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Health Psychol. Author manuscript; available in PMC 2021 March 01.

Published in final edited form as:

Health Psychol. 2020 March ; 39(3): 179–189. doi:10.1037/hea0000824.

Latino Adolescents' Daily Bicultural Stress and Sleep: Gender and School Context Moderation

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Abstract

Objective: Bicultural stress (i.e., challenge arising from navigating two cultural contexts) has significant consequences for Latino youth's health, but researchers have yet to examine the implications of bicultural stress for adolescents' sleep. The goals of this study were to examine whether individual and day-to-day (within-person) differences in bicultural stress were associated with Latino adolescents' sleep onset latency (i.e., time to fall asleep), sleep midpoint (i.e., sleep schedule), sleep duration (i.e., time asleep), and subjective sleep quality.

Methods: Participants were 209 Latino late adolescents (M_{age} = 18.10; 64.4% female) attending over 90 different high schools who completed seven daily diary surveys while wearing actigraph wristwatches (N = 1,320 daily observations). Participants also reported sleep problems in a standard survey. Statistical interactions were tested to assess moderation by gender and co-ethnic school composition.

Results: On average, more bicultural stressors across the week were associated with lower average sleep duration and more sleep problems for males (compared to females) and youth attending schools with higher (compared to lower) Latino student enrollment. Regarding day-to-day differences, more daily bicultural stressors than usual predicted longer sleep onset latency that night for males, earlier sleep midpoint that night, and less sleep duration that night for youth attending higher Latino-enrollment schools.

Conclusions: Latino adolescents' everyday experiences of bicultural stress relate to differences in sleep duration, timing, and quality, with important variation by gender and school context. Results advance existing theory regarding social position factors that differentiate the health implications of bicultural stress for Latino youth.

Keywords

bicultural; stress; sleep; Latino; adolescents; daily diary; actigraphy

Sleep has been proposed as a stress-sensitive mechanism of developmental, cultural, and biological significance, particularly during adolescence and the transition to adulthood (Becker, Langberg, & Byars, 2015). Late adolescence is a time period for increased opportunities but also increased responsibilities for decision-making around health

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behaviors, including sleep. According to U.S. nationally representative data, late adolescence (i.e., approximately 18 years of age) appears to be a particularly risky period for inadequate sleep (Maslowsky & Ozer, 2014). There are adverse health consequences of inadequate sleep during this developmental period, including greater risk for depression and obesity in adulthood (Kuo et al., 2015; Owens, 2014).

About one in four U.S. public school students are Latino[1] (National Center for Education Statistics, 2016), and Latinos will account for almost 30% of the U.S. population by 2060 (U.S. Census Bureau, 2015). Disrupted and inadequate sleep among Latino youth may contribute to broader ethnic-racial health disparities (e.g., Latinos' elevated risk for obesity; Guglielmo, Gazmararian, Chung, Rogers, & Hale, 2018). Many Latino youth experience bicultural stress from simultaneously navigating two cultural contexts on a daily basis (Romero & Roberts, 2003). Research has documented that these bicultural stressors contribute to poor mental and physical health (Kim, Schwartz, Perreira, & Juang, 2018a), but there has been limited attention to bicultural stress in relation to sleep, and more specifically, how stress-sleep relations may play out on a day-to-day basis among Latino late adolescents preparing for their transition to college.

After identifying a concerning absence of conceptual frameworks for conducting developmental and health research with youth of color, García Coll and colleagues (1996) introduced an integrative cultural-ecological model based in an understanding of social stratification mechanisms (e.g., racism, segregation) that account for the health and development of youth of color *via* the contextual demands they face in U.S. society (e.g., discrimination, immigrant-related challenges, acculturative/enculturative pressures; see also Causadias & Umaña-Taylor, 2018, for review). The current study was informed by this integrative model in several ways. First, the integrative model highlights a lack of specificity when researchers focus on variability between rather than *within* ethnic-racial groups. Thus, a diverse sample of Latino adolescents were recruited for this study during their final year of high school as they prepared for college, allowing for the consideration of variability in everyday stressors salient to this group at this time in development that is not possible in group comparative studies of sleep (e.g., Adam, Snell, & Pendry, 2007). Second, the integrative model articulates culturally-mediated *contexts* for youth health that are difficult to capture using traditional assessments. In this study, innovative methodologies, including daily diary stress reports and actigraphy measures, were adopted to advance understanding of Latino adolescents' sleep in naturalistic settings as real-world stress occurs. Third, the integrative model suggests that social position factors such as gender and school settings may magnify or diminish associations between contextual demands (i.e., stress) and outcomes. Thus, the theorized links between stress and sleep in this study included moderation tests by gender and co-ethnic school composition.

[1]There are complex historical origins of the pan-ethnic labels "Latino(a)," "Latinx," and "Hispanic," as well as regional preferences. "Latino" is used here to refer to an individual residing in the U.S. with family ancestry in a Spanish-speaking country in Latin America, the Caribbean, and parts of the U.S. that were formerly territories of Spain or México. Following conventions of the Spanish language, "Latina" is used in this paper when referencing females of Latin American ancestry, specifically.

