Article

Subjective Social Status and Adolescent Health: The Role of Stress and Sleep

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Abstract

Despite adolescence being a period marked by significant social changes, research on social status focuses largely on adults. This study examined whether school and societal subjective social status (SSS) are differentially associated with adolescent health above and beyond objective socioeconomic status (SES), and explored pathways linking SSS to health. Latino (n = 169) and Asian American (n = 77) adolescents (M age = 17.23, SD = 0.74; 59% female) completed self-reports of SSS, sleep, stress, and somatic symptoms. Parents reported income and education. Blood pressure (BP) measurements were obtained. Results indicate that independent of objective SES, lower school SSS was associated with higher diastolic BP whereas lower societal SSS was associated with more somatic symptoms. Sleep disruptions and perceived stress mediated the association between societal SSS and somatic symptoms. Results suggest that SSS may be more important to adolescent health than objective SES. Furthermore, school and societal SSS may differentially affect indicators of health through different pathways.

Keywords

status, health, sleep, stress, Latino, Asian

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Socioeconomic status (SES) clearly affects development throughout life, across many pathways, and at multiple levels (e.g., neighborhood, family, individual; Chen & Miller, 2013). The effects of low SES range from low birth weight in infancy (Parker, Schoendorf, & Kiely, 1994) to premature mortality in adulthood (Doubeni et al., 2012). However, most research focuses on objective SES (e.g., income, education, occupation). Increasing evidence suggests that *subjective* social status (SSS) also contributes to health. Past studies have primarily focused on adults—despite the fact that adolescence is a developmental period marked by significant social changes that facilitate development of their own sense of status (Erikson, 1968). This current study focuses on the associations between SSS and health, independent of objective SES, during the formative adolescent years. Specifically, we examine the relationship between SSS in different contexts and markers of adolescent health, and determine whether perceived stress and sleep help explain these links.

SSS is the perception of one's position compared with others within a particular social hierarchy (e.g., society, neighborhood, school). SSS may take into account educational attainment, respect, occupational status, income, satisfaction with standard of living, and feelings of future financial security (Goodman et al., 2001; Singh-Manoux, Adler, & Marmot, 2003). Among adults, lower societal SSS is associated with greater heart rate, hypertension, and mortality, and with worse self-rated health—above and beyond objective measures of status (Adler, Epel, Castellazzo, & Ickovics, 2000; de Castro, Gee, & Takeuchi, 2010; Franzini & Fernandez-Esquer, 2006). Interestingly, SSS may be a better predictor than objective SES for particular health outcomes, including health status and decline, long-standing illness or disability, diabetes, hypertension, and mortality (Demakakos, Nazroo, Breeze, & Marmot, 2008; Singh-Manoux, Marmot, & Adler, 2005).

Adolescence may be an especially important developmental period to examine SSS and health because it is a transitional period between childhood and adulthood. As adolescents gain an increasing sense of autonomy, their social self also develops (Erikson, 1968). The opinions of peers become more important given neural changes in social and affective processing, resulting in stronger motivation for peer acceptance and to be more responsive to others' perspectives (Crone & Dahl, 2012). As a result of increasing their autonomy and constructing a social identity, adolescents may develop their own sense of status. Traditional measures of early SES that are ascribed by parents' SES, then, may not appropriately capture adolescents' internalized perceptions of social standing. Given that SSS assesses one's own perceptions of social standing, it may be more strongly associated with some markers of adolescent health than objective SES. Indeed, a recent review suggests that

similar to the role of SSS in adult health, lower SSS is also associated with poorer adolescent physical health, including worse self-rated overall health and higher reports of health symptoms (Quon & McGrath, 2014). Although past work has elucidated the link between SSS and indicators of adolescent health, we have a limited understanding of how SSS differentially impacts health in distinctive contexts.

SSS is often measured with a ladder scale, with the top of the ladder representing the highest status and the bottom representing the lowest status (Goodman et al., 2001). Research suggests that the reference groups on the ladder (e.g., relative placement in society; relative placement in immediate social environment) can differentially affect health (Goodman et al., 2001; West, Sweeting, Young, & Kelly, 2010). Adolescent SSS is typically operationalized as the adolescent's perceptions of his or her family's status in society (societal SSS). However, adolescents spend a significant amount of time in school and may be particularly sensitive to their peers' evaluation (Somerville, 2013). According to ecological perspectives, systems most proximate to an individual exert the greatest influence on development (Bromfenbrennner, 1979). Thus, SSS in the context of the school community may be just as important for health as societal SSS (Glendinning, Love, Hendry, & Shucksmith, 1992). Consistent with this, school SSS, but not family SES, was associated with cortisol responses. Furthermore, the nature of the associations depended on whether social status was measured on the scholastic (e.g., doing well in school), peer (e.g., respected), or sports (e.g., sporty) dimension of the school community (West et al., 2010). These findings indicate the need to include the school context when investigating the effects of SSS during adolescence.

It is also unclear how SSS affects health during adolescence (Quon & McGrath, 2014). Research on objective SES suggests that psychological stress and sleep are probable pathways linking SSS and health. Individuals from lower SES report having more negative social experiences (Lantz, House, Mero, & Williams, 2005) and fewer resources to cope with psychological stress (Gallo, Bogart, Vranceanu, & Matthews, 2005). Similarly, lower SES individuals report more barriers to sleep quality and shorter sleep duration compared with their higher SES peers (Marco, Wolfson, Sparling, & Azuaje, 2012; Mezick et al., 2008). Greater psychological stress and poorer sleep, in turn, are associated with a wide range of adverse health outcomes (Cohen, Janicki-Deverts, & Miller, 2007; Irwin, 2015). There is mixed support for the mediating role of perceived stress and some support for the mediating role of sleep in the relation between *objective* SES and health (Matthews & Gallo, 2011; Moore, Adler, Williams, & Jackson, 2002; Van Cauter & Spiegel, 1999). It is unclear whether stress and sleep also

mediate the link between SSS and health. Explaining this link is particularly important during adolescence, when sleep disruptions are pervasive (Becker, Langberg, & Byars, 2015) and stress levels are just as high as—and sometimes higher than—those reported by adults (American Psychological Association, 2014).

