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# Subjective age and depressive symptoms among Chinese older adults: A moderated mediation model of perceived control and self-perceptions of aging

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ABSTRACT

Although subjective age has been shown to play an important role in older adults' experiences of depressive symptoms, the mediating and moderating mechanisms underlying this relationship have not been adequately examined. The present study aimed to investigate the mediating role perceived control plays between subjective age and depressive symptoms, as well as the moderating role self-perceptions of aging plays in this indirect relationship. To examine this, a cross-sectional study was conducted with 609 Chinese older adults, who completed measures of subjective age, perceived control, self-perceptions of aging, and depressive symptoms. The results indicated that: (1) possessing a younger subjective age is significantly associated with less depressive symptoms; (2) perceived control partially mediates the relationship between subjective age and depressive symptoms; and (3) the indirect effect of subjective age on depressive symptoms, through perceived control, is moderated by self-perceptions of aging, while the mediated path is stronger for older adults with less favorable self-perceptions of aging. The findings underscore the importance of identifying the mechanisms that moderate the mediated paths between subjective age and depressive symptoms.

## 1. Introduction

Subjective age, how old a person perceives him/herself to be, is a central component of aging (Diehl et al., 2014; Gabrian and Wahl, 2017). It reflects an individual's self-assessment of his/her position in life (Furstenberg, 2002) and, in regard to older adults, can provide information concerning a series of psychological and physiological processes and outcomes (Kotter-Grühn et al., 2016). There is considerable evidence that the majority of older adults feel younger than they actually are (Kleinspehn-Ammerlahn et al., 2008; Montepare, 2009; Rubin and Berntsen, 2006), which is generally considered to be a protective strategy (Weiss and Lang, 2012) and a form of defensive denial that allows individuals to disassociate themselves from stigmas attached to growing old (Peters, 1971; Ward, 1977).

Possessing a younger subjective age is very important for successful aging (Kotter-Grühn et al., 2016; Stephan et al., 2011) and, relative to chronological age, subjective age is a more powerful predictor of the physiological and psychological functions of older adults (Barak and Stern, 1986). Previous studies have shown that subjective age bias is significantly associated with depressive symptoms (Keyes and Westerhof, 2012; Shrira et al., 2014); specifically, individuals with younger subjective age report less depression (Spuling et al., 2013). For example, Infurna et al. (2010) found that feeling younger is closely related with lower depressive symptoms and a lower risk of developing major depression. Similarly, a study by Choi and Dinitto (2014) showed that older subjective age at baseline predicts higher depressive symptoms at follow-up. These findings suggest that, among older adults, feeling younger plays a critical role in inhibiting the development of depressive symptoms.

Nonetheless, prior research has primarily focused on the direct link between subjective age and depressive symptoms, meaning the roles of mediating and moderating variables that may be involved in the association remain largely unexplored (Choi and Dinitto, 2014). Determining such mediating and moderating mechanisms is critical for advancing our understanding of subjective age, as well as for developing effective intervention and outreach strategies. In addition, the majority of previous studies have been conducted in Western countries, particularly in youth-centered cultures (Kotter-Grühn et al., 2016); thus, these findings may not be generalizable to older adults in China, where there is a traditional culture of respecting and honoring the aged. Further, the predictive value of subjective age has been determined to differ cross-culturally (Kotter-Grühn et al., 2016; Westerhof and Barrett,

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2005), and this further strengthens the importance of exploring subjective age and its potential impact on depressive symptoms among Chinese older adults.

### 1.1. The mediating role of perceived control

Theorists have argued that subjective age is a distal predictor of consequential outcomes, and that it exerts its impact through potential behavioral, psychological, and physiological pathways (Stephan et al., 2011, 2014). A theoretical explanation for this is the presence of positivity bias or positive illusions (Teuscher, 2009) through which, it is suggested, feeling oneself to be younger can be regarded as a special form of self-motivation, self-enhancement, and self-protection (Gana et al., 2004; Montepare, 2009; Teuscher, 2009). In fact, subjective age may constitute a proxy for being able to control the challenges and experiences encountered during the aging process (Infurna et al., 2010). Previous empirical studies have indicated that subjective age is closely related to psychological variables such as perceived control and self-efficacy (Infurna et al., 2010); for example, Linn and Hunter (1979) found that individuals who regard themselves as younger have stronger perceived control; even when social class, disability, and impairment are controlled.

