

Are the Costs of Neuroticism Inevitable? Evidence of Attenuated Effects in U.S. Latinas

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Neuroticism is the heritable and stable personality trait defined by the tendency to experience negative emotion, be easily stressed, and slow to soothe. Neuroticism poses a risk for poor social and health outcomes that has been identified as a major public health concern. To date, factors that attenuate neuroticism's costs have not been identified. The goal of this work was to test the hypothesis that the costs of neuroticism would be attenuated in sociocultural contexts that emphasize readily accessible social support, emotional positivity, and physical proximity in interdependent relationships. U.S. Latino culture fits these characteristics. Two studies, an online survey study (Study 1) and a laboratory study (Study 2), tested whether three key costs of high neuroticism—less support (Study 1), more distress (Study 2), and blunted cortisol reactivity (Study 2)—would be attenuated in U.S. Latinas relative to non-Latinas of European and East Asian cultural background. Consistent with previous research, neuroticism was associated with less perceived support, more distress, and blunted cortisol reactivity in non-Latina women of European and East Asian cultural background. For Latina women, however, these effects were attenuated. Latina women who were high in neuroticism continued to feel supported, were not as distressed, and their cortisol reactivity was less blunted. The role of sociocultural context for generating a better understanding of personality processes and the social malleability of neuroticism's costs are discussed.

Keywords: neuroticism, culture, health, social support, cortisol reactivity

Neuroticism is a heritable and stable personality trait defined by the tendency to experience negative emotion, be easily stressed, and slow to soothe (Costa & McCrae, 1992; John & Srivastava, 1999). High neuroticism has been characterized as a major public health concern due to its persistent link with distressed relationships (e.g., Karney & Bradbury, 1997); depression, anxiety, and other Axis I disorders (Bachrach, Croon, & Bekker, 2012); and stress-related physical illness (Lahey, 2009; Smith, 2006). A large body of research has documented the costs of neuroticism for poor social and health outcomes, but factors that attenuate these costs have not been identified (see Lahey, 2009, for review). Yet iden-

tifying attenuated effects of neuroticism is important for understanding whether neuroticism's costs are socially malleable, how its costs unfold, and what entry points may be most promising for intervention. We theorized that sociocultural contexts that emphasize readily accessible social support, emotional positivity, and physical proximity in interdependent relationships may offer access to social integration and social support that is otherwise difficult for people high in neuroticism to obtain. If so, we reasoned that neuroticism's costs should be attenuated for members of these contexts. U.S. Latino culture fits these sociocultural characteristics (Campos et al., 2008; Holloway, Waldrip, & Ickes, 2009; Sabogal, Marin, Otero-Sabogal, VanOss Marin, & Perez-Stable, 1987). The goal of the present research was to test whether three key costs of high neuroticism—less support (Study 1), more distress (Study 2), and blunted cortisol reactivity (Study 2)—would be attenuated in U.S. Latinas.

Research indicates that the costs of neuroticism accumulate through intrapersonal and interpersonal processes. For people high in neuroticism, their strong responses to even minor experiences of threat, frustration, or loss lead to frequent negative emotion and symptoms of psychological distress that include stress and depression (e.g., Costa & McCrae, 1992; John & Srivastava, 1999; Lahey, 2009). This response tendency also takes a toll on the body. High neuroticism specifically has been linked to blunted cortisol reactivity patterns in women (Bibbey, Carroll, Roseboom, Phillips, & de Rooij, 2012; Oswald et al., 2006). Cortisol is a stress hormone that is the end product of the hypothalamic-pituitary-adrenal (HPA) axis that is part of the body's neuroendocrine

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system. The HPA axis is stress responsive; cortisol increases in response to certain acute stressors and this increase is adaptive and healthy. Blunted cortisol responses can be indicative of prolonged wear and tear on the HPA axis that is implicated in physical and mental disease (e.g., Chrousos & Gold, 1992; McEwen, 1998). The individual vulnerabilities that characterize neuroticism could be buffered by social support. Perceived social support, the perception of being loved and cared for by one's social network, is protective of mental and physical health (e.g., S. Cohen & Wills, 1985; Taylor, 2011; Wills, 1991). Meeting the needs of someone high in neuroticism, however, requires extra sensitivity and support that often exceeds what the social network provides (e.g., Lahey, 2009). For this reason, people high in neuroticism feel less supported and benefit less from their relationships (e.g., Bolger & Zuckerman, 1995; Kendler, Gardner, & Prescott, 2002, 2006, Lahey, 2009; Uchino, 2006). Overall, the high-neuroticism pattern is one of psychological distress, poorer health, and difficulty obtaining social support that meets one's needs.

The processes implicated in neuroticism's costs take place within sociocultural contexts, but little research has specifically considered the role of sociocultural context for neuroticism's costs. The extensive literature linking neuroticism with poor social and health outcomes has been largely drawn from participants of European cultural background whose sociocultural context is distinct in its emphasis on independence (e.g., Lahey, 2009; Markus & Kitayama, 1991). We theorized that sociocultural contexts that emphasize a combination of readily accessible social support, emotional positivity, and physical proximity in interdependent relationships may offer social integration and access to support that buffers the costs of neuroticism. U.S. Latino culture has been shown to have these characteristics (e.g., Campos et al., 2008; Holloway et al., 2009; Sabogal et al., 1987). A large literature documents that the sociocultural contexts of Latinos in the United States and in Latin America emphasize accessible social support (e.g., Campos et al., 2008; Keefe, Padilla & Carlos, 1979; Lugo Steidel & Contreras, 2003; Sabogal et al., 1987; Triandis, Marin, Lisansky, & Betancourt, 1984), emotional positivity (e.g., Holloway et al., 2009; Ruby, Falk, Heine, & Villa, 2012; Triandis et al., 1984) and physical proximity (e.g., Desmond & López Turley, 2009; Keefe, 1984; Lugo Steidel & Contreras, 2003; Sabogal et al., 1987) in interdependent relationships. These sociocultural characteristics have been implicated in the better-than-expected mental health and longer life of immigrant U.S. Latinos, a pattern at odds with the group's substantial disadvantage of low socioeconomic standing and ethnic minority status (e.g., Abraído-Lanza, Dohrenwend, Ng-Mak, & Turner, 1999; Alegría et al., 2008). Although not all Latinos obtain or want relationships that have these characteristics, the affordances for social integration and support provided by this sociocultural context could reasonably extend to those high in neuroticism and attenuate their distress and physiological dysregulation.

