Health Psychology

ISSN: 0278-6133

2021, Vol. 40, No. 1, 62–70
http://dx.doi.org/10.1037/hea0001029

Subjective Social Status and Inflammation: The Role of Culture and Anger Control

Jose C. Yong
Australian National University

Andree Hartanto and Jacinth J. X. Tan
Singapore Management University

Objective: Research on subjective social status (SSS) and inflammation risk suffers from a lack of cross-cultural data as well as inconsistent findings between SSS and the biomarker C-reactive protein (CRP). The current study addressed these issues by examining possible cultural differences in the SSS-CRP link with anger control as an underlying mechanism while controlling for potential confounds such as wealth, education, and health factors. ***Method:*** Participants comprised 1,435 adults from the Biomarker Project of the MIDUS (American) and MIDJA (Japanese) studies. Participants' SSS and tendency to control anger were assessed through surveys, and their CRP levels were measured through fasting blood samples. ***Results:*** Results showed that for Americans, CRP levels increased as SSS decreased, but for the Japanese, there was no relationship between SSS and CRP. Furthermore, this moderating effect of culture was mediated by anger control such that Americans controlled their anger less as SSS decreased, which then predicted higher levels of CRP, whereas the Japanese controlled their anger less as SSS increased, but this relationship did not predict CRP levels. These findings were specific to anger control (and not other varieties of anger) and robust to adjustment for a variety of potential confounds. ***Conclusions:*** Our findings demonstrate that culture exerts a moderating effect on the relationship between SSS and CRP, and this effect occurs through cultural differences in how SSS relates to anger control. The current study also highlights the need to consider cultural factors and psychosocial processes in further research on SSS and health.

Keywords: subjective social status, inflammation, C-reactive protein, culture, anger control

Supplemental materials: http://dx.doi.org/10.1037/hea0001029.supp

Subjective social status (SSS) is a robust predictor of health outcomes over and above that of objective measures of socioeconomic status (SES), namely income, educational level, and occupational status (Adler, Epel, Castellazzo, & Ickovics, 2000; Hoebel & Lampert, 2020). In particular, lower SSS may elicit stress responses that alter immune system functioning, such as the upregulation of inflammatory processes (e.g., Demakakos, Nazroo, Breeze, & Marmot, 2008; Freeman, Bauldry, Volpe, Shanahan, & Shanahan, 2016). Several findings, however, have called into question the robustness of the relationship between SSS and systemic inflammation. First, some studies have noted that the link between SSS and C-reactive protein (CRP)—a clinically useful biomarker of inflammation—was attenuated after adjustment for covariates (Demakakos et al., 2008; Sousa et al., 2016). Second, existing data for status effects on inflammation were derived primarily from Western cultures (cf., Muscatell, Brosso, & Humphreys, 2018), while evidence is emerging that inflammatory processes may vary as a function of psychosocial differences across cultures (Kitayama et al., 2015; Park et al., 2013; Ryff et al., 2015).

The primary goal of the current research was to examine if the SSS-CRP link varies culturally—a possibility that has been theorized (Ryff et al., 2015) but remains untested. In addition, we examined the role of anger control as an explanation for cross-cultural differences in the SSS-CRP link. An investigation of these factors will contribute to a richer account of the mechanisms underlying SSS and health outcomes and advance our understanding of the implications of culture on key psychosocial processes.

Subjective Social Status Versus Objective Socioeconomic Status and Health

Social status can be defined objectively as levels of material resources (e.g., income, educational level, occupational status; Oakes & Rossi, 2003) or subjectively as relative rank (Cohen et al., 2008). Much research has found strong associations between low SES and poorer health across both objective and subjective measures (Cundiff & Matthews, 2017; Manuck, Phillips, Gianaros, Flory, & Muldoon, 2010). One psychobiological account is that low-SES individuals tend to experience life difficulties that elicit chronic negative affect and trigger proinflammatory stress responses (e.g., excessive cortisol production; Lupien, King,

This article was published Online First September 17, 2020.

Jose C. Yong, College of Business and Economics, Australian National University; Andree Hartanto and Jacinth J. X. Tan, School of Social Sciences, Singapore Management University.

Correspondence concerning this article should be addressed to Jose C. Yong, who is now at the Nanyang Business School, Nanyang Technological University, 52 Nanyang Avenue, Singapore 639798. E-mail: jc.yong.2012@phdps.smu.edu.sg

Meaney, & McEwen, 2001), thereby negatively impacting health (Fiscella & Franks, 1997).

Although objective and subjective status both reliably predict health, increasing attention has been paid to the role of SSS (Kraus, Piff, Mendoza-Denton, Rheinschmidt, & Keltner, 2012). As individuals' judgments of the conditions of their lives are often influenced by the local context, such as the individuals to whom they compare their wealth (Tan, Kraus, Carpenter, & Adler, 2020), their subjective construal of social standing provides incremental insights into the psychological processes that underlie health gradients (Cundiff & Matthews, 2017). Studies that use the MacArthur Scale of Subjective Status (Adler et al., 2000), which asks respondents to indicate their position on a ladder representing their social standing in localized contexts (e.g., country, society, community), have shown that SSS predicts health outcomes across a wide variety of indices, such as vulnerability to flu (Cohen et al., 2008), diabetes (Demakakos et al., 2008), respiratory illness (Singh-Manoux, Adler, & Marmot, 2003), and inflammation (Freeman et al., 2016), and these associations held despite controlling for objective markers of SES (e.g., education, income; Cohen et al., 2008; Hoebel & Lampert, 2020; Singh-Manoux et al., 2003). However, the psychological processes underlying these associations remain poorly understood.

Subjective Social Status, C-Reactive Protein, and Culture

Some findings have called into question the robustness of the link between SSS and inflammation, particularly with CRP as an indicator. Inflammation is indexed by a range of biomarkers including icytokines/chemokines, immune-related effectors, acute phase proteins, reactive oxygen and nitrogen species, prostaglandins, and cyclooxygenase-related factors (Brenner et al., 2014). Among these, CRP (an acute phase protein found in the blood) is commonly used due to its sensitivity and ease of collection. Some studies have, however, observed a weakening of the SSS-CRP link after controlling for important covariates such as wealth, education, body mass index, health-related behaviors (e.g., smoking, drinking), and chronic diseases (G. D. Smith et al., 2005; Demakakos et al., 2008; Sousa et al., 2016). While this reduced significance may be due partly to treating covariates as mediators in adjusted models rather than as confounds, these findings nonetheless highlight the need to verify the efficacy of CRP as an index of inflammation.

