


Age and Gender Differences in Relationships Among Emotion Regulation, Mood, and Mental Health

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Abstract

Objective: We investigated the effects of age on mood and mental health-mediated emotion regulation, such as cognitive reappraisal and expressive suppression, and examined whether these relationships differ according to gender. **Method:** We recruited 936 Japanese participants. They comprised six age groups ranging from 20 to 70 years old, with 156 participants in each age group and equal numbers of men and women. **Results:** Structural equation model analysis showed that older participants were more likely to use cognitive reappraisal, further enhancing positive mood and reducing negative mood, whereas, age did not affect expressive suppression. Moreover, expressive suppression had a smaller impact on mood than cognitive reappraisal. A multi-group analysis showed significant gender differences. In men, cognitive reappraisal increased with age and influenced mood more positively than in women. **Discussion:** Our findings indicated gender differences in aging effects on emotion regulation. We discussed about these results from the cognitive process, motivation to emotion regulation, and cultural differences.

Keywords

cognitive reappraisal, expressive suppression, mood, mental health

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Late adulthood is a stressful time when people experience various losses in health, human relationships, and social roles, in comparison with any other stage of life. However, the subjective emotional happiness and psychological satisfaction of older adults are not very different from when they were younger, and their emotions are even more stable than that of young adults (Lawton, Kleban, Rajagopal, & Dean, 1992). This paradox can be explained by socio-emotional selectivity theory (SST; Carstensen, 2006; Carstensen, Isaacowitz, & Charles, 1999). The SST proposes that a future time perspective affects people's goals and motivation. Older adults who perceive their limited time horizons are motivated by emotion regulation, increasingly value emotional meanings, and invest their cognitive and social resources on obtaining emotional value. Consequently, older adults can maintain psychological well-being even under stressful situations. In contrast, young adults who perceive unlimited time horizons are motivated by knowledge acquisition, focus on the future, value new things, and invest their time and energy expanding their perspectives.

A previous study with young adults has found that participants paid greater attention to negative emotion and recalled it more frequently than positive

information (negativity bias; Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). Other studies have reported no such negativity bias and found that older adults, in contrast to young adults, paid greater attention to positive information and recalled it more frequently than negative information (Charles, Mather, & Carstensen, 2003; Mather & Carstensen, 2005). These phenomena are referred to as the positivity effect and support the SST, which acknowledges that older adults are motivated by emotion regulation. Studies on the positivity effect have focused on aging effects on cognitive processing, such as attention and memory for emotion-eliciting information. However, few studies have examined how control functions (emotion regulation) of information-elicited emotions change with age. Therefore, the present study aimed to focus on emotion

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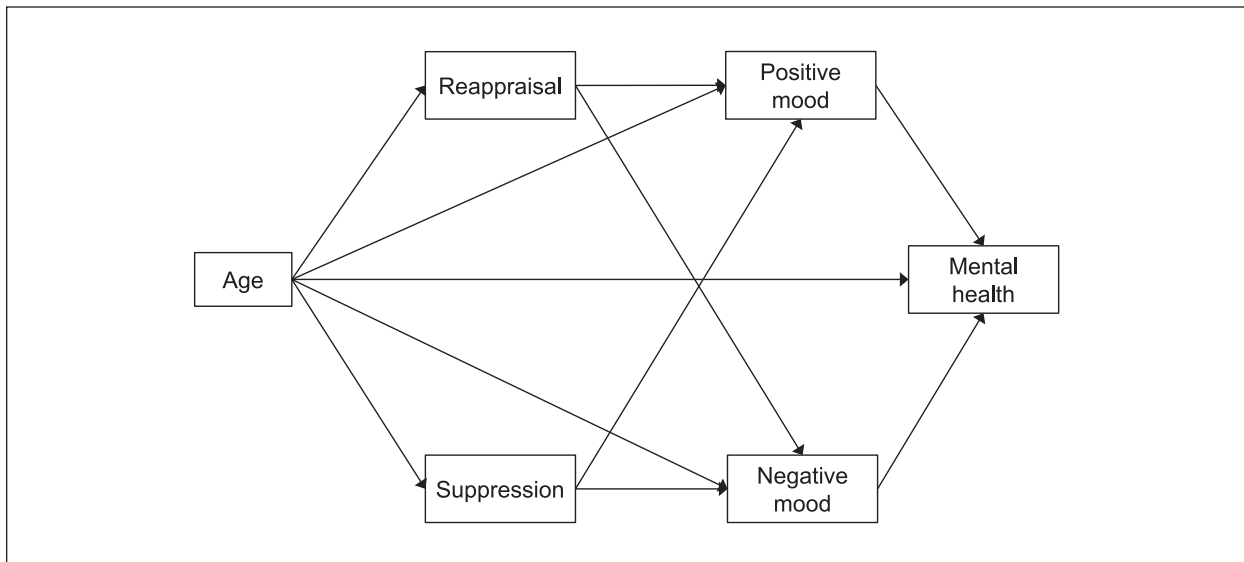