In this study, we focus specifically on somatic symptoms (e.g., headaches, stomachaches) and blood pressure (BP) as indicators of overall health because of their associations with future health. Somatic symptoms are associated with functional impairment and health service use (Campo, 2012) and are predictive of depression and other mental health disorders in adulthood (Bohman et al., 2012). Notably, somatic symptoms may also be manifestations of dysregulation of multiple physiological systems (e.g., autonomic nervous, immune, and neuroendocrine systems) that underlie health (Kozlowska, 2013). BP during adolescence is predictive of cardiovascular risk in adulthood (Gustafsson, Persson, & Hammarström, 2011) and is a component of metabolic risk, which begins to establish itself by childhood (Cook, Weitzman, Auinger, Nguyen, & Dietz, 2003; Zimmet et al., 2007).

The aims of this current study are to (a) examine whether societal and school SSS are differentially associated with adolescent physical health above and beyond objective SES, and (b) identify sleep and stress as underlying pathways. Adolescents' subjective accounts of status are likely to exert greater influence on their development than status that is ascribed to them (e.g. parental education and income). Further, because we expect adolescents' developing sense of status may depend on context, we expect school SSS (e.g., the more proximal context) to affect health more than societal SSS (e.g., the more distal context).

Method

Participants

Participants were 360 Latino and Asian American 11th- and 12th-grade adolescents (M age = 17.18, SD = 0.74) recruited from two schools. Thirty-nine additional adolescents from other ethnic backgrounds (e.g., European, n = 10; "Other," n = 8; etc.) were allowed to complete the study but were excluded from analyses given that the study was designed to focus on youth from Asian and Latino backgrounds. We focused on these two ethnic minority groups because there has been limited research on the psychosocial contributions to health among these ethnic minority groups despite the fact that they are the two fastest growing minority groups in the United States. Latino adolescents (94.7%) were primarily ethnically Mexican and first-generation (15%) or

second-generation (77%) Americans. Asian American adolescents (73.5%) were primarily ethnically Vietnamese and first-generation (19%) or second-generation (79%) Americans.

Measures

SES. Parents reported total annual household income before taxes and other deductions by selecting one of 11 categories (<US$10,000 to ≥US$100,000). Parents also reported their own and their spouse's highest level of education achieved. Income and education were standardized and averaged together to compute an index of objective SES.

SSS. The MacArthur Scale of Subjective Social Status–Youth Version (Goodman et al., 2001) assessed family status in U.S. society (societal SSS) and individual status in school (school SSS). Two 10-rung ladders were presented, one representing U.S. society and the other representing the respondent's school community. The top rungs of the ladders represent those with the highest standing (e.g., school: most respect, highest grades) whereas the bottom rungs of the ladders represent those with the lowest standing (e.g., societal: least money, education). Adolescents indicated the rungs that best represented their status in each context. Prior work has established the reliability of this measure and has related to a number of health outcomes among adolescents (Finkelstein, Kubzansky, & Goodman, 2006; Goodman et al., 2003; Goodman et al., 2001).

Perceived stress. The 10-item Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983) assessed the extent to which participants perceived their lives to be stressful ($\alpha = .77$). Adolescents indicated how frequently in the past month (0 = *never*, 4 = *very often*) they felt "upset because of something that happened unexpectedly" or "unable to control the important things in your life."

Sleep duration. Adolescents reported their average hours of nightly sleep in the past month (Pittsburgh Sleep Quality Index [PQSI]; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Studies that used subjective self-reports of sleep duration (Knutson & Lauderdale, 2007; Liu, Uchiyama, Okawa, & Kurita, 2000) have shown that self-report measures of sleep are modestly correlated with objective measures of sleep among adolescents (Lauderdale, Knutson, Yan, Liu, & Rathouz, 2008). Previous studies that used single items of sleep duration based on the PSQI found associations with health (Altman et al., 2012; Yu et al., 2007).

Sleep disruption. Two items ($r = .61$, $p < .001$) assessed sleep disruption: "How often have you experienced sleep problems?" in the past 2 weeks (1 = *not at all*, 4 = *almost every day*) and "My sleep was restless" in the past month (1 = *rarely*, 4 = *all of the time*). These items were standardized and averaged together ($\alpha = .76$). Most studies of sleep quality among youth use self-reports, and these measures are meaningfully associated with predicted outcomes (e.g., school performance; Dewald, Meijer, Oort, Kerkhof, & Bögels, 2010).

Somatic symptoms. Participants indicated how frequently (1 = *not at all*, 4 = *almost every day*) they experienced 11 somatic symptoms (e.g., headaches, upset stomach) during the past 2 weeks (Resnick et al., 1997; Udry & Bearman, 1998). Responses were averaged across items to create a composite variable ($\alpha = .83$).

BP. BP was assessed twice (1 minute apart) using an Omron HEM-712C Automatic BP Monitor. The cuff was placed around the nondominant arm of seated participants. The two readings were averaged.

Covariates. Adolescents reported on their age, sex, ethnicity, and engagement in regular exercise (i.e., physical activities that caused sweat, at least once a week). Research staff assessed participants' height and weight for body mass index (BMI).

