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Is Receiving Social Support Costly for Those Higher in Subjective Socioeconomic Status?

Emily D. Hooker[1] · Belinda Campos[2] · Lesa Hoffman[3] · Peggy Zoccola[4] · Sally S. Dickerson[5]

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Abstract

Background Although social support is generally thought to have positive consequences, this is not always the case. Receiving social support may threaten independence, which research has shown is more highly valued among those higher in socioeconomic status. As a result, support may be less strongly associated with positive outcomes for those higher in socioeconomic status (SES). Conversely, those lower in SES are more interdependent (Kraus, Piff, Mendoza-Denton, Rheinschmidt, & Keltner, 2012; Stephens, Markus, & Phillips, 2014) and may, therefore, be less threatened when receiving social support. This study examined SES as a moderator of how daily received support (within and between persons) predicted both daily psychological stressor appraisals and diurnal cortisol.

Method Healthy undergraduate students (N = 128) participated in a 3-day study. Participants completed one or more evening diaries the first day of the study and additional questionnaires upon awakening, throughout the day, and at bedtime during the following 2 days. Support was measured each evening and stressor appraisals and cortisol were measured throughout the day.

Results As expected, for those who reported higher subjective SES, receiving more support than usual (within-person support) was associated with a flatter pattern of diurnal cortisol the next day. Although SES did not moderate the association of either within- or between-person support with stressor appraisals, the receipt of more support on average (between-person support) was associated with higher reported resources to cope.

Conclusion The findings demonstrate that there may be physiological costs—but not psychological costs—associated with the receipt of support for those higher in socioeconomic status.

Keywords social support · socioeconomic status · diurnal cortisol · appraisals · daily diary · social class

Introduction

While considerable evidence suggests that *feeling* supported is beneficial, research on *actually receiving* social support is puzzling, and an accumulation of studies have found adverse correlates of receiving social support. Theory and research suggest that the receipt of support may inadvertently threaten independence, autonomy, and self-efficacy [1, 2]. As a result, those who more highly value independence may be less likely to benefit or may benefit less from the receipt of support. Understanding the unexpected, negative correlates of receiving social support may require careful consideration of the sociocultural context in which support interactions unfold [3]. Namely, those higher in socioeconomic status (SES) are more likely to highly value independence and competence, whereas those lower in SES are more likely to value interdependence with others [4, 5]. We utilized experience-momentary sampling and salivary bioscience to examine the potential for SES to moderate the extent to which

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✉ Emily D. Hooker
ehooker@unc.edu

[1] Department of Psychology and Neuroscience, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

[2] Department of Chicano/Latino Studies, School of Medicine, Department of Psychological Science, University of California, Irvine, Irvine, CA, USA

[3] Department of Psychological and Quantitative Foundations, University of Iowa, Iowa City, IA, USA

[4] Department of Psychology, Ohio University, Athens, OH, USA

[5] Department of Psychology, Pace University, New York City, NY, USA

received support in daily life, both within- and between-person, predicts stressor appraisals and diurnal cortisol.

Psychological and Physiological Correlates of Receiving Support

Studies have found a pattern whereby the receipt of social support in daily life is sometimes associated with positive outcomes, yet other times received support is associated with negative psychological outcomes. For example, two studies of daily received support have found that receiving support in daily life was associated with more contentment, passion, joy, and positive mood, as well as less anger, depression, and anxiety [6, 7]. But receiving support has also been associated with negative emotional outcomes when support was not reciprocated (i.e., only one partner provided support [8], also see [9]) or when the support did not convey understanding, care, and validation, or was not responsive [10]. Taken together, research in this area suggests that daily received support is a complex process that may differentially impact individuals' psychological well-being depending on the circumstances surrounding its provision.

Three studies, to our knowledge, have examined the link between daily received support and physiological responses. The first found that daily interactions with close, comforting, and supportive individuals was associated with lower cortisol stress reactivity to an acute, laboratory stressor [11]. In the two other studies, individual-difference moderators played a role in understanding the daily support and physiological activity association. For example, receiving support in older adults has been associated with no change in blood pressure for those lower in hostility but with greater blood pressure for those higher in hostility [12]. In the third study, gender emerged as a moderator. Wives exhibited more favorable stress-related endocrine responses throughout the day (steeper salivary diurnal cortisol slopes using two measurements of cortisol) when they reported more support than usual; however, husbands exhibited more unfavorable patterns of responding (flatter cortisol slopes from wake to bedtime) when they reported more support than typical for them [2]. These studies reveal inconsistent physiological patterns associated with receiving support in daily life; however, they also provide evidence that receiving support is sometimes associated with physiological costs.

Studies examining physiological correlates of received social support in daily life may provide critical information about mechanisms by which social support is linked with lower disease risk and mortality [13]. There is evidence that the receipt of social support can reduce the perception of threats or stressors in the environment [11] and may also aid in coping [14], thereby limiting the potential damage of repeated exposure or heightened responses to stressors [15]. Diurnal cortisol may be of particular importance to researchers due to its links with mortality and social processes. Cortisol, a glucocorticoid released from the hypothalamic-pituitary-adrenocortical (HPA) axis, shows a consistent pattern throughout the day, whereby it is higher in the morning, peaks approximately 30 minutes after waking, and then decreases throughout the day. Cortisol also increases in response to stressors—including social stressors [16]. A flatter slope of cortisol throughout the day (excluding the peak 30 minutes after awakening) is associated with better health outcomes and is seen as a likely mechanism linking stress and future poor health [17]. This idea is supported by evidence linking flatter diurnal cortisol slopes (excluding the awakening response) to a higher risk of earlier mortality [18]. Yet, both animal and human studies have consistently demonstrated social buffering of HPA-axis activity in response to stressors [19]. Nevertheless, to our knowledge, only one study has examined the link between support in daily life and diurnal cortisol (i.e., [2]).