According to the locus of control theory (Judge and Bono, 2001), differing attribution tendencies between individuals results in differing emotions, expectations, motivations, and behaviors; thus, this has an indirect influence on their lives and health. As an important psychosocial resource, perceived control plays a crucial role in successful aging (Bergland et al., 2014). There is empirical evidence that an individual who has higher perceived control is less likely to experience depression; for example, high perceived control has been determined to be closely linked to positive self-rated health status and to less depressive symptoms (Jang et al., 2006). In addition, Lachman and Weaver (1998) revealed that, among the middle-aged and elderly, stronger perceived control is associated with lower depressive symptoms. Furthermore, a study by Levy et al. (2002) demonstrated that perceived control partially mediates the relationship between subjective aging and functional health. Considering the literature reviewed above, the present study hypothesized that perceived control partially mediates the relationship between subjective age and depressive symptoms ($H_1$).

### 1.2. The moderating role of self-perceptions of aging

Although older adults who perceive themselves as having a stronger sense of control may experience less depressive symptoms, the positive effect is not consistent. This heterogeneity of outcomes may be contingent upon individual characteristics that moderate the impact of subjective age on depressive symptoms, such as self-perceptions of aging. Self-perceptions of aging refer to a person's experience and expectations of the aging process (Wolff et al., 2017). If an individual is satisfied with their aging, it shows that he/she has a favorable self-perception of their aging. Recent research has documented that self-perceptions of aging play a decisive role in the psychological well-being of older adults (Kleinspehn-Ammerlahn et al., 2008; Levy and Myers, 2004), and that it is closely associated with depressive symptoms (Barker et al., 2007; Freeman et al., 2016; Gattuso, 2001). For example, in a two-year follow-up study Freeman et al. (2016) found that, after controlling for demographic variables, among those with no depressive symptoms at baseline, older adults with higher negative self-perceptions of aging at baseline were significantly more likely to have developed or maintained their depressive symptoms two years later.

According to the self-regulation model (Leventhal et al., 2004), when older adults perceive aging threats, they adopt differing coping styles depending on their personal self-perceptions of aging. As an important inter-individual variability, self-perception of aging is likely to buffer the impact of stressful situations on depressive symptoms. Compared with more favorable self-perceptions of aging, when facing with age-related stressful events, older adults with less favorable self-perceptions of aging might have a more negative outlook of the future, tend to expect to experience more difficulties (Freeman et al., 2016), and further cope them in a negative way; in such cases the ability of resistance to risk of perceived control on older adults' depressive symptoms may be greatly weakened. Furthermore, aging attitude has been determined to be an important psychological factor for moderating the relationship between subjective age and negative emotions. For example, a recent study by Mock and Eibach (2011) revealed that the association of subjective age with negative affect is moderated by the aging attitudes of middle-aged and older adults. Considering that self-perceptions of aging can constitute a sub-classification of aging attitudes (Yan, 2012), the present study hypothesized that the indirect effect of subjective age on depressive symptoms, via perceived control, may be moderated by self-perceptions of aging ($H_2$).

### 1.3. The present study

The purposes of the present study were twofold. First, this study examined whether perceived control mediates the link between subjective age and depressive symptoms among Chinese older adults. Second, the study explored whether the indirect relationship between subjective age and depressive symptoms, through perceived control, is moderated by self-perceptions of aging. Fig. 1 illustrates the conceptual model applied. Specifically, based on the literature, the present study proposed the following hypotheses: ($H_1$) younger subjective age is associated with less depressive symptoms, and perceived control partially mediates the relationship between younger subjective age and less depressive symptoms; and ($H_2$) the indirect effect of subjective age on depressive symptoms via perceived control is stronger for older adults with less favorable self-perceptions of aging.

## 2. Methods

### 2.1. Participants

For our study sample, convenience sampling was applied in Chongqing and Sichuan, China, to recruit 646 older adults aged 60 years and above for a questionnaire survey. Excluding those who provided incomplete data and multivariate outliers ($[x\text{-}\mu]/\sigma > 3$ or $< -3$) (Sincich, 1986), a total of 609 survey responses were collected (mean age = 70.56, SD = 6.39; 253 men and 356 women). Of the participants, 150 (24.6%) were illiterate, 258 (42.4%) had received five years of education or less, 118 (19.4%) had received between five and eight years of education, 45 (7.4%) had received between eight and 11 years of education, and 38 (6.3%) had received 13 years or more of education. Up to 68.5% of the participants had a partner (i.e., were married). In terms of self-rated health, 31 (5.1%) reported "poor," 70 (11.5%) reported "fair," 115 (18.9%) reported "good," 285 (46.8%) reported "very good," and 108 (17.7%) reported "excellent." The average number of comorbidities was 0.84 (SD = 1.01).