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Bicultural Stress and Sleep

Building on the cultural-ecological focus of the integrative model (García Coll et al., 1996), Romero and Roberts (2003) defined bicultural stress as the perceived conflict that can arise from navigating and seeking acceptance within two sets of cultural norms, values, and languages. Bicultural stress can manifest in various ways during adolescence, including family stressors (e.g., parent-child acculturation discrepancies), discrimination (e.g., ethnic-racial insults or teasing), dual language demands (e.g., translating/interpreting for immigrant family members), and peer stressors (e.g., inter- and intra-group pressures; Romero & Roberts, 2003; Romero, Carvajal, Valle, & Orduña, 2007a). Latino adolescents report more frequent bicultural stress than their European American peers, and, among Latino adolescents, those of lower socioeconomic status (SES) and those with a greater Spanish-language orientation tend to report more frequent bicultural stress (Romero et al., 2007a). Greater bicultural stress has been associated with lower psychological well-being and higher depressive symptoms and substance use, both concurrently (Piña-Watson, Ojeda, Castellon, & Dornhecker, 2013; Romero et al., 2007a, 2007b) and longitudinally (e.g., Ángel Cano et al., 2015).

Stress can affect adolescents' sleep through a variety of mechanisms, including heightened cognitive and emotional arousal at bedtime brought on by pre-sleep worrying (Bartel, Gradisar, & Williamson, 2015) or sustained activation of threat-response systems in adaptation to contextual demands (Dahl & Lewin, 2002). Regarding indices of cultural stress, greater acculturation to the U.S. (McHale et al., 2011), more frequent ethnic-racial discrimination (Zeiders, 2017), and more burdensome language brokering experiences (Kim et al., 2018b) have been associated with lower self-reported sleep quality and less self-reported sleep duration. With one recent exception (Majeno et al., 2018), all of these studies have relied on self-report measures of sleep that can be conflated with adjustment. Further, none have considered the accumulation of various sources of bicultural stress in relation to sleep.

Gender Differences in Associations Between Bicultural Stress and Sleep

The integrative model suggests gender serves as a social position factor that modifies how ethnic-racial minority youth are exposed to, experience, and respond to contextual demands (García Coll et al., 1996). For Latino youth, the traditional gender roles of *marianismo* for women (i.e., responsibilities for family support and nurturance) and *machismo* for men (i.e., independence from emotional family needs and greater autonomy) shape how Latino adolescents are socialized to cope with stress (Liu, Gonzales, Fernandez, Millsap, and Dumka, 2011; Ojeda & Liang, 2014). Latino adults' mental health problems have been related to the self-silencing attitudes of *marianismo* for women (Sanchez, Smith, & Adams, 2018) and the restrictive emotionality of *machismo* for men (Fragoso & Kashubeck, 2000). Regarding bicultural stress, one study found that Latino males (compared to females) reported more frequent language-based discrimination (Romero et al., 2007a), but no gender differences were found in another study (Romero et al., 2007b).

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Associations between bicultural stress and Latino youth's health and adjustment have also differed by gender. Some evidence suggests that males may be at greater risk for poor health outcomes via language pressures and family stress. For example, Spanish competency pressures were more strongly associated with depressive symptoms for Latino male (compared to female) college students (Castillo et al., 2015). Greater family stress among Latino adolescents was more strongly associated with internalizing symptoms and lower psychological well-being for males, and discrimination stress was associated with lower psychological well-being for males (and these associations did not emerge for females; Piña-Watson et al., 2015). Finally, hypothesized coping mechanisms (e.g., active coping, social support) only emerged for Mexican-origin adolescent females and not males (Liu et al., 2011). Other studies of Latino youth have not found support for differential relations between stress and adjustment by gender (Ángel Cano et al., 2015; Kim et al., 2018b). Given gendered Latino cultural values, gendered ways of coping with stress, and potential gender differences in the ways bicultural stress may relate to health, the current study examined whether daily bicultural stress was related to sleep in different ways for males and females.

School Context Differences in Associations Between Bicultural Stress and Sleep

The integrative model also suggests school contexts serve as a social position factor that may constrain or support ethnic-racial minority youth in the process of adapting to contextual demand (García Coll et al., 1996), such as bicultural stress. School contexts with more representation of same ethnic group peers (i.e., higher co-ethnic school composition; Benner & Graham, 2013) can be protective settings characterized by reduced peer discrimination (Bellmore, Nishina, You, & Ma, 2012) and fewer student emotional health problems (Georgiades, Boyle, & Fife, 2013). On the other hand, consistent with stratification theory and the negative consequences of segregation and inequity in U.S. schools (García Coll et al., 1996), higher co-ethnic school composition has also been identified as a vulnerability factor for the health and adjustment of ethnic-racial minority students (e.g., Juvonen, Nishina, & Graham, 2006; Seaton & Douglass, 2014).

Regarding sleep, one study found that a greater sense of school belonging attenuated the negative associations of discrimination with self-reported sleep duration and quality for Latino and Asian American adolescents (Huynh & Gillen-O'Neel, 2016). The frequency and nature of bicultural stress are expected to manifest differently across school contexts with more or less representation of same-group peers (Kim et al., 2018a; Romero & Roberts, 2003). Given documented connections between school diversity and youth adjustment, prior mixed findings in the direction of these associations, and potential school context differences in the nature of daily stress and sleep, the current study also examined whether bicultural stress and sleep associations varied by co-ethnic school composition (i.e., proportion of Latino student enrollment).

The Current Study

In a systematic review of 17 discrimination and sleep studies, only one study of adults incorporated a daily diary design and used actigraphy to measure sleep objectively in

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naturalistic settings (Slopen et al., 2016). The current study made important contributions by using daily diaries and corresponding objective actigraph measures to examine Latino adolescents' daily experiences of bicultural stress in relation to sleep as they prepared for the college transition, including both average between-person differences (i.e., how adolescents differ from one another) and within-person differences (i.e., how experiences differ from day to day within the same individuals).

