Three Facets of Emotion Regulation in Old and Very Old Age:

Strategy Use, Effectiveness, and Variability

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Author Note

We share the materials (https://osf.io/nhzpw/) and analytic code of our study publicly on the Open Science Framework (https://osf.io/nq652/). The design, hypotheses, and analytical plan of this study were not preregistered. Parts of the data from this study have been presented at the 26th Biennial Meeting of the International Society for the Study of Behavioral Development, Rhodes, Greece, June 19th – 23rd 2022. This research was supported by the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG) awarded to Oliver K. Schilling, Ute Kunzmann, and Denis Gerstorf (grant numbers SCHI 1024/4-1, KU 1267/9-1, GE

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Abstract

The ability to regulate emotions in stressful situations is an important building block for high well-being across the lifespan. Yet, very little is known about how old and very old adults regulate their emotions. In this study, 123 young old adults (M_{age}= 67.18, *SD* = 0.94) and 47 very old adults (M_{age}= 86.70, *SD* = 1.46) were prompted six times a day for seven consecutive days to report both their stressors and ten emotion regulation strategies. Overall, there was little indication of age differences in the use of emotion regulation strategies during exposure to stressors, but very old, as compared with young old, individuals used three of the ten strategies considered here more intensively. The ten emotion regulation strategies were similarly effective across age groups based on their association with perceived overall emotion regulation success. We also did not find age group differences in within-strategy variability, defined as variation in using a given strategy across stressor situations. By contrast, between-strategy variability, defined as the selective use of fewer rather than many strategies across stressor situations, was lower for very old participants. Only between-strategy, and not within-strategy, variability contributed to overall emotion regulation success. There was no age group difference in this regard. Taken together, the evidence suggests small age differences in emotion regulation if at all. This is noteworthy given the advanced age of the very old subsample in this study and the deficits in multiple domains of functioning reported in the literature for this advanced age.

(247 words)

Three Facets of Emotion Regulation in Old and Very Old Age: Strategy Use, Effectiveness, and Variability

Old age is a life period characterized by losses in multiple domains of functioning. Particularly individuals in their eighties and nineties (the "very old") demonstrably experience increasingly pronounced decline in cognitive functioning, physical health, and other key areas of life (e.g., Baltes & Smith, 2003). Yet, researchers working in the field of emotional aging have argued that in the realm of emotion regulation, predictions about what kinds of age-related changes should occur are not easy to make. For example, Socioemotional Selectivity Theory (SST) proposes that because older individuals perceive their future lifetime as increasingly limited, they become highly motivated to regulate their emotions in ways that maximize emotional well-being (Carstensen, 2006). Building up on SST, the Strength and Vulnerability Integration Model (SAVI) further states that older adults deal well with the challenges they face because they can draw on an accumulated body of knowledge and experience with emotion regulation, although age-related vulnerabilities may increasingly counteract such age-related gains (Charles, 2010). Together, these theoretical considerations suggest that emotion regulation changes in complex ways during old and very old age. How and how well older individuals regulate their emotions may be shaped by both basic cognitive and physiological resources that are known to decline with age and by motivational and experience-based factors that potentially remain stable into very old age or even increase.

Previous research on aging and emotion regulation has largely compared young, middle-aged, and older adults (e.g., Kunzmann et al., 2005; Livingstone & Isaacowitz, 2019; Shiota & Levenson, 2009; Wirth & Kunzmann, 2018), and only very few studies have focused on age differences in emotion regulation within old age (e.g., Etxeberria et al., 2016). Given that old age is currently a rapidly growing age segment that lasts several decades for many individuals, our goal was to examine age differences within this age period. Following seminal work conducted by Paul Baltes and colleagues (e.g., Baltes & Smith, 2003), we distinguish

between the so-called young old age (below age 80) and the very old age (above age 80). Despite substantial individual differences within these two phases, previous work shows that for many people, there is a turning point around age 80 when a phase of continuity and selective growth (young old age) transitions to one increasingly characterized by social, cognitive, and health-related losses (the very old age; Baltes & Smith, 2003; Gerstorf et al., 2013). Seen in this light, continuity and growth in emotion regulation becomes increasingly unlikely as individuals enter very old age. However, given the paucity of empirical evidence and the lack of theories on emotional aging that focus specifically on old and very old age, we know little about emotion regulation in very old age. Thus, our goal was to conduct a daily life study and assess how young old and very old individuals regulate their emotions in response to daily stressors. In doing so, we captured a broad spectrum of ten different emotion regulation strategies and were interested in the habitual use, effectiveness, and variability of each strategy.