Procedures

After obtaining approval from the University's Office of Human Research Protection, participants were recruited from the 11th and 12th grades of two Southern California high schools via classroom presentations. Interested students took home consent forms and a demographic survey for their parents/guardians. Although all 11th- and 12th-grade students in the two schools were eligible to participate, of the students recruited through presentations, 36% returned both required assent and consent forms. Participants completed questionnaires during class in the same room. While other participants completed the questionnaires, individual participants were taken to a private corner by a trained staff to measure participants' BP, height, and weight. Among participating adolescents, 79.4% returned completed parent surveys. Participants from School 1 received US$5 and were entered into a raffle for T-shirts. Participants from School 2 did not receive any incentives in accordance with district policy.

Data Analyses

Analyses were conducted on adolescents who had complete data on status variables. The majority of adolescents (89%) reported their SSS; however, 72% of parents reported on objective measures of SES. Thus, the final analytic sample consisted of 246 adolescents (M age = 17.23, SD = 0.74; 59% female; 68.7% Latino, 31.3% Asian). Independent-samples t tests indicate that adolescents with incomplete data on status variables did not differ from those with complete data on age, objective SES, perceived stress, sleep duration, systolic blood pressure (SBP), diastolic blood pressure (DBP), and exercise (ps > .11). They did differ on somatic symptoms, $t(339) = -2.48$, $p = .01$; those excluded from analyses had fewer somatic symptoms ($M = 0.42$, $SD = 0.37$) than those included in analyses ($M = 0.52$, $SD = 0.29$).

Preliminary bivariate correlations were first conducted. Given that participants were recruited from schools, we next examined whether it was necessary to adopt a statistical approach that accounts for the hierarchical structure of individuals nested within schools. For all outcomes, intraclass correlations were ≤.001, which suggests that adolescents within schools were not more similar than adolescents from different schools. As such, we conducted a series of regression analyses to test our hypotheses. Regression analyses first focused on the relation between societal and school SSS and health (i.e., somatic symptoms, SBP, DBP). To examine whether societal and school SSS differentially predict health, models included both measures. All analyses controlled for objective SES and school. Sex and ethnicity were included as covariates given known sex and ethnic differences in reporting somatic symptoms (Pina & Silverman, 2004) and in BP levels (Muntner, He, Cutler, Wildman, & Whelton, 2004). Because of known associations with BP, models predicting BP included BMI and exercise (Cornelissen & Fagard, 2005; Reinehr, Kiess, de Sousa, Stoffel-Wagner, & Wunsch, 2006).

Significant associations between SSS variables and health outcomes were then tested for mediation by perceived stress and sleep variables. We first examined single mediation models, in which mediating variables were added in separately. Next, we added all mediators simultaneously to account for shared variance among variables. Indirect effects were tested for significance using 95% bias-corrected bootstrap confidence intervals (CIs) based on 5,000 bootstrap samples given that indirect effects are not normally distributed and bootstrapping does not rely on a normal sampling distribution (MacKinnon, Lockwood, & Williams, 2004). All analyses were conducted using SPSS 21. Indirect SPSS macros (Preacher & Hayes, 2008) were used to conduct the bootstrapping analyses.

Results

As shown in Table 1, subjectively, participants viewed their family status as middle class in American society and perceived themselves to have slightly higher status in their school. Average societal and school SSS in the present sample were slightly lower than observed in other samples, but variability of these measures was comparable with that in previous work (Goodman et al., 2003; Goodman et al., 2001). Average household incomes were between US$20,000 and US$30,000, and 46% of participants had parents who completed at least high school. There were no school differences in income and education (*p*s > .17). Overall, levels of perceived stress and somatic symptoms were low, and average levels of SBP and DBP were within normal range. Thirty-one adolescents (8.7%) were at risk for hypertension (i.e., SBP ≥ 120 mmHg and DBP ≥ 80 mmHg; National High Blood Pressure Education Program, 2005).

Societal SSS was modestly and positively associated with school SSS, and both measures were positively associated with objective SES. Lower societal SSS, more stress, shorter sleep duration, and more sleep disruptions were associated with more somatic symptoms. Both measures of SSS were unrelated to BP, and among the potential mediating variables, only higher levels of stress were related to lower SBP.

Hierarchical regression analyses first examined whether societal SSS and school SSS uniquely predicted health independent of objective SES. Lower societal SSS was related to more somatic symptoms (Table 2, column 1) whereas lower school SSS was related to higher DBP (Table 3, column 1). Neither societal SSS—*b* (*SE*) =0 .59 (0.47); β = .07, *p* = .20—nor school SSS—*b* (*SE*) = 0.01 (0.44); β = .00, *p* = .98—was related to SBP.

To test whether stress, sleep duration, and sleep disruptions mediated the association between societal SSS and somatic symptoms, variables were added separately to the model (Table 2, columns 2-4). For all mediators, the association between societal SSS and somatic symptoms became nonsignificant, while higher levels of the mediator were significantly associated with more somatic symptoms. When all mediators were added simultaneously, the societal SSS–somatic symptoms relation was attenuated such that greater stress and more sleep disruptions, but not sleep duration, were significantly associated with more somatic symptoms (Table 2, column 4).

To estimate the indirect effect of stress and sleep disruptions, we conducted two additional regression analyses predicting stress and sleep disruptions from societal SSS. Lower societal SSS was significantly related to more perceived stress, *b* (*SE*) = −0.08 (0.03), *p* < .01, and more sleep disruptions, *b* (*SE*) = −0.10 (0.04), *p* = .01. Bootstrapping confirmed that the association

Table 1. Descriptive Statistics and Bivariate Correlations Between Study Variables.