First, individual differences in daily bicultural stress (average of daily diaries across a week) were examined in relation to concurrent actigraph measures of sleep onset latency (i.e., time to fall asleep), sleep midpoint (i.e., middle point of falling asleep and waking), and sleep duration (i.e., amount of time asleep), as well as a concurrent report of sleep problems. *Hypothesis 1:* Adolescents who reported more daily bicultural stressors would have longer sleep onset latency, later midpoint, shorter duration, and more subjective sleep problems, on average, and these concurrent associations would be more pronounced for males compared to females (e.g., Castillo et al., 2015; Piña-Watson et al., 2015). Second, daily differences in experiencing more bicultural stressors than usual (i.e., within-person differences) were examined as a predictor of night-to-night variation in sleep. *Hypothesis 2*: Days characterized by more bicultural stressors than usual (relative to an adolescent's average level of bicultural stress throughout the week) would be followed by less sleep duration and more time to fall asleep specifically that night, and these associations would be stronger for males compared to females. Given prior mixed findings (e.g., Georgiades et al., 2013; Seaton & Douglass, 2014), directional hypotheses were not specified for co-ethnic school composition as a moderator.

Methods

Participants

Participants were 209 Hispanic/Latino(a) adolescents (M_{age} = 18.10, SD = 0.41; 64.4% female) recruited from over 90 different schools in a large metropolitan area in the U.S. Southwest as part of a broader multi-method study examining health and daily experiences among Latino adolescents transitioning to college (Doane et al., 2018). Adolescents participated during the spring of senior year (64.5%) or the summer prior to attending college (34.5%). See Supplementary Materials (Table S1) and Doane et al. (2018) for demographic characteristics of this sample. Two participants did not complete the actigraph or daily diary study components and were not included in these analyses (analytic N = 207 persons).

Procedure

The Arizona State University Institutional Review Board approved all procedures. Trained project staff visited participants' homes or hosted participants in a university lab to deliver study materials, gather survey responses, provide instructions regarding actigraphy and diary reporting procedures, and measure participants' height and weight. Staff members obtained signed consent; parental consent was also collected if participants were under the age of 18. Forms were presented in the preferred language of the participant and their guardian. From Sunday evening to the following Sunday morning, participants were instructed to wear a

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wrist-based accelerometer (actigraph watch) 24 hours a day (excluding bathing or swimming) for seven consecutive days and nights (M_{nights} = 6.63, SD = 0.81). Staff contacted participants via phone, text message, or e-mail based on preference to provide daily reminders and answer any questions that arose throughout the week. Participants completed daily diary reports via smartphones (97.5%) or paper-and-pencil diaries (2.5%) before bedtime (M = 6.39 diaries, SD = 1.16; see Doane et al., 2018). Participants also completed an online questionnaire at a time convenient for them before or during diary procedures, including questions about sleep, demographic information, related health behaviors, medical conditions (e.g., medication use), and emotional health (e.g., depressive symptoms). After the study, project staff retrieved study materials and compensated participants.

Measures

Actigraphy measured sleep.—Participants wore a Micro Motion Logger Watch (Ambulatory Monitoring, Inc. Ardsley, NY, USA) on their non-dominant wrist for seven consecutive days and nights. Full methodological details for actigraphy in this study are included in Supplementary Materials. Actigraphy has been validated against polysomnography (Sadeh et al., 1995) and has demonstrated good reliability when measured over five nights or more (Acebo et al., 1999). The current study included multiple objective sleep outcomes: (1) sleep onset latency (SOL; i.e., minutes spent in bed before falling asleep), (2) midpoint time (i.e., midpoint between sleep onset and waking), reflecting sleep schedule, and (3) sleep duration (i.e., total sleep minutes, excluding wake periods). Objective sleep data were missing from one participant (0.5%) due to mechanical problems, one participant (0.5%) who lost the actiwatch, and six participants (3.0%) who decided not to wear the actiwatch but participated in other procedures.

Subjective sleep problems.—Concurrently with their participation in the daily diary study, participants completed the Pittsburgh Sleep Quality Index (PSQI) as an indicator of subjective sleep problems (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). This 19-item self-report questionnaire includes questions regarding sleep quality and disturbance over the last month in seven domains: duration, SOL, disturbance, daytime dysfunction, efficiency, quality, and use of sleep medication. Participants were asked to record their responses to open-ended questions (i.e., “During the past month, how many hours of actual sleep did you get at night?”) and 4-point Likert scale questions (“During the past month, how often have you had trouble sleeping because you wake up in the middle of the night or early morning?”). Responses were coded from 0 (*not during the past month*) to 3 (*three or more times in a week*). The possible sum score ranged from 0 – 21, with higher scores indicating poorer sleep quality and more sleep disturbances; five or higher indicates clinically significant sleep problems (Buysse et al., 1989).

Daily bicultural stress.—In each bedtime daily diary report, participants were asked to respond “yes” or “no” to five items adapted from the 20-item Bicultural Stress Scale (Romero & Roberts, 2003) framed in a day-specific format (e.g., “Today I…felt uncomfortable when others made jokes or put down people of my ethnic background” and “…felt pressure to speak English or Spanish better” (see Supplementary Materials for

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additional details). This checklist of bicultural stress experiences was developed to represent the various dimensions of the original survey measure, including the domains of family, discrimination, dual language demands, and peers, which has been used reliably in numerous studies of Latino adolescents (e.g., Piña-Watson et al., 2013; Romero et al., 2007a, 2007b). For within-person analyses, the sum of "yes" responses for each day was used to measure the count of daily bicultural stressors. Each of the five items had < 0.8% missing data, and there were no missing data for the daily sum score (missing responses treated as zero). For between-person analyses, average daily bicultural stress was measured as the mean of each individual's daily scores.

