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Socioeconomic Status, Nocturnal Blood Pressure Dipping, and Psychosocial Factors: A Cross-Sectional Investigation in Mexican-American Women

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Abstract

Background—Despite established links between reduced nocturnal blood pressure (BP) dipping and cardiovascular disease, BP dipping research in Hispanics is limited.

Purpose—This study investigated socioeconomic status (SES) as a predictor of BP dipping and the contributions of psychosocial factors to this relationship. Analyses were conducted for the overall sample and separately for higher and lower acculturated women.

Methods—Mexican-American women ($N=291$; 40–65 years) reported demographics and completed psychosocial assessments and 36-h ambulatory BP monitoring.

Results—Lower SES related to reduced BP dipping in the overall sample and in more US-acculturated women ($r's=.17-.30$, $p's<.05$), but not in less-acculturated women ($r's=.07$, $p's>.10$).

An indirect effect model from SES to BP dipping via psychosocial resources/risk fits well across samples.

Conclusions—In Mexican-American women, the nature of SES gradients in BP dipping and the roles of psychosocial resources/risk differ by acculturation level.

Keywords

Ambulatory blood pressure; Nocturnal blood pressure dipping; Hispanic; Psychosocial; Socioeconomic status

A substantial body of evidence suggests that ambulatory blood pressure (BP) measures are more predictive of cardiovascular disease outcomes than clinic or resting assessments [1–4]. In addition to elevations in average BP levels during ambulatory monitoring, the circadian variability of BP may provide important information about cardiovascular disease risk. Specifically, during 24-h ambulatory monitoring, intra-individual variations in BP typically follow a rhythm in which BP falls to its lowest levels in the hours following sleep onset and then demonstrates a marked surge during the transition from sleep to wakefulness. The average 10–20 % decline in BP levels during sleep relative to waking is known as nocturnal BP dipping [5]. Blunted dipping (i.e., <10 %) is consistently associated with target organ damage [6] and cardiovascular disease events and mortality [7, 8]. Several studies indicate that nocturnal BP dipping is a better predictor of cardiovascular disease risk and outcomes than daytime BP levels [9–11].

Attenuated nocturnal BP dipping is more common among racial/ethnic minorities (particularly blacks [12, 13]) and individuals of low socioeconomic status (SES [14–17]). Notably, research conducted with black and non-Hispanic white participants showed SES effects to be independent of race [15] and to contribute to established racial/ethnic differences in BP dipping [14]. Given the association between low SES and attenuated BP dipping, there is a need to identify potentially modifiable mechanisms to target with interventions. Individuals of lower SES commonly exhibit a psychosocial profile characterized by elevated risk factors and reduced resources [18–20], and in turn, psychosocial factors have demonstrated associations with nocturnal BP dipping [21]. For instance, prior research has shown blunted dipping to be associated with greater hostility [22, 23], anger inhibition [24], depression [25], anxiety [25], and perceived discrimination and racism [26, 27]. Reduced intra- and interpersonal psychosocial resources, including social support [28–30], social integration and frequency of social contacts [31], social relationship depth [32], and life purpose [23], have also been linked with blunted dipping. Although there is a wealth of indirect evidence suggesting that psychosocial factors could contribute to the SES-dipping association, no study to our knowledge has directly investigated psychosocial mechanisms in this relationship.

On the whole, Hispanics experience disproportionately higher rates of various adverse social circumstances (e.g., lower SES, greater acculturation and discrimination stress), yet often exhibit better health outcomes than non-Hispanic whites [33–35]. This phenomenon, which has been termed the “Hispanic Paradox” [36], could represent the presence of health-protective buffers (e.g., cultural resources) against adversity, at least in some subgroups. Despite a large body of research demonstrating attenuated nocturnal BP dipping in some racial/ethnic groups (e.g., blacks [12]), there are only a few [13, 27] investigations of BP dipping in Hispanics. The two studies that have investigated BP dipping in Hispanics reported that blunted BP dipping was more common in Hispanic versus non-Hispanic white participants [13] and that perceived racism differentiated between “dippers” and “nondippers” (i.e., <10 %) in a multiethnic sample of Hispanic and black participants [27]. However, more research with specific Hispanic subgroups is needed, especially given the

reported variance in the strength and direction of relationships between psychosocial predictors and BP dipping across other racial/ethnic groups that have been studied more thoroughly (e.g., [30, 31, 37]).

