2020-11-30

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Recommended Citation
Peltz, J. S. (2020). The day-to-day impact of nighttime noise disturbances on college students' psychological functioning. *Journal of American College Health*. Advance online publication. https://doi.org/10.1080/07448481.2020.1842422

The Day-To-Day Impact of Nighttime Noise Disturbances on College Students' Psychological

Functioning

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Abstract

Objective: To understand environmental predictors (i.e., nighttime noise disturbance) of sleep health (i.e., restedness) in residential college students and its potential mental health consequences, this study examined daily variation in restedness upon awakening as a potential mediator between nightly environmental noise disturbances and daily fluctuations in depressive and anxiety symptoms.

Participants: The sample was comprised of 283 college students (M_{age} = 19.9, SD = 1.9; 79% female).

Methods: Multilevel structural equation modeling was conducted based on an initial self-report, online questionnaire and an online 7-day daily sleep (morning) and mood (evening) diary.

Results: Daily fluctuations in college students' reports of restedness (morning diary) mediated the association between the nighttime presence of noise disturbances (morning diary) and depressive and anxiety symptoms (evening diary).

Conclusions: Given the high prevalence of mental health problems in college students, creating more conducive sleep environments may help to prevent depressive and anxiety symptoms in this population.

Key words: College; sleep; environmental noise; mental health

Depression and anxiety remain the most highly cited reasons that college students seek counseling services, and their prevalence in this population continues to rise.[1] Almost 50% of college students report either depressive or anxiety symptoms as their primary concern when seeking counseling services,[1] and the pernicious correlates of these mental health issues include substance use problems, academic failure, and greater risks for suicide.[2–6] Predictors of mental health problems, such as depression and anxiety, are diverse, but insufficient and problematic sleep remains not only a consistent, negative influence, but also one that is often overlooked.[7,8] Although treatments for sleep problems have been shown to be effective in decreasing depression,[9] preventing mental health and sleep problems is always preferable. As highlighted by research on environmental disturbances to sleep and consistent with good sleep hygiene,[10,11] noise in the sleep environment remains a potent threat to a good night's sleep. In fact, research suggests that environmental noise potentially has a direct effect on depressive and anxiety symptoms.[12] Given college students' atypical schedules and their tight living quarters (i.e., dormitories), noise presents not only a challenge to sleep for students, but it also might impact their mental health through its influence on the sleep process and the level of refreshment one obtains from a night's sleep. Accordingly, the current study sought to examine the potential for college students' levels of restedness after poor sleep to serve as a mediator of the influence of environmental noise on their levels of depressive and anxiety symptoms.

Environmental Noise and Psychological Functioning

There is increasing evidence that noise disturbance has the potential to put people at risk for mental health issues.[12] Although prospective studies examining these links are exceedingly rare,[13] cross-sectional evidence suggests that noise disturbance, as a common environmental stressor, is associated with increased rates of depressive and anxiety symptoms in adults.[14]

Studies of noise disturbance have tended to examine common environmental noise stressors, such as traffic noise[12,15] or noise experienced as a result of one's occupation.[14] These sources of noise, when occurring at night, have been linked to insomnia and other sleep-related problems,[10,12] which are strongly linked to mental health problems.[9]

Previous studies of noise disturbance on sleep have also suggested that noise levels as low as 30-40 decibels, such as the sound generated from whispering to light rainfall, can disrupt sleep.[16] In addition, there are several factors that can moderate the effects of noise on sleep, such as age and sensitivity to noise.[17] Although extensive research in this area has measured acoustic sound levels (i.e., decibels),[16] subjective measurements of noise have been developed by the International Commission on the Biological effects of noise and remain a critical barometer of its effects.[18,19] Specifically, in a sample of university students, off-campus and on-campus students subjectively rated their environments to be similarly noisy despite higher objective levels of acoustically-measured noise occurring for the off-campus group.[18] Accordingly, the self-reported perception of noise provides an important source of information regarding its impact on sleep. Given the relative lack of prospective studies examining noise annoyance and mental health outcomes, the current study sought to examine the self-reported nightly occurrences of noise disturbance in dormitories as a potential predictor of college students' depressive and anxiety symptoms reported the following day over the course of a typical school week.