Furthermore, there is growing evidence that inflammatory processes are contingent on psychosocial characteristics that differ between cultures (Kitayama et al., 2015; Park et al., 2013; Ryff et al., 2015). For instance, reflecting cultural differences in self- versus other-orientation (Miyamoto et al., 2018), Americans' perceived constraints (i.e., not being able to do what they wanted to do) related more to compromised personal control, whereas perceived constraints for the Japanese were associated more with strained social relationships (Kitayama, Karasawa, Curhan, Ryff, & Markus, 2010). Correspondingly, personal control was found to be a stronger predictor of health for Americans, whereas relational strain was found to predict health more strongly for the Japanese. These emerging findings suggest that cultural differences may affect how status disparities matter for health, particularly through culturally distinct psychosocial experiences such as frustration and anger (Ryff et al., 2015).

Anger Control and Inflammation

Anger arises from feelings of injustice and has been linked to deleterious health behaviors such as alcoholism and drug abuse (Nichols, Mahadeo, Bryant, & Botvin, 2008; Sakusic et al., 2010). Anger also has been found to undermine relationships (Baron et al., 2007) and contribute to aggression in social contexts ranging from families (Mammen, Pilkonis, & Kolko, 2000) to workplaces (Hershcovis et al., 2007). High trait anger is correlated with poorer cardiovascular health (Williams, 2010) and various physical illnesses (Suinn, 2001).

Research on anger effects typically looks at *felt anger* (experience of anger arousal), *anger expression* (behavioral manifestation of anger arousal), and *anger control* (ability to manage angry feelings; Boylan & Ryff, 2013; Spielberger, Krasner, & Solomon, 1988), which have been documented to predict unique outcomes. For instance, Diong et al. (2005) found that felt anger was directly related to stress and lower perceived support, indirectly to avoidance coping, and both directly and indirectly to psychological distress and reduced psychological well-being. By contrast, anger control was associated with active and reappraisal coping and less avoidance coping. In turn, active and reappraisal coping predicted better psychological and physical health, whereas the opposite was true for avoidance coping.

While felt and expressed anger are often associated with poorer health, anger control determines whether anger persists enough to affect well-being. Anger is a ubiquitous emotion that is normally experienced by well-adjusted individuals (Tavris, 1982). However, whether mundane anger intensifies into full-blown or chronic rage and then takes a toll depends on the ability to manage anger. Reflecting self-control processes that promote effective coping, anger control allows individuals to remain calm while engaging in activities that allow the experience of negative affect to dissipate (Deffenbacher, Oetting, Lynch, & Morris, 1996). Importantly, anger control does not involve denying or suppressing anger when it occurs, which is characteristic of the "anger in" subdimension of anger expression and associated with increased arousal (i.e., higher pulse rate and blood pressure; Spielberger et al., 1988); rather, healthy regulation involves acknowledging those feelings, remaining composed, and engaging in appropriate actions to quell the anger (Kassinove & Tafrate, 2002).

Research has indeed shown that anger control is negatively related to inflammation (Diong et al., 2005) and positively associated with adaptive immune processes, lower cortisol reactivity to stressors (Gouin, Kiecolt-Glaser, Malarkey, & Glaser, 2008), and reduced cardiovascular reactivity (Mauss, Cook, & Gross, 2007). Some studies also have reported that anger control has stronger implications for health compared to felt anger or anger expression (Zilioli, Imami, Ong, Lumley, and Gruenewald 2017), particularly through inflammation as indexed by CRP (Boylan & Ryff, 2013). Thus, a focus on the relationship between anger control and inflammation may help to shed light on cultural differences in the SSS-CRP link.

The Role of Anger Control in Cultural Differences in the SSS-CRP Link

Research suggests that socially disadvantaged people are prone to anger due to life struggles and frustrations (Berkowitz, 1989; Markus, Ryff, Curhan, & Palmersheim, 2004). However, recent cross-country evidence indicates that culture may moderate this relationship between SSS and anger. While anger was expressed more among low- rather than high-status individuals in the United States, this was reversed in Japan where anger was expressed more among high- rather than low-status individuals (Park et al., 2013). These differences were argued to be due to cultural variations in the function of anger. As individuals with lower status have fewer life affordances relative to higher-status individuals, anger expression serves to vent frustrations associated with subordinate status in the United States (Berkowitz, 1989). By contrast, as Japanese interdependence orientation places a premium on social harmony, anger expression is frowned upon, while emotional control is routinely practiced (Matsumoto, Yoo, Nakagawa, & the 37 members of the Multinational Study of Cultural Display Rules, 2008). Moreover, as being in a position of power entitles the Japanese to express themselves (Taylor & Risman, 2006), anger is expressed more by high- versus low-status individuals in Japan (Park et al., 2013). Thus, anger may carry less negative health implications for the Japanese given that anger is an offshoot of privilege in Japan but of disadvantage in the United States. Indeed, Kitayama et al. (2015) showed that the link between anger expression and elevated health risks was robust for Americans, whereas anger expression predicted reduced health risks for the Japanese. Together, these findings suggest that anger-related factors may have more serious health implications for Americans than the Japanese.

Extending from these findings, we proposed that cultural variations in anger control may explain cross-cultural differences in the SSS-CRP link. Although studies have examined cultural differences in the relationship between SSS and anger expression but not anger control (Park et al., 2013), we speculated that restraint as a flipside to expression indicates that anger control will be exercised less by those who are more prone to anger (Zimprich & Mascherek, 2012). As such, we predicted that in the United States, high-SSS individuals would control their anger more than low-SSS individuals, whereas the opposite will be observed in Japan. Furthermore, as anger is more pertinent to difficulties for Americans than the Japanese, we predicted a stronger association between anger control and less inflammation for Americans.

The Current Study

We utilized data from the parallel Biomarker Projects of Midlife in the United States (MIDUS) and Midlife in Japan (MIDJA), which enabled us to test two central predictions—(a) culture moderates the relationship between SSS and inflammation as indexed by CRP, and (b) the moderating effect of culture on the SSS-CRP link is mediated by cultural differences in how SSS relates to anger control—with large and culturally representative samples while controlling for possible confounds. These data sets have been widely used to study cultural moderations of inflammatory predictors, including anger expression (Park et al., 2013), negative affectivity (Ishii, 2019), and social inequality (Ryff et al., 2015).

Method

Participants

To be eligible for the MIDUS and MIDJA Biomarker Project, participants had to complete the initial MIDUS or MIDJA survey and then indicate interest in the subsequent Biomarker Project. An initial set of 4,244 American and 1,027 Japanese midlife adults was randomly selected from across the United States and the Tokyo metropolitan area, respectively. Of these, 1,054 Americans and 382 Japanese eventually participated in the Biomarker Project, making up a total of 1,435 participants in the present research. MIDUS and MIDJA Biomarker Project participants were largely similar to those who participated only in the initial survey.[1] The MIDUS Biomarker Project sample, which was more ethnically heterogenous than the MIDJA Biomarker Project sample, consisted of 89.7% White, 2.6% African American, 1.1% Native American, 0.3% Asian, and 3.5% multiracial participants, and one MIDUS Biomarker Project participant was excluded due to missing data.