Figure 1. Hypothetic model in this study.

regulation and examine aging effects on emotion regulation, as well as relationships among emotion regulation, mood, and mental health.

The process model of emotion regulation is widely accepted (Gross, 2001). This model divides emotion regulation into two categories: antecedent-focused emotion regulation, which occurs prior to emotion generation, and response-focused emotion regulation, which occurs following emotional responses. Many emotion-regulation strategies have been investigated; however, Gross and John (2003) focused exclusively on the cognitive reappraisal strategy (“reappraisal” hereafter) and expressive suppression strategy (“suppression” hereafter). Reappraisal is an antecedent-focused strategy that alters emotional impact by cognitively changing how people perceive emotion-eliciting situations. Suppression is a response-modulated strategy that inhibits elicited emotions and emotion expressive-behaviors.

Based on previous studies that have focused on SST and emotion regulation, the present study used the hypothetical model indicated in Figure 1. It has been reported that reappraisal is an adaptive strategy for reinterpreting a given situation and improving negative emotions, even under stressful situations, thereby enhancing positive emotions and psychological well-being (Gross & John, 2003; Haga, Kraft, & Corby, 2009) and reducing negative emotions, depression, and anxiety (Dennis, 2007; Gross & John, 2003; Spaapen, Waters, Brummer, Stopa, & Bucks, 2014). Suppression can control negative mood expression, but cannot lower the frequency of negative mood experiences. The discrepancy between inner experiences and outer expressions caused by suppression leads to a sense of self-inconsistency; decreases positive emotions, psychological well-being, and subjective happiness (Gross & John, 2003); and increases negative emotions, anxiety, and depression (Fresco et al., 2007; Gross & John, 2003; Nolen-Hoeksema & Aldao, 2011; Spaapen et al., 2014). Suppression is recognized as a

maladaptive strategy and a psychopathological risk factor (Aldao, Nolen-Hoeksema, & Schweizer, 2010). Following these studies’ hypothesis model (Figure 1), we expect that reappraisal will enhance positive emotions and reduce negative emotions, enhancing mental health. Conversely, suppression will reduce positive emotions and increase negative emotions, decreasing mental health. As previous research has not consistently found an association between reappraisal and suppression (Haga et al., 2009; Spaapen et al., 2014), a corresponding path was not assumed in the hypothesis model.

Regarding the emotional regulation, it is expected that reappraisal will increase with age for the following reasons. First, the positivity effect means that older adults are typically more aware of positive aspects of situations—even when those situations are stressful. This would promote positive meaning in negative situations. Second, young adults may have difficulty reinterpreting situations positively due to their negativity bias. Thus, they will use reappraisal less. With respect to suppression, following the SST, older adults are motivated toward maintaining emotional well-being, the use of suppression that lead to a sense of self-inconsistency is expected to decrease. However, some studies focusing on older adults have reported inconsistent findings. In one study, age was not found to affect the use of reappraisal or suppression (Spaapen et al., 2014), but in another study, older adults were found to make use of suppression more frequently (Diehl, Coyle, & Labouvie-Vief, 1996).