Sleep Environments and Sleep Quality

The sleep environment is typically defined by the physical space (i.e., dorm room) and related aspects of the context in which sleep occurs (e.g., noise). Given the sizeable percentage of college students living in residence halls, undergraduates' sleep environments often include having to live with a roommate, especially for students in their first two years of college.[20]

Although students can control some aspects of their sleep environment, especially those associated with proper sleep hygiene (e.g., turning off screens),[8,11] external noise is largely beyond their control. In fact, research suggests that students living with a roommate commonly endorse sleep environment disturbances that include noise within residence halls.[20] Related research regarding transportation noise and sleep suggests that such external noises are associated with both physiologically- and subjectively-measured sleep disturbance.[10,21] Cross-sectional research in college students in residential settings has suggested that even when controlling for sleep hygiene behaviors, environmental noise is still associated with poor sleep quality and indirectly linked with college students' depressive symptoms.[8] In the current study, we expand on this previous research by examining a short-term longitudinal model in which environmental noise might be directly linked with daily fluctuations in restedness, or the level of refreshment one derives from the previous night's sleep, and that these daily fluctuations in restedness might ultimately mediate the association between environmental noise disturbances and students' depressive and anxiety symptoms.

Sleep Quality and Psychological Functioning

As a construct, sleep health can be assessed through multiple indicators, including feelings of restedness, and that such subjective indicators remain an important barometer of sleep quality.[22,23] Extensive research supports robust associations between sleep quality (e.g., restedness) and depressive symptoms in college-aged students.[5,24] In addition, not only has insufficient or shorter-duration sleep been found to be associated with increased depressive symptoms,[24] but also students who reported both high levels of sleep disturbance and depressive symptoms endorsed other negative outcomes, such as higher levels of anxiety, poorer cognitive performance, and worse physical functioning.[5] Building on cross-sectional research in this

area,[5,8,24] longitudinal research has suggested that the associations between sleep quality and depressive symptoms are most likely bidirectional.[25,26] It is important to note, however, that much of the literature linking sleep and depression longitudinally has focused on fairly long intervals (e.g., 6-12 months) between assessments.[26,27] Although research documenting the longitudinal links is critical to advancing the field, observations spaced too far apart are more at risk of supporting misleading conclusions than those spaced relatively close together.[28] In addition, diary-based studies that measure both sleep and mood simultaneously (e.g.,[29]) risk inflated associations due to measurement timing and cannot highlight the potential directionality of associations obtained through prospective designs. Accordingly, the current study sought to build on this previous work by examining daily covariation between restedness and depressive and anxiety symptoms by employing a diary-based methodology that assessed participants twice a day. Specifically, by separately assessing restedness (via a morning diary) and mood (via an evening diary), the current study sought to minimize inflated correlations due to constructs being measured at the same time while affording an opportunity to examine prospective associations between these constructs across a relatively short assessment interval.

The Current Study

Building on the cross-sectional work of Peltz and Rogge,[8] this study sought to examine the potential impact of self-reported environmental noise disturbances on college students' psychological functioning (i.e., depressive and anxiety symptoms) via their levels of restedness. To this end, the use of multi-level structural equation modeling afforded the opportunity to simultaneously model both the between- and within-person variation across an undergraduate's typical week during the semester and provided a more precise method to examine the direction of influence between these constructs. Accordingly, the current study was guided by the

following hypotheses. **Hypothesis 1:** We hypothesized that reports of environmental noise disturbances would predict both lower levels of restedness and higher levels of depressive/anxiety symptoms. **Hypothesis 2:** We further hypothesized that decreases in restedness from the previous night's sleep (assessed each morning) would predict increases in depressive/anxiety symptoms (assessed that evening). **Hypothesis 3:** We hypothesized that environmental noise would be significantly and indirectly associated with increases in depressive/anxiety symptoms through the mechanism of restedness. Given the established links between sleep quality and sleep hygiene as well as the potential impact of living with a roommate or trying to sleep in a busy dormitory setting, we included measures of sleep hygiene, the presence of a roommate, and the number of residents in one's dormitory/residence to control for their potential influence on our outcomes.