There is also evidence that the sociocultural context of Latinos differs from that of non-Latinos of European and East Asian cultural backgrounds in ways that may be relevant for neuroticism. In European background sociocultural contexts, a combination of independence and self-sufficiency from others, as well as social support and emotional positivity, is valued (e.g., D. Cohen, 2007; Markus & Kitayama, 1991; Taylor et al., 2004). In East Asian background sociocultural contexts, a combination of interdepen-

dence and physical proximity is valued, but emotional positivity is less emphasized and open support seeking is avoided (Kim, Sherman, Ko, & Taylor, 2006; Markus & Kitayama, 1991; Ruby et al., 2012; Taylor et al., 2004). Notably, the distinctive emphasis that Latino culture places on readily accessible social support, emotional positivity, and physical proximity in interdependent relationships is diluted with U.S. acculturation, but it continues to differentiate Latinos from non-Latinos into the third U.S. generation (e.g., Desmond & López Turley, 2009; Holloway et al., 2009; Sabogal et al., 1987; Triandis, Marin, Betancourt, Lisansky, & Chang, 1982; Triandis et al., 1984).

The sociocultural context of Latinos differs from that of non-Latino counterparts of European and East Asian background, but there is no indication that neuroticism itself differs among these groups. Neuroticism is similar in non-Latinos in the United States and Latinos in the United States and Mexico (e.g., Benet-Martínez & John, 1998; Church et al., 2011; Ramírez-Esparza, Gosling, Benet-Martínez, Potter, & Pennebaker, 2006). For example, a study by Church et al. (2011) of measurement invariance and differential item functioning for self-reported personality in U.S., Mexican, and Philippine samples found that neuroticism is comparable for U.S. and Mexican samples. There is some indication, however, that neuroticism may be viewed more favorably in some sociocultural contexts than others. At least one study has found that participants in the United States and Mexico rate themselves as higher in neuroticism when completing a personality measure in Spanish, but lower in neuroticism when completing the same measure in English (Ramírez-Esparza et al., 2006). This pattern did not reflect a general response tendency. Participants rated themselves as higher on the four other personality traits measured when responding in English. In sum, neuroticism is broadly comparable in U.S. Latinos and non-Latinos, but the sociocultural context in which this personality trait is likely to be expressed may vary in ways that are relevant for neuroticism's costs.

The Present Research

We report two studies of three key costs of high neuroticism: less support, more distress, and blunted cortisol reactivity. Both studies tested for attenuation in U.S. samples of women of Latino, European, and East Asian cultural background. We focused on women because they are generally higher in neuroticism than men (Costa, Terracciano, & McCrae, 2001), and the link of high neuroticism with blunted cortisol reactivity is clearly established in women but is less conclusive in men (e.g., Bibbey et al., 2012; Oswald et al., 2006). We focused on samples of Latino, European, and East Asian cultural background because the sociocultural context of these three groups varies in the emphasis placed on interdependent relationships characterized by social support, emotional positivity, and physical proximity. This group comparison approach that contrasts members of cultures known to systematically vary on specific psychological factors is useful for testing the sociocultural specificity of predictions and identifying relevant elements of culture for particular processes (e.g., Kitayama, Ishii, Imada, Takemura, & Ramaswamy, 2006).

Study 1 was an online survey study that tested whether neuroticism predicted perceived support in Latinas and non-Latinas of European and East Asian cultural background. Study 2 was a laboratory study that tested whether neuroticism predicted distress

and blunted cortisol reactivity in Latinas and non-Latinas of European and East Asian cultural background. For Study 2, participants completed self-report measures of distress and took part in a widely used laboratory stress task that assesses cortisol reactivity as an index of HPA-axis functioning (Trier Social Stress Test [TSST]; Kirschbaum, Pirke, & Hellhammer, 1993).

Study 1: Neuroticism and Perceived Support

Method

Participants. Three hundred eighty-two women participants of Latino ($n = 91$, 24%), European ($n = 154$, 40%), or East Asian ($n = 137$, 36%) cultural background took part in an online study of perceptions of social support at a California university in exchange for course extra credit. For the purposes of this research, participants were considered of Latino cultural background when they self-reported “Mexican, Mexican American, and/or Chicano” or “other Latino (e.g., Guatemalan, Colombian)”; of European cultural background when they self-reported “White, Caucasian, European”; and of East Asian cultural background when they self-reported “Chinese.” Consistent with California demographics, the majority of the Latino sample was of Mexican background (73%) but included women of Central and South American background (27%). Participant mean age was 20.09 years ($SD = 2.89$).

Procedure. Measures of demographic characteristics, personality, and perceived support were completed at a time and location of participant convenience. All study procedures were approved by the University of California, Irvine, Institutional Review Board.

Measures. Reliability was assessed with Cronbach’s alpha and is reported for the overall sample and three cultural background groups in Table 1.

Neuroticism. The 10-item Personality Inventory (TIPI) was used to measure neuroticism (e.g., Gosling, Rentfrow, & Swann, 2003). The TIPI is a shortened version of the Big Five Inventory (BFI) measure of the five-factor model of personality that has been shown to retain content validity in U.S. and non-U.S. samples, including community samples, Latinos, and non-Latinos (e.g., Gosling et al., 2003; Rammstedt & John, 2007). The TIPI reaches acceptable levels of convergence with longer Big Five personality measures and TIPI subscales predict well documented correlates of the Big Five (e.g., Jonason, Teicher, & Schmitt, 2011).¹ The two neuroticism items in the TIPI tap the tendency for emotional instability and negative emotionality (e.g., “I see myself as anxious, easily upset”) that is central to this personality trait. Participants rated each item using Likert scales (1 = *disagree strongly*; 7 = *agree strongly*), and responses were averaged to create an overall score.