### 2.2. Data collection procedures

This cross-sectional study protocol was approved by the

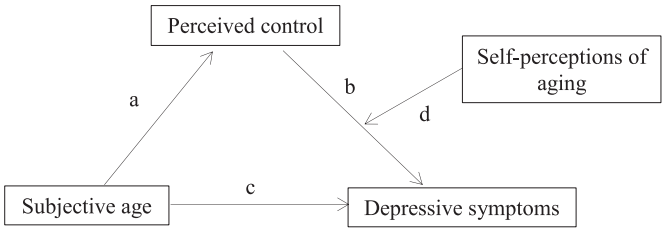


**Fig. 1.** The proposed moderated mediation model.

institutional review board at the institution with which the authors were affiliated. Prior to initiation of the study, all of the participants signed a consent form and were informed that they had the right to opt-out at any time. Pre-screening was firstly performed using Mini-Mental State Examination (MMSE) (Folstein et al., 1975) to assess the participants' cognitive function. Next, older adults with normal cognitive function successively completed demographic questionnaire, the Subjective Age Scale, the Personal Mastery Scale, the Attitudes toward Own Aging Subscale, and the Center for Epidemiologic Studies Depression Scale (CES-D) at community centers. For participants who could not read or write, the questionnaire was read aloud, and all answers were immediately reviewed so that the participants could help clarify their responses, if necessary (Tang et al., 2014). In addition, hierarchical multiple regression analysis revealed that the effect of mode of questionnaire delivery including experimenters reading or not reading questionnaire for participants on perceived control, self-perceptions of aging and depressive symptoms were not significant ($\beta$ = 0.01, 0.10 and −0.04, $p > .05$), controlling for educational level. Participants were offered ¥30 (about 4.3 US dollars) as a token of appreciation.

### 2.3. Measures

#### 2.3.1. Subjective age

In conformance with existing research (Rubin and Berntsen, 2006; Stephan et al., 2015; Westerhof and Barrett, 2005), subjective age was measured by asking participants "How old do you feel, in years?," and the value returned was classified as "felt age." For each participant, their felt age was then subtracted from their chronological age, and the difference was then divided by their chronological age, thereby obtaining a proportional discrepancy score, which was considered to represent subjective age (subjective age = [chronological age − felt age]/chronological age) (Eibach et al., 2010; Stephan et al., 2014). Here, a positive score indicated a younger subjective age, and a negative score indicated an older subjective age.

#### 2.3.2. Depressive symptoms

The Center for Epidemiologic Studies Depression Scale (CES-D), created by Radloff (1977), was used to assess the older adults' depressive symptoms. Specifically, the Chinese version of the CES-D, created by Wang et al. (1999) and which features 20 items, was used. Here, the participants were asked to report the frequency by which they had experienced a number of symptoms over the previous week. Answers were provided using a four-point scale (1 = less than one day; 2 = one to two days; 3 = three to four days; 4 = five to seven days). Four items were reversed before scoring, with higher scores signifying more depressive symptoms. The Cronbach's alpha for our sample was 0.89.

#### 2.3.3. Perceived control

The Personal Mastery Scale by Pearlin and Schooler (1978) was used to measure the older adults' level of perceived control. The scale comprises seven items, such as "there is little I can do to change many of the important things in my life." Participants were required to indicate their agreement with the items using a four-point Likert scale (ranging from 1 (*strongly disagree*) to 4 = (*strongly agree*)). Of these, five items were reversed before scoring, with higher scores indicating a stronger level of perceived control. For the present study, the Cronbach's alpha for the scale was 0.74.

#### 2.3.4. Self-perceptions of aging

The Attitudes toward Own Aging Subscale of the Philadelphia Geriatric Centre Morale Scale (PGCMS), which was developed by Lawton (1975), was adapted to measure the participants' self-perceptions of aging. Five items were presented to the participants, such as "I am as happy now as I was when I was younger." Participants responded to each item with either "yes" or "no," and these responses were scored as "1" and "0," respectively. Two items were reverse-scored so that all items measured favorable self-perceptions of aging, and higher scores indicated more favorable self-perceptions of aging. For this study, the Cronbach's alpha was 0.74.

