



# The role of anger regulation on perceived stress status and physical health



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## ABSTRACT

The purpose of this exploratory study was to cross-culturally examine associations among three different anger regulation strategies, namely, anger-in (AI), anger out (AO), and anger control (AC), perceived stress status as the psychological antecedent, and the number of claimed chronic medical conditions as the physical health. Large samples of American and Japanese adults participated in this study. The results show the cultural differences that are consistent with previous findings in the literature while extending them to the association with physical health. Consequently, culturally different path models were identified. In this study, we found that anger regulation affects perceived stress, which in turn, was associated with physical health. Discussion of these findings and their implications is provided.

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## 1. Introduction

Research on anger regulation has received increasing attention in the past few decades (Gross, 2014). Previous studies have identified the effects of different anger regulation strategies in everyday life (Akutsu, Yamaguchi, Kim, & Oshio, 2016; Gross, 2007). Recently, some studies have examined cultural differences with regard to the use of anger regulation strategies, as well as how the relationships between these strategies and their key antecedents and consequences systematically differ across cultures (Markus & Kitayama, 1991, 1994; Mauss & Butler, 2010). Three types of anger regulation have attracted particular attention: anger-in (AI) or anger suppression, anger-out (AO) or anger expression, and anger control (AC) (Spielberger, 1996).

Research on emotion regulation has also considered how individuals are culturally motivated to pursue their life goals, since this factor may influence one's handling of anger (Park et al., 2013). How anger out/anger expression influences one's health and well-being has been another topic of study. (Kitayama et al., 2015). However, there has been limited research examining the relationships between the three types of anger regulation and their antecedents (or moderators) and consequences (Butler, Lee, & Gross, 2007). Meanwhile, recent research has explored how two forms of self-construal (i.e., independent and interdependent) and the three types of anger regulation may influence life satisfaction (Akutsu et al., 2016).

This study addresses a significant gap in the literature by proposing an integrated model that can systematically examine the three different types of anger regulation with perceived stress status as the health-related antecedent and the number of chronic conditions as the physical health consequence. We constructed this model by using large U.S. and Japanese data samples to explore the associations between these factors, and we also compared systematic patterns between the U.S. and Japanese samples, since we were interested in whether the mediation effects would vary cross-culturally. In the concluding section, the study's implications and limitations are discussed, including directions for future research.

### 1.1. Anger regulation

Anger regulation is defined as the regulation of the emotion anger. In this study, anger regulation is categorized into three types: anger-in (AI) or anger suppression; anger-out (AO), or anger expression; and anger control (AC). Anger-in (AI) or anger suppression is defined as the inhibition of anger. In anger-in (AI) or anger suppression one can regulate one's feelings in one's mind; for example, one can withdraw from others, pout, or sulk (Spielberger, 1999). AI has been viewed as one function of anger regulation, but it is also related to conflict avoidance, guilt, irritability, rumination, and depressive symptoms (Gross & John, 2003; Martin & Dahlen, 2007; Park et al., 2013). Thus, anger-in (AI) or anger suppression may influence mental health problems linked to perceived stress and physical health. The definition of anger-out (AO) or anger expression is the expression of anger toward others; in this case, one expresses one's feelings of anger outwardly. For example, one may slam doors or say nasty things. Previous studies have found

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that anger-out (AO) or anger expression may reduce negative emotions and, paradoxically, promote greater well-being, lower perceived stress, and better physical health (Gross & John, 2003). AC refers to the primary reduction of the internal experience of anger, but a person exercising anger-control (AC) runs the risk of ignoring the adaptive functions of anger. Anger-control (AC) may lead to the failure to recognize the importance of the anger experience in facilitating beneficial physiological and psychological processes and physical health.

Anger-in (AI) or anger suppression has been associated with conflict avoidance, guilt, irritability, rumination, depressive symptoms, and decreased life satisfaction and subjective well-being (Gross & John, 2003; Martin & Dahlen, 2007). Therefore, anger-in (AI) or anger suppression might be related to mental health problems that lead to the increased onset of chronic conditions. Anger-in (AI) or anger suppression refers to the frequency with which angry feelings are experienced but not expressed (Spielberger, 1999). Individuals who suppress their anger also have a stronger perception of lacking social support (Palfai & Hart, 1997). Thus, similar to emotion suppression in general, anger-in (AI) or anger suppression is associated with psychological costs and maladjustment.