Perceived support. The 19-item MOS Social Support Survey (Sherbourne & Stewart, 1991) measures perceptions of four types of support: (a) affectionate (expressions of love and affection); (b) emotional/informational (expressions of positive affect and understanding, offering advice and guidance); (c) positive social interaction (availability to do fun things); and (d) tangible (material aid or behavioral assistance). Participants rated each item using Likert scales (1 = *none of the time*; 5 = *all of the time*), and responses were averaged to create an overall score.

Results

Preliminary analyses. We first examined the bivariate correlation of neuroticism and perceived support by cultural background. Neuroticism was not correlated with perceived support in the Latina sample ($r = .08$, $p = .44$) but was negatively correlated with perceived support in the European ($r = -.23$, $p < .01$) and East Asian ($r = -.28$, $p < .01$) samples. We next tested for cultural background mean differences in neuroticism and perceived support with one-way ANOVAs. Omnibus cultural background differences were followed up with independent sample t tests. Means and standard deviations for neuroticism and perceived support for the three groups are reported in Table 2. One difference emerged. East Asians reported lower perceived support, $F(2, 364) = 11.20$, $p < .001$, $\eta_p^2 = .06$, than European, $t(277) = -4.87$, $p < .001$, and Latina, $t(217) = -2.33$, $p < .02$, participants. European and Latina participants did not differ, $t(234) = 1.69$, $p = .09$. There were no cultural background differences for neuroticism, $F(2, 379) = 1.18$, $p = .31$, $\eta_p^2 = .01$.

Did Latinas who were high in neuroticism feel socially supported? We tested our central hypothesis with regression analyses that compared (a) Latina and European background participants (dummy coded: Latina = 1, European = 0) and (b) Latina and East Asian background participants (dummy coded: Latina = 1, East Asian = 0). Neuroticism scores were group centered by cultural background to assess effects of neuroticism within each group. For both models, main effects (cultural background, neuroticism) were entered in the first block and the interaction term (Cultural Background \times Neuroticism) was entered in the second block.

Significant interaction effects indicated that Latinas’ perceived support did not vary by neuroticism, whereas European background participants ($b = .18$, $p < .03$) and East Asian background participants ($b = .22$, $p < .01$) felt less supported if they were high in neuroticism (see Figure 1). This moderation effect emerged even though main effects indicated that higher neuroticism generally predicted less perceived support (European–Latina comparison, $b = -.20$, $p < .01$; East Asian–Latina comparison, $b = -.27$, $p < .01$) and Latina background predicted more perceived support than East Asian background ($b = .14$, $p < .04$).

Ruling out alternative explanations: Extraversion and agreeableness. Extraversion and agreeableness have been associated with attunement to social rewards and social relationships (John & Srivastava, 1999). In line with this link, perceived support was significantly correlated with both extraversion ($r = .26$, $p < .01$) and agreeableness ($r = .14$, $p < .01$) in the overall Study 1 sample. Thus, we examined the possibility that extraversion and agreeableness played a role in the attenuated cost of neuroticism for perceived support in Latinas. Our analysis found no mean differences in extraversion and agreeableness for the three groups (all $F_s < 1$). There was also no indication that extraversion and agreeableness interacted with neuroticism to predict perceived support. Multiple regressions that tested for three-way interactions of cultural background, neuroticism, and extraversion ($b = -.06$, $p = .43$, for the Latina and European comparison; $b = .05$, $p =$

¹ A list of publications that have used the TIPI is available at http://homepage.psy.utexas.edu/homepage/faculty/gosling/scales_we.htm

Table 1
Reliabilities for All Measures in Study 1 and Study 2

| Scale (Number of items) | Overall sample Cronbach's α | Latina background Cronbach's α | European background Cronbach's α | East Asian background Cronbach's α |
|------------------------------|---------------------------------------|--|--|--|
| Study 1 | | | | |
| Neuroticism (2) ^a | .65 | .61 | .60 | .69 |
| Perceived support (19) | .95 | .96 | .94 | .96 |
| | Overall sample Cronbach's α | Latina background Cronbach's α | Non-Latina background Cronbach's α | |
| Study 2 | | | | |
| Neuroticism (2) ^a | .72 | .63 | .80 | |
| Perceived support (19) | .94 | .94 | .93 | |
| Distress (56) | .92 | .92 | .93 | |

^a These somewhat low alpha levels are typical of this measure and stem from the two item scales that emphasize content validity rather than interitem overlap.

.55, for the Latina and East Asian comparison) and of cultural background, neuroticism, and agreeableness ($b = .02, p = .83$, for the Latina and European comparison; $b = .06, p = .45$, for the Latina and East Asian comparison) were not significant.

Discussion

As hypothesized, the cost of neuroticism for perceived support was attenuated in Latinas. Latinas who were high in neuroticism felt as supported as Latinas who were low in neuroticism. This was not true for women of European and East Asian cultural background, for whom high neuroticism was associated with feeling less supported. This pattern could not be explained by generally low levels of perceived support among Latinas. Latinas' perceived support was comparable with European background women and higher than East Asian background women. This pattern also could not be explained by interactions of neuroticism with extraversion or agreeableness that differed by cultural background. Neither extraversion nor agreeableness interacted with neuroticism and cultural background to predict perceived support.

