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Attitudes to Aging and Emotional Well-Being Among Middle-Aged and Older Adults During the COVID-19 Pandemic in China: The Mediating Role of Emotion Regulation

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ABSTRACT: Attitudes to aging exert impacts on emotional well-being, yet the underlying psychological mechanisms and their stability across middle and older adulthood remain insufficiently understood. Based on the dual-factor model of mental health and the constructivist theory of emotional aging, this study aimed to: (1) examine the mediating role of emotion regulation in the relationship between aging attitudes and emotional well-being during the COVID-19 pandemic; (2) test the cross-age consistency of this mediating mechanism between middle-aged and older adults. Middle-aged and older residents ($N = 653$) participated in this study from 22 April to 24 April 2020. Participants completed questionnaires to assess their attitudes to aging, the use of emotion regulation strategies, and their levels of emotional well-being. Mediation roles and confidence intervals (CIs) were calculated using a bootstrap resampling method. Results showed that (1) Older adults exhibited slightly higher negative attitudes to aging, calmness, and boredom than the middle-aged group. They also used rumination, distraction, and social sharing strategies a little more frequently than middle-aged adults. (2) Full-sample mediation analyses indicated that positive aging attitudes were positively associated with positive affect through adaptive emotion regulation, and negative aging attitudes were positively associated with negative affect through maladaptive emotion regulation. (3) Moderated mediation analyses revealed that age group or age did not significantly moderate either mediating pathway. The mediating effect of emotion regulation on the relationship between aging attitudes and emotional well-being appeared stable across the two age groups. These findings support the constructionist approach to emotional aging. Interventions for successful aging should consider cultivating positive aging attitudes and adaptive emotion regulation, as these approaches are potentially both valuable for middle-aged and older adults.

Keywords: Attitudes to aging; Emotional well-being; Emotion regulation; The dual-factor model of mental health; COVID-19

1. Introduction

The global population aged 60 and above is projected to account for 22% by 2050, highlighting the increasing significance of aging-related issues worldwide [1]. Individuals' attitudes to aging (ATA) have been identified as a pivotal determinant in shaping the psychological well-being of middle-aged and older adults [2,3]. ATA are multidimensional and influence multiple life domains, including physical health, interpersonal relationships, and social-emotional functioning [4]. However, the COVID-19 pandemic has exacerbated psychological distress and negative affective states among this diverse demographic [5]. This is particularly concerning, as both middle-aged and older individuals have faced increasing age-related challenges, such as declining physical health, age discrimination, and disruptions to employment and social engagement [6,7]. Under these conditions, emotion regulation could become a fundamental ability in the process of social adaptation, helping maintain well-being. Given that ATA may be associated with the emotion regulation individuals employ, which in turn shape affective outcomes, examining emotion regulation as a potential mediator can provide valuable insights into the psychological mechanisms linking ATA to well-being during the pandemic.

1.1. Attitudes to Aging and Emotional Well-Being

The ATA refers to one's feelings and perceptions of their own aging, encompassing both affective and cognitive representations [8]. Empirical studies have shown that positive attitudes toward aging are associated with more favorable and successful aging outcomes [9], whereas negative perceptions may exacerbate emotional reactivity to daily stressors [10] and increase the risk of mental illnesses [11]. While research has linked ATA to various mental health outcomes, a more comprehensive understanding of the multifaceted relationship between the positive attitudes to aging (PATA) and negative attitudes to aging (NATA) and mental health remains underexplored. The dual-factor model of mental health conceptualizes mental health as encompassing both positive and negative dimensions [12]. However, limited research has synthesized how PATA and NATA relate to the dual indicators of mental health within this framework. Recent studies have examined the validity of the dual-factor model in the context of older adults and found that PATA and NATA had opposite pathways on mental health outcomes [13,14]. Another study on older adults' aging attitudes and sleep quality found distinct relationships between the two attitude types and sleep quality. PATA played a moderating role between stressful life events and sleep quality, while NATA mediated this association, further highlighting the complex relationships between the two attitude types and older adults' well-being [15]. These align with similar results from previous studies [7,8], providing a valuable foundation for further in-depth research in this area.

The COVID-19 pandemic has exacerbated age stereotypes and ageism, potentially driving a shift toward more negative attitudes toward aging, particularly among older adults [10,16]. Compounding this dynamic, older adults faced substantially higher risks of severe illness and mortality from COVID-19 compared to younger and middle-aged groups, and they also reported greater anxiety in the face of pandemic-related stressors [16–18]. Interestingly, most research regarding ATA has focused on older adults, while paying less attention to middle-aged individuals. However, age-related loss experiences have been found to be associated with depressive symptoms in both middle-aged and older adults [19]. Moreover, age discrimination may increase aging anxiety through the internalization of self-perception about aging, resulting in subsequent negative consequences such as depression and loneliness, not only in older persons, but also in the middle-aged population [20]. These findings highlight the importance of investigating ATA patterns across middle-aged and older groups.