Participants in the MIDUS Biomarker Project stayed overnight at one of three clinical research centers in the United States (University of California, Los Angeles; Georgetown University; and University of Wisconsin-Madison) to have their fasting blood sample collected before breakfast on the second day (Love, Seeman, Weinstein, & Ryff, 2010). Similarly, participants in the MIDJA Biomarker Project had their fasting blood samples collected at the Yuki Medical Clinic situated near the University of Tokyo (Coe et al., 2011).

Ethics

Data collection for the MIDUS was approved by the Health Sciences Institutional Review Boards at the University of Wisconsin-Madison; University of California, Los Angeles; and Georgetown University, while data collection for the MIDJA was approved by the University of Tokyo. Data and materials from the MIDUS and MIDJA can be accessed via the Inter-University Consortium for Political and Social Research website at http://www.icpsr.umich.edu.

Measures

C-reactive protein. CRP was measured from blood samples collected between 0500 and 0700 for the entire American sample and between 0900 and 1145 for over 95% of the Japanese sample.

[1] American participants who participated in the Biomarker Project were similar to those who did not participate in terms of demographics (e.g., age, sex, race, marital status, economic status) and health characteristics (e.g., number of chronic diseases, number of physician visits in the prior year), except that Biomarker Project participants were more educated and less likely to smoke (Love et al., 2010). Similarly, Japanese participants who participated in the Biomarker Project were similar to those who did not participate in terms of demographics (e.g., age, educational attainment, family size, marital status, economic status) and health characteristics (e.g., number of chronic diseases, number of prescription medications taken, number of physician visits in the prior year), except that there was a higher proportion of women who participated further in the Biomarker Project and that Biomarker Project participants were less likely to smoke (Boylan, Tsenkova, Miyamoto, & Ryff, 2017).

The samples were stored in a −60°C to −80°C freezer before shipment on dry ice to the MIDUS Biocore Lab at the University of Wisconsin-Madison, after which they were assayed at either the MIDUS Biocore Laboratory or the Laboratory for Clinical Biochemistry Research (University of Vermont). CRP was measured using the BNII nephelometer (N Antiserum to Human Fibrinogen; Dade Behring, Inc., Deerfield, IL) with a particle-enhanced immunonepholometric assay range of 0.175–1100 μg/mL (reference range < 3 μg/mL). The laboratory intra- and interassay coefficients of variance for CRP were in acceptable ranges, with the ranges of the intraassay variance coefficient between 2.3% and 4.4% and the interassay variance between 2.1% and 5.7%. CRP scores were winsorized and log-transformed to reduce the influence of extreme outliers and skewness. There may be some concerns over the difference in blood collection timing between American and Japanese participants. Although temporal effects have been suggested for some inflammatory biomarkers such as interleukin-6 (Vgontzas et al., 2005) and fibrinogen (Kanabrocki et al., 1999), CRP has been found to be relatively stable across the day (Meier-Ewert et al., 2001). Thus, blood collection timing is unlikely to affect the findings of the current investigation.

Subjective social status. SSS was assessed using the MacArthur Scale of Subjective Social Status (Adler et al., 2000), which is widely used to measure social status in studies of culture (e.g., Hartanto, Lau, & Yong, 2020; Operario, Adler, & Williams, 2004) and health (e.g., Demakakos et al., 2008; Singh-Manoux et al., 2003). Participants were shown a picture of a ladder and instructed to rate their perceived social standing in their community by choosing the most appropriate rung ranging from 1 (reflects lowest SSS) to 10 (reflects highest SSS). The American sample had higher SSS ($M = 6.59$, $SD = 1.72$) than the Japanese sample ($M = 6.24$, $SD = 2.04$), $t = 3.20$, $p = .001$, but the distribution of SSS scores is relatively similar across both data sets, with the American sample having a skewness value of −0.809 ($SE = 0.076$) and the Japanese sample having a skewness value of −0.648 ($SE = 0.126$; see Appendix A in the online supplemental materials). While other measures of SSS may exist and the majority of studies have used the country (e.g., Cohen et al., 2008; Freeman et al., 2016) or society (e.g., Adler et al., 2000; Demakakos et al., 2008) versions of the ladder, we were limited by the fact that only the community ladder was available in our data set.

Anger control. Anger control was measured with the four-item Anger Control subscale of Spielberger's (1996) State-Trait Anger Expression Inventory, which is a cross-culturally validated and commonly used measure of anger tendencies (e.g., De Mojá, & Spielberger, 1997; P. B. Smith et al., 2016). Participants rated how often they attempt to manage their anger (e.g., "I control my temper"; "I keep my cool") on a scale of 1 (*almost never*) to 4 (*almost always*), and a composite score was derived by averaging the responses to these items ($\alpha_{MIDUS} = .69$ and $\alpha_{MIDJA} = .70$).

Covariates. Across culture, education attainment was standardized with a 7-point scale (1 = *eighth grade, junior high school*; 2 = *some high school, no diploma*; 3 = *graduated from high school*; 4 = *attended college, degree*; 5 = *graduated from 2 years college or vocational school*; 6 = *graduated from 4 or 5 years college (bachelor's degree)*; 7 = *attended or graduated from graduate school*), and occupational status was standardized with a 3-point scale (1 = *manual, blue-collar, or service*; 2 = *non-manual, white-collar, or clerical*; 3 = *managerial or professional*), which is consistent with operationalizations in previous studies using MIDUS and MIDJA data sets (Hartanto et al., 2020; Kitayama et al., 2015; Park et al., 2013). Health status was measured in terms of the number of chronic diseases (e.g., diabetes) experienced in the past 12 months. Obesity was indexed by waist-to-hip ratio (cf., Hartanto & Yong, 2018), calculated as the ratio of participants' waist around the navel to their hips at the widest point. Negative affectivity was measured by asking participants to rate how often they experienced six negative emotions (e.g., sad, hopeless, worthless) over the past 30 days (Mroczek & Kolarz, 1998) on a scale of 1 (*none of the time*) to 5 (*all of the time*), and items were averaged to derive a composite score.

Data Analysis

First, we aimed to test for cultural differences in the relationship between SSS and CRP. Second, we sought to determine whether these culturally distinct relationships are mediated by cultural differences in the relationship between SSS and anger control. In other words, the hypothesized mediated moderation would be confirmed when the difference between Americans and the Japanese in the SSS-CRP link is mediated by the difference between Americans and the Japanese in the relationship between SSS and anger control.

For our first prediction, we conducted a series of moderation analyses to test for an interaction effect between SSS and culture on CRP. When a significant two-way interaction of SSS × Culture was observed, simple slopes were computed to probe the interaction. To ensure the robustness of the hypothesized two-way interaction, we conducted three separate analyses, each with an additional set of covariates included. In the first model, we controlled for age, sex, education attainment, and occupational status to ensure that the associations between SSS and CRP held beyond the contribution of demographic factors and objective markers of SES. Second, we controlled for general health status and health behaviors that are known to covary with inflammation, including smoking experience, alcohol consumption, number of chronic diseases experienced in the past 12 months, and obesity (Kelley & Dantzer, 2011; Niskanen et al., 2004). Last, we controlled for negative affectivity to rule out potential emotion and mood confounds (Kelley & Dantzer, 2011).