The present study investigated the association between SES and BP dipping in a community-based sample of middle-aged Mexican-American women residing near the US–Mexico border in San Diego County. Structural equation modeling was used to investigate the associations of current household income and educational attainment with nocturnal systolic and diastolic blood pressure (SBP and DBP) dipping and the extent to which psychosocial resources and risk factors contributed to these relationships. We predicted that lower SES would be associated with a higher risk psychosocial profile (i.e., fewer resources, greater risk), which would in turn relate to less BP dipping. Furthermore, since SES disparities in several indicators of cardiovascular disease risk [38], including ambulatory BP [39], have been shown to vary by acculturation among Hispanic participants, analyses were also conducted separately for more and less US-acculturated participants (as indicated by preferred language, English or Spanish). It was hypothesized that the association between lower SES and less BP dipping would be attenuated in Mexican-American women who were less-acculturated to the mainstream US culture and who may therefore have greater access to cultural resources.

Methods

Sample and Recruitment

The current study is part of a larger investigation of cardiovascular risk (i.e., “Nuestra Salud,” or Our Health) in healthy, middle-aged Mexican-American women from communities in the US–Mexico border region of San Diego County. Participants were randomly selected from target communities using a list of households with Hispanic surnames and were recruited by telephone and mail between 2006 and 2009. Women who were 40–65 years of age, Mexican-American, literate, not pregnant, and free of chronic health problems (i.e., cardiovascular disease, diabetes, liver and kidney diseases, chronic inflammatory conditions, etc.) and medications with autonomic effects (e.g., stimulants, steroids, major tranquilizers) were eligible. Six hundred fifty-six women were screened by telephone, 363 (55.3 % of those screened) were eligible based on the above criteria, 321 (88.4 % of those eligible) agreed to participate, and 301 completed both the psychosocial questionnaires and ambulatory BP monitoring. Of these, $n=1$ did not register any valid BP values, $n=7$ had <3 nighttime BP values, and $n=2$ were excluded because they reported taking medications that can affect BP. Analyses were based on the remaining 291 participants.

Procedures

A detailed description of the methods is provided elsewhere [40]. In brief, data were collected over the course of two consecutive home visits, by trained, bilingual research technicians. Self-report assessments of sociodemographic and psychosocial characteristics were administered in the participant’s preferred language. A comprehensive physical examination, including a 36-h ambulatory BP monitoring assessment, was also conducted. The San Diego State University and the University of California San Diego Institutional Review Boards approved study procedures and all participants provided written informed consent.

Nocturnal BP Dipping

Ambulatory BP was assessed over two consecutive days during a typical work week, with small noninvasive devices (Spacelabs Model 90217-1Q) utilizing oscillometric detection

methods that have been shown to meet standards for accuracy and reliability set forth by the Association for the Advancement of Medical Instrumentation [41]. Participants were fitted with the monitor and instructed to wear it for a total of 36 h, removing it only to shower and dress. Participants were blinded to their readings throughout the assessment period. The monitors were programmed to record SBP and DBP once every 30 min during the day and every 60 min during sleeping hours (according to anticipated sleep and wake times, provided by the participant prior to the monitoring period), in dynamic inflation mode, and with one retry for erroneous readings. During the monitoring period, participants logged any medications taken (to screen for BP-affecting medications) and recorded actual sleep and wake times in a bedside diary. If actual sleep/wake times deviated from those anticipated, BP values were recoded as necessary to calculate accurate daytime and nighttime average BP values for each participant.