Study 2: Neuroticism, Distress, and Blunted Cortisol Reactivity

Method

Participants. Fifty-nine women of Latina ($n = 37$) and non-Latina ($n = 22$) cultural background were recruited at a California university and its surrounding community colleges as part of a larger study on social responses to stress. For the purposes of this

research, participants were considered of Latino cultural background when they self-reported "Mexican, Mexican American, and/or Chicano" or "other Latino (e.g., Guatemalan, Colombian)." The majority of the Study 2 Latina sample was also of Mexican background (78%) but included women of Central and South American background (22%). The non-Latina group consisted of women of European and East Asian background who were grouped together because of their similar neuroticism and support associations in Study 1. For the purposes of this research, participants were considered of European cultural background when they self-reported "White, Caucasian, European," and of East Asian cultural background when they self-reported "Chinese," "Japanese," or "Korean."

For Study 2, we sought to recruit a Latina sample that included U.S.-born and foreign-born participants, as well as participants from local community colleges to maximize generalizability. The Latina sample thus included both U.S.-born ($n = 21$) and foreign-born ($n = 16$) participants, with 27% from local community colleges. The non-Latina sample was majority U.S.-born ($n = 18$), with four participants indicating being born outside of the United States. Participant mean age was 20.68 years ($SD = 2.43$). Participants also indicated socioeconomic status (SES) with a single-item 5-point measure (1 = lower working class, e.g., unskilled workers, employed off-and-on; 3 = lower middle class, e.g., skilled trade such as carpentry, small entrepreneurs, run sizable farms, steady employment; 5 = upper upper class, e.g., do not have to work for a living, can travel around the world when you feel like it, family is able to live on inherited wealth). A one-way ANOVA showed that Latinas reported lower SES than non-

Table 2
Study 1: Means and Standard Deviations for Neuroticism and Perceived Support by Cultural Background

| | Latina background ($n = 91$) M (SD) | European background ($n = 154$) M (SD) | East Asian background ($n = 137$) M (SD) |
|-------------------|--|---|---|
| Neuroticism | 3.67 (1.38) | 3.56 (1.41) | 3.81 (1.43) |
| Perceived support | 4.28 (.72) _a | 4.42 (.56) _a | 4.05 (.71) _b |

Note. $N = 382$. Neuroticism on 1 (disagree strongly) to 7 (agree strongly) scale. Perceived support on 1 (none of the time) to 5 (all of the time) scale. Cultural background means that differ at $p < .05$ are indicated by _a and _b subscripts that differ in the same row.

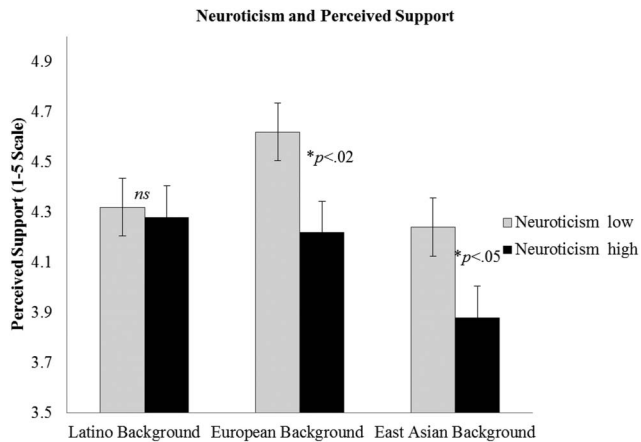


Figure 1. Interaction effects of the association of neuroticism with perceived support by cultural background (Study 1). Bars represent the standard error.

Latinas ($M = 2.43$, $SD = .99$ vs. $M = 3.27$, $SD = .70$), $F(1, 57) = 12.22$, $p < .001$, $\eta_p^2 = .18$.

Procedure. Participants were recruited through research participation pools, flyers, and class announcements. Potential participants who contacted the research team were screened by phone for major medical conditions; speech or math phobia; alcohol, tobacco, and drug use; and medication use that could affect cortisol levels. Six women were excluded based on these criteria. Participants who met criteria were scheduled for a 3-hr weekday laboratory session and instructed not to eat, drink caffeine, or engage in strenuous physical activity for at least one hour prior to the study. All participants were given the option of completing the study in English or Spanish, but all chose to complete the study in English. On the day of the study, participants were asked about their menstrual cycle phase, use of oral contraceptives, and whether they were undergoing exams during the week of study participation because these factors can influence cortisol reactivity.² All sessions began at 2:00 p.m. to control for cortisol's circadian variation. Participants were compensated with extra course credit or \$50. All study procedures were approved by the University of California, Irvine, Institutional Review Board.

Upon laboratory arrival, participants were given detailed information about all study procedures and reminded that they could skip any procedure and/or stop at any time. One participant chose to stop before completing the study. For the first 20 min, participants quietly completed self-report measures. After this 20-min period, the experimenter led the participant to an adjacent room for the TSST (Kirschbaum et al., 1993). A saliva sample was obtained one minute prior to the start of the TSST (−1 min). After the TSST, participants returned to the first room to complete additional self-report measures and provided eight additional saliva samples over the course of a 90-min period (at +1, +5, +10, +20, +30, +45, +60, and +90 min after the TSST). At the end of the session, participants were thanked and carefully debriefed to ensure that the TSST had no adverse effects.

Measures. See Table 1 for reliabilities.

Neuroticism. As in Study 1, the 10-item TIPI was used to measure neuroticism.

Perceived social support. As in Study 1, the 19-item MOS was used to measure perceived social support.

Distress. A distress composite consisting of measures of perceived stress, depressive symptoms, and physical health symptoms was used because the three are commonly reported by people who are high in neuroticism (e.g., Lahey, 2009). The composite score was derived by averaging the standardized scale scores of the three indices. Intercorrelations among the three indices ranged from $r = .35$ to $r = .77$ (all $ps < .03$) in the overall sample and for the Latina and non-Latina groups separately.