Individuals engaging in anger-out (AO) or anger expression display their feelings of anger openly, such as by slamming doors or saying rude or hurtful things. Previous research findings in Western contexts showed that the anger out (AO)/anger expression is likely to reduce negative emotions and, paradoxically, promote higher levels of well-being and reduced physical health problems (Gross & John, 2003).

Anger control (AC) is similar to anger-in (AI) or anger suppression, in that it involves not displaying anger to others and so not risking relational harmony. The important difference between the two, however, is that one may no longer experience anger after controlling it, whereas anger can increase when suppressed. In anger control (AC), an individual's challenging, complex emotions are absorbed so that other experiences and behaviors can proceed as normal (Whelton, 2004).

### 1.2. Culture and anger regulation

Culture plays an important role in anger regulation through socially shared and transmitted information systems. It is also reinforced by norms, values, beliefs, and everyday practices. Individuals growing up in European-American cultures, in general, may differ from people in East Asian cultures in how these individuals perceive their emotions, in most cases, urging other members of their culture to control their feelings through anger regulation.

Culture also provides the framework for either individual independence or interdependence (Markus & Kitayama, 1991, 1994). According to the cited authors, an independent self-construal may emphasize autonomy, uniqueness, and less interpersonal aspects of self-concepts, such as traits. In contrast, an interdependent self-construal may focus on interpersonal aspects of self-concepts, such as social expectations, social harmony, and social group memberships.

European-American cultures that value a highly independent self-construal may emphasize that the self is separate from the surrounding social context and focus on self-sufficiency, independence, and individual self-esteem, which constitute an independent self-construal. East Asian cultures that encourage a highly interdependent self-construal may emphasize the self as a constituent of a broader social context. Relevant concepts from these cultures may include the characteristics and qualities of the surrounding social environment, social expectations, social harmony, and social group memberships, which foster an interdependent self-construal (Markus & Kitayama, 1991, 1994).

Consequently, individuals who are from East Asian cultures may need to control their emotions and feelings more frequently than many people do in European-American cultures. In East Asian cultures, anger control may take on various meanings. A more concrete and differentiated theoretical framework for addressing individual differences

could thus focus specifically on how anger control is used in anger regulation.

For example, in European-American cultures, those individuals who have higher levels of independence may value their uniqueness and individual self-expression strongly, and they may encourage other members of their culture to express their inner thoughts and feelings directly and openly. In contrast, those in East Asian cultures who have higher levels of interdependence may strongly value conformity and cooperation, and they may encourage other members of their culture to control any thoughts and feelings that might interfere with interpersonal harmony. Thus, people with a more independent self-construal are less likely to use anger-in (AI) or anger suppression frequently than are those with a more interdependent self-construal. This anger regulation influences core aspects of anger expression, such as emotions linked to self-construal (Gross & John, 2003).

### 1.3. Psychological pathways underlying the relationship between anger regulation and physical health

Previous work has highlighted the need to examine whether psychological health serves as an underlying mechanism through which psychological constructs are linked with ill health, including inflammation and cardiovascular risk. These psychological constructs include the three types of anger regulation and their effects on physical health status (Kitayama et al., 2015). To date, research in this area is very limited. In a study of American subjects, Kitayama et al. (2015) found a robust link between greater anger-out (AO) or anger expression and increased behavioral health risks, which reduced physical health. As predicted, however, this association was diametrically reversed for the Japanese, among whom greater anger-out (AO) or anger expression predicted reduced behavioral health risk, which improved physical health. This relationship was explained, in part, by the Japanese subjects' greater overall psychological health in terms of the three types of anger regulation and their perceived stress status, as well as their greater participation in healthy activities; these characteristics were even more pronounced in older adults. One possible explanation for the influence of the three types of anger regulation on physical health mediated by perceived stress—an explanation that has not previously been tested—is a reduction in perceived stress. In fact, experiencing a high level of stress is a major risk factor for poor physical health outcomes (Cohen, Janicki-Deverts, & Miller, 2007). However, the timing of life stress may also be important in determining its long-term impact. There may be sensitive periods in the life cycle at which stress is more likely to generate poor long-term health outcomes (Lupien, McEwen, Gunnar, & Heim, 2009; Miller, Chen, & Parker, 2011), and the mechanism(s) underlying this possible relationship are still being elucidated. Thus, it could be that both the three types of anger regulation and perceived stress status may work together to influence health.