Potential Costs of Receiving Support

The benefits of receiving support may, in part, be undermined by the extent to which support threatens self-efficacy, independence, and autonomy. In a prior study of daily support, it was hypothesized that men, who tend to be more independently-oriented, would be more threatened by support and would exhibit flatter diurnal cortisol slopes [2]. They found that men did exhibit flatter diurnal cortisol slopes. Notably, this finding was mediated by self-efficacy: Men who felt less efficacious exhibited a flatter slope in diurnal cortisol [2]. This suggests that support—even support that appears responsive (e.g., "your spouse listened to or comforted you" [2])—may be associated with a flatter pattern of diurnal cortisol in those sensitive to threats to self-efficacy or independence. In an experimental study, Bolger and Amarel [1] experimentally manipulated social support by asking a confederate to either (1) convey social support directly to the participant or (2) convey the same information, but in the form of a question posed to the experimenter (a more indirect, and perhaps less threatening, form of support). Those who received support directly were more emotionally reactive to a laboratory stressor but only if the support threatened participants' sense of self-efficacy (i.e., their beliefs about being able to control and influence the world around them). That is, when support made people feel that others doubted their ability to cope with a stressor, it was associated with more negative emotional responses [1]. This study's experimental nature provides the most compelling evidence that receiving social support could have psychological costs (e.g., threats to self-efficacy and autonomy)—at least for individuals who are similar to those in this sample (i.e., New York University undergraduate students).

Sociocultural Context and Socioeconomic Status

> "For many, culture is experienced as the invisible assumption of 'normal'."
> -Campos and Kim (2017) [20]

SES—the social status individuals are afforded based on their income, education, and employment relative to others in their society—shapes norms, values, and worldview assumptions that constitute a form of culture that exerts a powerful influence on individuals. For example, lower SES is linked to a wide variety of social-psychological processes, including prosocial behavior [21], emotional expression [22], and situational attributions [23], and development across the lifespan is shaped by the cultural norms prescribed by varying social-class contexts [24]. Of particular relevance is emerging research illustrating that individuals higher in SES are also more likely to value independence, autonomy, and competency, while those lower in SES are more likely to value interdependent relationships [4, 5]. Given experimental evidence suggesting that support may threaten an individual's sense of independence or autonomy, the receipt of support may be less beneficial for those higher in SES. Conversely, those lower in SES may place lower value on independence and therefore may feel less threatened by the receipt of support. As a result, SES may be an important sociocultural factor to consider when examining the correlates of received social support. Drawing on this literature, we asked: Can SES moderate the experience of, and therefore the downstream correlates of, receiving social support in daily life?

Despite the potential for SES to be related to how individuals perceive and experience support, prior studies have not considered participants' SES as a potential factor in understanding received support and its correlates. Indeed, participant SES is seldom reported in papers on received social support. When SES is reported, it appears that many studies have been conducted predominantly with participants who tend to be of higher SES (e.g., college graduates, homeowners), which is a common limitation of social psychological research [25]. This disproportionate inclusion of higher-SES participants may also contribute to the tendency for studies to find received support to be associated with poorer psychological and physiological well-being. However, this possibility has yet to be tested. Furthermore, social support may be an important source of resilience for those lower in SES. Those lower in SES are at higher risk for poorer health outcomes [26]. Social relationships, and social support in particular, may mitigate the health risks associated with low SES [27, 28].

The Current Study

Through the use of experimental-momentary sampling and salivary bioscience, this study examined SES as a moderator of how daily received support is related to both daily psychological stress responses and diurnal cortisol both within and between persons. Prior research has shown that (1) those higher in SES tend to more highly value autonomy and (2) social support can threaten self-efficacy [1, 5, 29]. As a result, we hypothesized that for those higher in SES, higher reports of received support (both on average between persons, as well as relative to one's average, or within persons) would be associated with higher appraisals of stress and flatter diurnal cortisol slopes. However, for those lower in SES, we hypothesized the receipt of more support, either within- or between-person, would be associated with lower appraisals of stress and steeper diurnal cortisol slopes.

Accumulating evidence demonstrates that both objective and subjective reports of SES are related to the cultural norms that shape beliefs and behaviors [4, 5, 30]. Furthermore, measures of both types of SES have been uniquely related to future health outcomes [31]. However, there is not sufficient theoretical reason at this time to expect one measure to be more likely to moderate the correlates of received support. As a result, in this study, we examined both subjective and objective SES as moderators of the extent to which daily received support predicted psychological and physiological outcomes. Because both types of SES are related to cultural norms, we did not hypothesize that one measure would be more likely to moderate these relationships than the other. Instead, we examined both types of SES in order to provide a more complete assessment of the potential moderating role of SES.

Method

Participants

One hundred and twenty-eight eligible undergraduate students were recruited via campus online announcements and participated in this study. Additional details about eligibility criteria and exclusions are provided in the Supplemental Materials. Participants were 48.09% female and had a mean age of 19.86 (*SD* = 1.67) years old; 62.6% were of Asian background, 11.45% were of European background, and 25% were of multiethnic or other background groups.