In addition to age, previous studies have reported that gender affects the use of emotion-regulation strategies (Gross & John, 2003; Kwon, Yoon, Joormann, & Kwon, 2013; Nolen-Hoeksema & Aldao, 2011; Thomsen, Mehlsen, Viidik, Sommerlund, & Zachariae, 2005). For example, men use suppression more frequently than do women (Gross & John, 2003; Spaapen et al., 2014) and women use reappraisal more frequently than do men

(Spaapen et al., 2014). In addition, Nolen-Hoeksema and Aldao (2011) reported that only women increased their use of suppression with increasing age, further suggesting there are gender differences in the correlations between age and emotion-regulation strategies. McRae, Ochsner, Mauss, Gabrieli, and Gross (2008) and Domes et al. (2010) revealed sex differences in brain activity for reappraisal. Domes et al. (2010) suggested possibility that men enhanced the brain activity in emotion processing areas more efficiently. McRae et al. (2008) indicated that men use reappraisal automatically with less effort than do women. Following their findings, because automatic cognitive processing is retained and effortful cognitive processing is declined in the elderly, aging has a larger influence on reappraisal for women than for men. The present study was designed to first examine the compatibility of the hypothetical model described in Figure 1 with the survey data and then investigate whether there are gender differences in the paths between each variable.

Method

Participants and Procedures

The aim of the present study was to first elucidate correlations between age and emotion-regulation strategies and then explore gender differences in those correlations. To avoid biases in the age and gender of participants, we conducted a panel survey using a professional survey research agency (Macromill, Inc.). We recruited 936 Japanese participants (age = 20–79 years, $M = 49.09$, $SD = 16.57$). There were six age groups ranging from 20s to 70s, with 156 participants in each age group and equal numbers of men and women. We emailed a survey invitation to 6,213 adults between the ages of 20 and 79 years and closed the survey after collecting the allocated number of participant responses.

The survey was conducted online, and an email with a URL for the survey request and survey page was sent to participants. On the first page of the survey, we clearly indicated that (a) the survey intends to ask personal information, (b) filling out the questionnaire implies agreement to participate in the study, and (c) responses would be analyzed as personally unidentifiable statistical information and used for research purposes only. Participants were rewarded with points equivalent to 100 JPY (approximately US\$1.20) through the research agency. Macromill, Inc., guaranteed that the company would not provide personally identifiable information to any third party without a participant's prior consent. Before conducting the survey, we obtained ethical approval from the research ethics committee at the researchers' institution.

The entire questionnaire was presented in Japanese, displayed each basic attribute and scale on the website, and was programmed so that participants could only proceed to the next page if they responded to all questions on the current page. To increase the reliability of responses, a message was displayed requesting participants to double check or correct responses if necessary,

when a participant selected the same response number for all question items on the current page.

Survey

Emotion regulation. We used the Japanese version (Yoshizu, Sekiguchi, & Amemiya, 2013) of the Emotion Regulation Questionnaire (ERQ-J) developed by Gross and John (2003). The ERQ-J consists of 10 items: six items for reappraisal factors and four items for suppression factors. The internal consistency, test-retest reliability, and construct validity of the Japanese version have been verified in previous studies with undergraduate students. Each item was rated on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Mood condition. To measure positive and negative moods, we used the Japanese version (Sato & Yasuda, 2001) of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS is designed to assess participants' current moods toward each item using a 6-point scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). The scale consists of 16 items with eight items each for positive and negative moods. The present study calculated the total score of the eight items for each mood and used these results for analysis.

Mental health. To measure mental health, we used the 12-item version of the General Health Questionnaire (GHQ-12; Goldberg & Williams, 1988; Fukunishi, 1990). The GHQ-12 is designed to rate each item using a 4-point scale, with higher scores indicating poor mental health. The present study used the total score of the 12 items as the mental health index.