Following data collection, ambulatory BP data were screened consistent with criteria outlined by Marler et al. [42]. Using these guidelines, approximately 1 % of the data were considered artifactual and deleted. This resulted in an average of 52.29 (SD=8.17) daytime and 7.32 (SD=1.72) nighttime readings per participant. Participant noncompliance (e.g., premature removal of the monitor), equipment failure, and varying sleep and wake times contributed to the varied number of readings across participants. The remaining BP values were used to compute daytime and nighttime average SBP and DBP values for each participant; Hierarchical Linear Modeling 6.06 (Scientific Software International, Lincolnwood, IL, USA) with maximum likelihood estimation was used to account for clustered data (i.e., repeated measures within individuals). Nocturnal BP dipping was determined by dividing each participant's nighttime SBP and DBP means by their respective daytime SBP and DBP means. These values were then subtracted from 1.0 and multiplied by 100 to reflect percent dipping, with higher values indicating larger nighttime decreases in BP relative to daytime values (i.e., greater "dipping").

Socioeconomic Status

Self-reported education and household income were used to represent SES. Educational attainment was recoded into six categories for analysis [eighth grade or less, some high school (no degree), high school degree or equivalent (GED), associate's degree, bachelors degree, graduate degree]. Total (unadjusted) monthly household income was assessed on an ordinal scale in \$500 increments, ranging from <\$500 to \$8,000/month.

Psychosocial Resources and Risk Factors

Participants completed measures evaluating inter- and intrapersonal resources. The six-item Life Engagement Test [43] was used to examine purposeful engagement in valued life activities, and the Rosenberg Self-Esteem Scale was administered to assess self-esteem [44]. Two of the six self-esteem items exhibited zero variance in the present sample and were excluded from the scale to improve its psychometric properties. An abbreviated version of the Medical Outcomes Study Support Scale [45] from the Women's Health Initiative study [46] evaluated perceived social support. Optimism (i.e., low pessimism) was assessed using three items from the Life Orientation Test—Revised [47]. We only examined the negatively worded items because, consistent with prior studies, we found that the scale comprised two factors [48] and that SES was linked to "pessimism" but not "optimism" items [49, 50]. Thus, lower scores on this scale are purported to reflect higher optimism. To evaluate psychosocial risk, participants completed measures assessing negative cognitive-emotional factors. Anxiety was assessed with the 10-item Trait Anxiety Inventory [51], and depression was measured with the 20-item Center for Epidemiological Studies—Depression Scale Revised [52]. Cynical hostility (negative beliefs and attitudes towards others), was measured using a six-item version [53] of the Cook–Medley cynicism subscale [54]. Loneliness (i.e.,

social isolation) was assessed with a three-item scale developed by Hughes and colleagues [55]. Hopelessness was evaluated with two items that related to cardiovascular health outcomes in previous research [56, 57]. Analyses of internal consistency revealed adequate reliability across most scales (α 's=0.70–0.93 in the more acculturated subgroup; α 's= 0.73–0.93 in the less acculturated subgroup). For three of the shorter scales—self-esteem, pessimism, and hopelessness—reliability was relatively low in the more/less-acculturated groups at 0.41/0.47, 0.63/0.53, and 0.61/0.66, respectively.

Health-Related Covariates and Other Demographic Variables

Variables previously related to individual differences in BP level and reactivity in prior research were included as covariates in analyses of BP data [58]: age (in years), smoking status (0= no, 1=yes), and body mass index [BMI; body weight (in kg)/ height (in m²)]. Language of the survey was used as a proxy for acculturation, with English indicating greater, and Spanish indicating lesser acculturation to the US culture. Although a simple representation of the complex, multidimensional acculturation process [59], language is a reliable indicator that correlates well with scores on more elaborate scales [60] and is considered the strongest single acculturation indicator [61, 62]. Nativity, employment status, and insurance coverage are also reported in the current study for sample description.