It is rational to hypothesize that anger regulation has an effect on perceived stress, which, in turn, is the most substantially evidenced psychosocial factor that influences physical health (Cohen et al., 2007). In recent research, all three types of anger regulation have been shown to be correlated with stress. Hiding one's emotions may prevent others from detecting the need to provide support, which could contribute to the development or continuation of fatigue in the person concealing the emotions. Anger-in (AI) or anger suppression may also have a more direct and immediate impact on fatigue. Attempting to do anger out/anger expression distressing information may have the paradoxical effect of increasing the occurrence of such thoughts and associated distress (Trinder & Salkovskis, 1994).

Given these possible relationships between stress and all three types of anger regulation, the present study examines perceived stress status as a potential underlying psychosocial mechanism or psychological pathway explaining the relationship between anger regulation and physical health. This study aims to obtain a better understanding of the relationship role among three types of anger regulation—anger in

(AI) or anger suppression, anger out (AO) or anger expression, and anger control (AC)—and perceived stress status on physical health for older American and Japanese adults in a cross-cultural context. In particular, this study seeks to ascertain the degree to which people engage in perceived stress status as mediator and then determine influences that such thought processes exert on levels of physical health. Thus, the study expects three types of anger regulation and perceived stress status to be associated with levels of physical health across cultures. The study's measures might address the role of the cross-cultural outlook as it influences reports of physical health. A graphical presentation of the conceptual model that links the aforementioned factors is provided in Fig. 1.

## 2. Method

### 2.1. Participants

We used a subset of the Midlife Development in the United States (MIDUS) survey and the corresponding Midlife Development in Japan (MIDJA) survey conducted in 2008 to estimate the proposed model in this study. The MIDUS Project 4 of the second phase of the MIDUS (i.e., MIDUS II) was conducted in 2004 with the US sample. The MIDUS II used a subsample of participants ( $N = 1255$ ) from the original MIDUS study (i.e., MIDUS I). The final US sample consisted of 542 males and 713 females from 35 to 86 years old ( $M = 57.32$ ;  $SD = 11.5$ ).

The MIDJA survey was used ( $N = 1027$ ) with the sample in Japan. The final Japanese sample consisted of 505 males and 522 females from 30 to 79 years old ( $M = 54.3$ ;  $SD = 14.1$ ), living in the Tokyo metropolitan area. The participants completed a self-report questionnaire for the present study. A back-translation process was performed multiple times on the survey items by native speakers.

### 2.2. Preliminary analyses

To explore the associations between the key constructs, the cross-cultural measurement invariance using multiple-group confirmatory factor analysis (CFA) in structural equation modeling (SEM) was performed for all items with equality constraints (i.e., assuming covariance among all of the factors) in the U.S. and Japan. AMOS 18 (Arbuckle, 2009) was used for the CFA, which explored two models: (1) an unconstrained model with no path coefficients constrained to be equal for both cultures, and (2) a constrained model with all path coefficients constrained to be equal for both cultures. There were covariates among all latent variables in both models.

As suggested by Raykov, Tomer, and Nesselroade (1991), the SEM results were evaluated using two model fit indexes: the comparative fit index (CFI) and the root mean square error of approximation

(RMSEA). Fit indices of the unconstrained model were as follows:  $\chi^2 = 3062.68$ ,  $df = 525$ ,  $p < .001$ , CFI = .86, and RMSEA = .046; for the constrained model, they were  $\chi^2 = 3334.61$ ,  $df = 544$ ,  $p < .001$ , CFI = .85, and RMSEA = .047. Model fit indices over .95 and an RMSEA of .06 or less are regarded as indicative of good model fit (Bentler, 1990; Bollen, 1989; Hu & Bentler, 1999). The RMSEA values in this study indicate that both models have a very good fit with the data. Although the unconstrained model was better than the constrained model in terms of the CFI, there were no substantial differences in fit between the two models; both also had very good RMSEA values. The constrained model (i.e., with factor equivalence across the two cultural groups) was adopted as the baseline for the subsequent analyses, because of our interest in determining how the associations of the latent variables differ between the two cultures.

The coefficients were estimated using the constrained model of the CFA, and were all significant at  $p < .005$  (and some of them at  $p < .001$ ), with three exceptions: the correlation between anger-in (AI) or anger suppression and the number of chronic conditions in the U.S., and the correlations in Japan between anger expression and anger control, and between anger control and the number of chronic conditions.