The Concept of Emotion Regulation

Emotion regulation refers to "the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions" (e.g., Gross, 2015, p. 275). This definition highlights that emotion regulation is based on multiple distinct strategies. Individuals can regulate their emotions by selecting themselves into or out of certain situations (situation selection), changing aspects of the situation (situation modification), directing their attention toward or away from emotionally relevant information (attention deployment), altering the way they think about the situation (cognitive reappraisal), or modulating how they show their feelings (behavioral regulation). Each of these strategies is multidimensional itself. For example, people can engage in various specific cognitive reappraisals, such as thinking about a given stressor in detached or optimistic ways.

The variety of emotion regulation strategies have been examined in terms of habitual use, effectiveness, and variability (Gross, 2015). We refer to habitual use, effectiveness of

use, and variability of use as three facets of emotion regulation. In daily life studies, researchers have defined and operationalized these three facets as follows.

Habitual strategy use refers to the strategies an individual generally uses and stable interindividual differences in their intensity or frequency. Thus, habitual use of a given strategy means that people use this strategy intensively and frequently in their everyday life (e.g., Eldesouky & English, 2018).

The effectiveness of regulation has been defined by asking individuals to rate the success of their regulation attempts immediately after they regulated their emotions in stressful everyday life situations (e.g., Wylie et al., 2022). An alternative approach is to compare the intensity of negative affect during stressful situations while individuals regulate their emotions with stressful situations during which they did not regulate their emotions, assuming that negative affect is lower in the former than the latter (e.g., Livingstone & Isaacowitz, 2021).

Variability refers to the extent to which an individual uses emotion regulation strategies differently at different points in time (i.e., high variability means that a strategy is not always used evenly, but is used heavily at some times and not at all at others). This type of variability is referred to as temporal (Eldesouky & English, 2018) or within-strategy (Blanke et al., 2020) variability. Assuming that individuals face different situational contexts at different measurement time points in a study, high temporal or within-strategy variability is assumed to indicate that individuals adapt their strategies to the situational context. A second aspect of variability is referred to as between-strategy variability (Blanke et al., 2020); it refers to the extent to which an individual selectively uses a few strategies. Between-strategy variability is inversely related to what Eldesouky and English (2018) called categorical variability, where categorical variability is high when an individual uses many strategies and thus has a large repertoire of strategies. It is difficult to say which is more functional, between-strategy variability or categorical variability. However, when an individual's resources are limited, as is the

case in very old age, selective use of strategies and thus focusing on a few strategies is presumably more functional and adaptive (Baltes & Smith, 2003).

The different facets of emotion regulation – habitual use, effectiveness, and variability – may be positively related. For example, people might use certain emotion regulation strategies frequently because they use them successfully, or someone who uses emotion regulation strategies in more variable ways should be more effective. However, the links among facets could also be more complex. For example, it is easy to imagine someone using a strategy successfully and therefore not using it frequently. Seen in this light, it is difficult to generalize from one facet to another. Thus, to obtain a comprehensive picture of age differences in emotion regulation, it is important to examine the three facets separately, preferably within one research design.

Age Differences in Emotion Regulation: Theoretical Ideas

In principle, age differences can occur in all three facets of emotion regulation, habitual use, effectiveness, and variability. For example, if individuals increasingly prioritize positive over negative emotions as they age in order to maximize their emotional well-being in the very moment (Carstensen, 2006, Charles, 2010), then individuals should become more motivated to regulate their emotions and, particularly in times of stress, use strategies that down-regulate negative emotions more often and effectively as they age. In addition, due to their extensive experience-based knowledge, older adults may be particularly good at adapting their emotion regulation strategies to specific and constantly changing situational circumstances, perhaps leading to greater variability in the use of emotion regulation strategies with age.