Statistical Analyses

Analyses were performed in PASW Statistics 18.0 (SPSS, Inc., Chicago IL, USA) and MPlus Version 6 [63]. Model assumptions regarding linearity, normality, independence, and homoscedasticity of errors were assessed graphically and analytically and were adequately met. Descriptive statistics were calculated, and between-group comparisons evaluated potential acculturation subgroup differences on all study variables. Structural equation modeling was used to evaluate direct and indirect (via psychosocial resources and risk factors) pathways from SES to BP dipping. All analyses were conducted in the overall sample and separately for each acculturation subgroup. The SES latent variable was composed of two observed indicators (income, education) and was estimated in a broader model in which the other factors were specified. Psychosocial resources and risk was represented by a single latent factor (reflecting greater resources, lower risk), which proved to fit the data best in a previous analysis conducted in this cohort [64] [root mean square error of approximation (RMSEA)=.080–.096; standardized root mean square residual (SRMR)=.071–.080; standardized factor loadings >|.30|, $p<.05$]. Although a two-factor model also demonstrated acceptable model fit, the interfactor correlations between the risk and resource latent variables were extremely high (r^2 s=.80 across samples), suggesting collinearity and thus supporting the use of the single latent factor.

Two competing structural equation models were evaluated. In the first, direct pathways were specified from SES to the psychosocial resources/lower risk latent factor and from the latter to both SBP and DBP dipping (i.e., percent nighttime dipping variables). To provide a more conservative test of overall model fit, the error terms for the BP dipping variables were not allowed to correlate. In the second model, direct pathways from SES to the dipping variables were added. Age, smoking status, and BMI were specified as covariates in both models. The maximum likelihood robust estimation procedure employed by MPlus was used to estimate model parameters. This procedure provides a chi-square test statistic (Yuan–Bentler T^2 , $Y-B^2$, for current purposes [65]) and standard errors that are adjusted for multivariate non-normality and missing data. Descriptive model fit was evaluated using RMSEA and SRMR [66], with values ≤ 0.05 indicating good model fit and ≤ 0.08 indicating acceptable fit. Competing (nested) models were compared statistically using the chi-square difference test ($Y-B^2$) and descriptively using RMSEA and SRMR [67].

Results

Descriptive Statistics

Table 1 shows descriptive statistics for all study variables for the entire sample and each acculturation subgroup. On average, women were 49.67 years of age ($SD=6.66$). Relative to less acculturated women, more acculturated women were more likely to be born in the US, employed, report a higher income and level of educational attainment, and have health coverage (all $p's < .001$). The more acculturated subgroup also reported greater social support ($p=.001$) and lower hostility ($p=.04$). Average nocturnal BP dipping ranged from -8.96% (i.e., higher nighttime versus daytime mean BP) to 29.57% for SBP (mean= 13.14% , $SD=6.04\%$) and from -5.58 to 31.46% for DBP (mean= 15.6% , $SD=6.68\%$). Approximately 26% ($n=76$) and 19% ($n=55$) of participants exhibited a non-dipping pattern (i.e., $<10\%$) in SBP and DBP, respectively; US acculturation level did not differentiate between dippers and nondippers.

Latent Factor Loadings and Bivariate Associations

Table 2 shows the factor loadings for the SES and psychosocial resources/risk latent factors and the correlations among these latent factors and the BP dipping variables. In the overall sample and more US-acculturated subgroup, higher SES was associated with greater SBP dipping ($r=.19$ and $.30$, respectively; $p's < .05$) and DBP dipping ($r=.17$ and $.26$, respectively; $p's < .05$); SES was not significantly related to either dipping variable among less US-acculturated participants. Higher SES also predicted greater psychosocial resources/lower risk across samples ($r's=.32-.46$, all $p's < .05$), which, in turn, predicted greater BP dipping ($r's=.15-.28$, $p < .05$) with the exception of SBP dipping in the less US-acculturated group ($p=.11$).