For our second prediction, we conducted mediated moderation analyses using the SPSS PROCESS macro with 5,000 bias-corrected bootstrap samples to estimate the conditional indirect effect of culture through anger control on the relationship between SSS and CRP. Mediated moderation was considered significant if the 95% bias-corrected confidence intervals for the index of mediated moderation did not include zero (Hayes, 2015). Missing data in our analyses were imputed using an expectation-maximization algorithm (Dempster, Laird, & Rubin, 1977) with missing at random as our assumption.

Results

The descriptive statistics of each group's demographic and other key variables are presented in Appendix B in the online supplemental materials. American participants in the MIDUS Biomarker Project sample were significantly older, more educated, higher in waist-to-hip ratio, less likely to smoke, less likely to drink alcohol,

and less likely to experience negative emotions than the Japanese participants in the MIDJA Biomarker Project sample ($ps < .001$). It is interesting to note that the Japanese sample had lower CRP levels than the American sample, $t = 8.58$, $p < .001$, despite smoking and drinking more. These covariates were systematically controlled for in our main analyses.

Moderation analyses revealed significant two-way interactions of SSS × Culture on CRP (see Appendix C in the online supplemental materials) after controlling for demographics and SES in the first model ($\beta = .074$, $B = .039$, $SE = .015$, 95% CI [.010, .068], $t = 2.661$, $p = .008$), health status and health behaviors in the second model ($\beta = .064$, $B = .034$, $SE = .014$, [.006, .062], $t = 2.378$, $p = .018$), and negative affectivity in the third model ($\beta = .065$, $B = .034$, $SE = .014$, [.006, .062], $t = 2.389$, $p = .017$). SSS uniquely explained 0.3% of CRP variance in the first model, 0.2% of CRP variance in the second model, and 0.2% of CRP variance in the third model. Similarly, the interaction between SSS and culture uniquely explained 0.4% of CRP variance in the first model, 0.3% of CRP variance in the second model, and 0.3% of CRP variance in the third model.

Next, we probed the two-way interaction by conducting simple slopes analyses on the relationship between SSS and CRP for each culture. For American participants, we found significant negative associations between SSS and CRP across all three models: Model 1 ($B = -.023$, $SE = .009$, $p = .011$), Model 2 ($B = -.017$, $SE = .009$, $p = .048$), and Model 3 ($B = -.018$, $SE = .009$, $p = .046$). In contrast, the associations between SSS and CRP were nonsignificant for the Japanese sample across all models: Model 1 ($B = .017$, $SE = .012$, $p = .170$), Model 2 ($B = .017$, $SE = .012$, $p = .152$), and Model 3 ($B = .016$, $SE = .012$, $p = .167$). These results suggest that SSS independently predicted CRP only for Americans (see Appendix D in the online supplemental materials).

Having found that culture moderated the SSS-CRP link, we tested our second prediction by conducting mediated moderation analyses to determine whether the moderating effect of culture on the SSS-CRP link was mediated by cultural differences in the relationship between SSS and anger control. As shown in Appendix E in the online supplemental materials, we found significant two-way interactions between SSS and culture on anger control after controlling for demographics and SES in the first model ($\beta = -.108$, $B = -.253$, $SE = .071$, 95% CI [−.392, −.114], $t = -3.580$, $p < .001$), health status and health behaviors in the second model ($\beta = -.104$, $B = -.245$, $SE = .071$, [−.383, −.106], $t = -3.468$, $p < .001$), and negative affectivity in the third model ($\beta = -.103$, $B = -.242$, $SE = .071$, [−.380, −.103], $t = -3.419$, $p < .001$).

Simple slopes analyses revealed that SSS was positively associated with anger control for the American sample in all models: Model 1 ($B = .140$, $SE = .042$, $p = .001$), Model 2 ($B = .127$, $SE = .043$, $p = .003$), and Model 3 ($B = .116$, $SE = .044$, $p = .008$). In contrast, SSS was negatively associated with anger control for the Japanese sample in all models: Model 1 ($B = -.114$, $SE = .058$, $p = .051$), Model 2 ($B = -.118$, $SE = .058$, $p = .043$), and Model 3 ($B = -.125$, $SE = .059$, $p = .032$; see Appendix F in the online supplemental materials).

Last, we tested the significance of the overall hypothesized mediated moderation models using the SPSS PROCESS macro. The mediated-moderation effect was significant across all models: Model 1 ($B = .0029$, $SE = .0017$, 95% CI [.0001, .0069]), Model 2 ($B = .0028$, $SE = .0016$, [.0002, .0065]), and Model 3 ($B = .0028$, $SE = .0016$, [.0002, .0066]), thus indicating that differences between American and Japanese participants in the relationship between SSS and CRP were mediated by anger control and cultural variations in the relations between SSS and anger control.

To confirm that these relationships were specific to anger control and not other varieties of anger, we also conducted mediated-moderation analyses with other anger types that were available in the MIDUS and MIDJA data sets as potential mediators, specifically anger in (i.e., anger suppression), anger out (i.e., anger expression), anger adjustment, and trait anger. As shown in Appendix G in the online supplemental materials, only anger control mediated the differences between American and Japanese participants in the relationship between SSS and CRP. Furthermore, as shown in Appendix H in the online supplemental materials, this is likely due to the fact that only anger control and not any of the other types of anger significantly predicted CRP across all models ($ps < .05$).

Discussion

Using culturally distinct samples from the MIDUS and MIDJA Biomarker Project, we examined the moderating effect of culture on the SSS-CRP link and whether this effect is driven by cultural differences in the relationship between SSS and anger control while controlling for potential confounds. As predicted, culture moderated the SSS-CRP link—for American participants, CRP levels decreased as SSS increased, but for Japanese participants, there was no relationship between SSS and CRP. Furthermore, anger control mediated the moderating effect of culture—American participants controlled their anger less as SSS decreased, which predicted higher levels of CRP; conversely, although Japanese participants controlled their anger less as SSS increased, this relationship was unrelated to CRP levels. These findings are specific to anger control and robust over a range of covariates, including demographics, objective SES, health status, health behaviors, and negative affectivity.

Our results are consistent with research on cultural differences in anger tendencies as a function of social status (Park et al., 2013; Ryff et al., 2015). As anger is associated with frustrations in the American cultural context, the tendency to control anger increased with status and was therefore linked to less inflammation for Americans (Berkowitz, 1989). By contrast, anger control bore little significance on inflammation risk for the Japanese as emotional control is normative in Japan (Matsumoto et al., 2008) and anger propensity stems from the privilege of status, which is a desirable circumstance (Park et al., 2013).