Procedure

All procedures performed in this study were in accordance with the ethical standards of the institutional review board at a large public university and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This research was part of a larger study on how stressors (in the laboratory and daily life) affect psychological and physiological responses. Informed consent was obtained and demographics and other individual-difference measures were collected during the laboratory component of the study. In the laboratory session, participants were randomly assigned to complete a social-evaluative task (delivering a speech in front of an audience) or a non-social-evaluative task (delivering a speech alone)[1]. At the end of the laboratory session, participants

[1] This experimental manipulation was tested as a covariate in all models.

received instructions and materials needed to complete daily diaries. Participants completed one or more[2] evening diaries the day of the laboratory session and then additional questionnaires for the following 2 days upon awakening, at 12:00, 2:00, 4:00, 6:00, and 8:00 p.m., and at bedtime. Morning and bedtime questionnaires were completed via paper diaries. All other diaries were completed on PDAs (e.g., PalmPilots) programmed to beep at each of these timepoints, at which time participants were also prompted to take a saliva sample. These timepoints were selected to capture the full range of diurnal cortisol, which includes a peak 30 minutes after awakening and a steady decline over the course of the day. Those who were 90% or more compliant with their daily entries were entered into a lottery to win an Apple iPod. Participants were paid $25 for their completion of the laboratory phase of the study and $55 for the completion of the daily-diary component.

Measures

Social Support

Daily social support was measured with the following item at the end of the day: "Today, I felt that others responded to my needs/wishes." Participants could respond "not at all (1)," "a little," "moderately," "quite a bit," or "extremely (5)." Support items were lagged such that support on day 1 was entered into models predicting the dependent variables on day 2 and so on. Support was lagged because it was only measured once (at bedtime), but the dependent measures were assessed throughout the day. This ensured that support was always measured before the outcomes (i.e., appraisals, cortisol). Because support was measured on 2 days, and is therefore a time-varying predictor, we tested both within-person and between-person effects of support as fixed effects. Without distinguishing these two effects, the resulting support predictor would represent a conflated effect of both within- and between-person support [31]. A predictor to capture the within-person effect was created by subtracting an individual's support score on a given day from that individual's average support score across both days. This effect represents change in the outcome when support was higher or lower than that individual's average support across days. A predictor to capture the between-person effect was created by subtracting the sample mean from each individual's average across days. This effect represents change in the outcome when individuals receive higher or lower support than other individuals on average.

[2] The number of evening diaries depended on when the laboratory session started. Sessions in the afternoon allowed for more evening diaries than evening laboratory sessions.

Socioeconomic Status

Subjective SES was measured with the Macarthur Scale of Subjective Socioeconomic Status [32]. This scale featured a ladder with ten rungs representing "those who have the most money, the most education, and the most respected jobs" at the top. Participants reported their own rank, which corresponded with a number from 1 (lowest) to 10 (highest). Subjective SES was grand-mean-centered for analyses [33].

To measure objective SES, we used a measure of parental education. Prior research has used parental completion of a bachelor's degree as a factor distinguishing the working class from the middle class [29]. Participants reported the educational background of each of their parents by indicating their highest level of education from elementary school to graduate school. To maintain statistical power, parents' education level was recoded into a categorical variable whereby 0 = both parents completed less than a bachelor's degree; 1 = one parent completed a bachelor's degree or higher; and 2 = both parents completed a bachelor's degree or higher.

Stressor Appraisals

Daily appraisals of stress were measured up to four times the night of the laboratory session (day 1) and seven times throughout the following 2 days of diary measurements. Appraisals were measured with the following two questions: "Since the last beep, how often have you felt Stressed?," and "Since the last beep, how often have you felt you had Resources to Cope?" Participants could respond "0 = Never," "1 = Almost Never," "2 = Sometimes," "3 = Fairly Often," or "4 = Very Often." Each item was treated as a separate outcome variable. These items reflect aspects of the appraisal process that influence the psychological experience of stress [34] and directly assessed participants' subjective, psychological appraisals of stressors.

Diurnal Cortisol

The decision to include diurnal cortisol was driven by the theoretical relevance of diurnal cortisol to the goals of the larger study, and, unlike other psychophysiological measures (e.g., electrocardiography), saliva samples were feasibly implemented into a protocol that included multiple daily assessments. Saliva samples were collected eight times per day on the full 2 days of the daily diary portion of the study with Salivettes (Sarstedt, Inc., Newton, NC)[3]. Participants were instructed to

[3] Participants were asked to complete diaries and cortisol measurements at the same time—plus an additional saliva sample 30 minutes post-awakening; however, the exact time of cortisol measurements was not recorded. The timepoint (e.g., 2, 4, 6) was recorded and was used to match diary responses to cortisol samples. The time stamp on the diary was the time variable used for cortisol models.

store their samples in their freezers until the completion of the daily portion of the study. After samples were returned, they were stored at − 20 °C until the end of the study. At study completion, samples were shipped on dry ice to a laboratory for cortisol assessment. Cortisol levels for each sample were determined using an enzyme-linked immunosorbent assay (IBL-International, Hamburg, Germany). The assay had a lower limit of sensitivity of 0.005 μg/dL, with average inter- and intra-assay coefficients of covariance of less than 10%. Ninety-eight out of 1834 samples were missing (95% compliance). Given the positive skew in the cortisol data at each timepoint throughout the day, this variable was natural-log-transformed for use as an outcome in models with normal residuals.