### 2.3. Measurement instruments

Anger Regulation was accessed with the twenty-item anger subscales of the State-Trait Anger Expression inventory (STAXI; Spielberger, 1999). The anger-in (AI) or anger suppression scales are that the extent to which one can control their anger feelings in or one can suppress anger feelings, furious feelings, or lose one's mind. 8 items anger-in (AI) or anger suppression was measured on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Anger-out (AO) or anger expression refers to the extent to which one can express out one's anger feelings, furious feelings, or lose one's mind. 8 item anger expression was measured on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The anger control (AC) scales are that one can control the anger feelings, furious feelings, or lose one's mind from the physical or verbal expression and communication. 4 items anger control was measured on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Cronbach's alphas in the US were .82 (anger-in (AI) or anger suppression), .77 (anger expression), and .68 (anger control). Cronbach's alphas in Japan were .75 (anger-in (AI) or anger suppression), .80 (anger expression), and .70 (anger control).

Perceived Stress Scale was measured to ask the participants about their feelings and thoughts during the last month (Cohen, Kamarck, & Mermelstein, 1983). 10 items anger control was measured on a 5-point scale, ranging from 1 (never) to 7 (very often). In each cases, the participants will be asked to indicate how often they felt or thought a certain way. Cronbach's alphas were .77 in the US and in .70 Japan.

Physical health was assessed using the indicator of the number of chronic conditions. It is a continuous variable based on the total number of chronic conditions the respondent check to have experienced in the past 12 months.

## 3. Results

### 3.1. Preliminary analyses

Descriptive statistics and Pearson product-moment correlations between the variables in the model are presented in Table 1. In the U.S. sample, anger-in (AI) or anger suppression is positively related with anger-out (AO) or anger expression. Anger-in (AI) or anger suppression is also negatively related with anger control (AC). Anger-out (AO) or anger expression is negatively related with anger control (AC). Anger-in (AI) or anger suppression is positively related with perceived stress status. Anger-in (AI) or anger suppression is not related with the number of chronic conditions. Anger expression is positively related with

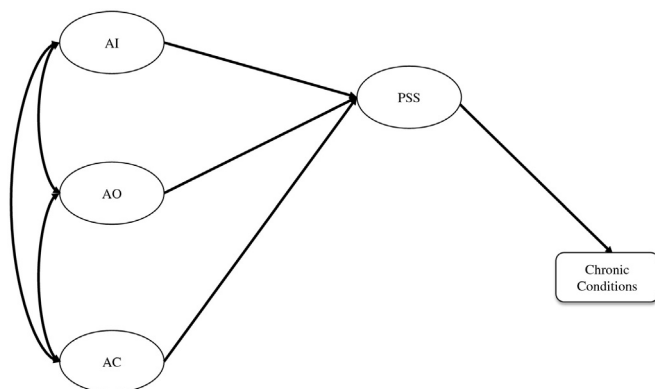


Fig. 1. Conceptual model. Note. This is the hypothetical model. AI = anger-in; AO = anger-out; AC = anger control, and PSS = perceived stress. Status.

perceived stress status. Anger expression is positively related with the number of chronic conditions. Anger control is negatively related with perceived stress status. Anger control is not related with the number of chronic conditions. Perceived stress status is positively related with the number of chronic conditions.

In Japan sample, anger-in (AI) or anger suppression is positively related with anger expression. Anger-in (AI) or anger suppression is also positively anger control. Anger expression is not related with anger control. Anger-in (AI) or anger suppression is positively related with perceived stress status. Anger-in (AI) or anger suppression is positively related with the number of chronic conditions. Anger expression is positively related with the number of chronic conditions. Anger control is positively related with perceived stress status. Anger control is not related with the number of chronic conditions. Perceived stress status is positively related with the number of chronic conditions.