	1	2	3	4	5	6	7	8	9	10
1. Societal SSS										
2. School SSS	.16**									
3. Objective SES	.29**	.16*								
4. Stress	−.26**	−.16**	−.10							
5. Sleep duration	.08	−.20**	−.11	−.16**						
6. Sleep disruptions	−.18**	−.10	−.06	.43**	−.32**					
7. BMI	.04	−.12*	−.13*	−.04	.03	−.01				
8. Somatic symptoms	−.17**	−.08	−.09	.59**	−.15*	.51**	−.02			
9. SBP	.07	−.05	.01	−.19**	.01	−.03	.45**	−.14*		
10. DBP	.05	−.05	.03	−.39	.00	.04	.22**	−.03	.59**	
M (*SD*)	5.02 (1.55)	6.77 (1.71)	−0.05 (0.82)	1.88 (0.60)	7.03 (1.54)	0.00 (0.90)	24.66 (5.29)	0.49 (0.28)	118.01 (13.77)	68.23 (8.90)
Range	1-10	2-10	−1.21-2.38	0-3.70	2-14	−0.95-2.07	15.86-44.68	0-1.36	87.50-165.50	47.50-112.50

Note. Somatic symptoms are log transformed. SSS = subjective social status; SES = socioeconomic status; BMI = body mass index; SBP = systolic blood pressure; DBP = diastolic blood pressure.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 2. Regression Analyses Predicting Somatic Symptoms.

	1		2		3		4		5	
	b (*SE*)	β	*b* (*SE*)	β	*b* (*SE*)	β	*b* (*SE*)	β	*b* (*SE*)	β
Intercept	0.70 (0.12)***		−0.14 (0.12)		0.75 (0.17)***		0.55 (0.10)***		−0.15 (0.16)	
Male	−0.12 (0.04)**	−.21	−0.06 (0.03)	−.10	−0.12 (0.04)**	−.21	−0.07 (0.03)*	−.12	−0.05 (0.03)	−.09
Asian	−0.01 (0.04)	−.02	−0.03 (0.04)	−.06	0.05 (0.05)	.08	−0.01 (0.04)	−.02	0.00 (0.04)	.01
School	−0.05 (0.04)	.08	0.10 (0.04)	.11	0.06 (0.04)	.10	0.05 (0.03)	.09	0.07 (0.03)	.13
Objective SES	−0.01 (0.03)	−.03	−0.01 (0.02)	−.03	−0.03 (0.03)	−.08	−0.01 (0.02)	−.03	−0.02 (0.02)	−.04
School SSS	−0.01 (0.01)	−.08	0.00 (0.01)	.03	−0.01 (0.01)	−.04	−0.01 (0.01)	−.05	0.01 (0.01)	.03
Societal SSS	−0.03 (0.01)*	−.14	0.00 (0.01)	.01	−0.02 (0.01)	−.10	−0.01 (0.01)	−.05	0.00 (0.01)	.02
Stress			0.29 (0.03)***	.59					0.21 (0.03)***	.43
Sleep duration					−0.03 (0.01)*	−.15			0.01 (0.01)	.06
Sleep disruptions							0.17 (0.02)***	.53	0.12 (0.02)***	.37
Adjusted R^2	.05		.35		.06		.32		.43	

Note. Model 1 examines the independent relations between societal SSS and school SSS and somatic symptoms. Models 2 to 4 test single mediation models in which each putative mediator was added to Model 1 (i.e., stress in Model 2, sleep duration in Model 3, and sleep disruption in Model 4). Model 5 reflects a multiple mediation model in which all stress, sleep duration, and sleep disruptions were simultaneously added to Model 1. SES = socioeconomic status; SSS = subjective social status.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 3. Regression Analyses Predicting DBP.

	1		2		3		4		5	
	b (*SE*)	β	*b* (*SE*)	β	*b* (*SE*)	β	*b* (*SE*)	β	*b* (*SE*)	β
Intercept	61.66 (4.69)***		64.44 (5.37)***		62.16 (6.22)***		61.99 (4.74)***		65.93 (7.09)***	
Male	1.59 (1.20)	.10	1.28 (1.23)	.07	1.70 (1.28)	.08	1.48 (1.21)	.08	1.43 (1.30)	.08
Asian	4.39 (1.41)***	.25	4.68 (1.43)***	.26	4.57 (1.51)***	.25	4.39 (1.41)***	.25	4.72 (1.54)***	.26
School	−1.44 (1.24)	−.08	−1.44 (1.24)	−.08	−1.40 (1.31)	−.08	−1.47 (1.24)	−.09	1.48 (1.32)	−.08
Objective SES	0.84 (0.77)	.08	0.80 (0.77)	.08	0.74 (0.83)	.07	0.83 (0.77)	.08	0.70 (0.83)	.07
BMI	0.55 (0.11)	.36	0.55 (0.11)***	.36	0.56 (0.12)***	.36	0.55 (0.11)***	.36	0.56 (0.12)***	.36
Exercise	−2.09 (1.39)	−.10	−2.10 (1.39)	−.10	−2.03 (1.48)	−.09	−2.14 (1.40)	−.10	−2.11 (1.49)	−.10
School SSS	−0.80 (0.36)*	−.15	−0.83 (0.36)*	−.16	−0.86 (0.39)*	−.16	−0.79 (0.36)*	−.15	−0.92 (0.40)*	−.18
Societal SSS	0.10 (0.38)	.02	0.00 (0.39)	.00	0.10 (0.41)	.02	0.06 (0.39)	.01	0.01 (0.42)	.00
Stress			−1.11 (1.04)	−.08					−0.82 (1.19)	−.06
Sleep duration					−0.08 (0.40)	−.02			−0.24 (0.43)	−.04
Sleep disruptions							−0.37 (0.65)	−.04	−0.50 (0.80)	−.05
Adjusted R^2	.16		.16		.15		.16		.15	