Model Testing

The two proposed structural equation models were tested in the overall sample and in each acculturation subgroup. According to descriptive indices, model 1 (indirect effects only model) fit the data well in all analyses [overall sample, $Y-B^2(df=96)=217.73$, $p < .05$, $RMSEA=.066$, $SRMR=.062$; more acculturated subgroup, $Y-B^2(df=96)=155.33$, $p < .05$, $RMSEA=.071$, $SRMR=.082$; less acculturated subgroup, $Y-B^2(df=96)=174.59$, $p < .05$, $RMSEA=.069$, $SRMR=.068$]. Building on model 1, direct pathways from SES to each dipping variable were then added (i.e., model 2); however, the direct pathways did not reach statistical significance in any analysis. Moreover, there was no difference in statistical ($Y-B^2(2)=0.62-2.45$ all $p's > .10$) or descriptive fit ($RMSEA=.001-.002$, $SRMR=.000-.001$) between models 1 and 2 in the overall sample or in either acculturation subgroup. Therefore, the more parsimonious model 1 was determined to be the “better-fitting” model.

Standardized structural/path coefficients for model 1 are presented in Fig. 1.¹ There were no statistically significant differences in the magnitudes of structural path coefficients between acculturation subgroups ($p's > .05$). In this controlled model, higher SES was related to significantly greater psychosocial resources/lower risk in all three samples

($R^2_{\text{overall}}=.14$, $R^2_{\text{more acculturated}}=.23$, $R^2_{\text{less acculturated}}=.10$; all $p's < .05$). Greater psychosocial resources/lower risk was associated with more SBP dipping in the overall sample ($R^2=.02$, $p < .05$) and more acculturated subgroup ($R^2=.07$, $p < .05$); however, psychosocial resources/lower risk was not significantly related to SBP dipping among the relatively less US-acculturated participants ($p=.11$). The indirect effect from SES to SBP dipping via

¹In response to a suggestion from an anonymous reviewer, analyses were repeated excluding individuals with <4 nighttime BP values. The pattern of results, in terms of direction and magnitude of effects, was quite similar across analyses. Thus, the larger sample size was maintained to maximize statistical power.

psychosocial resources/ lower risk was statistically significant in the overall sample ($ab=.06$, $p<.05$) and approached statistical significance in the more US acculturated subgroup ($ab=.13$, $p=.08$). This indirect effect was not tested in the less US-acculturated subgroup, as the compound path from psychosocial resources/lower risk to SBP dipping did not approach statistical significance. Greater psychosocial resources/lower risk was associated with more nighttime DBP dipping in all analyses

($R^2_{\text{overall}}=.04$, $R^2_{\text{more acculturated}}=.08$, $R^2_{\text{less acculturated}}=.03$; all p 's $<.05$). The indirect pathway from SES to DBP dipping via psychosocial resources/lower risk was statistically significant in the overall sample ($ab=.08$, $p<.01$), and approached statistical significance in both acculturation subgroups ($ab_{\text{more acculturated}}=.14$, $p=.06$; $ab_{\text{less acculturated}}=.06$, $p=.08$).

Discussion

This study is the first to examine the association between SES and nocturnal BP dipping in Mexican-American women. It is also the first investigation in any sample (to our knowledge) to explore psychosocial factors as potential explanatory mechanisms underlying the SES–BP dipping association. Findings revealed a significant association between higher SES and greater SBP and DBP dipping, but only among more US-acculturated women. Psychosocial resources and risk factors contributed to the SES gradient in BP dipping in this subsample; indirect pathways from SES to both SBP and DBP dipping (via psychosocial resources and risk factors) approached statistical significance.