Results

First, to check the reliabilities of the ERQ-J's factor items, we calculated Cronbach's alpha. The results showed adequate internal consistency ($\alpha = .83$ for the reappraisal factor, and $\alpha = .75$ for the suppression factor).

Table 1 shows the means, standard deviations, gender differences, and correlations for the measured variables. To determine gender differences, a t test for each variable revealed that suppression and negative mood scores for males were significantly higher than for females—suppression, $t(934) = 4.80$, $p < .001$, $r = .16$; negative mood, $t(934) = 2.89$, $p < .01$, $r = .10$. The correlational analysis showed significant moderate correlations among the measured variables, except for the correlations between suppression and mood and between age and suppression.

Structural Equation Model Analysis

We examined the fit of the data with the model (Figure 1), which was hypothesized based on previous studies, using an analysis of covariance. We used the goodness-of-fit

Table 1. Means, Standard Deviations, Gender Differences, and Correlations of the Measured Variables.

| Variable | M (SD) | | | Gender difference (t test) | Correlation | | | | |
|---------------------------------------|------------------|-----------------|-------------------|----------------------------|-------------|-------|-------|--------|--------|
| | Total n = 936 | Male n = 468 | Female n = 468 | | B | C | D | E | F |
| A. Age | 49.09 (16.57) | 49.28 (16.74) | 48.91 (16.41) | n.s. | .07* | .01 | .12** | -.24** | -.23** |
| B. Emotion regulation— Reappraisal | 4.19 (0.86) | 4.15 (0.82) | 4.23 (0.90) | n.s. | 1 | .43** | .26** | -.19** | -.22** |
| C. Emotion regulation— Suppression | 3.90 (0.96) | 4.05 (0.87) | 3.75 (1.02) | t(934) = 4.80, p < .001 | | 1 | .03 | .03 | -.07* |
| D. Positive mood | 25.91 (6.12) | 25.88 (6.12) | 25.95 (6.21) | n.s. | | | 1 | -.15** | -.30** |
| E. Negative mood | 23.35 (6.65) | 23.98 (6.57) | 22.73 (6.69) | t(934) = 2.89, p < .01 | | | | 1 | .48** |
| F. Mental health | 26.36 (6.42) | 26.26 (6.33) | 26.46 (6.52) | n.s. | | | | | 1 |

*p < .05. **p < .01.

statistic (GFI), comparative fit index (CFI), root mean square error approximation (RMSEA), and Akaike information criterion (AIC) as goodness-of-fit indices (for review, see Hoorper, Coughlan, & Mullen, 2008). The model is acceptable when GFI and CFI are .90 or more and RMSEA is .10 or less, which depends on the field under analysis. Smaller AIC indicate appropriate fit; AIC is used in comparison between models that explain the same data. Results showed a low goodness of fit of the model's indices, $\chi^2(4) = 206.79$, $p < .01$, GFI = .935, CFI = .761, RMSEA = .233, AIC = 240.785. Therefore, based on the results of the Wald test and modification indices, we created a new model with a path from reappraisal to suppression strategies. We considered the path from reappraisal to suppression as valid because (a) a balance between appraisal and suppression is important for emotion regulation (Arens, Balkir, & Barnow, 2013), and (b) reappraisal is a strategy that people implement before their emotions are fully generated and suppression is a strategy to inhibit the expression of generated emotions (Gross & John, 2003).

The results for the new model (Figure 2) indicated sufficient goodness of fit, $\chi^2(3) = 19.92$, $p < .01$, GFI = .993, CFI = .981, RMSEA = .075, AIC = 54.920. The path values show standardized coefficients, and all paths were significant, except the path from age to suppression. Age affected mood and mental health directly, and the positive effects were greater among older participants. In addition, age affected mood and mental health through emotion regulation. Older participants were more likely to use reappraisal, further enhancing positive mood and reducing negative mood. In contrast, age did not affect suppression. Suppression decreased positive mood and increased negative mood regardless of age.

In addition, the comparison of standardized coefficients of appraisal and suppression showed significant differences between emotion-regulation strategies for each mood (positive mood, $p < .05$; and negative mood, $p < .05$). These results indicate that reappraisal has a larger impact on mood than does suppression.