Note. Model 1 examines the independent relations between societal SSS and school SSS and DBP. Models 2 to 4 test single mediation models in which each putative mediator was added to Model 1 (i.e., stress in Model 2, sleep duration in Model 3, and sleep disruption in Model 4). Model 5 reflects a multiple mediation model in which all stress, sleep duration, and sleep disruptions were simultaneously added to Model 1. SES = socioeconomic status; BMI = body mass index; SSS = subjective social status; DBP = diastolic blood pressure.
*$p < .05$. **$p < .01$. ***$p < .001$.

between societal SSS and somatic symptoms was mediated by stress—indirect effect b (*SE*) = −0.02 (0.01), 95% CI = [−.033, −.004]—and sleep disruptions—indirect effect (*SE*) = −0.01 (0.01), 95% CI = [−.025, −.003].

It is possible that greater somatic symptoms increase perceptions of stress and sleep disruptions. Therefore, we tested somatic symptoms as the mediator of the societal SSS–stress and societal SSS–sleep disruption links. However, results suggest that somatic symptoms do not mediate either the association between society SSS and stress or the association between societal SSS and sleep.

Finally, none of the stress or sleep variables mediated the association between school SSS and DBP in single or multiple mediation models, and the association between school SSS and DBP remained significant (Table 3, columns 1-4).

Discussion

This study aimed to elucidate how sense of social status affects health during adolescence. We examined whether school and societal SSS are differentially associated with adolescent BP and somatic symptoms independent of objective SES. This study further explored stress and sleep as potential mechanisms linking SSS to adolescent health. Consistent with research on adult populations (Singh-Manoux et al., 2005), results suggest that SSS is a stronger predictor of adolescent health than objective SES. Measures of SSS, but not objective SES, were associated with adolescent BP and somatic symptoms. Specifically, lower societal SSS was associated with greater somatic symptoms, and lower school SSS was associated with higher DBP. Furthermore, lower societal SSS may increase somatic symptoms through greater levels of stress and disruption of sleep.

Our finding that SSS is associated with health above and beyond objective SES is consistent with current research that indicates SSS has an independent influence on health (Quon & McGrath, 2014). As adolescence is a time of heightened social comparison and a developing sense of social identity, it is not surprising that adolescents' internalized perceptions of social standing were better predictors of their health than an ascribed status based on their parents' SES. This is consistent with ecological theory because one's subjective interpretation of status is a characteristic of the individual—and therefore likely to have a direct effect on development—whereas family SES is a family characteristic that is further removed from the child, and thus likely to have an indirect effect on development (Bromfenbrennner, 1979). These results resonate with the call for measuring both objective and subjective measures of status to capture both relative

and absolute social positions and their independent effects on adolescent health (Quon & McGrath, 2014).

Results from the present study further indicate that societal and school SSS are differentially associated with health. Specifically, the more immediate and proximal environment, school SSS, was associated with DBP, an objective measure of health. However, the more distal environment, societal SSS, was associated with somatic symptoms, a subjective and self-reported measure of health. As with previous research (Goodman et al., 2003), adolescents provided lower ratings of societal SSS than of school SSS, and these two measures were only modestly correlated with each other. Furthermore, others have found that school SSS, but not societal SSS, was associated with greater odds of being overweight among adolescents (Goodman et al., 2003). Similarly, higher peer SSS increased risk whereas higher societal SSS was protective for substance abuse among Mexican youth (Ritterman et al., 2009). These results suggest that societal and school SSS are qualitatively different constructs and are consistent with the argument that peer status is an earned status whereas family social status is an assigned status (Hanson & Chen, 2007; West et al., 2010). Furthermore, school SSS is likely capturing more of the day-to-day contributions to status in a context (school) that is salient and meaningful to adolescents' emerging sense of self. These results indicate a need to include multiple referents, especially school, when investigating the effects of SSS during adolescence. Our study provides evidence of the differential association different measures of SSS have with health. However, more studies are needed to elucidate the extent to which these differential associations exist for a broader range of health outcomes.

We further found that adolescents who perceive their family to have lower standing in U.S. society reported higher levels of perceived stress and more restlessness and sleep problems. Perceived stress and sleep disruptions, in turn, were associated with greater reports of stomachaches and other somatic symptoms. Both the physical (e.g., noise) and social (e.g., crime) environments of poverty likely contribute to stress and poor health among youth (Schreier & Chen, 2013). Our research adds to this literature because we found that teenagers' perception of social standing—independent of their parents' income and educational attainment—can contribute to feelings of stress, sleep problems, and feeling sick. Furthermore, although sleep duration mediated the link between societal SSS and somatic symptoms, this pathway disappeared in the multiple mediation model. This suggests that the quality of sleep matters more than the quantity of sleep in explaining the association with somatic symptoms. Separating sleep quality from sleep duration is an important distinction considering that a recent review found differential associations with youths' school performance (Dewald et al., 2010). Collectively,

these findings indicate that one way to address SSS differences in somatic symptoms is to identify ways to improve youths' sleep quality and to better cope with stress.

There are effective treatments for adolescent sleep problems (e.g., behavioral therapy; Bootzin & Stevens, 2005), but few are implemented in schools. One intervention (Bei et al., 2013) targeted at adolescent girls with poor sleep found improvements in multiple sleep outcomes (e.g., greater sleep efficiency, duration). Another intervention that included students with or without sleep problems (Moseley & Gradisar, 2009) produced short-term improvements in regularized bedtimes (i.e., less of a discrepancy between weekdays and weekends) but not in other outcomes (e.g., daytime sleepiness). Authors suggested that future interventions should include parental sessions and better motivations for adolescents to maintain changes in behavior (Cain, Gradisar, & Moseley, 2011).