Co-ethnic school composition.—Participants' high schools were identified using university institutional data. High school enrollment characteristics were obtained through the National Center of Education Statistics (NCES). Consistent with prior research (Benner & Graham, 2013), co-ethnic school composition was determined for each participant by dividing number of Latino/Hispanic students by total number of students enrolled in their school during the same academic year.

Covariates.—Only covariates significantly associated with outcome variables in preliminary analyses were included. Regarding day-to-day differences, covariates included weekend vs. weekday (1 = Friday or Saturday; 0 = other nights) and daily caffeine use (1 = caffeine use, 0 = no caffeine use). Regarding between-person differences, covariates included whether participants completed the study protocol during the summer (n = 74 participants), body mass index (BMI) based on objective height and weight, immigrant generation (number from 0 to 7 indicating family members born in the U.S., including participant, parents, and grandparents; see Doane et al., 2018), parents' education level, depressive symptoms (Center for Epidemiologic Studies Depression Scale, CES-D; Radloff, 1977; α = .96), and anxiety symptoms and general perceived stress (Depression Anxiety and Stress Scales, DASS-42; Lovibond & Lovibond, 1995; α = .90 and .89, respectively).

Analytic Plan

Multilevel models were fit in M*plus* 7.4 (Muthén & Muthén, 1998–2012) using maximum likelihood estimation with robust standard errors to account for nested data (days within persons) and handle missing data. Two-level models were fit separately for each of three sleep outcomes: sleep onset latency (SOL), midpoint, and duration. In the first set of gender-moderated models, average bicultural stress, gender (1 = male), and their interaction were entered as Level 2 (between-person) predictors of model intercepts (average sleep; *Hypothesis 1*; N = 1,320 daily observations). Daily bicultural stress was also entered as a Level 1 (within-person) predictor of day-to-day variance in sleep, and gender was included as a Level 2 (between-person) predictor of individual differences in the day-to-day association between bicultural stress and sleep (i.e., cross-level interaction; *Hypothesis 2*). Covariates were included at Level 2 (e.g., summer participation, body mass index) and Level 1 (e.g., weekend night) if they were significantly correlated with sleep (Table S2) or significant in preliminary multilevel models. The second set of school-moderated models were similar, but only included data from participants who completed the study during the school year (N = 845 daily observations). Multiple linear regression models with maximum

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likelihood estimation were fit for the between-person outcome of concurrent subjective sleep problems, as these data were not nested.

Continuous Level 2 predictors were grand mean-centered, and daily bicultural stress at Level 1 was within-person centered (Enders & Tofighi, 2007). Significant interactions were probed using simple slopes techniques for multilevel modeling and multiple linear regression (Preacher, Curran, & Bauer, 2006). Specifically, associations between bicultural stress and sleep were plotted for males and females separately, and at +/−1 *SD* from the grand mean of co-ethnic school composition, following standard practice (Aiken & West, 1991).

Results

See Supplementary Materials for descriptive statistics and bivariate correlations (Table S2).

Gender Differences in Associations Between Bicultural Stress and Sleep

Adjusting for covariates, average bicultural stress (i.e., mean of all daily diaries for each participant) was not significantly associated with objective sleep outcomes, *p*s > .19. On average, males had longer SOL, $\gamma_{02} = 0.39$, $p < .01$, and lower duration, $\gamma_{02} = -0.76$, $p < .01$, than females. In addition, gender significantly moderated the association between average bicultural stress and duration, $\gamma_{03} = -0.62$, $p < .05$ (see Table 1). Probing simple slopes revealed that reporting one more daily stressor throughout the week predicted sleeping approximately 40.2 minutes less on average for males (35.6% of sample), $b = -0.67$, $p < .05$, but this association was not significant for females (64.4% of sample), $b = -0.05$, $p = .66$ (Figure 1a). Gender also significantly moderated the association between average bicultural stress and subjective sleep problems, $b_3 = 2.53$, $p < .05$ (Table 2). Probing simple slopes revealed that reporting one more daily stressor was associated with reporting approximately 2.80 more sleep problems for males, $b = 2.80$, $p < .01$, but this association was not significant for females, $b = 0.27$, $p = .43$ (Figure 1b).

Regarding day-to-day (within-person) differences, a greater number of bicultural stressors than usual (i.e., reporting more daily stressors relative to each participant's own average) was significantly associated with earlier midpoint, $\gamma_{10} = -0.12$, $p < .05$, but not with SOL or duration, *p*s > .10. Gender significantly moderated the day-to-day association of bicultural stress with SOL, $\gamma_{11} = 0.22$, $p < .05$ (Table 1). Probing simple slopes revealed that males took approximately 3.73 more minutes to fall asleep than females on days of more bicultural stress than usual (+1 *SD* above within-person mean; 14.6% of days), $b = 0.51$, $p < .01$, compared to approximately 1.96 more minutes than females on days of less stress than usual (−1 *SD* below within-person mean), $b = 0.28$, $p < .05$ (Figure 1c).

School Context Differences in Associations Between Bicultural Stress and Sleep

Average bicultural stress was significantly associated with less duration, $\gamma_{01} = -0.26$, $p < .05$, but not with SOL or midpoint, *p*s > .27. On average, students who reported an average of one more bicultural stressor during a typical school week slept approximately 16 minutes less. Adjusting for gender and other covariates, co-ethnic school composition significantly moderated the between-person association of average bicultural stress with subjective sleep problems, $b_5 = 3.63$, $p < .05$ (see Table 2). Probing simple slopes revealed that reporting one

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more daily stressor was associated with reporting approximately 1.28 more sleep problems for students who attended schools with higher (79%) Latino enrollment (+1 *SD* from mean; 19.1% of sample), $b = 1.28$, $p < .05$; this association was not significant for students who attended schools with average (53%) Latino enrollment (sample mean), $b = 0.33$, $p = .36$, or lower (27%) Latino enrollment (−1 *SD* from mean; 23.6% of sample), $b = -0.61$, $p = .24$ (Figure 2a).