Emotional well-being has been defined as the affective part of subjective well-being [21], which is an essential indicator of quality of life [3] and healthy psychological functioning. Based on the dual-factor

model of mental health [12], both positive affect (PA) and negative affect (NA) are considered key components of emotional well-being [22].

While prior studies suggest distinct roles for PATA and NATA in relation to mental health outcomes [2,12], the underlying psychological pathways linking ATA to emotional well-being remain unclear. Distinct patterns may also exist between middle-aged and older adult populations, as research indicates older adults tend to report more positive emotions and less anxiety compared to middle-aged individuals during the prolonged COVID-19 pandemic [18,23], despite being less influenced by optimism [24]. Investigating the relationship between emotional well-being and two types of ATA amid COVID-19 threats is therefore essential, as different attitudes may play distinct roles across middle-aged and older generations.

1.2. The Mediating Role of Emotion Regulation

How people manage their emotions through emotion regulation may be a crucial factor in understanding the associations between ATA and emotional well-being. Emotion regulation refers to the processes through which individuals modulate their emotions in response to external environments [25]. The capacity for effective emotion regulation is of paramount importance in fostering emotional well-being, particularly for those in the later stages of the life course [26–28].

Theoretical perspectives offer different predictions regarding age-related patterns in emotion regulation. On the one hand, the Socioemotional Selectivity Theory (SST) [25] and the Strength and Vulnerability Integration Model (SAVI) [29] both suggest that older adults tend to exhibit greater efficacy and efficiency in managing their emotions. SST posits that individuals' social motivations are shaped by their perceptions of their remaining lifetime. When people perceive their future time as limited, they prioritize emotionally meaningful, satisfying social goals [25], which might explain why older adults display more positive emotions and adopt more adaptive strategies compared to younger adults [30]. SAVI emphasizes that older adults' emotional well-being depends on whether they can avoid sustained, high-arousal negative stimuli. Age-related emotional advantages are evident when such stimuli are avoidable, but diminish or even vanish when they are unavoidable. Taken together, SST and SAVI suggest that older adults potentially be motivated to avoid arousal and experience more pleasant affect through emotion regulation during the COVID-19 pandemic [4,31].

On the other hand, recent theoretical advances, particularly the constructionist approach to emotional aging [32], emphasize that emotions are constructed by domain-general core systems and a conceptualization process that may remain relatively stable across adulthood. This perspective suggests that the fundamental psychological processes underlying emotional experiences may exhibit continuity rather than age-related differences. While older and middle-aged adults may differ in the frequency of specific strategies used [33,34], it remains unclear whether the mediating pathways through which ATA are linked to emotional well-being via emotion regulation are age-specific or consistent across age groups, particularly when facing health-threatening events.

Therefore, based on the dual-factor model of mental health [35], the present study aims to: (1) investigate whether adaptive and maladaptive emotion regulation strategies mediate the relationships between PATA and PA, NATA and NA, respectively; (2) employ moderated mediation analysis to test the age consistency of these mediating mechanisms across middle-aged and older populations.

2. Materials and Methods

2.1. Participants

The data were collected from 22 April to 24 April 2020, during the first wave of the COVID-19 pandemic in China. A web-link of the questionnaire was advertised on popular social network software in China, such as WeChat and QQ. A total of 7135 participants completed the self-report questionnaires.

Participants were excluded from the data analysis if they: (1) failed the lie detector test, which comprised 3 items, by false responses over two times; (2) exhibited straight-lining responses; (3) completed the questionnaires in less than 100 s or more than one hour. There were 5546 participants left after exclusions. Based on the China Health and Retirement Longitudinal Study (CHARLS) [36], we included participants aged 45 and above in the current study. To examine potential life-stage differences, we adopted a group-comparison design, classifying participants into the middle-aged group (45–59 years old) and the older group (≥60 years). This classification aligns with the statutory definition of "elderly" in Chinese policy [37] and is commonly employed in gerontological and social science research [38,39]. This research was examined and approved by the Ethics Review Board of Central China Normal University. Written informed consent was obtained from all participants prior to study commencement.