However, when considering age differences within old and very old age, the question arises whether these theoretical considerations are overly optimistic. In any case, they do not take into account that using emotion regulation strategies requires basic cognitive resources (e.g., Opitz et al., 2014; Urry & Gross, 2010) and that these resources typically decline in old

age (e.g., Baltes & Smith, 2003). This decline in resources, particularly concerning basic cognitive abilities, may prevent motivational or experiential strengths from being brought to bear in emotionally demanding situations and increasingly thwart the effectiveness of emotion regulation strengths. Seen in this light, it is unlikely that the use, effectiveness, or variability of emotion regulation strategies will continue to show age-related gains within old age.

Age Differences in Adulthood and Young Old Age: Empirical Evidence

Past evidence is not entirely consistent with the idea that the use, effectiveness, or variability of emotion regulation strategies uniformly increase during adulthood into young old age as one may had predicted from the previously introduced theories on emotional aging. As to the use of emotion regulation strategies, much of the evidence points to age-related maintenance into young old age (e.g., Eldesouky & English, 2018; Livingston & Isaacowitz, 2019). Age differences in the effectiveness of emotion regulation strategies may be strategy- specific. For example, laboratory studies have suggested that positive reappraisal may become more effective with age, whereas other forms of reappraisal become less effective (Shiota & Levenson, 2009). Notably, however, the only experience-sampling study that we are aware of that has examined age differences in the effectiveness of emotion regulation strategies to date did not find age differences in the effectiveness of any of the strategies (Livingstone & Isaacowitz, 2019). The evidence for age differences in the variability of emotion regulation strategies is particularly sparse. The two relevant studies showed that older, as compared with younger, adults' within-strategy or temporal variability was lower, suggesting that emotion regulation strategies may vary less over time (Benson et al., 2019; Eldesouky & English, 2018). Yet, there were no age differences in categorical variability, suggesting adults use a similar number of strategies regardless of their age (Eldesouky & English, 2018).

Together the evidence generally speaks to maintenance in the facets of emotion regulation although some specific aspects may show decline (e.g., the effectiveness of detached reappraisal), while others show growth (e.g., the effectiveness of positive reappraisal). Such

changes in specific aspects may ultimately mean that emotion-regulatory abilities remain stable overall (e.g., one strategy may effectively replace another). However, this conclusion may be premature, as previous studies have mostly focused on single facets of emotion regulation (e.g., effectiveness but not variability). Thus, future studies are needed that measure as many facets of emotion regulation as possible within the same sample of younger and older adults.

Age Differences within Old and Very Old Age: Empirical Evidence

The results reviewed above refer to studies conducted with samples that did not include sufficient numbers of very old individuals to examine age differences between young old and very old adults thoroughly. To the best of our knowledge, very few studies have examined age differences in emotion regulation in old and very old age.

As to the habitual use of emotion regulation strategies, a study conducted by Etxeberria et al. (2016) suggests that very old adults, as compared with young old adults, use proactive and problem-solving strategies less (e.g., venting one's emotions, confronting the source of the problem, seeking social support). However, very old individuals used so-called passive strategies such as accepting the problem, avoiding the problem, and suppressing one's feelings more often. These findings were obtained in a study in which participants were presented with two hypothetical vignettes and asked to indicate how they themselves would handle their emotions in the situations. A further study also suggests that very old, as compared with young old, individuals use proactive and problem-solving strategies less (e.g., tried to find out more about the situation or made a plan of action; Martin et al., 2008). In this study, participants reported how they would regulate their emotions when confronted with a health- and a family-related problem. Although the two studies show encouragingly consistent findings, at least in terms of proactive and problem solving strategies, their validity is limited because they each looked at only two stressors. Thus, studies examining age differences in emotion regulation based on a larger number of stressors would be desirable.