There are several evidence-based techniques to reduce stress, including relaxation, guided imagery, and mindfulness-based stress reduction (MBSR; Varvogli & Darviri, 2011). MBSR models appear to be feasible with children and adolescents, but large and well-designed studies need to be conducted to examine whether school-wide interventions are effective (Burke, 2010). Although more work is needed to find the best intervention for poor sleep and high stress among youth, these studies provide an important foundation.

We did not find significant mediators of the association between school SSS and DBP. One explanation could be our one-time survey measure of sleep quality did not fully capture this construct. Indeed, others who used actigraphy across multiple days found an association between poor sleep quality and hypertension among adolescents (Javaheri, Storfer-Isser, Rosen, & Redline, 2008). Alternatively, there may be potentially different pathways by which various aspects of SSS affect different markers of physical health. This is consistent with one study that found an association between school SSS and smoking, but this link was not explained by perceived stress (Finkelstein et al., 2006). Although it is unclear how school SSS is associated with DBP, others have suggested social support, health behaviors, and the importance of relative rank as potential mediating pathways between SSS and health (Quon & McGrath, 2014). Correlates of BP might also explain this link. For instance, low school SSS might be associated with negative emotions, unpleasant interactions, and fewer positive resources, all of which were associated with higher night BP among African American teenagers (Burford, Low, & Matthews, 2013). Exploring these factors may be a promising starting point.

Limitations and Future Directions

The present study has limitations that warrant caution in interpreting results. School status is a multidimensional construct (e.g., being popular is a different from having high academic achievement; West et al., 2010). Without knowing which dimension is driving student's overall perception of status, it is difficult to suggest specific recommendations to increase status. In addition, stress is a multidimensional construct, and our measure may not adequately capture stress (Matthews & Gallo, 2011). Future research that captures acute stress may find stronger associations with health.

Given the correlational and cross-sectional nature of the present study, it is possible that somatic symptoms may lead to greater perceptions of stress and disruptions in sleep rather than the other way around. Our reverse mediation analyses did not find evidence for this; however, longitudinal designs can help elucidate the directionality of this relationship. Although the effect sizes of SSS are modest (e.g., <.30 is small; Cohen, 1988), they are similar to the effects sizes we find with objective SES. This highlights that SSS is one of many factors that may contribute to adolescent health.

Our Asian and Latino sample is not representative of adolescents from these or other ethnic minority backgrounds; thus, the results may not be generalized to other adolescents. Moreover, these participants are drawn from a largely immigrant community, which may influence how these youths perceive SES and American society in general. As the population of third-generation Asian and Latino adolescents expands, research can examine generational differences in the associations between SSS and adolescent health. In addition, our participation rate was low, further limiting the generalizability of the results. The low participation rate was likely due to (a) limited access to all eligible students, as not all teachers gave permission to recruit from their classes; (b) failure of interested participants to provide both the parental consent and assent forms; and (c) the lack of "makeup" data collection times (e.g., during lunch, after school) for participants absent during the day of data collection. Despite the limited generalizability of these results, including participants from two of the fastest growing ethnic groups in the United States (U.S. Census Bureau, 2013) is an important step in understanding the link between social status and health-related outcomes across ethnic backgrounds.

Conclusion

Despite current limitations, the present study enhances our understanding of how SSS is associated with adolescent health and identifies potential underlying

pathways. Schools, parents, and others interested in improving the health of youth may find it more practical to address poor-quality sleep and stress than attempting to increase adolescents' social status. There are several promising interventions for adolescent sleep and stress problems, and breaking the link from sleep and stress to adolescent health may be one way to decrease health disparities associated with social status.

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References

Adler, N. E., Epel, E. S., Castellazzo, G., & Ickovics, J. R. (2000). Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy, White women. *Health Psychology*, *19*, 586-592.

Altman, N. G., Izci-Balserak, B., Schopfer, E., Jackson, N., Rattanaumpawan, P., Gehrman, P. R., . . . Grandner, M. A. (2012). Sleep duration versus sleep insufficiency as predictors of cardiometabolic health outcomes. *Sleep Medicine*, *13*, 1261-1270.

American Psychological Association. (2014). *Stress in America: Are teens adopting adults' stress habits?* Washington, DC: Author.

Becker, S. P., Langberg, J. M., & Byars, K. C. (2015). Advancing a biopsychosocial and contextual model of sleep in adolescence: A review and introduction to the special issue. *Journal of Youth and Adolescence*, *44*, 239-270.

Bei, B., Byrne, M. L., Ivens, C., Waloszek, J., Woods, M. J., Dudgeon, P., . . . Allen, N. B. (2013). Pilot study of a mindfulness-based, multi-component, in-school group sleep intervention in adolescent girls. *Early Intervention in Psychiatry*, *7*, 213-220.

Bohman, H., Jonsson, U., Päären, A., Von Knorring, L., Olsson, G., & Von Knorring, A.-L. (2012). Prognostic significance of functional somatic symptoms in adolescence: A 15-year community-based follow-up study of adolescents with depression compared with healthy peers. *BMC Psychiatry*, *12*, Article 90.

Bootzin, R. R., & Stevens, S. J. (2005). Adolescents, substance abuse, and the treatment of insomnia and daytime sleepiness. *Clinical Psychology Review*, *25*, 629-644.

Bromfenbrennner, U. (1979). *Ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.

Burford, T. I., Low, C. A., & Matthews, K. A. (2013). Night/day ratios of ambulatory blood pressure among healthy adolescents: Roles of race, socioeconomic status, and psychosocial factors. *Annals of Behavioral Medicine*, *46*, 217-226.