2.2. Measures

2.2.1. Attitudes to Aging

Attitudes to Aging were measured with a shortened version of the Chinese version of Attitude to Ageing Questionnaire (C-AAQ) [40], with two conceptualized dimensions: PATA and NATA. Reducing the number of scale items has been recognized as a strategy to improve research efficacy [41,42]. Hence, we selected four items from the C-AAQ, each measured on a 5-point Likert scale (1 = totally disagree, 5 = totally agree). Two items were used to measure PATA (*i.e.*, "As people getting older, they are better able to cope with life", "It is a privilege to grow old"), while two items were used to measure NATA (*i.e.*, "Old age is a time of loneliness", "Old age is a depressing time of life"). Higher scores on the PATA subscale indicated more positive attitudes toward aging, whereas higher scores on the NATA subscale reflected more negative attitudes. In the middle-aged group, the correlation between the two PATA items was 0.50 ($p < 0.001$), while the correlation between the two NATA items was 0.50 ($p < 0.001$). In the older group, the correlations between the two PATA items and the two NATA items were 0.60 ($p < 0.001$) and 0.61 ($p < 0.001$), respectively.

2.2.2. Emotion Regulation

The Emotion Regulation Strategies Scale was used to measure the ways individual regulated their emotions during the peak of the national pandemic [43]. The instruments were explicitly framed within the pandemic context, such as "during the pandemic, how did you typically regulate and manage your emotions". The scale consisted of 6 items, with reflection, reappraisal, social sharing, and distraction categorized as adaptive strategies; while rumination and expressive suppression were considered as maladaptive strategies [25,44]. Participants rated each item on a 5-point Likert scale ranging from 0 (not at all) to 4 (very much), with higher scores indicating greater frequency of strategy use. In the middle-aged group, the Cronbach's alphas were 0.70 for adaptive emotion regulation, and the correlation was 0.31 ($p < 0.001$) between the two maladaptive emotion regulation items. In the older group, the Cronbach's alphas were 0.70 for adaptive emotion regulation, and the correlation was 0.36 ($p < 0.001$) between the two maladaptive emotion regulation items.

2.2.3. Affect States

Items from the Positive and Negative Affect Schedule (PANAS) [45] were used to assess participants' current affective states. To optimize measurement efficiency [41,42], positive affect (PA) was measured with four items (*i.e.*, excited, energetic, calm, and relaxed). Similarly, negative affect (NA) was measured using four items (*i.e.*, angry, worried, bored, and lonely). Participants rated each item on a five-point scale ranging from 1 (not at all) to 5 (extremely), resulting in separate measures of PA and NA. Higher scores indicated higher levels of PA and NA, respectively. In the middle-aged group, the Cronbach's alphas were

0.77 for the PA subscale and 0.85 for the NA subscale. In the older group, the Cronbach's alphas were 0.81 for the PA subscale and 0.84 for the NA subscale.

2.3. Data Analysis

Descriptive statistics and correlations for all variables included in the models were conducted using SPSS version 26.0. The mediating effects were assessed using the PROCESS version 3.3 with a bootstrap procedure, with 5000 bootstrapped samples drawn and 95% confidence intervals calculated [46]. First, the mediating role of emotion regulation was examined using Model 4 of the PROCESS macro program. Next, Model 59 of the PROCESS macro program was used to examine the age differences in the mediating mechanism, conditional indirect effects were estimated for each group separately. And the significance of age group differences was tested using the moderated mediation index. A Harman's single factor test was performed to examine common method variance [47]. And variance inflation factors (VIFs) were examined to assess multicollinearity [48].

3. Results

3.1. Descriptive Statistics and Correlation Analysis

The Harman's single-factor test revealed that the total variance for a single factor was 22.37%, which was lower than the 40% threshold, indicating that common method variance was not a significant issue in the present study [47]. Additionally, the VIFs for all predictor variables were below 2, suggesting that multicollinearity did not exist in our study [48].

The demographic characteristics of the study sample are presented in Table 1. Overall, 194 participants (29.71%) were aged 60 years and older, and 370 (56.67%) were male. The majority of the sample (82.54%) resided in urban areas, and 608 participants (93.11%) lived with others. Regarding self-rated health status, the proportions of subjects with good, moderate, and poor health levels were 53.60%, 38.28%, and 8.12%, respectively. All participants reported higher PATA ($M = 3.17$, $SD = 0.96$) than NATA ($M = 2.68$, $SD = 1.07$) ($t = 8.858$, $p < 0.001$), with higher PA ($M = 3.28$, $SD = 0.83$) than NA ($M = 2.45$, $SD = 0.98$). Noteworthy, older adults reported higher NATA, NA, and used more emotion regulation strategies than the middle-aged group. To clarify the specific differences between the two groups, we conducted further comparisons of discrete emotions and regulation strategies, with gender, marital status, health status, region, and residence types as covariates. Specifically, older samples reported slightly higher levels of calmness ($F = 9.837$, $p = 0.002$, $\eta^2 = 0.015$) and boredom ($F = 11.873$, $p = 0.001$, $\eta^2 = 0.018$) than middle-aged participants. They also used social sharing ($F = 7.530$, $p = 0.006$, $\eta^2 = 0.012$), distraction ($F = 9.323$, $p = 0.002$, $\eta^2 = 0.014$) and rumination ($F = 5.354$, $p = 0.021$, $\eta^2 = 0.008$) somewhat more frequently for emotion regulation. Detailed demographics and specific differences for the two groups are provided in Supplementary Materials Tables S1 and S2.