We also observed lower CRP levels in the Japanese sample despite their higher rates of smoking and alcohol consumption compared to the American sample. While explaining cultural nuances in the impact of health-risking activities was beyond the scope of our investigation, this finding highlights the importance of paying heed to culture in research on health factors. For example, noted that in the United States, adults with more education were less likely to have ever smoked compared to adults with less education, whereas in Japan, more educated adults were more likely to have ever smoked compared to less educated adults. Furthermore, among those who had ever smoked, the Japanese were more likely to continue than the Americans. Plausibly, psy-

chological or lifestyle factors that accompany or contribute to such behaviors (e.g., smoking or drinking due to social status, socializing, business, etc.) may buffer against their alleged harms and are worthy of further scrutiny.

The culturally contingent approach of the present research carries useful implications for doctors and health practitioners. Clinical practice often aims to alleviate negative health symptoms through medication, but more holistic treatment would address the broader psychosocial factors that contribute to chronic somatization (Baer, 2004). In particular, people may have physical symptoms that stem from psychiatric conditions such as frustration or anxiety that are triggered by habitual experiences, and knowing how to modify lifestyle behaviors or engage in coping behaviors may nip the problem in the bud without resorting to prescription drugs that treat superficially while carrying side effects (Li, Yong, & Van Vugt, 2020). Insights from our findings include imparting coping skills guided by anger control, particularly to those who perceive themselves to be low in status and are thus prone to frustration, or promoting lifestyles that encourage healthy emotion regulation (e.g., meditation, mindfulness) or engagement in activities that shift focus away from social comparisons (e.g., art therapy, participating in social causes).

In sum, the current investigation demonstrated that our understanding of health and functioning can benefit from an appreciation of cultural differences in psychosocial factors. Numerous psychosocial factors already have been studied to understand their health risks, including education (Boylan & Ryff, 2013), neighborhood poverty (Leventhal & Brooks-Gunn, 2003), and attachment style (Liu, Cohen, Schulz, & Waldinger, 2011). Our findings build upon research that implicates the role of cultural distinct pathways underlying well-being. For instance, Hartanto et al. (2020) found that the relationship between social obligations and health depended on cultural variations in how obligations were perceived, such as whether they were a hindrance to individual autonomy or important for relational harmony. Thus, we stress the need for further investigations of culture, inflammation, somatization, and health risks in other psychosocial contexts to gain a better understanding of the cultural dynamics of well-being.

Limitations and Further Research

Despite utilizing large samples and ruling out many confounding factors, some limitations exist. First, although our model implies that SSS influences CRP levels, the use of correlational data hinders this causal inference. Future studies can experimentally manipulate SSS (e.g., Kraus, Côté, & Keltner, 2010) to examine whether the effect of momentary experiences of status on inflammation differs by culture or conduct longitudinal observations of cross-cultural health trajectories as a function of SSS. Studying health trajectories can help with understanding not only the mechanisms underlying SSS and health but also the onset age of SSS as a protective or risk factor of inflammation (e.g., Robert et al., 2009).

Second, midlife and older adults made up the MIDUS and MIDJA samples, thus limiting the generalizability of our findings to younger cohorts that might differ in their perceptions of and responses to status disparities (Coie, Dodge, & Coppotelli, 1982). American and Japanese individuals also differ in other psychosocial aspects that might contribute to variance in the findings, such as authority deference (Tyler, Lind, & Huo, 2000) and income inequality (Lindert & Williamson, 2017). Further consideration of these factors will enrich our understanding of the cultural dynamics underlying social status and health.

Third, as we were limited by what was available in the data set, SSS was assessed with the community ladder (Adler et al., 2000) and not other versions (e.g., country, society) that are used more often in health studies (e.g., Demakakos et al., 2008; Freeman et al., 2016). This limitation notwithstanding, given that the community ladder taps on more local comparisons of SES than the country or society ladder, the community ladder may be especially relevant for and impactful on well-being (Anderson, Kraus, Galinsky, & Keltner, 2012). A recent meta-analysis indeed showed that the community ladder was uniquely associated with health outcomes after accounting for the country ladder and objective SES (Zell, Strickhouser, & Krizan, 2018), thereby suggesting that social comparisons with more proximal others has greater health implications compared to social comparisons with more distal others. Furthermore, our use of the community ladder constitutes a novel contribution as we demonstrated its utility for health studies. That said, a more conservative interpretation of our findings is that culture and anger control are specifically associated with how *local* comparisons underlying SSS relate to CRP. Thus, a pertinent future direction is to examine whether these results also apply to country- or society-based SSS.

It is possible that the findings may have followed from our arguments simply because some arguments were based on published findings gleaned from the same data set. For example, we relied on the findings of Boylan and Ryff (2013), Park et al. (2013), and Kitayama et al. (2015), which were similarly derived from MIDUS and MIDJA samples, to substantiate our predictions. However, our arguments were also based on studies that were independent of MIDUS and MIDJA (e.g., Berkowitz, 1989; Diong et al., 2005; Matsumoto et al., 2008; Taylor & Risman, 2006), and our focus on anger control is novel where MIDUS and MIDJA studies are concerned. Nonetheless, future studies should aim to replicate and extend these findings with newer and broader cultural samples.

Last, some statistical concerns exist. Although we hypothesized that anger control was related to inflammation for Americans but not the Japanese due to distinct cultural pathways underlying anger, another possibility is that there might be significantly less variability in CRP in the relatively smaller Japanese sample, thus rendering it harder to find significant effects. The results also should be interpreted with caution as the Cronbach's alpha for anger control was low in both samples (α_{MIDUS} = .69 and α_{MIDJA} = .70) and the standardized beta coefficients of the SSS × CRP interaction (.064 to .074) suggest small effect sizes. Nevertheless, these small effect sizes are not trivial in the context of CRP. The variance explained by SSS and the interaction between SSS and culture on CRP are similar to if not higher than many important variables such as education status (Friedman & Herd, 2010), alcohol consumption (Mukamal, Cushman, Mittleman, Tracy, & Siscovick, 2004), and negative emotional experience (Sin, Graham-Engeland, Ong, & Almeida, 2015). Taken together, further studies with other populations, methods, and measures are warranted.

Conclusion

Drawing on two large and culturally distinct data sets, we demonstrated that culture moderated the link between SSS and CRP through differences in anger control. By shedding light on the psychosocial factors that underlie inflammation, the current study advances our understanding of health and well-being while highlighting the need to consider psychosocial factors within their cultural context in future research.

References

Adler, N. E., Epel, E. S., Castellazzo, G., & Ickovics, J. R. (2000). Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy white women. *Health Psychology, 19,* 586–592. http://dx.doi.org/10.1037/0278-6133.19.6.586

Anderson, C., Kraus, M. W., Galinsky, A. D., & Keltner, D. (2012). The local-ladder effect: Social status and subjective well-being. *Psychological Science, 23,* 764–771. http://dx.doi.org/10.1177/0956797611434537

Baer, H. (2004). *Toward an integrative medicine: Merging alternative therapies with biomedicine*. Walnut Creek, CA: Altamira Press.