Perceived stress. The Perceived Stress Scale measures subjective perceptions that demands are exceeding resources (S. Cohen, Kamarck, & Mermelstein, 1983). The 14-item version used in this study referred to stress perceptions of various kinds during the previous month (e.g., “How often have you found that you could not cope with all the things you had to do?”). Participants rated each item using a 5-point scale (1 = *never*; 5 = *very often*). Responses were averaged to create scale scores in which higher scores indicated higher stress.

Depressive symptoms. A 9-item version of the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977; Santor & Coyne, 1997) measured depressive symptoms (e.g., “I felt sad”). Participants rated each item using a 4-point scale (0 = *rarely or none of the time*; 3 = *most or all of the time*). Responses were summed to create scale scores in which higher scores indicated more symptoms.

Physical symptoms. The Cohen-Hoberman Inventory of Physical Symptoms (S. Cohen & Hoberman, 1983) is a 33-item measure of common physical symptoms (e.g., headache, stomach pain, fatigue) that predicts use of health services. Participants rated how much they were bothered by a particular symptom in the past 2 weeks on a 5-point scale (0 = *not bothered*; 4 = *extremely bothered*). Responses were summed to create scale scores in which higher scores indicated more physical symptoms.

TSST. The TSST (Kirschbaum et al., 1993) is a reliable elicitor of cortisol reactivity that consists of a 3-min preparation period, 5-min speech task, and a 5-min mental arithmetic task in front of two neutral, nonsupportive observers. All standard TSST procedures were followed. The observers were culturally diverse (e.g., Latino, European, East Asian, and mixed background) and included both genders. All observers went through extensive training procedures that were supervised by the first, second, and third authors; training included memorizing the scripts and practicing nonverbal behavior to carry out the observer role in a standardized way.

Participants were asked to stand at a marked spot and shown readily visible video recording equipment. Participants were told that experts trained in observing and analyzing behavior would later examine the video recording. For the speech task, participants were instructed to imagine that they were applying for a job of their choice and asked to talk about the personal qualities they

² Nine women (six Latinas, three non-Latinas) who reported using oral contraceptives were dropped from analyses due to the effects that oral contraceptives can have on cortisol, but this did not change the overall pattern of results. The Latina and non-Latina groups also did not differ in menstrual cycle phase on day of study participation, $t(48) = -.17$, $p = .87$. The Latina and non-Latina groups also did not differ in terms of whether they were undergoing exams during the week of study participation, $t_s < 1$, $ps \geq .29$.

would bring to the position. Participants were allowed to speak freely, but when they had remained silent for more than 5 s, the first observer stated, "You still have more time." When the participant finished speaking again, the first observer waited 20 s and then asked a series of open-ended questions in 30-s intervals for the remainder of the speech task. For the math task, participants were instructed to serially subtract 13 from 1,027 as quickly as possible without making a mistake. The second observer interrupted participants when they made a mistake and directed that they start over from the beginning.³

Saliva collection and assays. Saliva samples were collected using a sterile cotton salivette (Sarstedt, Nümbrecht, Germany). Each participant provided nine total samples. The first sample was obtained one minute prior to the start of the TSST and the eight additional samples were obtained at +1, +5, +10, +20, +30, +45, +60, and +90 min after the TSST. Samples were kept at room temperature until completion of the session and then stored at -70°C until assayed. Saliva samples can be stored at $20^{\circ}\text{C}/68^{\circ}\text{F}$ for up to 4 weeks without significantly affecting cortisol concentrations measured (Kirschbaum & Hellhammer, 1994). After thawing for biochemical analysis, samples were centrifuged for 10 min at 2,000 X g and $4^{\circ}\text{C}/39^{\circ}\text{F}$. Cortisol was determined by a commercially available enzyme immunoassay (ELISA, IBL-America, Minneapolis, MN). All samples were assayed in duplicate. The sensitivity of the assay is reported at 0.033 nmol/L, and the assay dynamic range is between 0 and 82.77 nmol/L. Inter- and intra-assay coefficients of variance are reported at 4.9% and 4.1%, respectively.

Cortisol reactivity indices. Four indices of cortisol changes in response to the TSST were generated for preliminary analyses.⁴ To represent total cortisol output over the course of the stress task, area under the curve with reference to ground (AUC_g) was calculated. To represent increases in cortisol output from the baseline measurement to the peak value after the stress task, area under the curve increase (AUC_i) was calculated. To represent cortisol reactivity in response to the TSST, mean cortisol increase (average cortisol level in the first 30 min after the TSST subtracted from the baseline) and maximum cortisol increase (maximum cortisol level after the TSST subtracted from the baseline) were calculated. The formulas for deriving these indices can be provided by the authors upon request.

Results

Preliminary analyses. First, the correlation matrix was examined (see Table 3). Despite the smaller sample, the neuroticism and

perceived support associations were similar to the patterns observed in Study 1. We next tested for Latina and non-Latina mean differences in neuroticism, perceived support, and distress with one-way ANOVAs. Means and standard deviations for neuroticism, perceived support, and distress for both groups are reported in Table 4. There were no significant mean differences (all $ps > .05$; all $\eta_p^2 \leq .03$). We also tested for the possibility of differences by nativity status within the Latina sample for neuroticism, social support, psychological distress, and the four indices of cortisol changes in response to the TSST. None of these analyses were significant (all $ps \geq .10$).⁵

Did Latinas who were high in neuroticism feel less distressed than non-Latina counterparts? Fischer's z tests were used to test the difference between the correlations of neuroticism and distress in Latinas and non-Latinas, due to the small sample size of Study 2 (Rosenthal & Rosnow, 1991). Neuroticism was significantly less associated with distress in Latina women ($r = .25$, ns) than non-Latina women ($r = .67$, $p < .001$), Fischer's $z = -1.94$, $p = .05$.