#### 2.3.5. Covariates

Demographic covariates included age, gender (coded as "0" for men and "1" for women), marital status (coded as "0" for "married" and "1" for "single"), and education level. In addition, comorbidity was assessed using the Self-administered Comorbidity Questionnaire (SCQ) developed by Sangha et al. (2003), which refers to the presence of heart disease, high blood pressure, lung disease, diabetes and so on; and self-rated health was assessed with a single question (i.e., "in general, would you say that your health is excellent, very good, good, fair, or poor?").

### 2.4. Data analysis

All analyses were performed using SPSS 22.0. First, descriptive statistics and bivariate correlations for all variables were determined. Then, we examined whether perceived control mediates the relationship between subjective age and depressive symptoms, and whether the mediation process is moderated by self-perceptions of aging, controlling for chronological age, gender, marital status, education level, number of chronic conditions, and self-rated health. The analyses of the mediation and moderation effects were performed using Hayes' PROCESS macro (2013). The bootstrapping method produces 95% bias-corrected confidence intervals of these effects from 5,000 resamples of the data (sample size = 200); confidence intervals that do not contain zero indicate significant effects.

## 3. Results

### 3.1. Common method variance

In order to avoid the common method variance, some measures, such as reverse scoring, were adopted to perform pre-procedural control of the study design. In addition, the Harman's single-factor method (Podsakoff et al., 2003) was used to conduct the common method variance test; the common factor number was set to 1, using Mplus for confirmatory factor analysis (CFA). The results' fit index was as follows: $\chi^2/df$ = −219.11, RMSEA = 0.07, CFI = 0.74, TLI = 0.73, indicating that there was no serious common method variance in the study data.

### 3.2. Preliminary analysis

Descriptive statistics (means and standard deviations) and Pearson correlation coefficients for all study variables are presented in Table 1. Approximately 55% of participants stated that they felt younger than their chronological age, with the average being 5% younger. For example, most 70-year-olds felt approximately 3.5 years younger. The correlation matrix showed that subjective age was unrelated to gender, marital status, and education level; however, older adults who felt younger had less chronic conditions and higher self-related health. Moreover, subjective age was negatively associated with depressive symptoms ($r = -0.25$, $p < .001$), while perceived control was negatively associated with depressive symptoms ($r = -0.58$, $p < .001$). Finally, younger subjective age was associated with higher levels of perceived control ($r = 0.20$, $p < .001$).

### 3.3. Testing for mediation effect

Hypothesis 1 stated that perceived control mediates the relationship between subjective age and depressive symptoms. The PROCESS macro (Model 4) developed by Hayes (2013) was used to test this mediation effect. The specific regression model parameters are shown in Table 2. Consequently, the bias-corrected bootstrap method further indicated

**Table 1**
Means, standard deviations, and correlation matrix ($N$ = 609).

| Variables | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Chronological age | 70.56 | 6.39 | – | | | | | | | | | |
| 2. Gender | 0.58 | 0.49 | −0.08* | – | | | | | | | | |
| 3. Marital status | 0.32 | 0.47 | 0.24*** | 0.21*** | – | | | | | | | |
| 4. Educational level | 5.36 | 3.95 | −0.07 | −0.35*** | −0.23*** | – | | | | | | |
| 5. Number of chronic conditions | 0.84 | 1.01 | 0.04 | 0.05 | −0.03 | −0.02 | – | | | | | |
| 6. Self-rated health | 2.39 | 1.06 | −0.04 | −0.08* | −0.01 | 0.19*** | −0.37*** | – | | | | |
| 7. Subjective age[a] | 0.05 | 0.10 | 0.11** | −0.07 | −0.02 | 0.03 | −0.18*** | 0.27*** | – | | | |
| 8. Perceived control | 18.91 | 3.76 | −0.06 | −0.10* | −0.10* | 0.17*** | −0.20*** | 0.39*** | 0.20*** | – | | |
| 9. Self-perceptions of aging | 2.67 | 1.72 | −0.11** | −0.03 | −0.08 | 0.10* | −0.21*** | 0.37*** | 0.25*** | 0.45*** | – | |
| 10. Depressive symptoms | 15.58 | 10.20 | 0.05 | 0.05 | 0.10** | −0.19*** | 0.22*** | −0.41*** | −0.25*** | −0.58*** | −0.52*** | – |