We noticed that there is not one study on age differences in the variability of emotion-regulatory strategies, focusing on old and very old age. Given that very old individuals have relatively few cognitive resources, they may use fewer emotion regulation strategies (suggesting higher between-strategy variability or lower categorical variability) more consistently (suggesting lower within-strategy or temporal variability).

The only study that had investigated age differences between young old and very old individuals in emotion regulation effectiveness was a study conducted in our own laboratory (Kunzmann et al., 2022). In this study, very old, as compared to young old, adults were less able to down-regulate their negative feelings in response to disturbing film clips. Age deficits were evident for all three strategies examined: detached reappraisal, positive reappraisal, and behavioral suppression. These findings speak against uniform improvement or maintenance in emotion regulation effectiveness in old and very old age. Yet, it is unclear whether the noted age differences that were observed at the level of subjective feelings in the lab also emerge in daily life as people go about their everyday routines and are confronted with stressors that may be more familiar and perhaps less emotionally charged than the laboratory stimuli.

The Present Study

Theories on emotional aging have painted a quite rosy picture of emotion regulation in old age; emphasizing age-related strengths related to motivation and accumulated experience (e.g., Carstensen, 2006). However, the evidence largely speaks to age-related stability rather than increases in emotion regulation during adulthood and young old age. In addition, because the ratio between age-related strengths and vulnerabilities becomes increasingly unfavorable as people reach very old age (e.g., Baltes & Smith, 2003), our predictions in this study with old and very old individuals assume at best age-related stability and more likely age-related losses in emotion regulation.

Our study was based on the same sample of young old and very old adults who participated in the laboratory session reported above, for which we showed that the effectiveness of

three emotion regulation strategies for reducing negative feelings in response to stressful film clips was significantly reduced in the very old adults (Kunzmann et al., 2022). With the same sample participating not only in a laboratory session but also in a weeklong experience sampling study, our goal in this project was to examine age differences in emotion regulation more comprehensively and within an ecologically highly valid study design.

First Set of Predictions: Age Differences in the Use of Strategies

Assuming an increasingly unfavorable ratio between emotion regulation facilitating and hindering factors in very old age, we did not expect an age-related increase in the use of strategies, but rather age-related stability or even a decrease. To address this prediction, we assessed a relatively large number of ten distinct strategies that people can use once a stressor occurs (see Table 1). It deserves note that many past studies, including our own, have often selected fewer strategies and, thus, provided a less comprehensive picture about age differences (e.g., Shiota & Levenson, 2009). As reviewed, particularly resource-intensive strategies may be used less intensively by very old, as compared with young old, individuals (Etxeberria et al., 2016; Martin et al., 2008). However, most of the present ten emotion regulation strategies are relatively resource demanding with perhaps two exceptions that both refer to distracting oneself from a stressor (e.g., Opitz et al., 2014, Scheibe et al., 2015; Urry & Gross, 2010). Given the relatedly sparse evidence for the resource load of the remaining eight strategies, we tested strategy-specific age differences exploratory.

Second Set of Predictions: Age Differences in the Effectiveness of Strategies

Because we already demonstrated age-related deficits in the effectiveness of three emotion regulation strategies in the present sample in the context of a laboratory study, we predicted that the very old individuals would generally report to be less successful in regulating their emotions during daily life stressors, due to overall less effective strategy use. Although age deficits should be particularly apparent for resource-intensive strategies (Etxeberria et al., 2016; Martin et al., 2008), because of the difficulty in determining the resource load of

each present strategy, we examined age differences in the effectiveness of specific strategies only exploratory. More specifically, for each strategy, we examined the extent to which its use in the stressful situation contributed to overall success of emotion regulation in that situation.

Third Set of Predictions: Age Differences in the Variability of Strategies

We expected that, for very old people, because of their greater limitations in cognitive and health resources, there is a greater need to limit themselves to a few emotion regulation strategies and then use these consistently. Thus, we expected higher between-strategy variability and lower within-strategy variability in very old, as compared to young old, individuals.