Baron, K. G., Smith, T. W., Butner, J., Nealey-Moore, J., Hawkins, M. W., & Uchino, B. N. (2007). Hostility, anger, and marital adjustment: Concurrent and prospective associations with psychosocial vulnerability. *Journal of Behavioral Medicine, 30,* 1–10. http://dx.doi.org/10.1007/s10865-006-9086-z

Berkowitz, L. (1989). Frustration-aggression hypothesis: Examination and reformulation. *Psychological Bulletin, 106,* 59–73. http://dx.doi.org/10.1037/0033-2909.106.1.59

Boylan, J. M., & Ryff, C. D. (2013). Varieties of anger and the inverse link between education and inflammation: Toward an integrative framework. *Psychosomatic Medicine, 75,* 566–574. http://dx.doi.org/10.1097/PSY.0b013e31829683bd

Boylan, J. M., Tsenkova, V. K., Miyamoto, Y., & Ryff, C. D. (2017). Psychological resources and glucoregulation in Japanese adults: Findings from MIDJA. *Health Psychology, 36,* 449–457. http://dx.doi.org/10.1037/hea0000455

Brenner, D. R., Scherer, D., Muir, K., Schildkraut, J., Boffetta, P., Spitz, M. R., . . . Hung, R. J. (2014). A review of the application of inflammatory biomarkers in epidemiologic cancer research. *Cancer Epidemiology, Biomarkers & Prevention, 23,* 1729–1751. http://dx.doi.org/10.1158/1055-9965.EPI-14-0064

Coe, C. L., Love, G. D., Karasawa, M., Kawakami, N., Kitayama, S., Markus, H. R., . . . Ryff, C. D. (2011). Population differences in proinflammatory biology: Japanese have healthier profiles than Americans. *Brain, Behavior, and Immunity, 25,* 494–502. http://dx.doi.org/10.1016/j.bbi.2010.11.013

Cohen, S., Alper, C. M., Doyle, W. J., Adler, N., Treanor, J. J., & Turner, R. B. (2008). Objective and subjective socioeconomic status and susceptibility to the common cold. *Health Psychology, 27,* 268–274. http://dx.doi.org/10.1037/0278-6133.27.2.268

Coie, J. D., Dodge, K. A., & Coppotelli, H. (1982). Dimensions and types of social status: A cross-age perspective. *Developmental Psychology, 18,* 557–570. http://dx.doi.org/10.1037/0012-1649.18.4.557

Cundiff, J. M., & Matthews, K. A. (2017). Is subjective social status a unique correlate of physical health? A meta-analysis. *Health Psychology, 36,* 1109–1125. http://dx.doi.org/10.1037/hea0000534

Deffenbacher, J. L., Oetting, E. R., Lynch, R. S., & Morris, C. D. (1996). The expression of anger and its consequences. *Behaviour Research and Therapy, 34,* 575–590. http://dx.doi.org/10.1016/0005-7967(96)00018-6

Demakakos, P., Nazroo, J., Breeze, E., & Marmot, M. (2008). Socioeconomic status and health: The role of subjective social status. *Social Science & Medicine, 67,* 330–340. http://dx.doi.org/10.1016/j.socscimed.2008.03.038

De Mojá, C. A., & Spielberger, C. D. (1997). Anger and drug addiction. *Psychological Reports, 81,* 152–154. http://dx.doi.org/10.2466/pr0.1997.81.1.152

Dempster, A. P., Laird, N. M., & Rubin, D. B. (1977). Maximum likelihood from incomplete data via the EM algorithm. *Journal of the Royal Statistical Society Series B: Methodological, 39,* 1–22. http://dx.doi.org/10.1111/j.2517-6161.1977.tb01600.x

Diong, S. M., Bishop, G. D., Enkelmann, H. C., Tong, E. M. W., Why, Y. P., Ang, J. C. H., & Khader, M. (2005). Anger, stress, coping, social support and health: Modelling the relationships. *Psychology & Health, 20,* 467–495. http://dx.doi.org/10.1080/08870440405123313339 60

Fiscella, K., & Franks, P. (1997). Does psychological distress contribute to racial and socioeconomic disparities in mortality? *Social Science & Medicine, 45,* 1805–1809. http://dx.doi.org/10.1016/S0277-9536(97)00111-1

Freeman, J. A., Bauldry, S., Volpe, V. V., Shanahan, M. J., & Shanahan, L. (2016). Sex differences in associations between subjective social status and C-reactive protein in young adults. *Psychosomatic Medicine, 78,* 542–551. http://dx.doi.org/10.1097/PSY.0000000000000309

Friedman, E. M., & Herd, P. (2010). Income, education, and inflammation: Differential associations in a national probability sample (the MIDUS study). *Psychosomatic Medicine, 72,* 290–300. http://dx.doi.org/10.1097/PSY.0b013e3181cfe4c2

Gouin, J.-P., Kiecolt-Glaser, J. K., Malarkey, W. B., & Glaser, R. (2008). The influence of anger expression on wound healing. *Brain, Behavior, and Immunity, 22,* 699–708. http://dx.doi.org/10.1016/j.bbi.2007.10.013

Hartanto, A., Lau, I. Y.-M., & Yong, J. C. (2020). Culture moderates the link between perceived obligation and biological health risk: Evidence of culturally distinct pathways for positive health outcomes. *Social Science & Medicine, 244,* 112644. http://dx.doi.org/10.1016/j.socscimed.2019.112644

Hartanto, A., & Yong, J. C. (2018). Measurement matters: Higher waist-to-hip ratio but not body mass index is associated with deficits in executive functions and episodic memory. *PeerJ, 6,* e5624. http://dx.doi.org/10.7717/peerj.5624

Hayes, A. F. (2015). An index and test of linear moderated mediation. *Multivariate Behavioral Research, 50,* 1–22. http://dx.doi.org/10.1080/00273171.2014.962683

Hershcovis, M. S., Turner, N., Barling, J., Arnold, K. A., Dupré, K. E., Inness, M., . . . Sivanathan, N. (2007). Predicting workplace aggression: A meta-analysis. *Journal of Applied Psychology, 92,* 228–238. http://dx.doi.org/10.1037/0021-9010.92.1.228

Hoebel, J., & Lampert, T. (2020). Subjective social status and health: Multidisciplinary explanations and methodological challenges. *Journal of Health Psychology, 25,* 173–185. http://dx.doi.org/10.1177/1359105318800804

Ishii, K. (2019). Cultural influences in somatosensory amplification and their association with negative affective states. *Asian Journal of Social Psychology, 22,* 106–112. http://dx.doi.org/10.1111/ajsp.12342

Kanabrocki, E. L., Sothern, R. B., Messmore, H. L., Roitman-Johnson, B., McCormick, J. B., Dawson, S., . . . Scheving, L. E. (1999). Circadian interrelationships among levels of plasma fibrinogen, blood platelets, and serum interleukin-6. *Clinical and Applied Thrombosis/Hemostasis, 5,* 37–42. http://dx.doi.org/10.1177/107602969900500108

Kassinove, H., & Tafrate, R. C. (2002). *The practical therapist series. Anger management: The complete treatment guidebook for practitioners*. Atascadero, CA: Impact Publishers.