Method

Participants

A total of 283 college students provided both baseline and diary data for the study (drawn from a larger pool of 335 respondents completing only the baseline survey – information on this larger sample can be found in [8]). Respondents had to be at least 18 years of age and currently enrolled in a college or university to participate in the study. The mean age of the current sample ($n = 283$; 79% female) was 19.9 years ($SD = 1.9$), and the majority of participants were Caucasian (68%), with 19% Asian or Pacific Islander, 7% multi-racial, 4% Latino, 1% African American, and less than 1% Native American. Participants were predominately first- and second-year students (32% and 31% respectively) with 22% reporting as juniors, 14% seniors, and 1% in their fifth year or beyond. Of the longitudinal sample ($n = 283$), 85% lived in an on-campus

residence hall, which averaged approximately 58 students ($SD = 58.4$) per facility. Finally, 54% of the longitudinal sample ($n = 153$) reported having at least one roommate.

Procedure

The study was approved by the Institutional Review Boards affiliated with each data collection site, and informed consent was obtained prior to participation. Participants were recruited from psychology classes from small ($< 2,500$ students) and mid-sized ($< 6,000$ students) colleges/universities in Upstate New York (87%) and from a psychological research website (13%; i.e., http://psych.hanover.edu/research/). The baseline survey took roughly 20-25 minutes to complete. In the baseline survey, participants proposed start dates for daily diary collection (helping to ensure that travel and/or school breaks did not coincide with the diary collection period). On average, respondents started the diary portion of the study approximately 4 days following completion of the baseline survey. The 7-day daily diary was divided into two sections, a morning survey to assess the previous night's sleep and an evening survey to assess their mood during the day. Respondents were sent one email invitation at 6 a.m. to complete the morning diary and a second email invitation at 9 p.m. to complete the evening diary each day for seven consecutive days. Each morning diary invitation requested respondents to complete the survey within an hour of waking up, and each evening survey invitation requested completion within an hour of going to bed. As incentives to participate, all respondents were given chances to win a $100 cash prize for each diary survey completed, and eligible participants received course credit for completing the initial survey.

Diary Adherence. All participants completed at least one daily diary assessment, with 257 respondents (91%) completing at least 4 days of the diary (8 assessments). Among those giving diary data, respondents completed assessments on an average of 6.1 days, thus providing

a total of approximately 1,726 diary entries (87.1%) out of 1,981 total possible entries. ANOVA

and χ^2 analyses suggested that the 283 respondents participating in the daily diaries did not differ

from participants who only completed the baseline survey on sleep quality, levels of depressive

or anxiety symptoms, number of dormitory residents, age, or gender. However, the students

completing the sleep diaries were more likely to live with at least one roommate ($\chi^2(1) = 9.54$, p

$< .01$, 91% vs. 78%). Taken as a set, these results suggest that the sample providing daily diary

data was largely comparable to the full sample. To help defray the impact of attrition on our

analyses,[30] we included a dichotomous variable coding for the presence of a roommate as an

additional control in our models. Finally, using current best practice guidelines, we used FIML

estimation within Mplus to handle missing data from the longitudinal model, thereby retaining

the full sample in our analyses.[31]

Measures

Environmental Noise (Morning Diary). Based on the recommendations of the

International Commission on the Biological Effects of Noise,[19] environmental noise was

assessed with a 2-item measure each morning for each of the 7 consecutive days of the daily

diary. Respondents indicated the presence (No = 0; Yes = 1) of noise annoyances either while

they were 1) trying to get to sleep or 2) during the night while they were sleeping. Accordingly,

"0" was coded if students did not report a noise disturbance, and "1" was coded if students

reported any noise disturbance before or during the previous night's sleep. Self-reported noise

disturbances included "loud music," "roommates," and "hallway noise."

Restedness (Morning Diary). Restedness was self-reported with a 1-item measure in the

morning for each of the 7 consecutive days of the daily diary. Adapted from the

recommendations of Ohayon and colleagues,[32] the measure assessed the level of restedness

("Indicate how rested you felt upon awakening.") that was rated on a 11-point response scale (0

– "*exhausted*" to 10 – "*very refreshed*") with higher scores indicating higher levels of

refreshment upon awakening.