Multi-Group Analysis on Gender Differences

To examine gender differences in the effects of age on emotion regulation and emotion regulation on mood, we conducted a multi-group analysis. First, we simultaneously tested a model across male and female groups without imposing any equality constraints (baseline model: Figure 3). Next, 12 different multi-group models, with different sets of constraints between the gender groups, were compared with the baseline model (M0) and chi-square tests were conducted. Table 2 presents the series of nested models that were tested. A significant chi-square difference between two models suggests gender differences on the constrained path. Results revealed that M7 and M11 were significantly different from M0; in M7, the path from reappraisal to mood was constrained to be equal between gender, and in M11, the paths from age to reappraisal and age to mood were constrained. Compared with females, males were more likely to use reappraisal as they aged, and their moods were improved by reappraisal.

Discussion

The aim of the present study was to examine the effects of aging on emotion-regulation strategies and gender differences in those effects. Regarding reappraisal, in light of the positivity effect in older adults (Charles et al., 2003) and negative bias in young adults (Baumeister et al., 2001), we expected that the use of reappraisal would increase with age. In addition, the SST predicts that older adults with limited time horizons are more likely to be motivated toward maintaining emotionally meaningful goals. In this respect, we expected that maladaptive suppression less frequently with aging. The results indicated gender differences in aging effects on emotion regulation. Men were more likely to use reappraisal as they aged, but no correlations were found between suppression and age. However, aging did not affect reappraisal or suppression in women.

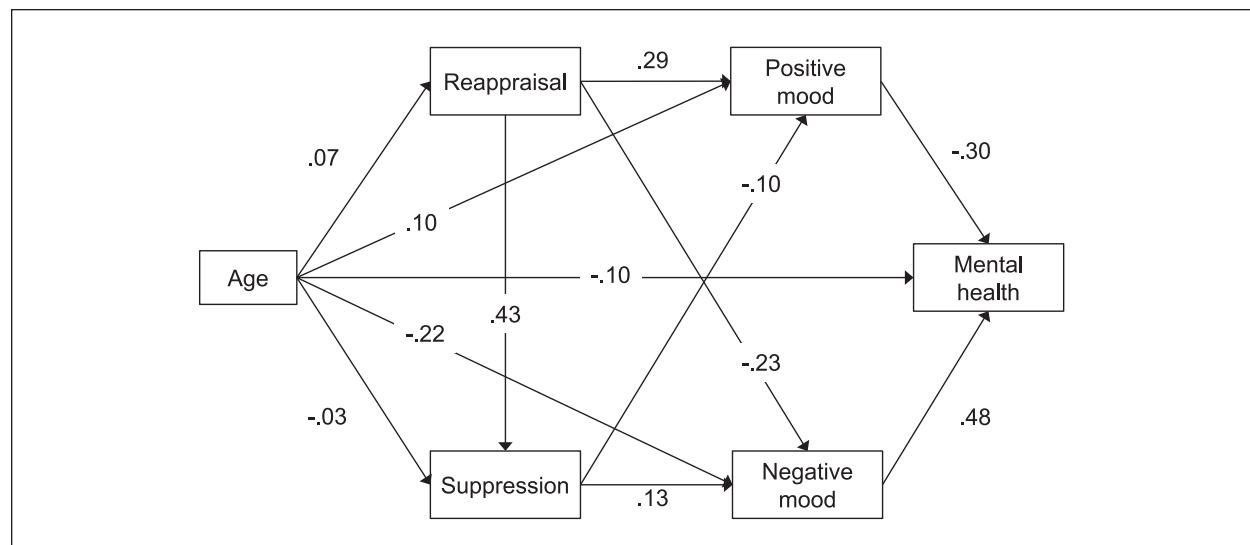


Figure 2. Estimates from structural equation modeling examining the effects of age, reappraisal and suppression on mood and mental health.