Note.
[a] Higher values represent younger subjective age. Gender was dummy coded such that 0 = *men* and 1 = *women*. Marital status was dummy coded such that 0 = *married* and 1 = *single*.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

that the indirect effect of subjective age on depressive symptoms through perceived control (ab = −0.05, 95% CI = [−0.10, −0.01]) was statistically significant (Table 2), and the mediation effect accounted for 28% of the total effect. Furthermore, the direct effect of subjective age on depressive symptoms was statistically significant ($c = -0.12$, $t = -3.12$, 95% CI = [−0.20, −0.05], $p < .01$). Therefore, the relationship between subjective age and depressive symptoms was partially mediated by perceived control, supporting Hypothesis 1.

### 3.4. Subjective age and depressive symptoms: testing for moderated mediation

Next, the PROCESS macro (Model 14) developed by Hayes (2013) was conducted to test the potential moderated mediating model. The results are shown in Table 3. It was determined that subjective age has a significant effect on perceived control ($\beta = 0.11$, $t = 2.42$, 95% CI = [0.02, 0.20], $p < .05$), and the effect of perceived control on depressive symptoms was statistically significant ($\beta = -0.38$, $t = -10.55$, 95% CI = [−0.45, −0.31], $p < .001$). Further, subjective age was negatively associated with depressive symptoms ($\beta = -0.08$, $t = -2.13$, 95% CI = [−0.16, −0.01], $p < .05$), and the interaction item of perceived control and self-perceptions of aging was positively related to depressive symptoms ($\beta = 0.08$, $t = 2.58$, 95% CI = [0.02, 0.14], $p < .05$).

The bias-corrected bootstrap method indicated that the indirect effect of subjective age on depressive symptoms, through perceived control, was moderated by self-perceptions of aging, with the index of moderated mediation being 0.01 (95% CI = [0.01, 0.02]). When self-perceptions of aging were more favorable (i.e., 1 SD above the mean), there was a mediation effect between subjective age and depressive symptoms through perceived control, with the index of the mediation effect being −0.03 (95% CI = [−0.06, −0.01]). Meanwhile, when self-perceptions of aging were less favorable (i.e., 1 SD below the mean), there was also a mediation effect between subjective age and depressive symptoms through perceived control, with the index of the mediation effect being −0.05 (95% CI = [−0.10, −0.01]). Therefore, Hypothesis 2 was supported.

Following Aiken and West (1991), the present study explored the predictive effect of perceived control on depressive symptoms, conducting separate examinations for more and less favorable self-perceptions of aging in order to further illustrate the nature of the moderation effect. A simple slope test indicated that when self-perceptions of aging were more favorable, higher levels of perceived control were associated with less depressive symptoms ($\beta_{simple} = -0.40$, $t = -4.55$, $p < .001$). Furthermore, when self-perceptions of aging were less favorable, the effect of perceived control on depressive symptoms was much stronger ($\beta_{simple} = -0.59$, $t = -6.04$, $p < .001$) (Fig. 2).

## 4. Discussion

The present study found that, in the context of Chinese traditional culture, which holds respecting and honoring the aged as a core value, younger subjective age is significantly associated with less depressive symptoms among older adults. This provides empirical support for the phenomenon of youthful subjective age bias in a non-western culture. A possible interpretation of this finding is that, in recent decades, Chinese

**Table 2**
The mediating role of perceived control.

| | Perceived control | | | Depressive symptoms | | |
|---|---|---|---|---|---|---|
| | *β* | *t* | 95% CI | *β* | *t* | 95% CI |
| Chronological age | −0.01 | −1.00 | (−0.02, 0.01) | −0.01 | −0.14 | (−0.01, 0.01) |
| Gender | −0.06 | −0.76 | (−0.23, 0.10) | −0.13 | −1.88 | (−0.27, 0.01) |
| Marital status | −0.13 | −1.55 | (−0.30, 0.04) | .11 | 1.53 | (−0.03, 0.26) |
| Educational level | 0.02 | 1.88 | (−0.01, 0.04) | −0.02* | −2.29 | (−0.04, −0.01) |
| Number of chronic conditions | −0.06 | −1.52 | (−0.14, 0.02) | 0.05 | 1.38 | (−0.02, 0.11) |
| Self-rated health | 0.30*** | 7.65 | (0.23, 0.38) | −0.16*** | −4.63 | (−0.23, −0.09) |
| Subjective age | 0.110* | 2.42 | (0.02, 0.20) | −0.12** | −3.12 | (−0.20, −0.05) |
| Perceived control | | | | −0.48*** | −13.68 | (−0.54, −0.41) |
| $R^2$ | 0.18 | | | 0.40 | | |
| *F* | 18.60*** | | | 50.58*** | | |