The initial rise in cortisol (i.e., the cortisol awakening response, 30–45 minutes after awakening) was assessed as part of the larger study but not included in these analyses. This a priori decision was based on prior literature asserting that the Cortisol Awakening Response (CAR) is distinct from diurnal cortisol in both innervating mechanisms and in physiological purpose [35–38] and is consistent with prior examinations of diurnal cortisol [39]. Furthermore, prior evidence links diurnal cortisol, but not the CAR, with mortality [18].

Demographic Information and Covariates

Participants reported their racial/ethnic background; in order to maintain statistical power, groups were reduced to three categories: Asian background (Chinese, East Asian/Indian, Korean, Filipino, Vietnamese, Japanese), European background, and Other/Multiethnic background (Black, Middle Eastern, Chicano, Latino, Native American; each group in this category represented < 5% of the total sample). Demographic variables, including age and sex, were tested as covariates in models predicting all outcomes. Additional covariates included body mass index (BMI), menstrual cycle phase, sleep quality, caffeinated beverages, cigarettes, alcoholic drinks, minutes of exercise, prescription medications, and negative events. Complete details about these covariates are described in the Supplemental Materials.

Data Analysis Strategy Using Multilevel Models

The use of experience-momentary-sampling data and repeated salivary measures required a unique data analytic approach. We chose to use multilevel modeling in this study for a number of reasons. First, multilevel modeling allows for the modeling of both within-person and between-person effects. That is, we can better understand how the receipt of more support than usual on a given day is linked to the trajectory of cortisol the following day, and we are able to test whether those who receive more support on average exhibit significantly different trajectories of cortisol responses. Furthermore, the data analytic strategy we utilized in this paper modeled the quadratic and linear rates of change in diurnal cortisol, which cannot be modeled with AUC or difference calculations that are often used to examine diurnal cortisol.

All daily diary timepoints (at level 1) were nested within days (at level 2), which in turn were nested within people (at level 3). Multilevel models using residual maximum likelihood (REML) were estimated using xtmixed in STATA IC 13. In order to determine how the multilevel models could best account for the dependence within days and within persons, we first tested a series of random intercepts and slopes for each outcome as follows. First, we included day as a fixed effect at level 2, as well as a random intercept to account for mean differences across persons at level 3 (model A). We used a likelihood ratio test (LRT) to compare model A with model B in which a second random intercept was added at level 2 for differences across days within persons. After determining what type of fixed effect(s) for time of day (i.e., linear or quadratic) best represented the daily pattern of change in the outcome (at level 1), we then used LRTs to assess the need for a random slope for time of day across persons (at level 3) and across days within persons (at level 2). As described below, all relevant covariates were then entered and were maintained only if they were significantly associated with the outcome variable. Time-varying (within persons) covariates that were measured throughout the day (e.g., caffeine) were entered simultaneously into one model, whereas time-invariant (between-person) covariates were entered simultaneously in another model. Finally, we added the primary predictors of interest: daily social support, objective and subjective SES, and each interaction between daily social support and SES.

If participants were not able to provide one particular sample on a given day, the other samples that day and their samples on other days were still included in the models (which helps to satisfy the assumption of missing at random implied by the use of likelihood estimation for the models).

Results

Descriptive Statistics

Descriptive information and correlations for the key variables of interest are presented in Table 1. Across people and across days, participants reported that others responded to their needs and wishes "moderately" on average. The average level of subjective SES was 4.85 out of 10, which is somewhat lower than in studies of similar undergraduate samples (e.g., [21, 23]), and ranged from 2 to 9. Twenty-six percent of participants (26.36%) reported that both of their parents completed less than a bachelor's degree, 27.91% reported that one of their parents completed a bachelor's degree or more education beyond a bachelor's degree, and 45.74% reported that both of their parents completed at least a bachelor's degree. In this sample,

Table 1 Descriptive statistics and correlations of the key variables of interest

Variable	*M(SD)*	Support	Subjective SES	Objective SES	Stressed	Resources
Support	2.83(0.91)					
Subjective SES	4.85(1.47)	**− 0.17**				
Objective SES[a]		**0.13**	− 0.01			
Stressed	2.41(0.89)	0.02	**− 0.10**	0.00		
Resources	2.89(1.15)	**0.36**	**− 0.13**	**0.11**	**0.15**	
Cortisol	8.64(2.78)	**− 0.10**	0.00	0.02	− 0.02	**− 0.07**

Support = daily report that others responded to participants' needs/wishes averaged across days. Stressed = daily reports of how stressed participants felt averaged across timepoints and days. Objective SES = parent's education. Resources = daily report of participants' perceptions of resources to cope averaged across timepoints and days. [a] 0 = both parents completed less than a bachelor's degree, 1 = one parent completed at least a bachelor's degree, 2 = both parents completed at least a bachelor's degree. Cortisol = diurnal cortisol (nmol/L) averaged across timepoints and days. Spearman's rank correlation coefficients reported for continuous by ordinal correlations. Bold values indicate $p < 0.05$

subjective SES and objective SES were not significantly correlated with each other (Spearman's *rho* = − 0.02, $p = 0.528$).