Table 1. Participants Characteristics and Associations with Primary Variables (*N* = 653).

Variables	N	PATA Mean (SD)	F	NATA Mean (SD)	F	AR Mean (SD)	F	MR Mean (SD)	F	PA Mean (SD)	F	NA Mean (SD)	F
Age (years)			0.229		5.391 * (0.008)		4.849 * (0.007)		15.614 *** (0.023)		3.441		18.858 *** (0.028)
45–59	459	3.18 (0.95)		2.61 (1.04)		2.33 (0.75)		1.66 (0.91)		3.25 (0.84)		2.34 (0.96)	
60–76	194	3.14 (1.02)		2.83 (1.14)		2.47 (0.67)		1.97 (0.90)		3.38 (0.83)		2.70 (0.97)	
Gender			4.082 * (0.006)		2.449		0.416		16.656 *** (0.025)		1.081		9.535 ** (0.014)
Male	370	3.18 (0.95)		2.61 (1.04)		2.33 (0.75)		1.66 (0.91)		3.25 (0.84)		2.34 (0.96)	
Female	283	3.14 (1.02)		2.83 (1.14)		2.47 (0.67)		1.97 (0.9)		3.38 (0.83)		2.70 (0.97)	
Education			1.823		2.199		0.28		0.217		0.48		1.147
primary	29	3.03 (0.85)		3.10 (1.19)		2.31 (0.81)		1.74 (0.91)		3.27 (0.63)		2.74 (0.81)	
junior	115	3.15 (1.03)		2.67 (1.12)		2.33 (0.73)		1.82 (0.92)		3.26 (0.78)		2.48 (0.95)	
senior	253	3.12 (0.97)		2.63 (1.06)		2.36 (0.75)		1.75 (0.93)		3.27 (0.84)		2.43 (0.97)	
Undergraduate	226	3.3 (0.93)		2.63 (1.03)		2.41 (0.71)		1.74 (0.91)		3.29 (0.88)		2.38 (1)	
Graduate	30	2.92 (1.1)		3.03 (1.22)		2.39 (0.77)		1.68 (0.86)		3.48 (0.88)		2.62 (1.11)	
Marital status			0.214		4.372 * (0.011)		0.904		0.206		0.522		7.640 * (0.013)
single	39	3.10 (0.90)		3.03 (1.19)		2.26 (0.76)		1.82 (0.8)		3.38 (0.67)		2.87 (0.88)	
married	614	3.18 (0.97)		2.66 (1.06)		2.38 (0.73)		1.75 (0.93)		3.28 (0.84)		2.42 (0.98)	
Health status			3.728 * (0.011)		10.032 *** (0.030)		0.043		11.727 *** (0.035)		5.979 ** (0.018)		26.584 *** (0.076)
① poor	53	2.97 (0.98)		3.05 (1.07)		2.39 (0.69)		2.17 (0.84)		3.08 (0.84)		3.06 (0.99)	
② moderate	250	3.09 (0.88)	③ > ① ③ > ②	2.83 (1.04)	① > ③ ② > ③	2.36 (0.67)		1.87 (0.90)	① > ② > ③	3.19 (0.79)	③ > ① ③ > ②	2.64 (0.91)	① > ② > ③
③ good	350	3.26 (1.02)		2.51 (1.07)		2.37 (0.78)		1.61 (0.92)		3.39 (0.85)		2.22 (0.96)	
Region			0.243		4.376 * (0.007)		0.204		9.205 ** (0.014)		0.472		5.410 * (0.008)
urban	539	3.18 (0.96)		2.64 (1.06)		2.37 (0.73)		1.71 (0.91)		3.27 (0.84)		2.41 (0.97)	
rural	114	3.13 (1.04)		2.87 (1.12)		2.4 (0.73)		1.99 (0.92)		3.33 (0.84)		2.64 (1.02)	
Residence types			5.187 * (0.008)		0.626		3.986 * (0.006)		1.017		1.053		8.267 * (0.013)
live alone	45	2.86 (0.89)		2.80 (1.25)		2.16 (0.79)		1.89 (0.79)		3.16 (0.92)		2.85 (0.92)	
live with others	608	3.20 (0.97)		2.67 (1.06)		2.39 (0.73)		1.75 (0.93)		3.29 (0.83)		2.42 (0.98)	
Monthly income			2.881		0.777		2.029		1.246		1.382		0.278
0–5000	258	3.06 (0.95)		2.62 (1.12)		2.3 (0.69)		1.69 (0.94)		3.22 (0.82)		2.42 (0.97)	
5001–20,000	311	3.25 (0.94)		2.69 (1.04)		2.41 (0.74)		1.81 (0.89)		3.34 (0.8)		2.46 (0.97)	
20,000+	84	3.23 (1.11)		2.79 (1.09)		2.44 (0.81)		1.79 (0.95)		3.29 (0.99)		2.50 (1.06)	