Did Latinas who were high in neuroticism have less blunted cortisol reactivity than non-Latina counterparts? We tested this hypothesis using a multilevel modeling approach. Multilevel modeling is a flexible and powerful approach for testing the effect of individual differences on repeated measures outcomes. In the present study, it allowed for a different cortisol reactivity pattern to be estimated for each person, and for the associations of individual differences with multiple indices of cortisol response to be examined in a single model that adjusts for the reliability of each participant's data points. Thus, multilevel modeling has a number of advantages over traditional analytic approaches that rely on area under the curve (AUC) indices, and is particularly appropriate for testing our hypothesis that the association of neuroticism with blunted cortisol reactivity would be attenuated in Latinas.

To begin hypothesis testing, we first modeled the cortisol reactivity trajectories of each individual in the sample. These preliminary analyses suggested that a cubic model described the trajectories best. This model included three polynomials as predictors of cortisol values: linear time, squared time, and cubic time. The coefficients for each polynomial capture relevant characteristics of the cortisol trajectory. The coefficient for linear time captures the linear trend over the course of saliva sampling, indicating the extent to which cortisol output increased or decreased from the beginning to the end of the sampling period. The coefficient for squared time reflects the cortisol response that is of primary interest for assessing blunted cortisol reactivity. A negative quadratic coefficient captures the curvature in cortisol trajectories, indicating the extent to which cortisol values rose and fell as a function of the TSST. The coefficient for cubic time captures the extent to which the curve flattened out as it returned to

Table 3
Study 2: Correlation Matrix for Neuroticism, Perceived Support, and Distress by Latina and Non-Latina Background

| | Latinas ($n = 37$) | | |
|--------------------------|----------------------|------|-------|
| | 1 | 2 | 3 |
| Non-Latinas ($n = 22$) | | | |
| 1. Neuroticism | — | -.07 | .25 |
| 2. Perceived support | -.19 | — | -.45* |
| 3. Distress | .67* | -.23 | — |

Note. $N = 59$. Correlations for the Latina sample are above the diagonal; correlations for the non-Latina sample are below the diagonal.

** $p < .01$.

³ TSST observers rated participant TSST performance. ANOVA analyses showed no difference in positive or negative performance by cultural background group, ($F_s < 1$, $ps \geq .27$).

⁴ Cortisol values were not transformed for analysis.

⁵ Study 2 included the ARSMA-II scale (Cuéllar, Arnold, & Maldonado, 1995) and both U.S.-born and foreign-born Latinas reported moderate U.S. acculturation but also high culture-of-origin acculturation. The reduction in sample size generated by separating the Latina sample into these two groups precludes strong conclusions about the role of acculturation and will not be discussed further.

Table 4
Study 2: Means and Standard Deviations for Neuroticism, Perceived Support, and Distress by Latina and Non-Latina Background

| | Latinas (<i>n</i> = 37) <i>M</i> (<i>SD</i>) | Non-Latinas (<i>n</i> = 22) <i>M</i> (<i>SD</i>) |
|-------------------|--|--|
| Neuroticism | 2.96 (1.31) | 3.50 (1.74) |
| Perceived support | 4.27 (.70) | 4.27 (.61) |
| Distress | 12.33 (5.62) | 10.18 (5.70) |

Note. *N* = 59. Neuroticism on 1 (*disagree strongly*) to 7 (*agree strongly*) scale. Perceived support on 1 (*none of the time*) to 5 (*all of the time*) scale. For distress, nonstandardized means are presented for ease of interpretation.

baseline. These curvature estimates were highly correlated with the four AUC indices used in preliminary analyses ($r_s > .90$).

To test the central hypothesis, we examined whether differences in cultural background and neuroticism (Level 2) were predictive of individual differences in cortisol trajectories (Level 1). There was no main effect of cultural background on cortisol values at the start of the task ($b = 1.09, t = .24, p = .81$), overall change of cortisol values across time ($b = 2.39, t = 1.15, p = .26$), or the cortisol response (rise and fall; $b = .25, t = 1.09, p = .28$). Cortisol values at the start of the task did not differ as a function of neuroticism ($b = 1.15, t = .76, p = .45$), but higher neuroticism predicted a more blunted cortisol response ($b = .17, t = 2.30, p = .03$), as reflected by the quadratic time effect indicating that higher neuroticism was also associated with a smaller increase in the level across all measurements and returned to baseline more rapidly ($b = -1.61, t = -2.38, p = .02$). In sum, cortisol reactivity was similar for Latinas and non-Latinas and neuroticism was generally associated with more blunted cortisol reactivity. Next, we tested for the hypothesized interaction effect. A significant interaction of cultural background and neuroticism indicated that neuroticism predicted less blunted cortisol reactivity in Latinas relative to non-Latinas, ($b = -.17, t = 2.27, p = .02$). Figure 2 illustrates the observed patterns.

Discussion

As hypothesized, neuroticism was not predictive of distress and less predictive of blunted cortisol reactivity in Latinas relative to non-Latinas. The latter finding is particularly notable because it indicates that the attenuated costs of neuroticism observed for Latinas extend from self-report to health relevant physiology. These findings rule out the possibility that attenuated costs of neuroticism for Latinas derive from a response tendency on the part of Latinas that may have obscured the costs of neuroticism for this group. The literature on HPA-axis functioning in Latinos is sparse, but there is some indication that more time in the United States (e.g., Squires et al., 2012) and higher acculturation (e.g., Mangold, Mintz, Javors, & Marino, 2012) are associated with more blunted cortisol patterns. We did not find Latina nativity differences, but a tendency for blunting with more time in the United States could only have worked against our hypothesis that the costs of neuroticism for HPA-axis functioning would be attenuated in Latinas.

General Discussion

Neuroticism may not have the same consequences across socio-cultural contexts. In two studies, we found that three key costs of neuroticism were attenuated in Latinas. Relative to non-Latinas of European and East Asian cultural background, Latinas who were high in neuroticism continued to feel supported, were not as distressed, and had less blunted cortisol reactivity. These findings make two novel contributions. First, they show that neuroticism's costs can be attenuated. As such, these findings suggest that neuroticism's association with poor social and health outcomes are socially malleable. Second, they point to facets of the Latino sociocultural environment—social support, emotional positivity, and physical proximity—that can be a focus of future research to generate a better understanding of how the costs of neuroticism unfold and identify promising entry points for intervention.