Kelley, K. W., & Dantzer, R. (2011). Alcoholism and inflammation: Neuroimmunology of behavioral and mood disorders. *Brain, Behavior, and Immunity, 25*(Suppl. 1), S13–S20. http://dx.doi.org/10.1016/j.bbi.2010.12.013

Kitayama, S., Karasawa, M., Curhan, K. B., Ryff, C. D., & Markus, H. R. (2010). Independence and interdependence predict health and wellbeing: Divergent patterns in the United States and Japan. *Frontiers in Psychology, 1,* 163. http://dx.doi.org/10.3389/fpsyg.2010.00163

Kitayama, S., Park, J., Boylan, J. M., Miyamoto, Y., Levine, C. S., Markus, H. R., . . . Ryff, C. D. (2015). Expression of anger and ill health in two cultures: An examination of inflammation and cardiovascular risk. *Psychological Science, 26,* 211–220. http://dx.doi.org/10.1177/0956797614561268

Kraus, M. W., Côté, S., & Keltner, D. (2010). Social class, contextualism, and empathic accuracy. *Psychological Science, 21,* 1716–1723. http://dx.doi.org/10.1177/0956797610387613

Kraus, M. W., Piff, P. K., Mendoza-Denton, R., Rheinschmidt, M. L., & Keltner, D. (2012). Social class, solipsism, and contextualism: How the rich are different from the poor. *Psychological Review, 119,* 546–572. http://dx.doi.org/10.1037/a0028756

Leventhal, T., & Brooks-Gunn, J. (2003). Moving to opportunity: An experimental study of neighborhood effects on mental health. *American Journal of Public Health, 93,* 1576–1582. http://dx.doi.org/10.2105/AJPH.93.9.1576

Li, N. P., Yong, J. C., & Van Vugt, M. (2020). Evolutionary psychology's next challenge: Solving modern problems using a mismatch perspective. *Evolutionary Behavioral Sciences*. Advance online publication. http://dx.doi.org/10.1037/ebs0000207

Lindert, P. H., & Williamson, J. G. (2017). Inequality in the very long run: Malthus, Kuznets, and Ohlin. *Cliometrica, 11,* 289–295. http://dx.doi.org/10.1007/s11698-016-0153-6

Liu, L., Cohen, S., Schulz, M. S., & Waldinger, R. J. (2011). Sources of somatization: Exploring the roles of insecurity in relationships and styles of anger experience and expression. *Social Science & Medicine, 73,* 1436–1443. http://dx.doi.org/10.1016/j.socscimed.2011.07.034

Love, G. D., Seeman, T. E., Weinstein, M., & Ryff, C. D. (2010). Bioindicators in the MIDUS national study: Protocol, measures, sample, and comparative context. *Journal of Aging and Health, 22,* 1059–1080. http://dx.doi.org/10.1177/0898264310374355

Lupien, S. J., King, S., Meaney, M. J., & McEwen, B. S. (2001). Can poverty get under your skin? Basal cortisol levels and cognitive function in children from low and high socioeconomic status. *Development and Psychopathology, 13,* 653–676. http://dx.doi.org/10.1017/S0954579401003133

Mammen, O. K., Pilkonis, P. A., & Kolko, D. J. (2000). Anger and parent-to-child aggression in mood and anxiety disorders. *Comprehensive Psychiatry, 41,* 461–468. http://dx.doi.org/10.1053/comp.2000.16567

Manuck, S. B., Phillips, J. E., Gianaros, P. J., Flory, J. D., & Muldoon, M. F. (2010). Subjective socioeconomic status and presence of the metabolic syndrome in midlife community volunteers. *Psychosomatic Medicine, 72,* 35–45. http://dx.doi.org/10.1097/PSY.0b013e3181c484dc

Markus, H. R., Ryff, C. D., Curhan, K. B., & Palmersheim, K. A. (2004). In their own words: Well-being at midlife among high school-educated and college-educated adults. In O. R. Brim, C. D. Ryff, & R. C. Kessler (Eds.), *How healthy are we? A national study of well-being at midlife* (pp. 273–319). Chicago, IL: The University of Chicago Press.

Matsumoto, D., Yoo, S. H., & Nakagawa, S., & the 37 members of the Multinational Study of Cultural Display Rules. (2008). Culture, emotion regulation, and adjustment. *Journal of Personality and Social Psychology, 94,* 925–937. http://dx.doi.org/10.1037/0022-3514.94.6.925

Mauss, I. B., Cook, C. L., & Gross, J. J. (2007). Automatic emotion regulation during anger provocation. *Journal of Experimental Social Psychology, 43,* 698–711. http://dx.doi.org/10.1016/j.jesp.2006.07.003

Meier-Ewert, H. K., Ridker, P. M., Rifai, N., Price, N., Dinges, D. F., & Mullington, J. M. (2001). Absence of diurnal variation of C-reactive protein concentrations in healthy human subjects. *Clinical Chemistry, 47,* 426–430. http://dx.doi.org/10.1093/clinchem/47.3.426

Miyamoto, Y., Yoo, J., Levine, C. S., Park, J., Boylan, J. M., Sims, T., . . . Ryff, C. D. (2018). Culture and social hierarchy: Self- and other-oriented correlates of socioeconomic status across cultures. *Journal of Personality and Social Psychology, 115,* 427–445. http://dx.doi.org/10.1037/pspi0000133

Mroczek, D. K., & Kolarz, C. M. (1998). The effect of age on positive and negative affect: A developmental perspective on happiness. *Journal of Personality and Social Psychology, 75,* 1333–1349. http://dx.doi.org/10.1037/0022-3514.75.5.1333

Mukamal, K. J., Cushman, M., Mittleman, M. A., Tracy, R. P., & Siscovick, D. S. (2004). Alcohol consumption and inflammatory markers in older adults: The Cardiovascular Health Study. *Atherosclerosis, 173,* 79–87. http://dx.doi.org/10.1016/j.atherosclerosis.2003.10.011

Muscatell, K. A., Brosso, S. N., & Humphreys, K. L. (2018). Socioeconomic status and inflammation: A meta-analysis. *Molecular Psychiatry*. Advanced online publication. http://dx.doi.org/10.1038/s41380-018-0259-2

Nichols, T. R., Mahadeo, M., Bryant, K., & Botvin, G. J. (2008). Examining anger as a predictor of drug use among multiethnic middle school students. *The Journal of School Health, 78,* 480–486. http://dx.doi.org/10.1111/j.1746-1561.2008.00333.x