Co-ethnic school composition significantly moderated the day-to-day (within-person) association of bicultural stress with duration, $\gamma_{11} = -0.84$, $p < .05$ (Table 3). Simple slopes revealed that reporting one more bicultural stressor than usual predicted sleeping approximately 14 minutes less that night for students who attended schools with higher Latino enrollment, $b = -0.24$, $p < .05$; this association was not significant for students who attended schools with average Latino enrollment, $b = -0.02$, $p = .79$, or lower Latino enrollment, $b = 0.20$, $p = .11$ (Figure 2b). See Supplementary Materials for detailed post-hoc sensitivity analyses for all findings.

Discussion

For the rapidly growing U.S. Latino population, sleep deficits and poor-quality sleep may contribute and serve to maintain broader ethnic-racial health disparities (Guglielmo et al., 2018). Sleep is sensitive to daily stressors (Becker et al., 2015), and stress that stems from the process of navigating two sets of cultural norms, values, and languages presents unique challenges for youth from immigrant families (Kim et al., 2018a). The current study advanced an integrative cultural-ecological model of development (García Coll et al., 1996) by assessing the frequency of these bicultural stressors and collecting corresponding actigraph measures of sleep across seven days in the contexts of Latino late adolescents' daily lives as they prepared for the college transition. This study was the first to examine both average between-person and day-to-day within-person associations of bicultural stress with multiple sleep indices, while accounting for diversity among Latino youth that differentiate their everyday experiences and health. Latino male adolescents who generally experienced a greater number of bicultural stressors across a typical week tended to sleep less at night and subjectively reported more sleep problems, compared to their male peers who experienced fewer bicultural stressors. Further, Latino adolescents attending higher Latino-enrollment schools (~79% Latino) who experienced more daily bicultural stressors also reported more subjective sleep problems, compared to their peers attending similar schools who experienced fewer bicultural stressors. Day-to-day analyses also revealed significant within-person associations; greater daily bicultural stress than usual (i.e., more stress than their average level for the week) predicted more time to fall asleep that night (for males and not females), earlier sleep timing that night (i.e., midpoint), and less time asleep that night (for youth attending higher Latino-enrollment schools).

Unlike previous ethnic-racial group comparative studies of adolescents' sleep, the current study utilized a within-group design to test the everyday occurrence of bicultural stress theorized to help explain differences in Latino adolescents' sleep, both on average and from day to day. The results demonstrated gender differences in the frequency of diary-reported bicultural stress, average objectively-measured sleep patterns, subjective sleep quality, and

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the associations of bicultural stress with sleep timing and duration. Previous research on gender differences in adolescents' self-reported sleep has been mixed in Latino samples (McHale et al., 2011; Zeiders, 2017). In the current study using objective actigraphy measures of Latino adolescents' sleep, females and males did not differ on average sleep schedules, but males tended to have longer sleep onset latency and less sleep duration than females. In contrast, females in this study reported more sleep problems than males. Based on these findings, strategies to promote high quality sleep and health for Latino adolescents, particularly during the college transition, should carefully consider how messages may need to be tailored differently for males and females. Further, future sleep research may benefit from within-gender designs to more thoroughly consider gender role expectations and coping socialization among Latino adolescents (e.g., Sanchez et al., 2018).

Consistent with prior studies showing that associations between bicultural stress and poor adjustment may be more pronounced in males (Castillo et al., 2015; Piña-Watson et al., 2015) and *Hypothesis 1*, Latino male adolescents who reported one more bicultural stressor than their male peers throughout the week slept approximately 40 minutes less per night and reported almost three more sleep problems, on average, reflecting differences in both objectively measured sleep quantity and reported sleep quality. In the first test of day-to-day (within-person) relations of bicultural stress with sleep and consistent with *Hypothesis 2*, sleep onset latency was approximately 4 minutes longer for Latino males on the 15% of days when they reported more bicultural stress than their own average level, widening the average gender difference in time to fall asleep. Sleep midpoint was also earlier following days characterized by more bicultural stress than usual, but this within-person association did not significantly differ by gender.

In traditional Latino culture, the gender-based value of *machismo* and associated negative stereotypes for the dominant ways Latino men are expected to behave without the need for assistance likely influence how Latino male adolescents cope with everyday stress (Ojeda & Liang, 2014). Latino males may also struggle with perceptions of poor language competence and language-based teasing more than females (Castillo et al., 2015; Romero et al., 2007a), and Latino male adolescents are monitored less frequently by their parents than females (Lac et al., 2011). Thus, Latino male adolescents may require additional supports from their families or schools to help alleviate negative sleep consequences that may result from the daily contextual demands of bicultural stress. Indeed, previous research has shown that positive daily social connection and time spent with family are positively associated with sleep quality (Sladek & Doane, 2015; Tavernier, Heissel, Sladek, Grant, & Adam, 2017). Conversely, there is much to be learned in future research with Latina female adolescents, who reported more bicultural stressors and more subjective sleep problems than their male peers, on average, but evidenced no corresponding objectively measured sleep alterations. Results from the present study across multiple sleep indices and between/within-person analyses point to the need to examine protective factors among Latina adolescents that help to explain their relatively better sleep timing and duration, and contribute to their resiliency in responding to bicultural stress. However, Latina adolescents' subjective sleep quality was not related to their daily experiences of bicultural stress, highlighting the need for future research to also identity other factors that may account for gender differences in sleep quality during this key developmental period of transitioning to adulthood.