Burke, C. A. (2010). Mindfulness-based approaches with children and adolescents: A preliminary review of current research in an emergent field. *Journal of Child and Family Studies*, *19*, 133-144.

Buysse, D. J., Reynolds, C. F., III, Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research*, *28*, 193-213.

Cain, N., Gradisar, M., & Moseley, L. (2011). A motivational school-based intervention for adolescent sleep problems. *Sleep Medicine*, *12*, 246-251.

Campo, J. V. (2012). Annual research review: Functional somatic symptoms and associated anxiety and depression–developmental psychopathology in pediatric practice. *The Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *53*, 575-592.

Chen, E., & Miller, G. E. (2013). Socioeconomic status and health: Mediating and moderating factors. *Annual Review of Clinical Psychology*, *9*, 723-749.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associate.

Cohen, S., Janicki-Deverts, D., & Miller, G. E. (2007). Psychological stress and disease. *Journal of the American Medical Association*, *298*, 1685-1687.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, *24*, 385-396.

Cook, S., Weitzman, M., Auinger, P., Nguyen, M., & Dietz, W. H. (2003). Prevalence of a metabolic syndrome phenotype in adolescents: Findings from the third National Health and Nutrition Examination Survey, 1988-1994. *Archives of Pediatrics & Adolescent Medicine*, *157*, 821-827.

Cornelissen, V. A., & Fagard, R. H. (2005). Effects of endurance training on blood pressure, blood pressure–regulating mechanisms, and cardiovascular risk factors. *Hypertension*, *46*, 667-675.

Crone, E. A. & Dahl, R. E. (2012). Understanding adolescence as a period of social-affective engagement and goal flexibility. *Nature Reviews Neuroscience, 13*(9), 636-650.

de Castro, A. B., Gee, G. C., & Takeuchi, D. T. (2010). Examining alternative measures of social disadvantage among Asian Americans: The relevance of economic opportunity, subjective social status, and financial strain for health. *Journal of Immigrant and Minority Health*, *12*, 659-671.

Demakakos, P., Nazroo, J., Breeze, E., & Marmot, M. (2008). Socioeconomic status and health: The role of subjective social status. *Social Science & Medicine*, *67*, 330-340.

Dewald, J. F., Meijer, A. M., Oort, F. J., Kerkhof, G. A., & Bögels, S. M. (2010). The influence of sleep quality, sleep duration and sleepiness on school performance in children and adolescents: A meta-analytic review. *Sleep Medicine Reviews*, *14*, 179-189.

Doubeni, C. A., Schootman, M., Major, J. M., Torres Stone, R. A., Laiyemo, A. O., Park, Y., . . . Sinha, R. (2012). Health status, neighborhood socioeconomic context, and premature mortality in the United States: The National Institutes of Health–AARP Diet and Health Study. *American Journal of Public Health*, *102*, 680-688.

Erikson, E. (1968). *Identity: Youth and crisis*. New York, NY: W.W. Norton.

Finkelstein, D. M., Kubzansky, L. D., & Goodman, E. (2006). Social status, stress, and adolescent smoking. *Journal of Adolescent Health*, *39*, 678-685.

Franzini, L., & Fernandez-Esquer, M. E. (2006). The association of subjective social status and health in low-income Mexican-origin individuals in Texas. *Social Science & Medicine*, *63*, 788-804.

Gallo, L. C., Bogart, L. M., Vranceanu, A.-M., & Matthews, K. A. (2005). Socioeconomic status, resources, psychological experiences, and emotional responses: A test of the reserve capacity model. *Journal of Personality and Social Psychology*, *88*, 386-399.

Glendinning, A., Love, J. G., Hendry, L. B., & Shucksmith, J. (1992). Adolescence and health inequalities: Extensions to Macintyre and West. *Social Science & Medicine*, *35*, 679-687.

Goodman, E., Adler, N. E., Daniels, S. R., Morrison, J. A., Slap, G. B., & Dolan, L. M. (2003). Impact of objective and subjective social status on obesity in a biracial cohort of adolescents. *Obesity Research*, *11*, 1018-1026.

Goodman, E., Adler, N. E., Kawachi, I., Frazier, A. L., Huang, B., & Colditz, G. A. (2001). Adolescents' perceptions of social status: Development and evaluation of a new indicator. *Pediatrics*, *108*, e31.

Gustafsson, P. E., Persson, M., & Hammarström, A. (2011). Life course origins of the metabolic syndrome in middle-aged women and men: The role of socioeconomic status and metabolic risk factors in adolescence and early adulthood. *Annals of Epidemiology*, *21*, 103-110.

Hanson, M. D., & Chen, E. (2007). Socioeconomic status and health behaviors in adolescence: A review of the literature. *Journal of Behavioral Medicine*, *30*, 263-285.

Irwin, M. R. (2015). Why sleep is important for health: A psychoneuroimmunology perspective. *Annual Reviews in Psychology*, *66*, 143-172.

Javaheri, S., Storfer-Isser, A., Rosen, C. L., & Redline, S. (2008). Sleep quality and elevated blood pressure in adolescents. *Circulation*, *118*, 1034-1040.

Knutson, K. L., & Lauderdale, D. S. (2007). Sleep duration and overweight in adolescents: Self-reported sleep hours versus time diaries. *Pediatrics*, *119*, E1056-E1062.

Kozlowska, K. (2013). Functional somatic symptoms in childhood and adolescence. *Current Opinion in Psychiatry*, *26*, 485-492.

Lantz, P. M., House, J. S., Mero, R. P., & Williams, D. R. (2005). Stress, life events, and socioeconomic disparities in health: Results from the Americans' Changing Lives Study. *Journal of Health and Social Behavior*, *46*, 274-288.