Niskanen, L., Laaksonen, D. E., Nyyssönen, K., Punnonen, K., Valkonen, V. P., Fuentes, R., . . . Salonen, J. T. (2004). Inflammation, abdominal obesity, and smoking as predictors of hypertension. *Hypertension, 44,* 859–865. http://dx.doi.org/10.1161/01.HYP.0000146691.51307.84

Oakes, J. M., & Rossi, P. H. (2003). The measurement of SES in health research: Current practice and steps toward a new approach. *Social Science & Medicine, 56,* 769–784. http://dx.doi.org/10.1016/S0277-9536(02)00073-4

Operario, D., Adler, N. E., & Williams, D. R. (2004). Subjective social status: Reliability and predictive utility for global health. *Psychology & Health, 19,* 237–246. http://dx.doi.org/10.1080/08870440310001638098

Park, J., Kitayama, S., Markus, H. R., Coe, C. L., Miyamoto, Y., Karasawa, M., . . . Ryff, C. D. (2013). Social status and anger expression: The cultural moderation hypothesis. *Emotion, 13,* 1122–1131. http://dx.doi.org/10.1037/a0034273

Robert, S. A., Cherepanov, D., Palta, M., Dunham, N. C., Feeny, D., & Fryback, D. G. (2009). Socioeconomic status and age variations in health-related quality of life: Results from the national health measurement study. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 64B,* 378–389. http://dx.doi.org/10.1093/geronb/gbp012

Ryff, C. D., Miyamoto, Y., Boylan, J. M., Coe, C. L., Karasawa, M., Kawakami, N., . . . Kitayama, S. (2015). Culture, inequality, and health: Evidence from the MIDUS and MIDJA comparison. *Culture and Brain, 3,* 1–20. http://dx.doi.org/10.1007/s40167-015-0025-0

Sakusic, A., Avdibegovic, E., Zoricic, Z., Pavlovic, S., Gaspar, V., & Delic, A. (2010). Relationship between anger, alcoholism and symptoms of posttraumatic stress disorders in war veterans. *Medicinski Arhiv, 64,* 354–358.

Sin, N. L., Graham-Engeland, J. E., Ong, A. D., & Almeida, D. M. (2015). Affective reactivity to daily stressors is associated with elevated inflammation. *Health Psychology, 34,* 1154–1165. http://dx.doi.org/10.1037/hea0000240

Singh-Manoux, A., Adler, N. E., & Marmot, M. G. (2003). Subjective social status: Its determinants and its association with measures of ill-health in the Whitehall II study. *Social Science & Medicine, 56,* 1321–1333. http://dx.doi.org/10.1016/S0277-9536(02)00131-4

Smith, G. D., Lawlor, D. A., Harbord, R., Timpson, N., Rumley, A., Lowe, G. D., . . . Ebrahim, S. (2005). Association of C-reactive protein with blood pressure and hypertension: Life course confounding and mendelian randomization tests of causality. *Arteriosclerosis, Thrombosis, and Vascular Biology, 25,* 1051–1056. http://dx.doi.org/10.1161/01.ATV.0000160351.95181.d0

Smith, P. B., Easterbrook, M. J., Celikkol, G. C., Chen, S. X., Ping, H., & Rizwan, M. (2016). Cultural variations in the relationship between anger coping styles, depression, and life satisfaction. *Journal of Cross-Cultural Psychology, 47,* 441–456. http://dx.doi.org/10.1177/0022022115620488

Sousa, A. C., Zunzunegui, M.-V., Li, A., Phillips, S. P., Guralnik, J. M., & Guerra, R. O. (2016). Association between C-reactive protein and physical performance in older populations: Results from the International Mobility in Aging Study (IMIAS). *Age and Ageing, 45,* 274–280. http://dx.doi.org/10.1093/ageing/afv202

Spielberger, C. D. (1996). *State-Trait Anger Expression Inventory: Professional manual*. Odessa, FL: Psychological Assessment Resources.

Spielberger, C. D., Krasner, S. S., & Solomon, E. P. (1988). The experience, expression, and control of anger. In M. P. Janisse (Ed.), *Health psychology: Individual differences and stress* (pp. 89–108). New York, NY: Springer-Verlag. http://dx.doi.org/10.1007/978-1-4612-3824-9_5

Suinn, R. M. (2001). The terrible twos—Anger and anxiety. Hazardous to your health. *American Psychologist, 56,* 27–36. http://dx.doi.org/10.1037/0003-066X.56.1.27

Tan, J. J. X., Kraus, M. W., Carpenter, N. C., & Adler, N. E. (2020). The association between objective and subjective socioeconomic standing and subjective well-being: A meta-analytic review. *Psychological Bulletin*. Advanced online publication. http://dx.doi.org/10.1037/bul0000258

Tavris, C. (1982). *Anger: The misunderstood emotion*. New York, NY: Simon & Schuster.

Taylor, T., & Risman, B. J. (2006). Doing deference or speaking up: Deconstructing the experience and expression of anger. *Race, Gender, & Class, 13,* 60–80.

Tyler, T. R., Lind, E. A., & Huo, Y. J. (2000). Cultural values and authority relations: The psychology of conflict resolution across cultures. *Psychology, Public Policy, and Law, 6,* 1138–1163. http://dx.doi.org/10.1037/1076-8971.6.4.1138

Vgontzas, A. N., Bixler, E. O., Lin, H.-M., Prolo, P., Trakada, G., & Chrousos, G. P. (2005). IL-6 and its circadian secretion in humans. *Neuroimmunomodulation, 12,* 131–140. http://dx.doi.org/10.1159/000084844

Williams, J. E. (2010). Anger/hostility and cardiovascular disease. In M. Potegal, G. Stemmler, & C. Spielberger (Eds.), *International handbook of anger* (pp. 435–447). New York, NY: Springer. http://dx.doi.org/10.1007/978-0-387-89676-2_25

Zell, E., Strickhouser, J. E., & Krizan, Z. (2018). Subjective social status and health: A meta-analysis of community and society ladders. *Health Psychology, 37,* 979–987. http://dx.doi.org/10.1037/hea0000667

Zilioli, S., Imami, L., Ong, A. D., Lumley, M. A., & Gruenewald, T. (2017). Discrimination and anger control as pathways linking socioeconomic disadvantage to allostatic load in midlife. *Journal of Psychosomatic Research, 103,* 83–90. http://dx.doi.org/10.1016/j.jpsychores.2017.10.002

Zimprich, D., & Mascherek, A. (2012). Anger expression in Swiss adolescents: Establishing measurement invariance across gender in the AX scales. *Journal of Adolescence, 35,* 1013–1022. http://dx.doi.org/10.1016/j.adolescence.2012.02.008

Received September 11, 2019
Revision received June 25, 2020
Accepted July 7, 2020 ■