     Psychological Functioning (Evening Diary). To assess students' psychological

functioning (i. e., depressive and anxiety symptoms), respondents self-reported on their anxiety

(2 items) and depressive (2 items) symptoms in an adapted version of the Patient Health

Questionnaire-4[33] in the evening portion of their diary. Although the anxiety portion of the PHQ-

4 has demonstrated slightly higher sensitivity/specificity than the depressive symptoms portion,[34]

the depressive symptoms portion has demonstrated strong reliability and validity in adolescent

samples.[35] Respondents reported each evening how much they had been bothered by the

following symptoms since waking up that morning: "feeling nervous, anxious or on edge", "not

being able to stop or control worrying", "little interest or pleasure in doing things", and "feeling

down, depressed, or hopeless." The items were rated on 4-point response scales ("not at all" to

"nearly all day") and were summed so that higher scores indicated higher levels of depressive

and anxiety symptoms ($\alpha = .93$).

     Sleep Hygiene (Baseline). Sleep hygiene was assessed with the 28-item Adolescent

Sleep Hygiene Scale,[11] assessing sleep-facilitating and sleep-inhibiting practices along 9

dimensions: physiological (e.g., drinking caffeinated beverages before bed), cognitive,

emotional, sleep environment, daytime sleep (i.e., napping), substance use, bedtime routine,

sleep stability, and bed sharing. Items were rated on 6-point response scales (0 - "*always*" to 5 -

"*never*"), and a score was calculated by taking the mean of all individual items such that higher

scores indicate better sleep hygiene practices ($\alpha = .80$).

Additional Covariates (Baseline). Two additional measures were included at baseline to

assess other potential influences on the sleep-related environment: 1) the number of residents in a

respondent's residence hall or dormitory, and 2) if the respondent shared his/her room with at

least one roommate. Finally, due to the possibility that students in higher class years might be

less likely to live in dormitories, all respondents reported their class year (1 = first-year to 5 =

fifth-year or beyond).

Analytic Strategy

The repeated observations from the daily diaries represented multiple assessments nested

within students. To appropriately model the nested nature of the data, multilevel SEM models

(Mplus, Version 8),[36] using a mediational framework,[37] were used. As depicted in our conceptual

model (Figure 1), repeated assessments within individual students across time (i.e., 7-day daily

diary data) were modeled at level 1, and student-reported data at baseline, which served as

predictors of both restedness and depressive/anxiety symptoms, were modeled between students

at level 2. Based on the best practices articulated by Preacher and colleagues,[37] we employed a 1-

1-1 mediational model that included both noise disturbances and restedness (mediator) as

predictors of depressive/anxiety symptoms (Figure 1). Because many commonly used multilevel

modeling approaches are at high risk of conflating the between- and within-level components of

mediational effects, the multilevel SEM approach distinguishes the variation associated both

between-person (at level 2, representing between-student trait-like differences on the variables in

the model) and within-person (i.e., the repeated assessments at level 1, representing state-like

fluctuations of the variables on each day of the diary period) by creating level 2 latent variables

based on the level 1 predictors (within-student fluctuations) that thereby represent the stable

portion of those constructs across the diary period for each student (see Figure 1).[37] In terms of

our process model, this multilevel framework allows for indirect effects to be tested both at the

between-student level (i.e., level 2, examining how latent variables representing typical levels of

the variables of interest are associated across students) as well as at the within-student level (i.e.,

level 1, examining how within-student fluctuations in the variables covary across the days of the week; see Figure 1). Using current best practices, we used asymmetric confidence intervals to test the significance of the level 1 and level 2 mediational paths.[38]