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This study also advanced García Coll and colleagues' (1996) call to examine social position variables in developmental health research, revealing that Latino adolescents attending schools with relatively higher Latino student enrollment who endorsed one more daily bicultural stressor throughout a typical school week also reported between one and two more sleep problems, on average. Regarding day-to-day differences, for these same adolescents attending high Latino-enrollment schools, sleep duration was approximately 14 minutes less following days of more bicultural stressors than usual (i.e., within-person increase). Although some previous research has identified higher co-ethnic school composition as a protective resource for youth of color with respect to emotional and behavioral health (e.g., Benner & Graham, 2013; Georgiades et al., 2013), other studies have demonstrated the negative consequences of higher co-ethnic school composition, including more depressive symptoms following days of ethnic-racial discrimination in these contexts (Seaton & Douglass, 2014). Given the negative impacts of a segregated education system on development (García Coll et al., 1996), schools with higher minority enrollment may serve as potentially inhibiting environments characterized by fewer resources that exaggerate the daily consequences of bicultural stress. For example, adolescents attending schools with higher Latino enrollment in this study also tended to have parents with lower levels of education, setting up additional contextual demands for these adolescents navigating the transition to college. Further research is needed to understand what may be protective about contexts characterized by less co-ethnic representation in schools, such as the potential benefits of school diversity.

Despite notable strengths, the study was not without limitations. First, participants were recruited from the same large metropolitan area during their last year in high school based on acceptance to a 4-year public university in the southwestern U.S. Future research should explore how bicultural stress may relate to sleep and other aspects of health among youth of different ethnic-racial groups, of different ages, and in different settings (e.g., middle school, higher education, workforce). Second, the sample was disproportionately female but representative of the national college-going rate for Latinos (61% female; NCES, 2016). Third, in order to reduce participant burden and the relatively low frequency of each diary-reported bicultural stressor in isolation, it was not possible to separately test which components of daily bicultural stress may have stronger associations with sleep. Future work should consider other culturally-relevant measures of daily stressors that may account for additional variance in naturalistic sleep assessment. As has been a focus of previous sleep studies, future research should also attend to other important moderating influences at the daily (e.g., daily screen/technology time and other social experiences), individual (e.g., evening chronotype), and contextual (e.g., neighborhood danger) levels, and further, investigate how these factors intersect with daily stress and sleep to influence youth health outcomes (Adam et al., 2007; Becker et al., 2015). Finally, future research should examine potential bidirectional associations between stress and multiple indicators of sleep duration and quality (e.g., Doane & Thurston, 2014). Though the diary design did allow temporal precedence for within-person associations, the subjective sleep quality survey measure was assessed concurrently; thus, the temporal precedence of sleep problems and bicultural stress could not be established in this study.

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The present study was strengthened by innovative methodological features, including smartphone daily diary reports across a full week, objective actigraph measures of typical sleep timing and duration, subjective reports of sleep quality, and a diverse representation of school contexts. Results revealed both average between-person and day-to-day differences in bicultural stress as predictors of sleep onset latency, sleep midpoint, sleep duration, and subjective sleep problems in the everyday lives of Latino adolescents preparing for the transition to college, who comprise a diverse and rapidly growing portion of the young U.S. population. Advancing the role of social position factors in developmental health research (García Coll et al., 1996), these stress-sleep associations were differentiated by adolescents' gender and school context. Based on results of the current study, future research and intervention development should consider pathways to reduce bicultural stress and its harmful consequences, including coping strategies that may be more readily available to Latina female adolescents and to students in less ethnic-racially segregated schools.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Portions of these data were presented at the 2018 biennial meeting of the Society for Research on Adolescence. We thank the research participants and staff of the *Transiciones* project, without whom this research would not have been possible. Special thanks to Jennifer Kennedy. This research was supported by a William T. Grant Foundation Scholars Award to L.D.D. M.R.S. was supported by the National Science Foundation Graduate Research Fellowship program (Grant No. DGE-1311230), L.D.D. and H.P. were supported by a William T. Grant Foundation Mentoring Award, and L.D.D. was further supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health under Award Number R01HD079520. Any opinion, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the funding institutions.

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Figure 1a

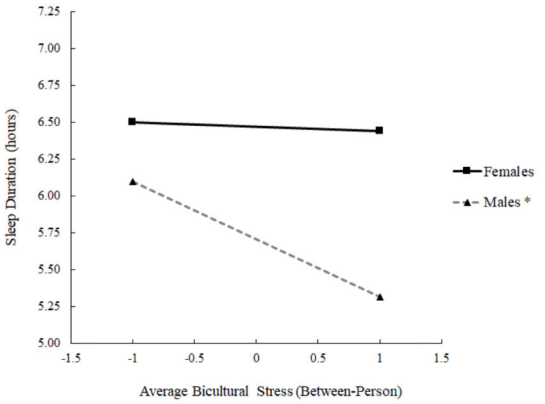

Figure 1c

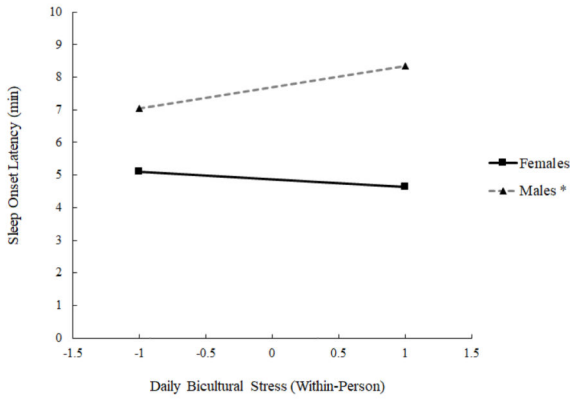

Figure 1b

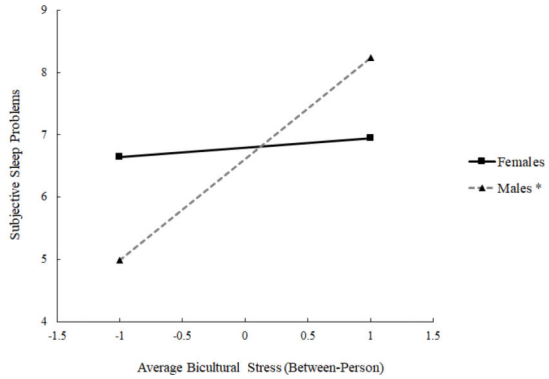

Figure 1:

Simple slopes for associations of bicultural stress (+/−1 SD from grand mean or within-person mean) with sleep by gender. *p < .05.a

Figure 1a: Simple slopes for association of average daily bicultural stress (+/−1 SD from grand mean) with sleep duration by gender. *p < .05.

Figure 1b: Simple slopes for association of average daily bicultural stress (+/−1 SD from grand mean) with subjective sleep problems by gender. *p < .05.

Figure 1c: Simple slopes for association of daily bicultural stress (+/−1 SD from within-person mean) with sleep onset latency by gender. *p < .05.

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Figure 2a

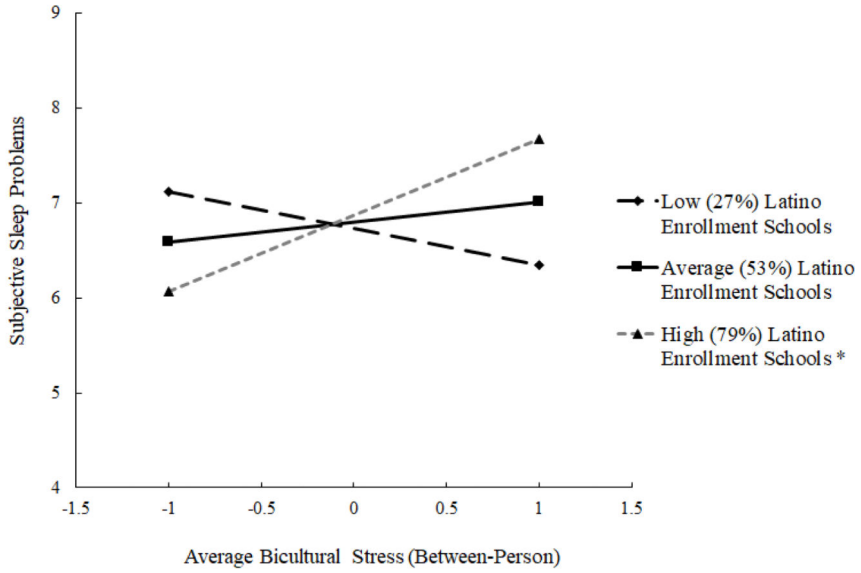

Figure 2b

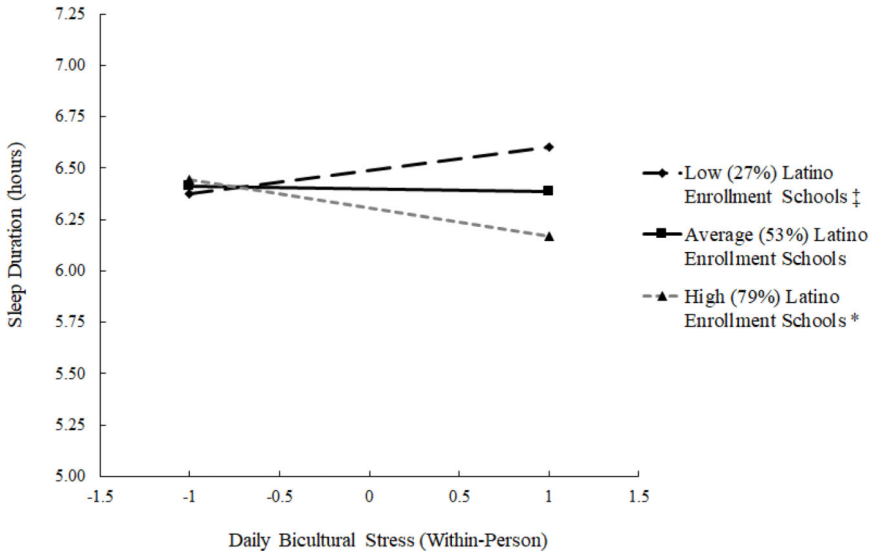

Figure 2:

Simple slopes for associations of bicultural stress (+/−1 SD from grand mean or within-person mean) with sleep by co-ethnic school composition (+/− 1 SD from grand mean). ‡p = .11. *p < .05.

Figure 2a: Simple slopes for association of average daily bicultural stress (+/−1 SD from grand mean) with subjective sleep problems by co-ethnic school composition (+/−1 SD from grand mean). *p < .05.

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Figure 2b: Simple slopes for association of daily bicultural stress (+/−1 SD from within-person mean) with sleep duration by co-ethnic school composition (+/−1 SD from grand mean). ‡p = .11. *p < .05.