Lauderdale, D. S., Knutson, K. L., Yan, L. L., Liu, K., & Rathouz, P. J. (2008). Self-reported and measured sleep duration: How similar are they? *Epidemiology*, *19*, 838-845.

Liu, X., Uchiyama, M., Okawa, M., & Kurita, H. (2000). Prevalence and correlates of self-reported sleep problems among Chinese adolescents. *Sleep*, *23*, 27-34.

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research*, *39*, 99-128.

Marco, C. A., Wolfson, A. R., Sparling, M., & Azuaje, A. (2012). Family socioeconomic status and sleep patterns of young adolescents. *Behavioral Sleep Medicine*, *10*, 70-80.

Matthews, K. A., & Gallo, L. C. (2011). Psychological perspectives on pathways linking socioeconomic status and physical health. *Annual Review of Psychology*, *62*, 501-530.

Mezick, E. J., Matthews, K. A., Hall, M., Strollo, P. J., Jr., Buysse, D. J., Kamarck, T. W., . . . Reis, S. E. (2008). Influence of race and socioeconomic status on sleep: Pittsburgh Sleep SCORE project. *Psychosomatic Medicine*, *70*, 410-416.

Moore, P. J., Adler, N. E., Williams, D. R., & Jackson, J. S. (2002). Socioeconomic status and health: The role of sleep. *Psychosomatic Medicine*, *64*, 337-344.

Moseley, L., & Gradisar, M. (2009). Evaluation of a school-based intervention for adolescent sleep problems. *Sleep*, *32*, 334-341.

Muntner, P., He, J., Cutler, J. A., Wildman, R. P., & Whelton, P. K. (2004). Trends in blood pressure among children and adolescents. *Journal of the American Medical Association*, *291*, 2107-2113.

National High Blood Pressure Education Program. (2005). *The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents*. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Heart, Lung, and Blood Institute, National High Blood Pressure Education Program.

Parker, J. D., Schoendorf, K. C., & Kiely, J. L. (1994). Associations between measures of socioeconomic status and low birth weight, small for gestational age, and premature delivery in the United States. *Annals of Epidemiology*, *4*, 271-278.

Pina, A. A., & Silverman, W. K. (2004). Clinical phenomenology, somatic symptoms, and distress in Hispanic/Latino and European American youths with anxiety disorders. *Journal of Clinical Child & Adolescent Psychology*, *33*, 227-236.

Preacher, K. J. & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879-891.

Quon, E. C., & McGrath, J. J. (2014). Subjective socioeconomic status and adolescent health: A meta-analysis. *Health Psychology*, *33*, 433-447.

Reinehr, T., Kiess, W., de Sousa, G., Stoffel-Wagner, B., & Wunsch, R. (2006). Intima media thickness in childhood obesity: Relations to inflammatory marker, glucose metabolism, and blood pressure. *Metabolism*, *55*, 113-118.

Resnick, M. D., Bearman, P. S., Blum, R. W., Bauman, K. E., Harris, K. M., Jones, J., . . . Udry, J. R. (1997). Protecting adolescents from harm: Findings from the National Longitudinal Study on Adolescent Health. *Journal of the American Medical Association*, *278*, 823-832.

Ritterman, M. L., Fernald, L. C., Ozer, E. J., Adler, N. E., Gutierrez, J. P., & Syme, S. L. (2009). Objective and subjective social class gradients for substance use among Mexican adolescents. *Social Science & Medicine*, *68*, 1843-1851.

Schreier, H., & Chen, E. (2013). Socioeconomic status and the health of youth: A multilevel, multidomain approach to conceptualizing pathways. *Psychological Bulletin*, *139*, 606-654.

Singh-Manoux, A., Adler, N. E., & Marmot, M. G. (2003). Subjective social status: Its determinants and its association with measures of ill-health in the Whitehall II study. *Social Science & Medicine*, *56*, 1321-1333.

Singh-Manoux, A., Marmot, M. G., & Adler, N. E. (2005). Does subjective social status predict health and change in health status better than objective status? *Psychosomatic Medicine*, *67*, 855-861.

Somerville, L. H. (2013). The teenage brain sensitivity to social evaluation. *Current Directions in Psychological Science, 22*(2), 121-127.

Udry, J. R., & Bearman, P. S. (1998). *New perspectives on adolescent risk behavior* (I. R. Jessor, Ed.). Cambridge, UK: Cambridge University Press.

U.S. Census Bureau. (2013). *Asians fastest-growing race or ethnic group in 2012, Census Bureau Reports* [Press relase]. Retrieved from https://www.census.gov/newsroom/press-releases/2013/cb13-112.html

Van Cauter, E., & Spiegel, K. (1999). Sleep as a mediator of the relationship between socioeconomic status and health: A hypothesis. *Annals of the New York Academy of Sciences*, *896*, 254-261.

Varvogli, L., & Darviri, C. (2011). Stress management techniques: Evidence-based procedures that reduce stress and promote health. *Health Science Journal*, *5*, 74-89.

West, P., Sweeting, H., Young, R., & Kelly, S. (2010). The relative importance of family socioeconomic status and school-based peer hierarchies for morning cortisol in youth: An exploratory study. *Social Science & Medicine*, *70*, 1246-1253.

Yu, Y., Lu, B. S., Wang, B., Wang, H., Yang, J., Li, Z., . . . Xing, H. (2007). Short sleep duration and adiposity in Chinese adolescents. *Sleep*, *30*, 1688-1697.

Zimmet, P., Alberti, K. G. M., Kaufman, F., Tajima, N., Silink, M., Arslanian, S., . . . Caprio, S. (2007). The metabolic syndrome in children and adolescents—An IDF consensus report. *Pediatric Diabetes*, *8*, 299-306.

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