Note. Solid lines refer to significant standardized coefficient. Dashed lines refer to non-significant standardized coefficient. Model fitness, $\chi^2(3) = 19.92$, $p = .000$, GFI = .993, CFI = .981, RMSEA = .075, AIC = 54.92. GFI = goodness-of-fit statistic; CFI = comparative fit index; RMSEA = root mean square error approximation; AIC = Akaike information criterion.

In regard to reappraisal, the effect of aging was observed in men, but not in women. This gender difference in reappraisal can be explained by a gender difference in the cognitive process of reappraisal. McRae et al. (2008) investigated brain activity during reappraisal by showing negative emotion-eliciting images to participants. According to their findings, compared with women, men demonstrated down-regulated amygdala activity related to emotional responses and less prefrontal activity related to cognitive and emotion control. Prefrontal activity is commonly considered to reflect the effortful and conscious process of cognitive and emotional control. McRae et al. (2008) pointed out the possibility that men use reappraisal automatically with less effort than do women. Unlike McRae et al. (2008), Domes et al. (2010) reported that small clusters within prefrontal cortex were more activated in men than in women; however, men also showed activation in other brain regions (e.g., the mid-temporal gyrus, amygdala, insula, and fusiform gyrus). Domes et al. (2010) therefore suggested that men may reappraise situations more effectively than women by using a widespread brain network. Aging-related decline in brain function is more apparent in the prefrontal area (Raz et al., 2005). For men, the use of reappraisal is an automatic process and/or a widespread network process that does not depend only on the prefrontal area, which declines with age. Although research has not reached consensus regarding sex differences in the cognitive processes underlying reappraisal, these findings may explain why reappraisal was observed to increase more with age among men than in women. Moreover, given that men depend on an automatic process and women depend on a conscious process, we predicted that there would be no aging effect in men, but that the use of reappraisal would decrease in

women. However, aging did not negatively affect the use of reappraisal. Reappraisal was likely to be promoted by the positivity effect (Mather & Carstensen, 2005) commonly seen among older adults, which involves paying greater attention to and recalling positive information more than negative information.

Suppression controls expressions of not only positive emotions but also negative emotions. However, emotions themselves are not removed; therefore, suppression generates a sense of inconsistency between the inner experience of emotions and the outer expression of emotions or behaviors. For this reason, suppression is considered a maladaptive strategy (Gross & John, 2003) and we predicted that the use of suppression would decrease in late adulthood. However, no relationships between suppression and aging were observed, regardless of gender. Although an aging effect was specifically observed in men for reappraisal, it was not observed for suppression. This further suggests that the effects of aging differ by type of emotion regulation. Shiota and Levenson (2009) conducted a study on young (20s), middle-aged (40s), and older (60s) adults to examine the effects of reappraisal and suppression on (a) subjective emotional experience; (b) physiological indices, such as heartbeat and blood pressure; and (c) facial expression while participants viewed sad and disgusting film clips. The findings from their study elucidated that older adults are better at positive reappraisal compared with other generations, but no differences between age groups were found for suppression. Moreover, reappraisal had a modest effect in reducing facial expression in all ages. From these results, Shiota and Levenson (2009) stated that aging effects on emotion regulation may be observed in the internal aspects of emotions (subjective experience and peripheral physiology), but not in the