SES–Nocturnal BP Dipping Associations

Consistent with findings in other populations [14–17], lower SES was associated with attenuated nocturnal SBP and DBP dipping. However, a closer examination revealed that these patterns prevailed only among the more acculturated Mexican-American women; SES did not relate to BP dipping in less-acculturated women. These findings are similar to those from an earlier investigation in the same cohort, which identified a clearer inverse relationship between SES and cardiometabolic risk (i.e., as defined by the components of the metabolic syndrome) in more relative to less acculturated women [64]. Steffen et al. [39] also found that SES gradients in ambulatory BP varied by acculturation level. Specifically, higher SES (i.e., educational attainment) predicted *lower* 24-h SBP among non-Hispanic white participants, yet related to *higher* 24-h SBP in Hispanic immigrants to the US. Moreover, Hispanic immigrants with higher US-acculturation showed a *weaker* though still positive relationship between SES and 24-h SBP, relative to their less US-acculturated counterparts [39]. Taken together, these findings suggest that less US-acculturated Hispanics (in particular) may benefit from culturally driven behavioral or social resources that help buffer the effects of low SES environments and thus potentially contribute to the Hispanic Paradox that has been observed in prior research [36]. However, with increased acculturation to Western society, the SES–health risk relationship begins to approximate the inverse gradient typically observed in industrialized nations [68–70], in which lower SES exerts a negative influence on health through a variety of potential mechanisms, including material or structural factors (e.g., basic resources, health-care access, environmental exposures), interrelated lifestyle and biological risk factors (e.g., obesity, smoking), and psychosocial factors [71, 72].

The Contribution of Psychosocial Resources and Risk Factors

Investigating potentially modifiable predictors of reduced nocturnal BP dipping can help identify intervention targets for cardiovascular disease prevention and for the management of existing cardiovascular disease. The current study evaluated a latent factor representing psychosocial resources/lower risk as a potential mechanism linking reduced SES with blunted nocturnal BP dipping. Similar to previous findings (e.g., [18–20]), lower SES was

consistently associated with a higher risk psychosocial profile, which, in turn, predicted attenuated SBP dipping (especially in more US-aculturated women) and DBP dipping (in all women). The indirect effects of SES on BP dipping via psychosocial resources/risk reached statistical significance in the overall sample and approached significance in both subgroups; however, these findings were most consistent among more acculturated women (and with DBP dipping).

Notably, based on estimates from previous research, the magnitude of the relationship between psychosocial factors and BP dipping observed in this study is likely to have clinically significant implications. Ohkubo et al. [10] reported that a 5 % increase in nocturnal BP dipping was associated with an approximately 20 % lower risk of cardiovascular mortality. In the present study, a one standard deviation increase in the latent factor representing greater psychosocial resources/lower risk was associated with roughly a 1–2 % increase in BP dipping. Drawing on findings from previous research [10], an improvement of this magnitude translates to a relative risk reduction of approximately 4–8 % for cardiovascular mortality. Psychosocial resources and risk factors may contribute to SES disparities in nocturnal BP dipping by partially mediating established relationships between lower SES and relevant health-risk factors (e.g., smoking, obesity [72–74]), by contributing to sleep problems commonly associated with a nondipping pattern [75–77], and/or by influencing stress pathways. In regard to the latter, some research has shown individuals of lower SES to experience greater psychological stress than their higher SES counterparts [78], in part due to stressors and hazards encountered in many low SES neighborhoods [79, 80], and/or a limited ability to purchase resources or services that reduce the experience or minimize sources of stress. Moreover, the reduced psychosocial resources (e.g., social support, optimism) and greater risk factors (e.g., depression, anxiety) that commonly accompany low SES (e.g., [18–20]) may impair one's ability to buffer the physiological effects of experienced stress [81]. Notably, cortisol dysregulations that underlie the stress response [82] are also linked to blunted nocturnal BP dipping [83].