Note.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

**Table 3**
The moderated mediating effect of subjective age on depressive symptoms.

| | Perceived control | | | Depressive symptoms | | |
|---|---|---|---|---|---|---|
| | *β* | *t* | 95% CI | *β* | *t* | 95% CI |
| Chronological age | −0.01 | −1.00 | (−0.02, 0.01) | −0.01 | −1.01 | (−0.02, 0.01) |
| Gender | −0.06 | −0.76 | (−0.23, 0.10) | −0.12 | −1.81 | (−0.26, 0.01) |
| Marital status | −0.13 | −1.55 | (−0.30, 0.04) | 0.11 | 1.61 | (−0.03, 0.25) |
| Educational level | 0.02 | 1.88 | (−0.01, 0.04) | −0.02** | −2.66 | (−0.04, −0.01) |
| Number of chronic conditions | −0.06 | −1.52 | (−0.14, 0.02) | 0.04 | 1.10 | (−0.03, 0.10) |
| Self-rated health | 0.30*** | 7.65 | (0.23, 0.38) | −0.12*** | −3.54 | (−0.19, −0.05) |
| Subjective age | 0.11* | 2.42 | (0.02, 0.20) | −0.08* | −2.13 | (−0.16, −0.01) |
| Perceived control | | | | −0.38*** | −10.55 | (−0.45, −0.31) |
| Self-perceptions of aging | | | | −0.27*** | −7.50 | (−0.34, −0.20) |
| Perceived control × self-perceptions of aging | | | | 0.08* | 2.58 | (0.02, 0.14) |
| $R^2$ | 0.18 | | | 0.46 | | |
| *F* | 18.60*** | | | 50.76*** | | |

Note.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

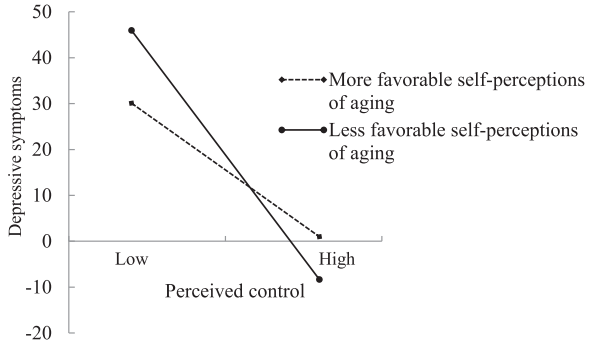


**Fig. 2.** Association between perceived control and depressive symptoms, moderated by self-perceptions of aging.

older adults have been likely to have negative aging experiences and to develop negative aging attitudes (Chow and Bai, 2011; Lai, 2009; Liang, 2014). In order to disengage from the "typical" old age and counteract negative stereotypes of aging, Chinese older adults might develop younger subjective age as a self-protection strategy (Liang, 2014). The findings may pave the way for future interventions interested in inducing a younger subjective age to alleviate older adults' depressive symptoms. For instance, Stephan et al. (2013) succeeded in inducing a younger subjective age by redirecting older adults' attention to downward social comparison with same-aged peers. Even so, the ethical concerns and the potential repercussion of inducing younger subjective ages still remain the key issue that we must seriously consider in future research. More importantly, the present study adds to the literature by examining the mediating role perceived control and the moderating role self-perceptions of aging play in the relationship between subjective age and depressive symptoms. Our finding may provide clear and valuable insights regarding the mechanisms involved in depressive symptoms in old age.