To control for proximal factors that could also influence students' sleep, we also included sleep hygiene, the approximate number of dormitory residents, the students' class years, and whether or not the students lived with one or more roommates as between-student predictors of their levels of restedness and depressive/anxiety symptoms. Given that multilevel modeling is tasked with parsing variance between levels (i.e., distinguishing between-person differences from within-person variation on the variables being examined), all multilevel modeling techniques are unable to provide standardized path coefficients. However, to maximize the generalizability of the current findings, we prepared the data in a way that could provide approximations of standardized path coefficients within this multilevel framework. We did this by standardizing all variables (i.e., converting all predictors, controls, and outcomes to z-scores) before entering them into the analysis (level 1 variables standardized at level 1 – across all subjects and observations – and level 2 variables standardized at level 2 – across all subjects). Thus, a level 1 effect of B = .50 would suggest that for every one standard deviation higher on the predictor on a specific day of the study, the model would predict outcome scores .50 standard deviations higher. Model fit was assessed with the comparative fit index (CFI;[39] > .90 indicating good fit), the root-mean-square error of approximation (RMSEA;[40] < .08 indicating good fit) and the standardized root-mean-square residual (SRMR;[41] < .10 indicating good fit). As shown in Figure 2, the model demonstrated very good fit.

Results

Preliminary Analyses

Descriptive statistics for the sample and intercorrelations among the key variables are presented in Table 1. Regarding the intercorrelations (Table 1), higher levels of nighttime environmental noise (summed across the entire week) were associated with lower average levels

of restedness and higher average levels of depressive/anxiety symptoms (both averaged across

the 7 days of the daily diary). Higher levels of average restedness were associated with fewer

average depressive/anxiety symptoms and better sleep hygiene. Higher levels of average

depressive/anxiety symptoms were associated with worse sleep hygiene. Finally, higher class

years were associated with better sleep hygiene and fewer dormitory residents; and the presence

of at least one roommate was associated with worse sleep hygiene, earlier class year, and more

residents living in the dormitory or residence hall.

Predicting Daily Restedness

Consistent with Hypothesis 1, the presence of nighttime noise disturbances ($B = -.49$, SE

$=. 13$) were associated with decreases in daily levels of restedness (Table 2, Figure 2). Also

shown in Table 2 at the between-person level, worse sleep hygiene at baseline predicted lower

levels of restedness across the 7 days of the daily diary ($B =.15$, $SE =. 05$). After controlling for

these effects at the between-person level, the presence of nighttime noise disturbances was also

significantly associated with corresponding increases in restedness ($B = -.05$, $SE =. 02$) at the

within-person level (Table 2, Figure 2).

 Predicting Daily Levels of Depressive Symptoms

As shown in Table 2 and Figure 2 at the between-person level, and consistent with

Hypothesis 2, increases in daily restedness were associated with corresponding decreases in

depressive/anxiety symptoms ($B = -.46$, $SE =. 12$). Furthermore, higher baseline levels of sleep

hygiene ($B = -.14$, $SE =. 04$) were associated with decreases in daily restedness (Table 2). After

controlling for these effects at the between-person level, increases in restedness, but not

nighttime noise disturbances, were significantly associated with corresponding decreases in daily

depressive/anxiety symptom levels (B = -.11, SE =. 02) at the within-person level (Table 2, Figure 2).

Mediation

Consistent with Hypothesis 3, the indirect effect of environmental noise disturbances on students' depressive/anxiety symptoms was significant: the presence of nighttime noise disturbances predicted lower levels of restedness, which, in turn, predicted higher levels of students' depressive/anxiety symptoms (Between-student Indirect Effect = .23, SE = .08, p < .05; 95% CI: .068 – .383). This result suggests that, even after controlling for baseline covariates, college students' sleep environments marked by the presence of nighttime noise disturbances predicted poorer restedness and that this lower level of restedness ultimately predicted higher levels of depressive/anxiety symptoms. However, after controlling for those indirect paths, the direct effect of noise disturbance on their depressive/anxiety symptoms was neither significant at the between-student level (B = -.05, SE = .24, ns) nor at the within-student level (B = -.01, SE = .02, ns). The results suggest that, even after controlling for more stable between-person differences (by creating the latent variables at level 2), daily fluctuations in students' levels of restedness mediated the effects of fluctuations in each students' report of the previous night's noise disturbance predicting corresponding fluctuations in their reports of depressive/anxiety symptoms at the end of each day.

Discussion

Building on the research linking poor sleep quality and psychological functioning in college students,[5] the current study demonstrated that the presence of nighttime noise disturbances exerted a negative influence on students' mental health via their level of restedness. By controlling for consequential individual (i.e., sleep hygiene) and environmental (i.e., presence

of a roommate, number of dormitory residents) correlates of restedness and by employing more

rigorous analytical techniques to capitalize on college students' daily patterns of sleep, the

current study provides another potential avenue through which colleges/universities might

address students' mental health problems. Specifically, our findings support prevention-focused

initiatives to facilitate better sleep environments for college students to both improve their sleep

and ultimately their mental well-being.