### 3.2. Main analyses

In the multiple group, the path analyses in the structural equation modeling were conducted to explore the proposed model as a set of restrictive models. First, we examined an unconstrained path model in which none of the path coefficients were constrained between the two cultural groups for the multiple group analyses. We then started to explore the best-fit model in reference to fit indices, in which the path coefficients were constrained to be equal for the two groups or to be zero. Thereafter, we showed that the final model (Fig. 2) could be the best fit for the data in this study. The fit indices were as follows:  $\chi^2(546) = 337.70, p < .01$  (CFI = .85, RMSEA = .047). Fig. 2 lists the path coefficients used in such a model. As shown in Fig. 2, for the US samples, anger-in (AI) or anger suppression positively influenced the perceived stress status (PSS) ( $\beta = .50, p < .01$ ), as did anger expression ( $\beta = .15, p < .01$ ). However, anger control negatively influenced PSS ( $\beta = -.14, p < .01$ ). Anger-in (AI) or anger suppression was related negatively to the number of chronic conditions ( $\beta = -.11, p < .01$ ), as was anger control ( $\beta = -.10, p < .01$ ), while PSS positively influenced the number of chronic conditions ( $\beta = .18, p < .01$ ). In addition, there was covariance between anger-in (AI) or anger suppression and anger expression ( $\beta = .07, p < .01$ ), anger expression and anger control ( $\beta = -.18, p < .01$ ), and anger-in (AI) or anger suppression and anger control ( $\beta = -.06, p < .01$ ).

As shown in Fig. 2, for the Japanese samples, anger-in (AI) or anger suppression positively influenced PSS ( $\beta = .67, p < .01$ ). Meanwhile, anger expression did not affect PSS ( $\beta = .05, n.s.$ ), although anger control negatively influenced it ( $\beta = -.07, p < .01$ ). Anger-in (AI) or anger suppression related positively to the number of chronic conditions ( $\beta =$

.08, *n.s.*), while anger control related negatively to the number of chronic conditions ( $\beta = -.05, n.s.$ ) and PSS positively influenced the same ( $\beta = .23, p < .01$ ). Additionally, there was covariance between anger-in (AI) or anger suppression and anger expression ( $\beta = .65, p < .01$ ), anger expression and anger control ( $\beta = .00, n.s.$ ), and anger-in (AI) or anger suppression and anger control ( $\beta = .22, p < .01$ ).

### 3.3. Cross-cultural processes

In order to identify the cross-cultural process, the critical ratios for differences between parameters were conducted in Fig. 2. The culturally different processes between the US and Japanese samples reflected the effect of anger-in (AI) or anger suppression on perceived stress status, of anger-in (AI) or anger suppression on the number of chronic conditions. Specifically, the positive association of anger-in (AI) or anger suppression with perceived stress status was significantly larger in the Japanese sample ( $\beta = .67$ ) than in the US sample ( $\beta = .50$ ). The negative association of anger-in (AI) or anger suppression with the number of chronic conditions was significantly larger in the US sample ( $\beta = -.11$ ) than in the Japanese sample ( $\beta = .08$ ). The positive association of anger-out (AO) or anger expression with perceived stress status was significantly larger in the US sample ( $\beta = .15$ ) than in the Japanese sample ( $\beta = -.05$ ). The negative association of anger control (AC) with the perceived stress status was significantly larger in the U.S. sample ( $\beta = -.14$ ) than in the Japanese sample ( $\beta = -.07$ ). The negative association of anger control (AC) with the number of chronic conditions were significantly larger in the US sample ( $\beta = -.10$ ) than in the Japanese sample ( $\beta = -.05$ ). Moreover, the positive association of perceived stress status with the number of chronic conditions were significantly larger in the Japanese sample ( $\beta = .18$ ) than in the U.S. sample ( $\beta = .23$ ).