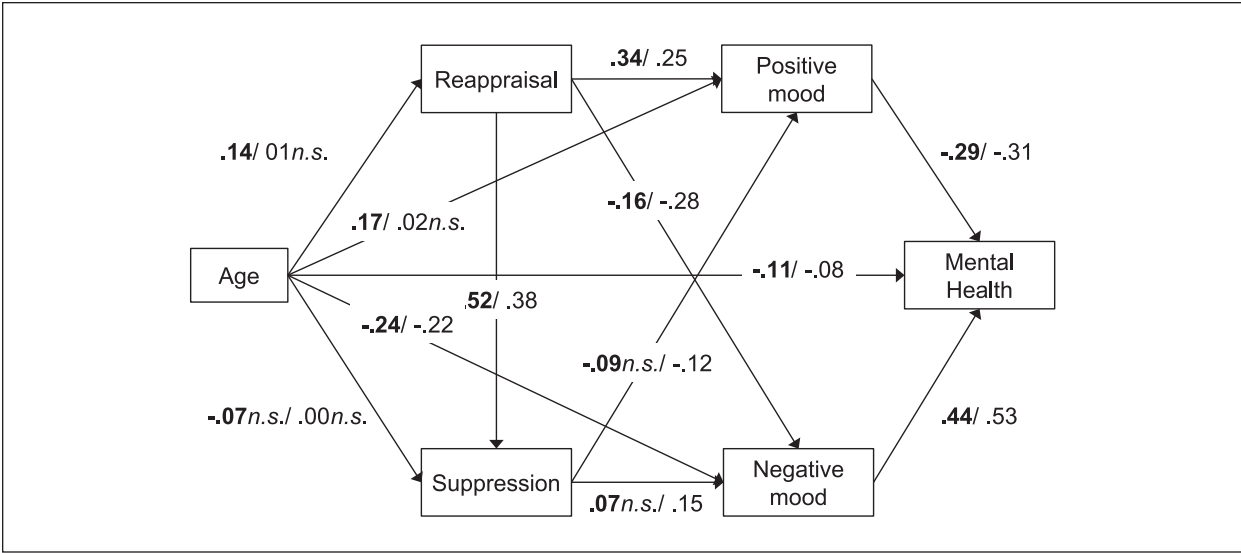


Figure 3. The baseline model of multi-group analysis to test the gender difference.
Note. Standardized path coefficients are presented for male (in bold) before the slash and for female after the slash. Non-significant paths are denoted by n.s.

Table 2. Goodness-of-Fit Indices and Model Different Test by Applying Different Equality Constraints for the Multi-Group Analyses Across Gender.

| Model | Constrained paths | χ^2 (df) | CFI | NFI | RMSEA | AIC | Model comparison with M0 | |
|-------|--|---------------|-----|-----|-------|-------|--------------------------|---------|
| | | | | | | | $\Delta\chi^2$ (df) | p Value |
| M0 | All free (baseline) | 21.18 (6) | .98 | .98 | .05 | 93.18 | | |
| M1 | Age to reappraisal | 24.66 (7) | .98 | .97 | .05 | 94.66 | 3.48 (1) | .06 |
| M2 | Age to suppression | 22.18 (7) | .98 | .98 | .05 | 92.18 | 1.00 (1) | .32 |
| M3 | Age to emotion regulation (M1 + M2) | 25.67 (8) | .98 | .97 | .05 | 93.67 | 4.49 (2) | .11 |
| M4 | Reappraisal to suppression | 24.57 (7) | .98 | .97 | .05 | 94.57 | 3.39 (1) | .07 |
| M5 | Reappraisal to positive mood | 24.14 (7) | .98 | .97 | .05 | 94.14 | 2.96 (1) | .09 |
| M6 | Reappraisal to negative mood | 23.30 (7) | .98 | .98 | .05 | 93.30 | 2.12 (1) | .15 |
| M7 | Reappraisal to mood (M5 + M6) | 26.26 (8) | .98 | .97 | .05 | 95.54 | 6.36 (2) | .04* |
| M8 | Suppression to positive mood | 21.26 (7) | .98 | .98 | .05 | 91.26 | .08 (1) | .78 |
| M9 | Suppression to negative mood | 21.90 (7) | .98 | .98 | .05 | 91.90 | .72 (1) | .40 |
| M10 | Suppression to mood (M8 + M9) | 21.97 (8) | .98 | .98 | .04 | 89.97 | .80 (2) | .67 |
| M11 | Age to mood mediated reappraisal (M1 + M7) | 33.13 (10) | .97 | .96 | .05 | 97.13 | 11.956 (4) | .02* |
| M12 | Age to mood mediated suppression (M2 + M9) | 26.15 (10) | .98 | .97 | .04 | 90.15 | 4.97 (4) | .29 |

Note. CFI = comparative fit index; NFI = normed-fit index; RMSEA = root mean square error approximation; AIC = Akaike information criterion.
*p < .05.

expression of emotional responses. In our study, therefore, the use of suppression did not increase with age.