The present study adds to the existing, though inconsistent body of research investigating the role of psychosocial factors in SES disparities in health (for a review, see [84]). Similar to our earlier investigation of cardiometabolic risk in the current cohort [64], the present findings indicate that psychosocial resources and risk factors (at least as represented here) may be more relevant to SES gradients in cardiometabolic health in more acculturated Mexican-American women. Additional research is needed to further explore this framework in other homogeneous subgroups, or in large, diverse samples taking meaningful subgroup differences (e.g., descent, gender, acculturation) into account via sample stratification or moderation analyses.

Limitations

The current study provides novel information about associations among SES, psychosocial factors, and BP dipping in an understudied population. However, findings should be considered in light of the following limitations. First, the cross-sectional design precludes causal conclusions; additional (prospective) research is needed to evaluate the temporal precedence of SES in predicting psychosocial resources/risk factors and BP dipping, and of psychosocial resources/risk factors in predicting BP dipping, and whether modifying psychosocial factors affects nocturnal BP dipping over time. Second, acculturation subsample findings should be interpreted in light of the reduced sample sizes and limited power to observe statistical significance. Third, the relevance of traditional markers of SES (i.e., education and income) and of psychosocial risk and resource factors for Hispanic and immigrant populations remains undetermined. Research that incorporates alternative conceptualizations of SES, such as subjective measures of status [85], and culturally driven risk (e.g., discrimination) or resource factors (e.g., strong family ties) could better elucidate

sociocultural risks in this population and particularly in less acculturated women. Furthermore, although stress is often highlighted as a potential mechanism underlying health disparities, we found inconsistent evidence for an association between SES and stress in the current sample. Because the observed pattern was complicated and varied across measure type (e.g., chronic stress, life events, perceived stress) and domain (e.g., work-related versus interpersonal stress), associations between SES and stress will be reported in a separate manuscript [86]. In the present study, acculturation was assessed with a single proxy indicator (i.e., language preference). Although this dichotomous representation provided a straightforward way to partition the sample and examine SES gradients across acculturation subgroups, we acknowledge the potential limitations inherent to proxy indicators (e.g., limited sensitivity [87]). Reliance on a single night of ambulatory monitoring (and therefore, a reduced number of nighttime BP values) and on self-reported sleep and wake times rather than an objectively quantified indicator of sleep (e.g., actigraphy) is an additional limitation, which may have introduced error in determining nocturnal BP dipping levels. It is also notable that the current study focused explicitly on psychosocial mediating pathways in the SES–BP dipping association; investigating alternative mechanisms (e.g., sleep quality, physical activity) was beyond the scope of this paper, yet is an important direction for future research. Lastly, these findings should be interpreted in the context of sample characteristics (i.e., Mexican-American females residing near the US–Mexico border), and may not be generalizable to other segments of the Hispanic population. Furthermore, because a non-Hispanic white comparison group was not included, a direct evaluation of findings across these groups was beyond the scope of the present study, yet is an important direction for future research.

Conclusions

The current study investigated SES as a predictor of nocturnal BP dipping and the contribution of psychosocial factors to this association, among middle-aged Mexican-American women. The SES–BP dipping gradient was nearly “flat” in the less US-acculturated subgroup; however, a clear relationship between lower SES and reduced BP dipping was observed among the relatively more US-acculturated women. Furthermore, a marginally significant indirect SES effect via psychosocial resources and risk factors highlights a variety of potentially modifiable mechanisms underlying this gradient that can be targeted for intervention in this group. Specifically, as Mexican-Americans acculturate to the mainstream US culture, interventions aiming to reduce psychosocial distress (e.g., depression, anxiety, hostility) and increase or replenish psychosocial resources (e.g., social support, optimism) may be beneficial in moderating the adverse effects of SES on cardiovascular disease risk. Further, since the adverse physical effects of diminished nocturnal BP dipping may accumulate over time, and given that psychosocial resources and risk factors begin developing early in the life course [88], future research should consider implementing interventions among younger women.

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Fig. 1.