Stressor Appraisals

Stressor appraisals were measured six times a day and were nested within people. Participants reported the time they completed each diary, which was converted into a variable representing the minutes since midnight. This variable was used to represent time of day in models predicting stressor appraisals. Time of day was centered on minutes since awakening in all analyses. A three-level model with both person and day as random intercepts was tested. The linear slope of time of day and the quadratic slope of time of day were also tested as fixed effects with random slopes varying across person and day. Prior to adding the interaction between SES and support, the following covariates were also entered as fixed effects: negative events*day, age, sex, experimental condition (from the laboratory portion of the study), ethnicity, and objective SES. Subsequent models dropped non-significant effects.

Perceptions of Stress

Participants' reports of feeling stressed were best modeled with a random intercept for each person and for each day. We hypothesized that the association between support and reports of stress would be moderated by socioeconomic status. To examine this hypothesis, we tested the following interactions within a single model: within-person support*subjective SES and between-person support*subjective SES. Neither interaction was significant. This means that the association of either within- or between-person support with perceptions of stress was not moderated by subjective SES. There also were no significant main effects of subjective SES or either type of support (p values > 0.28). Similarly, when these interactions were removed, there were no main effects of either subjective SES or type of support (p values > 0.24)[4]. In other words, neither type of support nor subjective SES was a significant predictor of perceptions of stress.

We also tested whether objective SES interacted with within-person or between-person support to predict next-day reports of how stressed participants felt. Objective SES did not interact with within-person or between-person support (p values > 0.17), nor were any conditional main effects significant. This means that objective SES did not moderate the association of either type of support with perceptions of stress, nor was objective SES significantly associated with perceptions of stress as a main effect. In a model with no SES variables, there were no main effects of either support variables (p values > 0.41).

Resources to Cope

Resources to cope were best modeled with a random intercept for each person, a random intercept for each day, and a random slope of timepoint (within day) across days and persons (i.e., two random slopes). Ethnic background was the only significant predictor of resources to cope (χ^2 (2, $N = 125$) = 7.73, $p = 0.02$). Those of European backgrounds reported higher resources to cope on average than those of Asian backgrounds ($\gamma = 0.84$, $SE = 0.33$, $p = 0.01$). There were no other significant differences between other ethnic background groups.

Next, we modeled the interactions of interest: within-person support*subjective SES and between-person support*subjective SES. Controlling for ethnic background, neither interaction was significant (p values > 0.19) nor was there a main effect for subjective SES. Thus, subjective SES did not moderate the association of within- or between-person support and reports of resources to cope. There was, however, a between-person simple main effect for support ($\gamma = 0.45$, $SE = 0.10$, $p < 0.001$), such

[4] Tables are not included for non-significant findings but are available upon request.

that participants who reported higher average support also reported higher average resources to cope than other participants. This finding did not change after controlling for objective SES, subjective SES, or previous-day negative events. After removing non-significant interactions and predictors, the main effect of between-person support remained significant ($\gamma = 0.45$, $SE = 0.10$, $p < 0.001$) (Table 2); participants who reported higher average support also reported greater resources to cope on average than other participants.

Finally, we tested whether objective SES interacted with each different type of support. Objective SES did not interact with within-person or between-person support (p values > 0.27); therefore, SES did not moderate the link between either type of support and resources to cope.

Diurnal Cortisol

Cortisol was measured seven times a day (excluding the 30 minutes past waking measurement) and was nested within people. The variable representing when participants provided saliva samples—minutes since midnight—was converted to hours since midnight and centered on hours since awakening in all analyses. A three-level model with both person and day as random intercepts was tested. The linear slope of time of day and the quadratic slope of time of day were also tested as fixed effects with random slopes varying across person and day. The following covariates were also tested as fixed effects before entering the key variables of interest: negative events*day, coffee sum*day, alcohol sum*day, exercise today*day, wake time, sleep quality, BMI, menstrual phase, age, sex, condition, ethnicity, and objective SES. Subsequent covariate reduction and modeling building mirrored that of appraisal models.

Diurnal cortisol responses were best modeled with a random intercept for persons, a linear random slope for time of day (in hours), and a quadratic random slope for time of day. When tested with all other possible covariates, sex ($\gamma = 0.12$, $SE = 0.06$, $p = 0.035$), BMI ($\gamma = -0.02$, $SE = 0.01$, $p = 0.012$), and hours since awakening ($\gamma = -0.09$, $SE = 0.02$, $p < 0.001$) were significant predictors of average diurnal cortisol and were maintained as covariates.

Subjective SES

We first tested whether support and subjective SES would interact to predict the linear or quadratic rate of change in cortisol responses throughout the day. This model showed a significant interaction between the quadratic form of time, the within-person effect of support, and subjective SES ($\gamma = 0.001$, $SE = 0.001$, $p = 0.028$), which remained the same when controlling for previous-day negative events and objective SES. To better understand this effect, the non-significant interactions among time, between-person support, and subjective SES were removed. The interaction of time of day*time of day*within-person support*subjective SES remained significant (Table 3) ($\gamma = 0.001$, $SE = 0.001$, $p = 0.028$). Figure 1 (support graphed at one standard deviation above and below the mean) illustrates that support had a greater effect on diurnal cortisol responses for those who reported higher subjective SES. For those higher