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Table 1:

Fixed effects estimates from multilevel models predicting sleep from bicultural stress, gender, and their interaction

	Sleep Onset Latency (natural log of minutes)		Sleep Midpoint (24-hour clock)		Sleep Duration (hours)	
Fixed effects	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***
Intercept, γ_{00}	1.77*	0.08	3.19*	0.10	6.47*	0.09
Level 2 (person-specific)						
Average bicultural stress, γ_{01}	0.14	0.11	−0.09	0.14	−0.05	0.12
Male, γ_{02}	0.39*	0.13	0.32†	0.19	−0.76*	0.15
Average bicultural stress x Male, γ_{03}	−0.46	0.31	0.62	0.41	−0.62*	0.31
Summer participation, γ_{04}	−0.30*	0.11	1.25*	0.21	0.58*	0.14
Body mass index, γ_{05}					−0.03*	0.01
Level 1 (day-specific)						
Daily bicultural stress, γ_{10}	−0.08	0.05	−0.12*	0.05	0.03	0.09
Daily bicultural stress x Male, γ_{11}	0.22*	0.10	−0.19	0.14	−0.05	0.22
Weekend, γ_{20}			1.14*	0.10	0.49*	0.11

Note. 1320 days nested within 207 individuals. Sleep onset latency = time to fall asleep (natural log of minutes); Sleep midpoint = median of sleep start and sleep end time (0.00 = midnight, 3.00 = 3:00 AM, etc.); Sleep duration = time asleep (in hours); Level 1 bicultural stress centered within-person; continuous level 3 predictors grand -mean centered; Male: 1 = Male, 0 = Female; Summer participation: 1 = study completed in summer months, 0 = study completed during school year; Weekend: 1 = Friday or Saturday night, 0 = all other nights; Est. = partial regression coefficient estimate (unstandardized); *SE* = robust standard error.

† $p < .10$.

* $p < .05$.

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Table 2:

Multiple linear regression model predicting subjective sleep problems from bicultural stress, gender, co-ethnic school composition, and their interactions

	Subjective sleep problems					
	Moderated by gender			Moderated by co-ethnic school composition		
	N = 207 individuals			*N* = 132 individuals		
	R^2 = .338			R^2 = .484		
	Est.	*SE*	β	Est.	*SE*	β
Intercept, b_0	6.80*	0.25	--	6.80*	0.25	--
Average bicultural stress, b_1	0.27	0.34	0.05	0.33	0.36	0.08
Male, b_2	−0.19	0.39	−0.03	0.38	0.47	0.06
Average bicultural stress x Male, b_3	2.53*	0.86	0.20	2.52*	0.92	0.22
Co-ethnic school composition, b_4	--	--	--	0.27	0.96	0.02
Average bicultural stress x Co-ethnic school composition, b_5	--	--	--	3.63*	1.41	0.18
Summer participation, b_6	0.23	0.37	0.04	--	--	--
Body mass index, b_7	0.06†	0.03	0.11	0.06†	0.03	0.12
Immigrant generation, b_8	0.21*	0.08	0.17	0.28*	0.10	0.21
Parent education, b_9	−0.10	0.08	−0.08	−0.08	0.11	−0.06
Depressive symptoms, b_{10}	0.08*	0.02	0.29	0.12*	0.03	0.39
Anxiety symptoms, b_{11}	0.02	0.04	0.05	−0.02	0.04	−0.04
General perceived stress, b_{12}	0.07*	0.03	0.20	0.10*	0.04	0.30

Note. Male: 1 = Male, 0 = Female; Co-ethnic school composition: 1.00 = 100% Latino, 0.00 = 0% Latino; Summer participation: 1 = study completed in summer months, 0 = study completed during school year; Immigrant generation: 0 = participant, parents, and both sets of grandparents born outside U.S., 7 = all born in U.S. Parent education: 1 = completed less than high school, 10 = professional degree. Depressive symptoms: CES-D scale (Radloff, 1977). Anxiety symptoms and general perceived stress: DASS (Lovibond & Lovibond, 1995). Est. = partial regression coefficient estimate (unstandardized); *SE* = standard error of the unstandardized coefficient; β = standardized beta weight.

† $p < .10$.

* $p < .05$.

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Table 3:

Fixed effects estimates from multilevel models predicting objective sleep from bicultural stress, co-ethnic school composition, and their interaction

	Sleep Onset Latency (natural log of minutes)		Sleep Midpoint (24-hour clock)		Sleep Duration (hours)	
Fixed effects	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***
Intercept, γ_{00}	1.69 *	0.09	3.09 *	0.10	6.40 *	0.10
Level 2 (person-specific)						
Average bicultural stress, γ_{01}	0.12	0.11	0.04	0.11	−0.26 *	0.12
Co-ethnic school composition, γ_{02}	0.23	0.29	−0.05	0.31	−0.35	0.29
Average bicultural stress x Co-ethnic school composition, $\gamma 03$	−0.35	0.50	0.83 †	0.45	−0.60	0.48
Male, γ_{04}	0.69 *	0.16	0.21	0.19	−0.70 *	0.15
Body mass index, γ_{05}					−0.05 *	0.01
Level 1 (day-specific)						
Daily bicultural stress, γ_{10}	−0.01	0.09	−0.09 †	0.06	−0.02	0.08
Daily bicultural stress x Co-ethnic school composition, $\gamma 11$	0.03	0.24	−0.002	0.32	−0.84 *	0.35
Weekend, γ_{20}			1.46 *	0.11	0.85 *	0.12

Note. 845 days nested within 132 individuals who participated during the school year. Sleep onset latency = time to fall asleep (natural log of minutes); Sleep midpoint = median of sleep start and sleep end time (0.00 = midnight, 3.00 = 3:00 AM, etc.); Sleep duration = time asleep (in hours); Level 1 bicultural stress centered within-person; continuous level 3 predictors grand-mean centered; Male: 1 = Male, 0 = Female; Weekend: 1 = Friday or Saturday night, 0 = all other nights; Est. = partial regression coefficient estimate (unstandardized); *SE* = robust standard error.

† $p < .10$.

* $p < .05$.