Results of analyses investigating the indirect pathways from SES to SBP and DBP percent nighttime dipping via the psychosocial resources/risk latent variable. Standardized structural/path coefficients represent **overall sample**, *more US acculturated (English-speaking)*, *less US acculturated (Spanish-speaking)*. Analyses controlled for age (in years), body mass index, and smoking status. * $p < .05$; ** $p < .01$; *** $p < .001$

Table 1

Descriptive statistics for sociodemographic variables, ambulatory blood pressure variables, and psychosocial resource and risk factors in the overall sample and within each acculturation subgroup

	Overall ^a N=291 N (%)	More acculturated ^b N=121 N (%)	Less acculturated N=170 N (%)	p value ^a
Educational attainment				<.001
<High school diploma/GED	101 (34.7)	11 (9.1)	90 (52.9)	
High school diploma/GED	190 (65.3)	110 (90.9)	80 (47.1)	
Household monthly income ^b				<.001
<\$3000	120 (42.0)	26 (21.8)	94 (56.3)	
\$3000	166 (58.0)	93 (78.2)	73 (43.7)	
Working full or part time ^c	189 (65.2)	92 (76.0)	97 (57.4)	<.001
Health coverage	207 (71.1)	105 (86.8)	102 (60.0)	<.001
Born in the US	73 (25.1)	66 (54.5)	7 (4.1)	<.001
Ambulatory blood pressure	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	
SBP nighttime dipping (%)	13.14 (6.04)	13.69 (5.71)	12.74 (6.26)	.19
DBP nighttime dipping (%)	15.60 (6.68)	16.13 (6.68)	15.22 (6.67)	.25
Psychosocial resource factors				
Life engagement	21.20 (2.82)	21.02 (2.52)	21.31 (3.01)	.38
Self-esteem	5.68 (0.68)	5.69 (0.65)	5.67 (0.71)	.86
Social support	19.48 (6.69)	20.96 (6.12)	18.43 (6.88)	.001
Optimism ^d	5.73 (1.81)	5.57 (1.60)	5.84 (1.94)	.20
Psychosocial risk factors				
Anxiety	16.37 (4.73)	16.02 (4.36)	16.61 (4.98)	.30
Depression	27.99 (10.75)	26.93 (9.15)	28.75 (11.73)	.16
Hopelessness	3.46 (1.41)	3.36 (1.34)	3.52 (1.47)	.34
Hostility	2.33 (1.80)	2.08 (1.69)	2.51 (1.85)	.04
Loneliness	1.93 (2.08)	1.78 (1.99)	2.04 (2.14)	.30

DBP diastolic blood pressure, SBP systolic blood pressure

^a p values pertain to differences between more- versus less-acculturated subgroups

^b Five missing data points; income and education categories were collapsed for descriptive purposes

^c One missing data point

^d Lower scores reflect greater optimism

Table 2

Factor loadings for the final measurement models and bivariate associations among latent variables for the overall sample/more acculturated subgroup (English speaking)/less acculturated subgroup (Spanish-speaking)

	SES	Psychosocial resources/risk	SBP % dipping
CFA factor loadings			
Education	1.00/1.00/1.00		
Income	.66/.77/.43		
Life engagement		1.00/1.00/1.00	
Self-esteem		.61/.61/.62	
Social support		.49/.58/.43	
Optimism ^a		-.46/-.57/-.40	
Anxiety		-.80/-.68/-.84	
Depression		-.64/-.36/-.75	
Hopelessness		-.49/-.50/-.50	
Hostility		-.40/-.38/-.40	
Loneliness		-.65/-.57/-.67	
Bivariate associations			
SES	–		
Psychosocial			
Resources/risk	.36/.46/.32	–	
SBP % dipping	.19/.30/.07	.15/.24/.11	–
DBP % dipping	.17/.26/.07	.20/.28/.18	.83/.85/.83

CFA confirmatory factor analyses, DBP diastolic blood pressure, SBP systolic blood pressure, SES socioeconomic status. Statistically significant correlations ($p < .05$) are shown in bold text.

^a Lower scores reflect greater optimism