Although sleep hygiene can be taught to and improved in college students,[42]

environmental noise disturbances remain largely out of an individual's control and the

consequences of such environmental perturbations can adversely affect daytime functioning.[8] In

the current study, we provide evidence based on a prospective design that demonstrated that

reports of noise disturbances, which both made it harder to get to sleep and to maintain sleep,

resulted in students' daily reports of poorer restedness. Importantly, our measure of restedness

provided a distinct assessment of students' sleep that minimized the potential overlap associated

with other measures of sleep quality, such as sleep latency (i.e., the time it takes to fall asleep)

incidences of wake-after-sleep-onset. Consistent with previous research,[8] this finding emerged

despite controlling for the significant influence of sleep hygiene, which included the tendency for

students to engage in daytime napping as well as pre-bed caffeine and alcohol consumption.

Furthermore, the current study's use of daily diary assessments highlights the day-to-day role

that poorer restedness might play in a college students' life. Specifically, at the within-student

level, decreases in restedness from the previous night's sleep predicted increases in students'

depressive and anxiety symptoms measured at the end of the following day. This result is

consistent with previous research that suggests that beyond the influence of sleep duration, the

level of refreshment derived from a night of sleep is as, and at times more, consequential on daytime functioning.[43]

Although colleges aspire to create hospitable living conditions, some residential colleges and universities have taken steps to specifically create "quiet" residence halls or specific floors within residence halls.[44] The term "quiet" space can take on diverse meanings, ranging from 24-hour designated quiet to specific periods during the night, such as 10 p.m. to 7 a.m. In addition, whereas some schools can dedicate entire residence halls as "quiet" spaces, it is often only possible to allocate specific floors to this type of environment. Whatever the case, college students are a captive audience, often times with little choice about where they can live. Given the wide-ranging consequences of poor sleep, it is incumbent on colleges to offer spaces that can support students' sleep needs.

Limitations

Several limitations in the current study must be acknowledged. First, all measures are self-report, increasing the potential for response-bias. Future studies should augment self-report surveys with more objective methods (i.e., actigraphy) to more thoroughly test the presented model. Furthermore, we relied on students reporting instances of noise occurring at night, which has been shown to be a significant predictor of students' sleep quality.[8] Although these noises were loud enough to disturb the students, recordings of decibel levels would have afforded a more objective assessment of the level of noises perceived as annoying to the student. Future studies should therefore seek to augment subjective reports of noise with more objective measures, such as decibel-capturing sound meters. Second, the current study highlights the unidirectional pathway from students' restedness to psychological functioning. Although our longitudinal design supports the directionality of our findings, research suggests that the

associations between sleep and mood are bidirectional,[25,26] so it is entirely possible that the

opposite direction of influence could also emerge. The same holds true for the occurrence of

noise disturbance and restedness, which were reported at the same time each morning on the

daily diary and effectively demonstrated a cross-sectional association. Future studies will ideally

include models that can simultaneously test reciprocal and fully prospective associations

amongst these constructs to clarify this issue. Third, students were not asked to report on

diagnosed sleep disorders or their use of sleep aids in helping them get to sleep. Future studies

would benefit from assessing the extent to which the presence of sleep disorders and the use of

sleep medication might influence the other constructs in our model. Finally, the sample was

predominately Caucasian, female, and from colleges primarily in Upstate New York.

Accordingly, the findings may only generalize to a similar population and future studies should

seek more diverse college populations.

Conclusion

The current study underscores the potential of improving college students' mental health

by addressing environmental disturbances to their sleep. Although sleep hygiene-related

interventions have demonstrated their effectiveness in college and adolescent populations,[42,45]

such interventions are not widespread and may not ultimately be of use in the face of external

noise. Accordingly, future research on sleep-related interventions, such as mandatory "quiet"

spaces in residence halls, for college students remains an area for growth and provides important

opportunities to support students' well-being and academic achievement.[3,10] In light of the

current findings, it appears that it is time for colleges to more consistently assess the

environments they provide for college students to live in, as the integrity of these spaces appears

to be as influential on students as other high-profile aspects of college life, such as heavy

drinking and other risky behaviors.[2]

Declaration of interest: None.