Note: PATA = Positive attitudes to aging; NATA = Negative attitudes to aging; AR = Adaptive Emotion Regulation; MR = Maladaptive Emotion Regulation; PA = Positive Affect; NA = Negative Affect. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Means, standard deviations, and partial correlations among the study variables are shown in Table 2, with a few relevant demographic variables (age, gender, health status, marital status, and region) controlled. PATA were positively correlated with adaptive emotion regulation ($r = 0.208$, $p < 0.001$) and PA ($r = 0.276$, $p < 0.001$). NATA were positively correlated with maladaptive emotion regulation ($r = 0.261$, $p < 0.001$) and NA ($r = 0.451$, $p < 0.001$). Additionally, PA was negatively correlated with NA ($r = -0.243$, $p < 0.001$). Notably, PATA were not significantly correlated with NATA ($r = 0.043$, $p = 0.261$) or NA ($r = 0.007$, $p = 0.832$). Similarly, the associations between NATA and adaptive emotion regulation ($r = 0.044$, $p = 0.281$) or and PA ($r = -0.037$, $p = 0.307$) were not significant.

Table 2. Means, Standard Deviations, and Correlations Between the Variables ($N = 653$).

	$M \pm SD$	1	2	3	4	5	6	7	8
1. Positive attitudes to aging	3.17 ± 0.97	1							
2. Negative attitudes to aging	2.68 ± 1.07	0.043	1						
3. Adaptive emotion-regulation	2.37 ± 0.73	0.208 ***	0.044	1					
4. Maladaptive emotion-regulation	1.76 ± 0.92	0.162 ***	0.261 ***	0.411 ***	1				
5. Rumination	1.77 ± 1.14	0.072	0.227 ***	0.350 ***	0.813 ***	1			
6. Expressive suppression	1.74 ± 1.11	0.191 ***	0.194 ***	0.312 ***	0.800 ***	0.302 ***	1		
7. Positive affect	3.28 ± 0.84	0.276 ***	−0.037	0.228 ***	0.010	−0.052	0.071	1	
8. Negative affect	2.45 ± 0.98	0.007	0.451 ***	0.040	0.342 ***	0.289 ***	0.263 ***	−0.243 ***	1

Note: M = Mean; SD = Standard Deviation. *** $p < 0.001$.

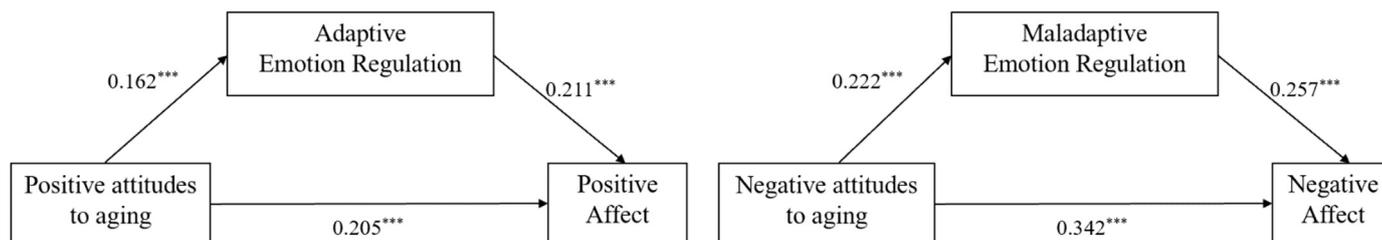### 3.2. Mediation Model Analysis

The results of the mediation analyses are presented in Table 3. The first mediation model (Model 4 in PROCESS) was assessed, with PATA, adaptive emotion regulation strategies, and PA as the variables of interest, and health status as a covariate. PATA positively predicted adaptive emotion regulation ($\beta = 0.162$, $p < 0.001$) and PA ($\beta = 0.205$, $p < 0.001$). Additionally, adaptive emotion regulation positively predicted PA ($\beta = 0.211$, $p < 0.001$). The bias-corrected bootstrap procedure revealed a significant indirect effect of PATA on PA through adaptive emotion regulation (Effect = 0.034, 95% CI [0.018, 0.066]; accounting for 14.23% of the total effect), supporting the mediating role of adaptive emotion regulation in the link between PATA and PA among middle-aged and older adults (Figure 1).