The costs of neuroticism are extensively documented (see Lahey, 2009). Perhaps because of its strong heritable component and well-documented costs, little attention has been paid to the contribution of the social environment to neuroticism's costs. To our knowledge, this is the first research to demonstrate attenuated costs for neuroticism. This evidence for social malleability indicates that the risk of neuroticism for poor social and health outcomes is a product of both individual tendencies and social environments. By identifying a sociocultural context in which the costs of neuroticism are attenuated, this work highlights the possible positive contributions of the social environment to limiting neuroticism's costs and identifies a context that may produce additional novel insights regarding the expression of neuroticism and perhaps other traits.

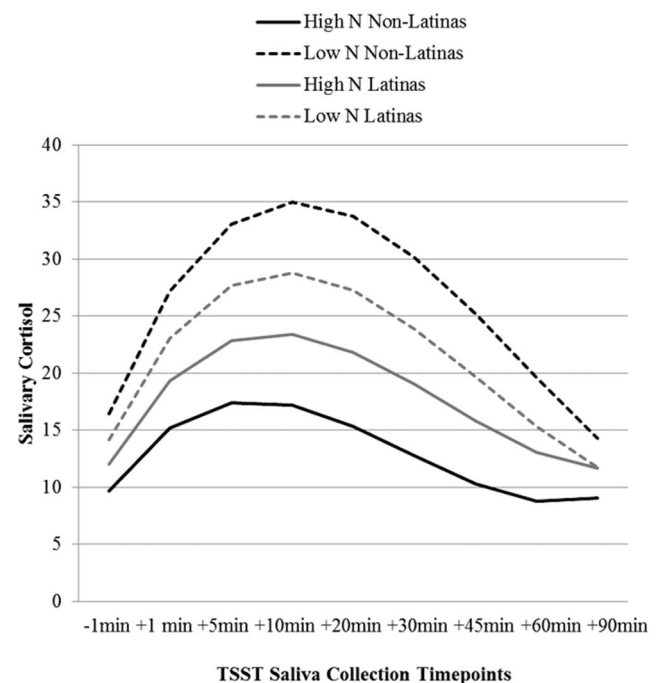


Figure 2. Salivary cortisol responses to social stress test (TSST) by Latina and non-Latina background and neuroticism. Flatter lines indicate blunted cortisol reactivity patterns that are indicative of prolonged wear and tear on the HPA-axis system.

We interpret the observed attenuation effects for neuroticism in terms of Latino culture's emphasis on social support, emotional positivity, and physical proximity in interdependent relationships, but full explication of these mechanisms awaits future research. The comparison of Latinas to non-Latinas of European and East Asian background whose sociocultural context varies systematically in terms of social support, emotional positivity, and physical proximity in interdependent relationships suggest these three factors work in concert. After all, social support and emotional positivity are also highly valued in European American culture, but the costs of neuroticism are most widely documented in this group. Latino and East Asian cultures both value physical proximity in interdependent relationships, but East Asians' reluctance to openly seek social support may render support less available to East Asians high in neuroticism. In combination, however, social support, emotional positivity, and physical proximity in the context of interdependence may limit the full costs of neuroticism from unfolding. Social support is robustly linked with mental and physical health and can be protective against the negative effects of stress (e.g., *S. Cohen & Wills, 1985*). Positive emotions help undo negative emotions and their physiological consequences (*Fredrickson & Levenson, 1998*). Physical proximity, particularly to family with whom relationships do not need to be established and are less easily dissolved, may help people high in neuroticism to stay integrated and supported in a social network.

A specific combination of sociocultural factors may contribute to diminished costs of neuroticism, but in what ways might these factors work together? One possibility is that an emphasis on positive emotion and physical proximity sets the tone for higher perceived social support, and higher perceived support is the proximal contributor to attenuated costs of neuroticism. This potential pathway is consistent with research studies that highlight the direct effects of social support for relationship (e.g., *Kiecolt-Glaser & Newton, 2001*) and health (e.g., *S. Cohen & Wills, 1985*) benefits. To test this complex possibility, the specific behaviors and attributions associated with social support, positive emotion, and physical proximity in the course of everyday life, at critical developmental stages (e.g., early childhood, older adults), and across levels of neuroticism will need to be studied in samples of varying cultural background. This line of work may identify other sociocultural contexts in which attenuated costs of neuroticism may be observed as well as within-group variation among Latinas. Our Latina samples were of Mexican, Central American, and South American background, but the latter two groups are less well studied than their Mexican background counterparts. Latinas are a diverse group with substantial within-group sociocultural variability deriving from many world cultures, including those of Europe and Asia. A focus on the described hypothesized pathway for attenuating the costs of neuroticism that also capitalizes on this sociocultural variability is likely to prove useful for understanding the sociocultural shaping of the costs of neuroticism.

The correlation of neuroticism with perceived support in Latinas hovered around zero in both Study 1 and Study 2. To better understand this pattern, more research is needed on the role of cultural factors and social circumstances for perceived support in Latinas. In Study 1, Latinas reported higher mean levels of perceived support than East Asian counterparts whose sociocultural context emphasizes avoiding support seeking

(e.g., *Taylor et al., 2004*). In contrast, the sociocultural context of Latinas and European background women both emphasize open support seeking, and these two groups reported similar levels of perceived support. We suggest that two additional factors may be relevant for perceived support in Latinas. One factor is that Latinas tend to be of lower SES than non-Latino counterparts, and low SES is known to undermine relationships and compromise support (e.g., *Maisel & Karney, 2012*). The second factor is that Latino culture places particular emphasis on social support from family (e.g., *Campos et al., 2008; Sabogal et al., 1987*). An examination of the specific contribution of these factors for perceived support in Latinas may yield additional insights that are relevant for understanding social support and its correlates in Latinas and others.