Table 2 The effects of support on daily resources to cope

	Estimate	*SE*	*p* value	95% CI		*r* effect size
Fixed Effects						
Day	− 0.037	0.052	0.475	− 0.139	0.065	0.063
Minutes since wake	0.000	0.000	0.295	0.000	0.000	0.094
Ethnic background group[a]						
European American	0.842	0.299	0.005	0.256	1.428	0.245
Multi/Other	0.312	0.218	0.152	− 0.115	0.739	0.127
Within-person support	− 0.006	0.044	0.890	− 0.091	0.079	0.013
Between-person support	0.450	0.101	0.000	0.252	0.649	0.369
Intercept	2.687	0.134	0.000	2.424	2.950	0.873
Random-effects parameters						
Random intercept: person	1.102	0.211				
Random slope: minutes since wake	0.000	0.000				
Covariance: person, minutes since wake	0.000	0.000				
Random intercept: day	0.375	0.118				
Random slope: minutes since wake	0.000	0.000				
Covariance: day, minutes since wake	0.000	0.000				
Residual variance	0.428	0.022				

Based on 125 participants with 239 days and 1272 longitudinal records. [a] 0 = Asian American background

Table 3 The interactive effect of support and subjective SES on diurnal cortisol

	Estimate	*SE*	*p*-value	95% CI		*r* effect size
Fixed Effects						
Day	− 0.002	0.033	0.945	− 0.067	0.062	0.006
BMI	− 0.019	0.007	0.006	− 0.032	− 0.006	0.240
Sex[a]	0.078	0.048	0.103	− 0.016	0.171	0.144
Wake time	− 0.081	0.015	0.000	− 0.111	− 0.051	0.424
Between-person support	− 0.014	0.026	0.586	− 0.064	0.036	0.048
Hours since wake	− 0.133	0.010	0.000	− 0.153	− 0.114	0.764
Hours since wake^2	0.001	0.001	0.113	0.000	0.002	0.139
Within-person support	0.079	0.059	0.183	− 0.037	0.195	0.118
Hours since wake*within-person support	− 0.018	0.015	0.218	− 0.047	0.011	0.109
Hours since wake ^{2}*within-person support	0.001	0.001	0.224	− 0.001	0.003	0.108
Subjective SES	− 0.009	0.024	0.708	− 0.055	0.038	0.033
Hours since wake*subjective SES	0.002	0.007	0.815	− 0.011	0.015	0.020
Hours since wake ^{2}*subjective SES	0.000	0.000	0.641	− 0.001	0.001	0.042
Within-person support*subjective SES	0.063	0.038	0.097	− 0.012	0.138	0.146
Hours since wake *within-person support*subjective SES	− 0.019	0.010	0.044	− 0.038	0.000	0.176
Hours since wake ^{2}*within-person support*subjective SES	0.001	0.001	0.028	0.000	0.002	0.192
Intercept	3.795	0.210	0.000	3.382	4.207	0.849
Random effects parameters						
Random intercept: person	0.003	0.021				
Random slope: hours since wake	0.002	0.002				
Random slope: hours since wake^2	0.000	0.000				
Covariance: person, hours since wake	0.000	0.005				
Covariance: person, hours since wake^2	0.000	0.000				
Covariance: hours since wake, hours since wake^2	0.000	0.000				
Residual variance	0.379	0.015				

Based on 126 participants with 1590 longitudinal records. Day = highest level of time in this model. Hours since wake = lowest level of time in this model. [a] 0 = female, 1 = male

in SES, the receipt of more support than usual was linked with a flatter slope in diurnal cortisol the following day, which is believed to be a pattern associated with poorer health outcomes. Those higher in SES who also reported lower support than usual exhibited a steeper pattern of diurnal cortisol the following day. This effect was significant at least 15 hours after awakening on average ($\gamma = -0.528$, $SE = 0.26$, $p = 0.041$). This effect did not change when controlling for objective SES. There was no main effect of between-person support, nor did it interact with subjective SES to predict cortisol through the day. This indicates that reporting higher support on average (between-persons support) was not linked with cortisol responses throughout the day, nor did subjective SES moderate the link of between-person support.

Objective SES

When a model with interactions between all forms of time, all forms of support, and objective SES was estimated, and subjective SES was controlled, there were no significant interactions[5]. Although the omnibus tests of all interactions with objective SES were not significant, there was a significant difference in the quadratic rate of change in cortisol between two objective SES groups. Participants who reported one parent with a bachelor's degree exhibited steeper slopes in diurnal cortisol than those who reported neither of their parents had a bachelor's degree ($\gamma = -0.003$, $SE = -2.03$, $p = 0.042$).

Discussion

In this study, we tested the potential moderating role of subjective and objective SES in the relationship between daily received social support and next-day psychological stressor appraisals and diurnal cortisol responses within and between persons. Theoretical and empirical work on SES has shown that those

[5] These findings were unchanged when subjective SES was not controlled for.