A second mediation model (Model 4 in PROCESS) was then assessed to examine whether maladaptive emotion regulation mediated the relationship between NATA and NA among the two age groups, with gender, health status, living situation, marital status, and monthly household income per capita as covariates. The results showed that NATA positively predicted maladaptive emotion regulation ($\beta = 0.222$, $p < 0.001$) and NA ($\beta = 0.342$, $p < 0.001$). Maladaptive emotion regulation also positively predicted NA ($\beta = 0.257$, $p < 0.001$). The bias-corrected bootstrap procedure showed a significant indirect effect of negative ATA on NA through maladaptive emotion regulation (Effect = 0.057, 95% CI [0.037, 0.093]; accounting for 14.29% of the total effect), which also supported the mediating role of maladaptive emotion regulation between NATA and NA across both age groups (Figure 1).

Specifically, as previous research has argued that rumination and expressive suppression may manifest different emotional goals [44], a parallel mediation model (Model 4 in PROCESS) was additionally tested, with NATA as the independent variable, rumination and expressive suppression as parallel mediating variables, and NA as the dependent variable. Results showed that both indirect effects via rumination and expressive suppression were significant (Effect = 0.033, 95% CI [0.015, 0.056]; Effect = 0.024, 95% CI [0.009, 0.045]). Detailed information is provided in the Supplementary Materials Table S3.

Table 3. Summary of the Mediation Models.

Predictor	Outcome	SE	β	t	p	95% CI
Positive attitudes to aging	Adaptive emotion regulation	0.029	0.162	5.566	<0.001	[0.105, 0.219]
Positive attitudes to aging	Positive affect	0.033	0.205	6.303	<0.001	[0.141, 0.269]
Adaptive emotion regulation	Positive affect	0.043	0.211	4.925	<0.001	[0.127, 0.295]
Negative attitudes to aging	Maladaptive emotion regulation	0.032	0.222	6.943	<0.001	[0.159, 0.285]
Negative attitudes to aging	Negative affect	0.031	0.342	11.004	<0.001	[0.281, 0.402]
Maladaptive emotion regulation	Negative affect	0.037	0.257	6.988	<0.001	[0.185, 0.329]

Figure 1. The mediation analysis of emotion regulation. Note: Path values are path coefficients. *** $p < 0.001$.

3.3. Moderated Mediation Analysis

As shown in Table 4, the moderated mediation model revealed that the interaction between PATA and age group on adaptive emotion regulation was not significant ($\beta = -0.076$, $p = 0.217$). The interactions between PATA and age group on PA ($\beta = -0.070$, $p = 0.919$), between adaptive emotion regulation and age group on PA were also not significant ($\beta = -0.089$, $p = 0.366$). Specifically, the conditional indirect effects showed a significant indirect effect in the middle-aged group (Effect = 0.042, 95% CI [0.019, 0.069]), while the indirect effect was not significant in the older group (Effect = 0.015, 95% CI [−0.007, 0.054]). The moderated mediation index was −0.027 (95% CI [−0.063, 0.019]), suggesting that age group did not significantly moderate this mediating pathway.

Similarly, none of the interactions between NATA and age group on maladaptive emotion regulation ($\beta = 0.015$, $p = 0.825$), NATA and age group on NA ($\beta = -0.025$, $p = 0.703$), or maladaptive emotion regulation and age group on NA were non-significant ($\beta = 0.116$, $p = 0.149$). The indirect effects were significant in both the middle-aged group (Effect = 0.047, 95% CI [0.021, 0.080]) and the older group (Effect = 0.077, 95% CI [0.034, 0.130]). The moderated mediation index was 0.030 (95% CI [−0.022, 0.090]), which was also non-significant, indicating that the mediating role of maladaptive emotion regulation was consistent across two age groups.

Table 4. Summary of Moderated Mediation Models.

Dependent Variable	Path	SE	β	t	p	95% CI
Adaptive emotion regulation	Positive attitudes to aging	0.087	0.263	3.032	0.003	[0.093, 0.433]
	Age group	0.063	0.143	2.286	0.023	[0.020, 0.266]
	Positive attitudes to aging × age group	0.062	−0.076	−1.236	0.217	[−0.197, 0.045]
Positive affect	Positive attitudes to aging	0.097	0.215	2.219	0.027	[0.025, 0.405]
	Adaptive emotion regulation	0.131	0.313	2.394	0.017	[0.056, 0.570]
	Age group	0.069	0.168	2.436	0.015	[0.033, 0.304]
	Positive attitudes to aging × age group	0.069	−0.007	−0.101	0.919	[−0.142, 0.128]
	Adaptive emotion regulation× age group	0.098	−0.089	−0.904	0.366	[−0.282, 0.104]
Maladaptive emotion regulation	Negative attitudes to aging	0.095	0.200	2.102	0.036	[0.013, 0.386]