Data availability: Data from the current study are available from the corresponding upon request.

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Table 1. Psychometrics and Correlations Amongst Variables (N = 283).

Measures									
Primary Variables (Mediation Model)	Range	M	SD	1	2	3	4	5	6
1. Nighttime Environmental Noise (Occurrences per Week)[a]	0 - 9	1.4	1.7	-					
2. Average Restedness	1 - 10	5.3	1.5	**-.24**	-				
3. Average Depressive/Anxiety Symptoms	0 - 5	0.7	0.9	**.13**	**-.32**	-			
Control Variables (Baseline)									
4. Sleep Hygiene	1.9 - 5.0	3.2	0.5	-.05	**.21**	**-.26**	-		
5. # of Dormitory Residents	0 - 150	57.7	58.4	.04	-.01	.11	-.06	-	
6. College Year	1 -5	2.2	1.1	-.08	.04	-.11	**.26**	**-.33**	-
7. Roommate(s) (No = 0; Yes =1)	54% lived with roommate(s)			.02	-.07	-.06	**-.17**	**.19**	**-.56**

Note. All **bolded** correlation are significant at *p* < .05.

[a] There were 299 noise occurrences reported out of a total of 1981 nights of the 7-day diary. Although this predictor is coded dichotomously in our model (0 vs. 1), we chose to provide the sum total of occurrences during the week to provide a clearer picture of the overall sleep environment.

Table 2. Coefficients for Mediation Models at the Between- and Within-Student Levels.

Between-Student

| | Predicting Restedness | | | | |
| | | | | 95% CI | |
Baseline Predictors	B	SE	*p*-value	LL	UL
Sleep Hygiene	**.15**	**.05**	**.003**	**.05**	**.25**
# of Dormitory Residents	.01	.04	.881	-.07	.08
College Year	-.07	.05	.193	-.17	.04
Roommate(s) (No = 0; Yes =1)	-.13	.09	.163	-.30	.05

Daily Predictor					
Nighttime Environmental Noise	**-.49**	**.13**	**.000**	**-.75**	**-.23**

| | Predicting Daily Depressive/Anxiety Symptoms | | | | |
| | | | | 95% CI | |
Baseline Predictors	B	SE	*p*-value	LL	UL
Sleep Hygiene	**-.14**	**.04**	**.001**	**-.22**	**-.05**
# of Dormitory Residents	.06	.05	.172	-.03	.16
College Year	-.10	.06	.137	-.22	.03
Roommate(s) (No = 0; Yes =1)	**-.35**	**.13**	**.008**	**-.61**	**-.09**

Daily Predictors					
Nighttime Environmental Noise	-.05	.24	.849	-.52	.43
Restedness	**-.46**	**.12**	**.000**	**-.70**	**-.22**

Within-Student

| | Predicting Restedness | | | | |
| | | | | 95% CI | |
Daily Predictors	B	SE	*p*-value	LL	UL
Nighttime Environmental Noise	**-.05**	**.02**	**.028**	**-.10**	**-.01**