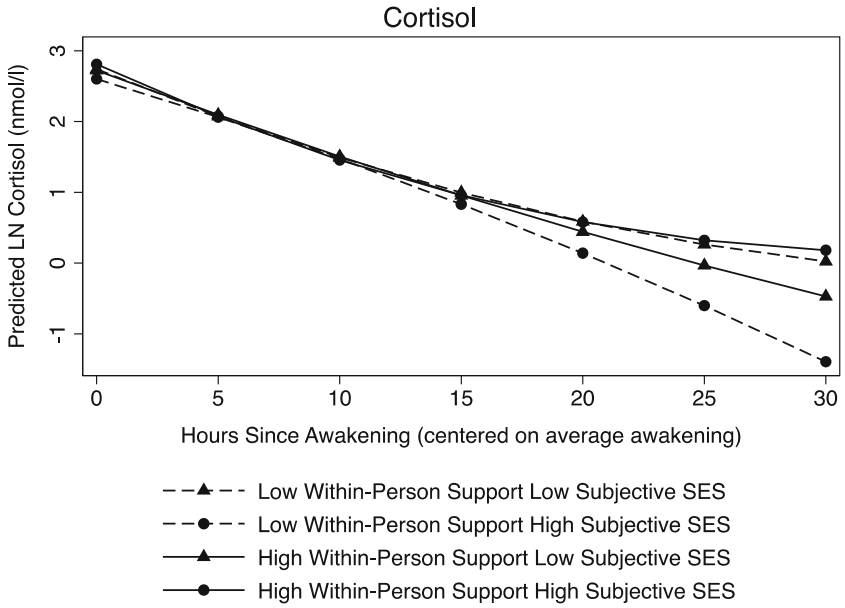

Fig. 1 Within-person support and subjective SES interact with the quadratic rate of change in diurnal cortisol. The lines represent 1 *SD* above and below the mean of within-person support and subjective SES

higher in SES tend to value independence and autonomy, and we reasoned that this approach to the self may be threatened when receiving support [1]. As predicted, for those higher in SES, the receipt of more support than usual on the previous day (within-person support) was associated with a flatter pattern of diurnal cortisol the following afternoon and evening—a pattern that is associated with higher mortality risk [18]. Those higher in SES who reported lower received support than usual (within-person support) exhibited a steeper, or potentially more healthful, pattern of diurnal cortisol the following day. In this study, the receipt of more support than usual, or within-person support, was a stronger predictor of cortisol responses the next day for those higher in SES. We did not find that subjective or objective SES moderated the link between either within- or between-person daily support and next-day stressor appraisals, but those who reported more support on average (between-person support) reported higher resources to cope the following day; neither within- or between-person support was significantly associated with reports of how stressed participants felt. These findings suggest that daily responsive support is a predictor of higher reported resources to cope, but this support may not be without physiological costs for those higher in subjective SES who may be sensitive to self-relevant threats to autonomy or competency [5, 40].

Our findings showed that those who reported more support on average (between-person support) also reported higher resources to cope the following day. We did not find that within-person support was related to resources to cope, nor did we find that subjective or objective SES moderated the association between daily received social support and next-day stressor appraisals. Although we expected SES to moderate the link between within- and between-person support and stressor appraisals, our measure of support at least partially represents responsive support—support that is validating, understanding, caring, and responsive to the needs of the recipient [41]—which may operate differently than other types of received support (e.g., mismatched support). Our daily support item asked participants to indicate the extent to which others responded to their needs/wishes, which closely reflects the components of responsive support. Prior work has demonstrated that responsive support is associated with positive psychological outcomes [10, 42], which suggests that responsive support may sidestep the threats to the self that can undermine the efficacy of received support. In other words, our findings provide support for the idea that responsive support can be psychologically beneficial for those who may be particularly sensitive to threats to independence or autonomy (i.e., those higher in SES), as well as those who place lower value on independence (i.e., those lower in SES).

Subjective SES was, however, a significant moderator of next-day diurnal cortisol responses. Given that those higher in SES are more likely to value independence [4, 5], we hypothesized that more support on average (between-person) and more support than usual (within-person) would be associated with higher stressor appraisals or flatter diurnal cortisol (a pattern that is believed to be more health-risky [18]). While individuals may feel that others validated, understood, and cared for them—that they received responsive support—in an interpersonal exchange, this does not preclude the possibility that this exchange induced "feelings of indebtedness or obligation" (p. 420, [43] or lack of independence [44], and prior research demonstrates that seemingly responsive support is not always beneficial [2, 10]. We found that those who were higher in subjective SES exhibited

flatter diurnal cortisol in the afternoons and evenings when they received more support than usual on the previous day (within-person support). When they reported lower support than usual, those higher in subjective SES exhibited steeper diurnal cortisol, which is believed to be a more health-protective effect. This finding is consistent with prior research demonstrating that acute threats to valued aspects of the self are associated with significant increases in acute cortisol responses to stressors but are not always associated with similar increases in stressor appraisals [16]. Furthermore, the observed pattern is consistent with prior research demonstrating that receipt of daily support may be threatening for those who more highly value independence [2]. In sum, these findings (1) highlight the importance of examining both psychological and physiological outcomes when aiming to better understand the costs and consequences of receiving support, and (2) provide initial evidence that the receipt of more support than usual may be associated with negative physiological correlates for those higher in SES.

For those who were lower in subjective SES, they exhibited cortisol trajectories that more closely reflected the pattern of those who reported higher subjective SES and higher support, which was a flatter diurnal cortisol slope. This pattern of diurnal cortisol is believed to represent risk of poorer future health [18], and prior studies have linked this pattern with lower SES [45]. A small body of literature has demonstrated that lower-objective-SES African Americans who are high in academic achievement and emotional well-being simultaneously exhibit poorer physiological well-being [46]. These authors called this "skin-deep resilience," which reflects the diminishing health benefits of psychological resources for those who endure chronic and widespread societal marginalization. In the present study, the receipt of daily support may have been insufficient to offset the physiological costs of low subjective and objective SES on diurnal cortisol highlighting the potential benefits and limitations of receiving support for those who report lower subjective or objective SES. Nevertheless, future studies would be strengthened by the inclusion of multi-system measurement of biological outcomes and other indicators of HPA-axis-activity as other outcomes may also be related to the receipt of social support.