This study revealed that younger subjective age is positively associated with perceived control, thereby reducing older adults' depressive symptoms, which is similar to the findings of previous research (Levy et al., 2002). A possible explanation for this mediating effect is the motivational approach (Teuscher, 2009), which assumes that younger subjective age is a special form of self-enhancement. Specifically, older adults who feel younger than their chronological ages tend to have higher levels of general or specific self-efficacy (Boehmer, 2007; Schafer and Shippee, 2010; Stephan et al., 2011; Teuscher, 2009), believe that they can negotiate the aging process more smoothly, and exercise better control of their own living environment, meaning they experience higher levels of life satisfaction and less negative emotions (Bergland et al., 2014). It has also been suggested that individuals with strong perceived control have a higher degree of autonomy and self-efficacy. They are confident that they can successfully solve problems and satisfy their own needs. Thus, they take the initiative to adjust their status to adapt to changes in the environment, such as by adopting an active coping strategy, consequently reducing the incidence of depressive symptoms and undesirable moods (Hobfoll and Walfisch, 1986). In contrast, individuals with weak perceived control believe their outcomes are caused by uncontrollable external factors (such as fate and opportunity); they believe that making personal efforts is futile (Judge and Bono, 2001), and may experience more psychological pressure. Considering the above, our findings provide empirical support for the view that perceived control plays an important role in the relationship between feeling younger and depressive symptoms among older adults.

The study also found that the mediating effect of perceived control between subjective age and depressive symptoms is moderated by self-perceptions of aging. Specifically, a simple slope test indicated that the relationship between perceived control and depressive symptoms is stronger for Chinese older adults with less favorable self-perceptions of aging than for those with more favorable self-perceptions of aging. This pattern is similar to others reported in previous research (Mock and Eibach, 2011). It has been suggested that older adults with less favorable self-perceptions of aging are more strongly affected by negative aging stereotypes (Levy and Banaji, 2002). In particular, it is widely believed that older adults who have lost their abilities and competences in many areas (Richeson and Shelton, 2006) are more likely to develop less favorable self-perceptions of aging, experience lower levels of self-efficacy, and lack the confidence to maintain good memory or other cognitive skills; consequently, they adopt evasive or passive methods of addressing their situations, and have increased incidences of depressive symptoms. To some extent, individual attitudes and beliefs often constitute a self-fulfilling prophecy (Jussim et al., 2003; Levy et al., 2002); this means that people's positive and negative expectations for their futures can evoke cognitive and behavioral processes, which in turn can turn the original expectations into reality. Thus, individuals who perceive themselves as aging less favorably are more likely to suffer deteriorations in their mental health (Levy et al., 2002; Levy, 2003) and to experience depressive symptoms. Although mathematically equivalent model or alternative model could have been interpreted (for example, subjective age mediating the effect of perceived control between depressive symptoms), the analysis in this study depend on empirical findings and theoretical statements about subjective age, self-perceptions of aging and its role in emotional state among older adults (e.g., Barker et al., 2007; Choi and Dinitto, 2014; Freeman et al., 2016; Keyes

and Westerhof, 2012).

Several limitations must be considered when interpreting the results of the present study. First, the targets of this study were older adults who were able to live independently of their communities, rather than a clinical sample (e.g., none of the participants had cognitive impairments). Therefore, the current findings should not be generalized to other populations. However, to resolve this, future studies could apply this model to other samples (e.g., clinical samples). Second, we cannot make any causal inferences from the cross-sectional design (Preacher, 2015), especially in the direction of the relationship between subjective age and depressive symptoms, which might be bidirectional. Further studies should use experimental designs or longitudinal designs to provide robust empirical evidence for the causal assumptions that are made in this study. Third, this study used a unidimensional measure of subjective age. Although the most widely used operationalization of subjective age involves asking individuals how old they are (Kotter-Grühn et al., 2016), researchers have identified multidimensionality in the subjective age construct, stating that it includes dimensions such as felt age, apparent age, behavioral age, and interest age (Kastenbaum et al., 1972). Thus, future studies should pay more attention to the multidimensionality of subjective age and explore whether other subjective age dimensions, such as apparent age, behavioral age, and interest age, can contribute to depressive symptoms among older adults.

Despite these limitations, the present study confirmed possible cross-cultural similarities regarding youthful subjective age bias in Chinese older adults. This study supports the theory that subjective age can be considered a potential alternative marker of development time and that it is associated with depressive symptoms in older adults. Furthermore, our findings revealed that perceived control may serve as a potential mechanism by which subjective age is associated with depressive symptoms. Moreover, it addresses the critical issue of "what works for whom," revealing that the mediation mechanism is moderated by self-perceptions of aging, and the indirect impact of younger subjective age on depressive symptoms, through increased perceived control, appears to be stronger for older adults who hold less favorable self-perceptions of aging. In summary, our findings may provide insights into the mechanisms underlying the relationship between subjective age and depressive symptoms among Chinese older adults and demonstrate the importance of the moderated mediation model.

## Conflict of interest

None

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