The findings of this work highlight the need for additional research on the role of sociocultural factors in the expression of personality. Personality is conceptualized as an individual's typical response to environments, but studying how personalities are expressed and manifested in varying sociocultural contexts may lead to novel insights about the nature of personality. In the case of neuroticism, sociocultural context may shape particular facets of this trait and these facets may play a key role in its costs. There is general agreement that neuroticism is defined by the tendency to experience negative emotion, be easily stressed, and slow to soothe in response to frustrating situations, threats, or loss (e.g., *Costa & McCrae, 1992; John & Srivastava, 1999; Lahey, 2009*). This was captured by the TIPI measure we used. *Costa and McCrae's (1992)* NEO, however, measures six facets theorized to underlie high neuroticism: anxiety, hostility, depression, self-consciousness, impulsivity, and vulnerability. Future research can use the NEO to examine the role of these specific facets for neuroticism's costs. It may also be important to extend beyond established measures to obtain a deeper understanding of how neuroticism is experienced and expressed across sociocultural contexts. In a related vein, the measures used in these two studies have all been used in previous studies that include Latinas, but there continues to be need for additional research that validates measures in multiple populations.

For Latinas, evidence of attenuated costs of neuroticism has implications for the Latino Health paradox pattern, in which U.S. Latino immigrants show better than expected mental health and longer life despite their substantial disadvantages of low socioeconomic standing and ethnic minority status (e.g., *Abraído-Lanza et al., 1999; Alegría et al., 2008*). Recent research has emphasized the role of health behaviors, such as eating, exercise, and smoking in this counterintuitive pattern. However, it is also possible that features of Latino culture that emphasize social support, positive emotion, and physical proximity play a role in this pattern. Unfortunately, the paradox pattern disappears with more time in the United States, and it may also be the case that the buffers of Latino culture against the costs of neuroticism disappear with more time and greater exposure to the independent sociocultural norms that predominate in the United States. Although Latinas may or may not personally endorse U.S. cultural independence, they are certainly more likely to be surrounded by U.S. sociocultural norms that are linked with neuroticism's costs. We did not find differences in U.S.-born and foreign-born Latinas in Study 2, but this may have been due to our small subgroup sample size. Future research should examine how the association of neuroticism with

social and health outcomes in Latinas changes with U.S. acculturation.

A novel aspect of our work was the assessment of cortisol reactivity in Latinas and a comparison group of non-Latinas. HPA-axis functioning has important implications for health (e.g., de Kloet, Joëls, & Holsboer, 2005; Dickerson & Kemeny, 2004), but little research on this topic has focused on Latinos. More research is needed. The few studies that have examined HPA-axis functioning in Latinos have used samples that are all Latino and focused on the cortisol awakening response (CAR; e.g., Mangold et al., 2012), an index that is conceptually different from cortisol reactivity in response to an externally induced stressor that we studied. Mangold et al. (2012), however, did examine the association of neuroticism with the CAR. Interestingly, they did *not* find main effects of neuroticism for the CAR or an interaction of Neuroticism \times Time for the CAR in their all Latino sample. Rather, they only found an association of neuroticism with a more blunted CAR in interaction with higher U.S. acculturation. These findings are consistent with our theorizing that the sociocultural context of Latinos attenuates the costs of neuroticism.

The findings of this work show that the costs of neuroticism are attenuated in Latinas, but it does not follow that Latinas are less at risk for poor social and health outcomes than others. Latinas face considerable adversity from many sources, including the stressors of low SES and ethnic minority status that are known to negatively impact health. These adversities may contribute to the high rates of depression, anxiety, and attempted suicide in U.S. Latinas (Alegría et al., 2008; Zayas & Pilat, 2008). We also speculate that sociocultural contexts that value supportive, emotionally positive, and physically proximal interdependent relationships may be beneficial when relationships are available, but this same context may exacerbate distress when relationships are not available. For immigrant women, separation from social networks in their new U.S. life may pose a particularly high risk for mental and physical health. For U.S.-born women, family conflict that violates values for positive relationships may pose a particularly high risk for mental and physical health. In these circumstances, Latinas who are high in neuroticism may suffer the typical, or even amplified, costs associated with this personality vulnerability.

The present research has a number of strengths. The findings showed conceptual replication of attenuated costs of neuroticism in three domains—perceived support, distress, and cortisol reactivity—that included both subjective experience and health relevant physiology. The comparison of multiple groups that systematically differ in terms of relevant sociocultural characteristics establishes the specificity of the attenuation effects to the sociocultural characteristics of Latinos. Indeed, the observed data patterns are remarkable considering that U.S. Latinas are more likely to be of low SES than the two non-Latina comparison groups studied. From an exclusively SES perspective, we could have reasonably expected neuroticism's costs to be amplified in Latinas. There were also limitations. The Study 2 sample was small. We note, however, that this unique sample yielded novel findings indicating that attenuated costs of neuroticism for Latinas are evident in both self-report and physiology. Our work focused on women because women are more likely to be high in neuroticism, and the effects of neuroticism for blunted cortisol reactivity are more clearly established in women. High neuroticism, however, has been suggested to be more disadvantageous for men than

women, because women seek support more openly (Swickert & Owens, 2010). Thus, it will important for future research to study whether attenuated costs of neuroticism extend to Latino men. The small Study 2 sample limited our ability to examine acculturation effects, but we note that student samples are likely to be highly U.S. acculturated and this provided a more conservative test of our sociocultural context predictions. Despite these limitations, the findings of these two studies show, for the first time, that neuroticism's costs are not inevitable.

In sum, this work provides novel insight into the contribution of sociocultural factors to neuroticism's widely documented costs and the relevance of Latinos for understanding social factors implicated in these costs. As the social contexts of people high in neuroticism become better studied, we hope that a new understanding of how neuroticism's costs unfold may be generated and new entry points for interventions aimed at reducing these risks may be identified.

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