Limitations and Future Directions

One limitation of this study was the inclusion of only 2 days of support reports. More days of support assessment would increase confidence that an individual's daily variation from their mean across assessment days represents meaningful variation in their daily experience. However, the other study that examined the link between received support and diurnal cortisol included 6 days of measurements (although only two measures of cortisol per day), and they also found a within-person effect such that men (who tend to be more independently-oriented) who received more support than usual exhibited a flatter pattern of diurnal cortisol [2]. This aligns with our findings showing that more support than usual was linked with flatter diurnal cortisol for those higher in subjective SES.

The measurement of support in this study also differs somewhat from how daily support and responsiveness have been assessed in prior studies. Although this measure of support appears to reflect responsive support, it has not been validated as a measure of responsive support. Nevertheless, our measure has the advantage of being a continuous measure of support, while many studies have used a single dichotomous item to measure received support in daily life. Future studies that include multiple continuous items measuring the receipt of social support will undoubtedly contribute to a more complete understanding of its consequences.

A final consideration in the interpretation of these findings is in the measurement of SES. The complexity inherent in determining one's own subjective SES may have contributed to different patterns in the relationship between SES and received support by type of SES. It has been argued that subjective SES best represents individuals' socioeconomic histories and cultures [47, 48], and objective SES may be too limited in scope to capture the complex social phenomenon that contributes to variations in received support by SES. As a result, for students whose status may be changing and whose status may be based on their families' statuses and their own, subjective SES may best represent their socioeconomic standing. Moreover, although the chosen measure of objective SES was selected because having parents with bachelor's degrees may be an important distinction between those who identify as middle class and those who identify as working class [29], with only three groups, it may not be a sensitive-enough measure. Understanding the full scope of the impact of daily received support or daily received responsive support requires that future researchers conduct similar studies in socioeconomically-diverse university and community samples to allow a better understanding of how socioeconomic inequity shapes support processes.

Implications for Salivary Bioscience

Advances in salivary bioscience have expanded opportunities for theoretical innovation in understanding how psychosocial processes, like the receipt of support, are related to physiological parameters in daily life and, potentially, long-term health. With these methodological advances, our statistical approaches must also evolve to addresses and capitalize on the unique nature of repeated, daily, or nested data. This study utilized three-level models to capture both fluctuation and change in psychological and physiological responses throughout the day for 3 days. Data of this nature offer unique opportunities to model within- and between-person effects, but it also adds complexity to the analytic process. While there are

several ways to analyze this type of data, below we discuss the benefits of the approach we implemented.

Salivary cortisol that is nested, in this case, by person, day, and timepoint throughout the day, is best analyzed with multilevel models. Although it is possible to calculate a diurnal cortisol slope with two measurements—morning and evening cortisol—there are limitations to this method. Doing so will yield a less precise estimate of the pattern of change in cortisol throughout the day and, therefore, will introduce error. As a result, it may be more difficult to detect an association between predictors and diurnal cortisol. Multilevel modeling also allows researchers to account for variation in saliva-sample timing across participants. For example, there may be significant variation in the saliva-measurement timing when participants are asked to provide a sample at bedtime. Moreover, in our analyses, we found that cortisol throughout the day was best represented by a quadratic pattern of change, which is impossible to model with the traditional method of slope calculation between two morning and evening assessments. By including multiple days of assessment, we were also able to obtain a more reliable pattern of cortisol responses and were able to look at next-day effects of our predictors.

Including multiple days of assessment also allowed for the incorporation of time-varying predictors, which opens the door for a more precise understanding of how variables like support and cortisol responses are related. In our study, social support was a time-varying predictor because participants reported the support they received on multiple days. As a result, we were able to also look at within-person variation in support processes and its relationship to change in cortisol across the day for multiple days. Electronic time stamps from the diaries were used to estimate cortisol sample times throughout the day, which is an advantage over relying on participants' self-report; however, electronic monitoring caps on saliva collection devices may provide more accurate estimates. In this study, we also chose to look at the lagged effect of support. Imagine if we did not test the lagged effect of support and instead examined the association between support reported at bedtime and cortisol throughout the same day. In this case, the temporal order of the predictor (measured second) and outcome (measured first) would interfere with the reasonable interpretation that support predicts cortisol throughout the day. In this study, due to the lagging, support was reported before any outcomes were measured. While this study was not experimental and we cannot conclude that support caused cortisol responses, the lagged design of our analyses provides evidence that support (moderated by SES) predicted cortisol responses. Further development of quantitative methods and salivary bioscience techniques will allow for more thorough theory-testing and a more nuanced understanding of the relationship between psychosocial and physiological processes.

Conclusions

This study tested the extent to which the receipt of support in daily life was related to stressor appraisals and diurnal cortisol for those of varying socioeconomic statuses. We found evidence that receiving more responsive support in daily life on average is associated with lower stressor appraisals the following day; however, there may be physiological costs of receiving more support than usual for those higher in SES. These findings underscore the importance of examining both psychological and physiological correlates of daily received support and also the value of considering the importance of social-class culture on close-relationship processes.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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