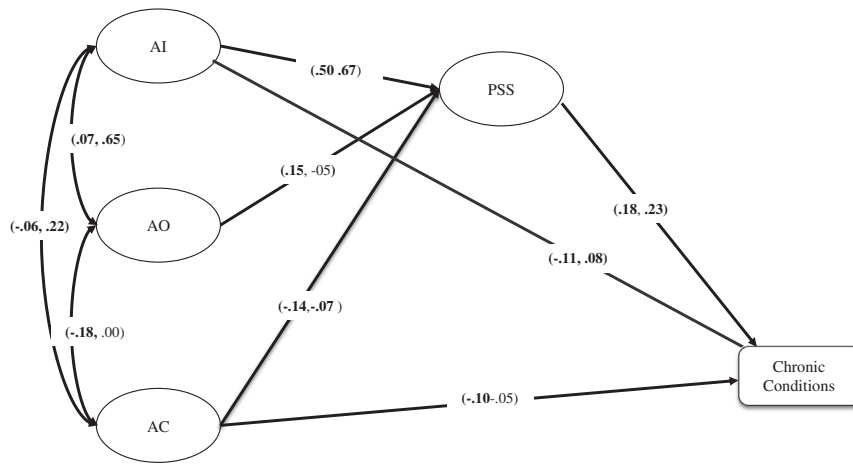
## 4. Discussion and conclusions

This study's purpose was to examine the following: (1) the effects of dominant anger regulation on physical health and (2) the potential moderating effects of perceived stress status on the relationship between anger regulation and physical health within the United States and Japan. The results partially concur with previous research on culture and theoretical models of physical health (Kitayama et al., 2015). Overall, this study confirms the conceptual physical health model, and our data indicate the existence of a culturally specific process (Kitayama et al., 2015). The results of this study indicate that anger-in (AI) or anger suppression in the US and Japan impacted physical health mediated by the perceived stress status (Cohen et al., 2007).

**Table 1**  
Descriptive statistics and bivariate association between study variables.

	1	2	3	4	5	N	M(SD)
1 Anger-in (AI) or anger suppression							
US	–	0.45**	–0.48**	0.60**	0.02	1249	14.65 (4.16)
Japan		0.65**	0.22**	0.70**	0.23**	380	14.11 (3.68)
2 Anger-out (AO) or anger expression							
US		–	–0.20**	0.44**	0.08**	1250	12.91 (3.30)
Japan			0.01	0.49**	0.18**	381	12.25 (3.63)
3 Anger control (AC)							
US			–	–0.31**	–0.13**	1251	9.92 (2.28)
Japan				0.08**	–0.02	379	8.04 (2.50)
4 Perceived Stress Status							
US				–	0.15**	1248	22.24 (6.34)
Japan					0.28**	379	25.99 (5.75)
5 Chronic Conditions							
US					–	1253	2.30 (2.34)
Japan						377	2.31 (2.02)

\*\*  $p < 0.01$ .



**Fig. 2.** The model estimation results. Note. AI = anger-in; AO = anger-out; AC = anger control, and PSS = perceived stress status. The path coefficients which are significant at  $p < 0.01$  level are in boldface. The left side of path coefficients is the U.S. The right side of path coefficients is Japan.

Furthermore, anger-in (AI) or anger suppression in the United States was negatively correlated with physical health. In other words, the results indicated that anger-in (AI) or anger suppression in the United States has the potential to increase physical health. However, anger-in (AI) or anger suppression's correlation with physical health was stronger in the United States than in Japan. Anger-out (AO) or anger expression in the United States was also positively correlated with perceived stress status, which led to high levels of physical health. In other words, the results indicated that anger-out (AO) or anger expression has the potential to increase physical health when mediated by perceived stress status in the United States. Anger control (AC) in the United States was negatively correlated with physical health. In other words, the results indicated that anger control (AC) in the United States has the potential to increase physical health. Anger control (AC) in the United States was negatively correlated with physical health mediated by the perceived stress status. In other words, the results indicated that anger control (AC) in the United States has the potential to increase physical health mediated by perceived stress. However, anger control (AC)'s correlation with physical health was stronger in the United States than in Japan. The results of the simultaneous analysis of several groups in path analysis revealed specific dimensions of anger regulation through which perceived stress status promoted motivational and healthy behavior (Cohen et al., 2007; Kitayama et al., 2015).

These seemingly counterintuitive findings build upon and are consistent with previous research in the field of anger regulation, indeed. The conceptual framework of Akutsu et al. (2016), which relates self-construal and anger regulation with life satisfaction, supports these empirical findings regarding cross-cultural differences; they also include adult samples from the United States and Japan in considering impacts on physical health status. Butler et al. (2007), in their theoretical framework of anger regulation, also offered empirical evidence of the model's applicability to cross-cultural frameworks; the present results extend the potential age range of the model to include emerging adults. Moreover, the good fit of the mediation model demonstrated that anger-in (AI) or anger suppression does take a toll on physical as well as mental health outcomes; this result is consistent with prior findings that anger-in (AI) or anger suppression is often associated with negative psychosocial consequences (Gross & John, 2003). Beyond this finding, the study revealed that anger-in (AI) or anger suppression is less likely to affect physical health, though in the U.S. sample only. Finally, our results make an important contribution to the body of empirical knowledge on how perceived stress status may moderate the relation between anger regulation and physical health.