	Age group	0.077	0.161	2.079	0.038	[0.009, 0.313]
	Negative attitudes to aging × age group	0.067	0.015	0.222	0.825	[−0.116, 0.146]
	Negative attitudes to aging	0.093	0.373	4.022	0.001	[0.191, 0.555]
Negative affect	Maladaptive emotion regulation	0.109	0.104	0.951	0.342	[−0.111, 0.319]
	Age group	0.073	0.098	1.342	0.181	[−0.046, 0.242]
	Negative attitudes to aging × age group	0.065	−0.025	−0.382	0.703	[−0.153, 0.103]
	Maladaptive emotion regulation × age group	0.080	0.116	1.444	0.149	[−0.042, 0.274]

3.4. Supplementary Analyses

A series of supplementary analyses was conducted to examine the robustness and extensibility of the hypothesized models. First, we tested the reverse mediation model (*i.e.*, adaptive emotion regulation mediated the association between NATA and NA, and maladaptive emotion regulation mediated the association between PATA and PA), and the results showed that all paths were not significant. The absence of significant indirect effects in these reverse models provided evidence for the discriminant validity of the dual-factor approach, demonstrating that positive and negative constructs are associated through distinct regulatory pathways rather than cross-domain associations. Second, we tested the moderating role of key demographic variables (age, health status, region, and gender) in the hypothesized models (Model 59 in PROCESS), and all moderating effects were not significant. This indicated that the mediating mechanism of emotional regulation between aging attitudes and affective states was relatively consistent across groups with different levels of health, gender, or residential backgrounds, and the age-related mediating pattern was robust. Detailed information is presented in the Supplementary materials Tables S4 and S5.

4. Discussion

The current study investigated the mediating role of emotion regulation in the association between attitudes to aging and emotional well-being and examined the cross-age consistency of this mechanism among middle-aged and older adults during the COVID-19 pandemic. First, results revealed that compared to middle-aged adults, older adults reported slightly higher levels of NATA, boredom, and calmness, alongside a slightly higher overall frequency of emotion regulation strategies used. More importantly, the mediating role of emotion regulation manifested age-related consistency across the two age groups. Adaptive emotion regulation mediated the relationship between PATA and PA, whereas maladaptive emotion regulation mediated the link between NATA and NA.

The present study revealed a relatively consistent pattern of emotional well-being in both middle-aged and older adult participants. Specifically, both age groups reported a prevalent experience of positive affect despite the threats posed by the COVID-19 pandemic. Additionally, ATA was significantly associated with affective states in both age groups, which is consistent with previous research conducted during and before the pandemic [13,18,20,28]. In particular, PATA were linked to higher PA, while NATA were linked to higher NA. These findings are accordant with the dual-factor model of mental health, demonstrating that PATA and NATA have independent, parallel associations with emotional well-being [14,15]. Notably, age-related increases in negative attitudes toward aging (NATA) among older adults may stem from COVID-ageism [10,31], while their marginally higher levels of both calmness and boredom might suggest a shift toward lower-arousal emotional experiences consistent with SST [29]. They also employed social sharing, distraction, and rumination more frequently, likely as attempts to regulate this low-arousal emotional landscape [34,49].

Beneath these group differences, the two mediation models further supported the dual-factor model in our data, indicating that positive and negative pathways to well-being in midlife and later adulthood may operate concurrently, with relatively balanced regulatory efforts and emotional outcomes [35]. For the positive pathway, PATA may help individuals maintain better mood states and facilitate adaptive

functioning, improving effective stress management by enhancing adaptive emotion regulation to deal with ongoing uncertainties and stresses [8,13,14]. For the negative pathway, individuals with NATA may have difficulties disengaging their attention from undesirable information (*i.e.*, ageism, morality, economic recession) and even internalize stereotypical views [7], decreasing their self-regulation capacity for life management [13,15]. Importantly, however, the frequency differences in strategy use do not imply that the effectiveness or functional role of these strategies differs by age. The moderated mediation indices demonstrate that the functional pathways linking aging attitudes to emotional well-being through emotion regulation operate similarly in both age groups. This might align with the constructionist perspective on emotional aging [32]. While emotional strategies or momentary affect may vary across individuals and contexts, the underlying conceptualization systems that construct emotional experiences are relatively stable across adulthood.