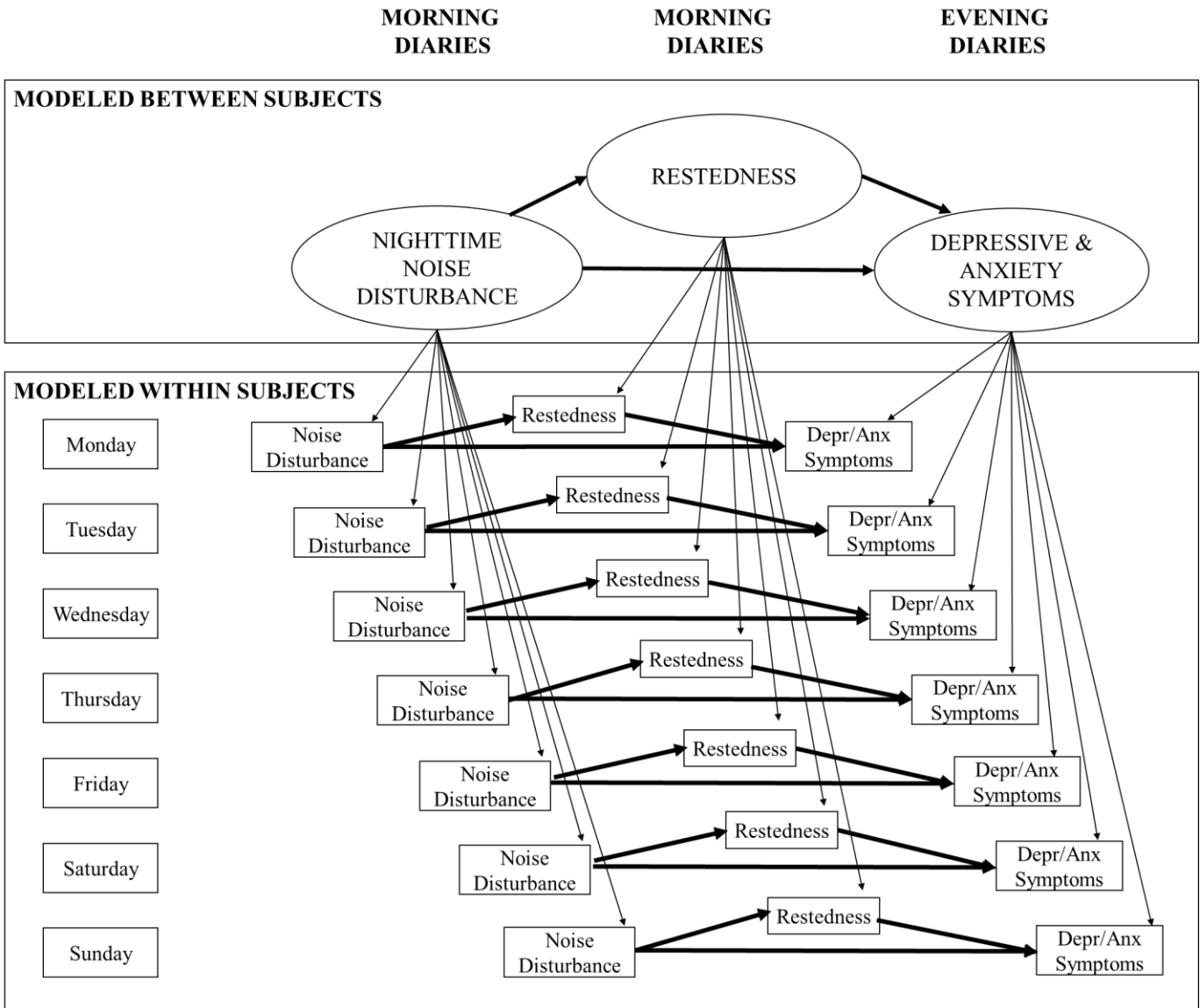| | Predicting Daily Depressive/Anxiety Symptoms | | | | |
| | | | | 95% CI | |
Daily Predictors	B	SE	*p*-value	LL	UL
Nighttime Environmental Noise	-.01	.02	.690	-.04	.02
Restedness	**-.11**	**.02**	**.000**	**-.16**	**-.06**

Figure 1. Conceptual Model.

Figure 2. Results from Multilevel SEM Model.

MORNING DIARIES **MORNING DIARIES** **EVENING DIARIES**

RESTEDNESS

-.49*** → ... -.46***

NIGHTTIME NOISE DISTURBANCE

DEPRESSIVE & ANXIETY SYMPTOMS

-.05

Model Fit
$X^2(24) = 245.3$;
RMSEA = .01;
CFI = .99;
$SRMR_{bw} = .04$

DIFFERENCES BETWEEN STUDENTS

FLUCTUATIONS WITHIN STUDENTS ACROSS DAYS

RESTEDNESS

-.05* → ... -.11***

NIGHTTIME NOISE DISTURBANCE

DEPRESSIVE & ANXIETY SYMPTOMS

-.01

*$p < .05$; ** $p < .01$; *** $p < .001$.