(0.79, 14.25)**	**2.21** *	**0.03**	−0.95	(−7.76, 5.86)	−0.28	0.00	**−0.41**	**(−0.82, 0.00)**	**−1.95** *	**0.02**
Household income (in $10k)	1.38	(−0.67, 3.44)	1.33	0.01	**−2.70**	**(−4.79, −0.61)**	**−2.55** **	**0.04**	−0.08	(−0.21, 0.05)	−1.28	0.01
		Adjusted $R^2 = 0.08$, $F = 4.84^{**}$				Adjusted $R^2 = 0.12$, $F = 5.45^{**}$				Adjusted $R^2 = 0.13$, $F = 7.22^{**}$		
Subjective SEP	**9.06**	**(2.94, 15.19)**	**2.92** **	**0.05**	**−5.66**	**(−11.90, 0.59)**	**−1.79** ***	**0.02**	**−0.60**	**(−0.98, −0.23)**	**−3.18** **	**0.06**
Education (in years)	−1.57	(−4.86, 1.73)	−0.94	0.01	−0.34	(−3.71, 3.02)	−0.20	0.00	0.09	(−0.11, 0.29)	0.88	0.01
		Adjusted $R^2 = 0.07$, $F = 4.34^{**}$				Adjusted $R^2 = 0.08$, $F = 4.54^{**}$				Adjusted $R^2 = 0.12$, $F = 6.71^{**}$		

Note. $N = 177$. Univariate models include each variable entered singularly. Paired models include both variables simultaneously, with covariates indicated (covariate B coefficients not shown). Models are consistent when age, ethnicity, and employment status are also included as covariates (results not shown). CI = confidence interval; SEP = socioeconomic position. Bolded values indicate statistical significance.

* $p < :05$.

** $p < :01$.

*** $p < :08$.

TABLE 4

Regression Models: Sleep Quality and Sleep Latency

Variable	Sleep Quality				Sleep Latency			
	B	*95% CI*	*t*	η^2	*B*	*95% CI*	*t*	η^2
Univariate models								
Gender (male)	−0.43	(−1.56, 0.71)	−0.74	0.00	−0.11	(−0.43, 0.20)	−0.72	0.00
Age	0.06	(−0.01, 0.12)	1.71	0.01	0.01	(−0.01, 0.03)	1.43	0.01
Ethnicity (Caucasian)	0.20	(−0.75, 1.16)	0.42	0.00	0.13	(−0.14, 0.40)	0.94	0.01
Employment status (employed)	−0.71	(−1.87, 0.44)	−1.22	0.01	−0.15	(−0.47, 0.16)	−0.95	0.01
Subjective SEP	**−0.42**	**(−0.69, −0.15)**	**−3.07** **	**0.05**	−0.05	(−0.13, 0.03)	−1.25	0.01
Household income (in $10k)	**−0.17**	**(−0.27, −0.08)**	**−3.57** **	**0.07**	**−0.04**	**(−0.06, −0.01)**	**−2.41** *	**0.03**
Education (in years)	**−0.18**	**(−0.33, −0.05)**	**−2.60** **	**0.04**	**−0.06**	**(−0.10, −0.02)**	**−2.77** *	**0.04**
Paired SEP models (covariate: gender)								
Subjective SEP	−0.23	(−0.55, 0.08)	−1.45	0.01	−0.02	(−0.10, 0.07)	−0.42	0.00
Household income (in $10k)	**−0.14**	**(−0.25, −0.02)**	**−2.31** *	**0.03**	**−0.03**	**(−0.06, 0.00)**	**−1.88** *	**0.02**
	Adjusted R^2 = 0.07, F = 5.03 **				Adjusted R^2 = 0.03, F = 2.91 *			
Subjective SEP	**−0.34**	**(−0.63, −0.06)**	**−2.41** *	**0.03**	−0.02	(−0.10, 0.06)	−0.55	0.00
Education (in years)	**−0.13**	**(−0.28, 0.01)**	**−1.86** *	**0.02**	**−0.05**	**(−0.10, −0.01)**	**−2.51** *	**0.04**
	Adjusted R^2 = 0.06, F = 4.42 **				Adjusted R^2 = 0.03, F = 2.78 *			
Post hoc models (covariates: gender, mental health, & stress)								
Subjective SEP	−0.11	(−0.41, 0.18)	−0.74	0.00	−0.01	(−0.10, 0.08)	−0.13	0.00
Household income (in $10k)	**−0.09**	**(−0.18, −0.00)**	**−2.04** *	**0.03**	−0.02	(−0.05, 0.01)	−1.56	0.01
	Adjusted R^2 = 0.21, F = 12.23 **				Adjusted R^2 = 0.05, F = 3.06 *			
Subjective SEP	−0.18	(−0.45, 0.09)	−1.35	0.01	−0.01	(−0.08, 0.08)	0.02	0.00
Education (in years)	**−0.12**	**(−0.26, 0.01)**	**−1.79** ***	**0.02**	**−0.05**	**(−0.09, −0.01)**	**−2.42** **	**0.03**
	Adjusted R^2 = 0.21, F = 12.03 **				Adjusted R^2 = 0.07, F = 4.24 **			

Note. N = 177. Univariate models include each variable entered singularly. Paired models include both variables simultaneously, with covariates indicated (covariate B coefficients not shown). Models are consistent when age, ethnicity, and employment status are also included as covariates (results not shown). CI = confidence interval; SEP = socioeconomic position. Bolded values indicate statistical significance.

* $p < .05$.

** $p < .01$.

*** $p < .07$.