It is noteworthy, however, that the indirect effects through emotion regulation accounted for approximately 14% of the total effects, indicating that the direct pathways from aging attitudes to emotional well-being were substantially stronger. This pattern suggests that aging attitudes exert a more direct and automated influence on emotional outcomes. As fundamental cognitive schemas, attitudes toward aging shape how individuals interpret age-related experiences, anticipate their future, and appraise daily events [11,18]. These influences likely operate through multiple systems, such as affective responses or meaning-making processes, which together contribute to the robust direct associations observed in our data. From a constructionist perspective, attitudes may function as part of the conceptual framework that individuals draw upon to construct emotional experiences [32], further explaining their potent direct effects. Given that direct and indirect pathways may represent different levels of psychological processing, future research should explore how these multiple mechanisms interact and whether their relative contributions differ across contexts or populations.

In summary, our findings demonstrate that emotion regulation mediates the relationship between attitudes to aging and emotional well-being in both middle-aged and older adults, and crucially, that these mediating pathways are consistent across age groups. Positive attitudes to aging foster positive affect through adaptive emotion regulation, while negative attitudes to aging exacerbate negative affect through maladaptive regulation. Therefore, interventions aimed at promoting the emotional well-being of middle-aged and older adults should emphasize both enhancing positive attitudes toward aging and mitigating negative perceptions of aging.

5. Limitations and Future Directions

There are several limitations that warrant consideration. First, the study relied on self-report measures to evaluate emotion regulation strategies and affect states. And emotion response data collected may have been restricted by specific items used in the assessment instrument [34]. In addition, the present findings did not differentiate between self-perceptions of aging and generalized aging stereotypes, suggesting that future research should incorporate more fine-grained measures of aging perceptions. Second, though the study identified plausible pathways linking aging attitudes, emotion regulation, and emotional well-being, the cross-sectional design precluded any causal conclusions. Third, no significant moderating effects of key demographic covariates were detected, which may also reflect limitations inherent to our sample, cross-sectional design, and measurement approach. Future research is warranted to delineate the boundary conditions of the current findings by examining other potential moderators, such as personality traits and specific health conditions. Fourth, the present findings must be interpreted within the specific cultural context of China, which may shape both aging attitudes and preferred emotion regulation strategies [50]. Caution should be exercised when generalizing the findings to other cultural backgrounds or groups. Future research should employ longitudinal or dynamic methods to explore how these associations unfold over time and across changing contexts, particularly during and after major life stressors.

6. Conclusions

This study provides novel evidence on the relationship between individuals' attitudes to aging and their emotional well-being when facing threatening life events, and this psychological pattern exhibits cross-age consistency among middle-aged and older adults. Stressful events such as the COVID-19 pandemic may amplify differences in emotional experiences or strategy use, but do not alter the fundamental mechanisms linking aging attitudes to well-being. These core mechanisms operate similarly across the second half of life, underscoring the stability of fundamental associative patterns even in the face of adversity.

Statement of the Use of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors did not use any AI text-generation tools for drafting. In the final manuscript polishing stage, the authors used Deepseek to refine the article's content and structure. Following the use of these tools, the author has thoroughly reviewed and edited the content and assumes full responsibility for the published material.

Supplementary Materials

The following supporting information can be found at: https://www.sciepublish.com/article/pii/926, Table S1: General Characteristics of the middle-aged group ($N = 459$) and the older group ($N = 194$). Table S2: General Characteristics of the emotion and strategies in two groups. Table S3: Results of the parallel mediation analysis. Table S4: Summary of the Opposite mediation models. Table S5: Moderation analysis of demographic variables (age, area and gender).

Author Contributions

Conceptualization, W.P., X.L. (Xiaoyu Lu) and X.L. (Xu Li); Methodology, W.P., X.L. (Xiaoyu Lu) and X.L. (Xu Li); Software, X.L. (Xiaoyu Lu), S.W. (Shuang Wang); Validation, S.W. (Sisi Wu); Formal Analysis, X.L. (Xiaoyu Lu); Investigation, L.D., J.W.; Resources, W.P.; Data Curation, Z.H.; Writing—Original Draft Preparation, W.P., X.L. (Xiaoyu Lu); Writing—Review & Editing, W.P., X.L. (Xiaoyu Lu) and X.L. (Xu Li); Visualization, S.W. (Sisi Wu); Supervision, W.P. and X.L. (Xu Li); Project Administration, W.P.; Funding Acquisition, W.P. and X.L. (Xu Li).

Ethics Statement

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of Central China Normal University (protocol code CCNU-IRB-202002001b, date of approval: 15 February 2020).

Informed Consent Statement

Informed consent was obtained from all participants prior to their involvement in the study.

Data Availability Statement

Datasets of this study are available from the corresponding author on reasonable request.

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Declaration of Competing Interest

The authors declare that they have no known financial or personal conflicts of interest that could have influenced the design, conduct, data analysis, or reporting of this research.

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