This study's findings are in line with the traditional Japanese belief that individuals' anger-in (AI) or anger suppression is the necessary result of an interdependent self-construal, which leads to higher levels of perceived stress status and lower levels of physical health in Japan. Thus, people in Japan may focus on their own shortcomings and ways to save face, which contributes to higher levels of perceived stress status.

The question then arises whether a more interdependent self-construal that may result in anger in/anger-in (AI) or anger suppression could be more useful than an independent self-construal as a way to predict higher levels of perceived stress status and lower levels of physical health. For the present sample in Japan, we thus cautiously suggest that, because anger in/anger-in (AI) or anger suppression is primarily a means of maintaining face, an interdependent self-construal may become a more salient variable for predicting higher levels of perceived stress status and lower levels of physical health.

The finding that anger-in (AI) or anger suppression was less detrimental to physical health among individuals who had high perceived stress is similar to that of a prior study (Butler et al., 2007). However, our study is noteworthy because it is the first to show that perceived stress status is a mediator of the anger-in (AI) or anger suppression–physical health link in both samples and the anger control–physical health link in the U.S. sample.

The results of this study also showed that the negative impact of anger-in (AI) or anger suppression was even stronger in the U.S. sample than in the Japanese sample as a direct effect. One possible explanation of this unexpected, stronger negative relationship is that independence, uniqueness, and free thinking are valued more in the U.S. than conformity, causing those who suppress their anger to be more out of touch with prevailing social practices and expectations.

The negative association of anger control (AC) with physical health was significant only in the U.S. sample, whereas there was no significant difference in the strength of impact between the U.S. and Japanese samples. Anger control (AC) involves cognitive effort to achieve an emotional change or reappraisal (Gross, 2014; Gross & John, 2003). Anger control (AC), as specified by Spielberger (1996) (and as understood in this study), occurs only after anger is felt. However, given that individual anger control (AC) has negative effects on perceived stress status, anger control (AC) by means of reappraisal could function more instinctively and, thus, be less laborious and stressful for the U.S. sample (Mauss, Bunge & Gross, 2007; Mauss, Cook & Gross, 2007).

Consistent with our proposed model, anger-out (AO) or anger expression was not significantly associated with physical health through perceived stress status in the U.S. sample. Thus, this study did not

support the findings of Kitayama et al. (2015) regarding the positive link between anger-out (AO) or anger expression and biological health risks among the U.S. sample using the same dataset; however, this relationship was apparently reversed for the Japanese sample, among which greater anger expression predicted reduced behavioral risks.

#### 4.1. Limitations and implications for future study

Some limitations of this study should be mentioned. First, our large sample datasets were limited to two cultures, the United States and Japan; in future studies, data should be collected from other countries and regions. Second, the cross-sectional research design is limited in discerning causal relationships. To address this issue, a longitudinal research design and data should be used. Third, as is typical for single-method studies, our findings were likely influenced by common-method variance that can both artificially increase and decrease the correlations observed between variables (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). In addition, the data in this study were all self-reported, so the results are prone to common-method bias. However, our examination of the influence of scale length required a common-method approach to the measurement of anger regulation, perceived stress, and number of chronic conditions to ensure that scale length—and format—differences were not distorted by different methods.

Despite these limitations, the present results suggest that future research needs to explore the questions examined in this study using data on anger regulation, perceived stress, and number of chronic conditions and criterion information that are not self-ratings. This is particularly important because short measures of psychological and social factors may be the most useful in different settings.

This study indicates that anger-in (AI) or anger suppression has unique, culturally specific influence on physical health as mediated by perceived stress, whereas anger control (AC) has this impact in the United States only. Anger-in (AI) or anger suppression and anger control (AC) might not be contextual and culture-dependent, but rather cross-cultural differences, and they could be further elicited by environmental cues (Oyserman, 2011); thus, this study might point out the implications of focusing on physical health as mediated by perceived stress. For example, since this study found associations among anger-in (AI) or anger suppression, anger-out (AO) or anger expression, anger control (AC), and perceived stress and identified effects of the physical health, such implications might be the necessary first step in further research.

In conclusion, this study has identified the impact of anger regulation on physical health condition in different cultural contexts; more specifically, the proposed model of physical health shows that it is important to focus on individuals' anger-in (AI) or anger suppression, anger-out (AO) or anger expression, and anger control (AC) because these self-views serve as clues to other cultural and individual values and behaviors that affect one's health and well-being.

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