In the initial hypothesized model, reappraisal and suppression were set as independent variables, as previous research has found no association between reappraisal and suppression (e.g., $r = -.09$, Spaapen et al., 2014; $r = -.03$, Haga et al., 2009). However, this model was dismissed on the basis of the covariance structure analysis. In response, we adopted another model with a path from reappraisal to suppression, repeated the analysis, and achieved sufficient goodness-of-fit indices. This result implies that, whereas aging does not directly affect suppression, reappraisal increases with age and

suppression increases through reappraisal. Reappraisal enhances positive mood expression and reduces negative mood expression (Gross & John, 2003). In addition, older adults positively reappraise conflicts to control negative emotions (Diehl et al., 1996). The correlation between reappraisal and suppression observed in the present study suggests that, by using reappraisal or reinterpretation of a negative experience, individuals attempt to prevent an inconsistency between the subjective emotional experience and the expressed emotion.

In addition, the effects of suppression on mood were smaller compared with the effects of reappraisal in the present study. A meta-analysis on the correlations

between regulation strategies and mental health by Aldao et al. (2010) reported that adaptive strategies were weakly correlated with depression, whereas maladaptive strategies, including suppression, were strongly correlated with depression. The reason for such different findings for the effects of emotion regulation on mood and mental health is presumably due to cultural differences in emotion regulation. A study that focused on undergraduate students across 23 countries examined the effects of cultural differences on reappraisal and suppression (Matsumoto, Yoo, Nakagawa, & Cul, 2008). The study reported that (a) the effect of cultural differences was larger for suppression than reappraisal, and (b) suppression is necessary to determine emotional responses that best fit a social context. In countries such as Japan, people value interpersonal relationships and place a high importance on self-control of thoughts and behaviors that could hinder social solidarity and traditional order. A study with Japanese undergraduates (Yoshizu et al., 2013) did not confirm any correlation between suppression and negative emotional experience or well-being. The participants in our study were also Japanese, and the correlations between suppression and mood were not significant. Based on these findings, suppression is not a maladaptive strategy in a culture where people frequently use suppression. In addition, our results that age and gender did not affect suppression indicate that the participants did not experience major discomfort using suppression because they use suppression in their culture, regardless of age and sex.

Limitations of the Study and Future Directions

The present study provided evidence that the effects of aging on emotion regulation differ for reappraisal and suppression and that there are gender differences in those effects. Nonetheless, this study's methodology introduced some limitations. First, we did not directly examine the efficacy of each strategy. Therefore, we cannot say that older men use reappraisal more effectively than do women or other generations. Experimental methods should be utilized to determine whether aging affects the efficacy of strategies. Second, the significant results for the direct paths from age to mood and age to mental health indicated that factors other than reappraisal and suppression influence mood and mental health. Third, although general mental health was defined as an outcome in this study, gender differences may change if we use more specific outcome such as depression or positive outcome such as happiness. In addition, we conducted an online survey, and the rate of Internet use among the elderly is lower than among other populations. Some selection bias may therefore have affected the sample.

This research suggests key directions for future research. Our findings regarding suppression were different from previous studies. The use of emotion-regulation strategies differs by ethnic group (Arens et al., 2013;

Consedine, Magai, & Horton, 2005; Flynn, Hollenstein, & Mackey, 2010) and culture (Kwon et al., 2013; Turliuc & Bujor, 2013). The emotion-regulation strategies that people value differ between cultures that place importance on protecting and promoting the pursuit of individual happiness and those that place value on social order and human relationships (Matsumoto et al., 2008). Future studies should consider cultural influences, such as how much people value the pursuit of individual happiness or human relationships, to elucidate cultural effects on emotion-regulation strategies and correlations between aging and emotion-regulation strategies.

Declaration of Conflicting Interests

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