Past age-comparative studies did not test for age group differences in the effectiveness of emotion-regulation strategy variability. However, Blanke and colleagues (2020) reported that higher levels of both types of variability were associated with lower negative affect in samples of young adults, at least after statistical control of depressive symptoms. This may suggest that the two types of variability are effective in down-regulating negative affect. In explorative analyses, we tested how both types of variability are associated with the self-reported success of emotion regulation attempts in the present two age groups.

Additional Statistical Control Analyses

Given that there may be age differences in the number, diversity, and seriousness of daily stressors upon which young old and very old participants regulated their emotions (e.g., Brose et al., 2013), we analyzed these three stressor-related variables as covariates in additional analyses. There may also be changes in the assessed variables over the course of the daily diary study (e.g., Bolger & Laurenceau, 2013), thus, a time variable that coded elapsed time since the start of the study was also included in the statistical control analyses. In addition, we controlled for gender, education, and physical health in additional analyses because these variables could be related to emotion regulation or differ by age group (e.g., Charles, 2010; Smith & Baltes, 2003). Finally, the two age groups, born in 1950-1952 and 1930-32 were socialized in different political systems, the former German Democratic Republic (GDR;

socialist system in eastern Germany) or the Federal Republic of Germany (FRG) in the west. Because these prior experiences may have an impact on emotion regulation, we examined study site (Leipzig, former GDR vs. Heidelberg, former FRG) as another covariate.

Methods

Transparency and Openness

We share materials and the analytical code in the form of R syntax of our study publicly at the Open Science Framework (OSF; links reported in the Author Note). Data for this manuscript is only available upon request to the corresponding author.[1] We did not determine the sample size by an a priori power analysis because the sample was part of an ongoing long-term longitudinal study; however, we report power estimations based on the actual sample size below. Design, hypotheses, and analytic strategy of this study have not been preregistered. The study is part of a multi-component design also involving physiological measures (e.g., cortisol: Kornadt et al., 2022) and a lab-based component (e.g., involving an emotion regulation task: Kunzmann et al., 2022). Details about the study design, procedures, and measures obtained can be viewed in the study materials OSF link reported in the Author Note.

Sample

Our analyses are based on data from the EMIL study (Emotional Reactivity and Emotion Regulation – A Multi-Timescale Approach Added to ILSE; for more details, see Gerstorf et al., 2022; OSF link: https://osf.io/nhzpw/).

The young old group was comprised of 123 individuals born between 1950 and 1952 (age range 66–69; women 47%) and the very old group encompassed 47 very-old adults individuals born between 1930 and 1932 (age range 84-90 years; women 60%). All young old and 32 of the very-old adults were selected from the Interdisciplinary Longitudinal Study of Adult Development (ILSE), an ongoing multidisciplinary longitudinal study that consists of four waves of data collection in Leipzig and Heidelberg, covering some 25 years of observation (see Sattler et al., 2017). To increase statistical power, we recruited 15 additional very-old

participants from the community via newspaper ads. The two most important predictors of sample selectivity were better cognitive performance and fewer depressive symptoms (Schilling et al., 2022). Thus, results from this study may not generalize to less positively selected segments of the larger population (see Table 2 for sample characteristics).

General Procedure

The ethics committees of the Faculty of Behavioral Studies, University Heidelberg and the German Society for Psychology (DGPs) approved the EMIL project and all participants provided informed consent. For the daily life assessment, participants were provided with a large-display tablet with touch screen interface (iPad; a codebook describing the full scope of the EMIL study is available at https://osf.io/6s4gw). In an initial baseline session, participants were introduced to the handling of the iPad and other devices that are not relevant for present purposes. Next, a one-week daily life assessment phase was started, including six assessments (beeps) per day. At waking and prompted by audio signals at 10 a.m., 1 p.m., 4 p.m., 7 p.m., and 9 p.m., participants provided self-reports on stressors and emotion regulation, which were analyzed in the current study. Depending on their daily schedule, participants were allowed to deviate by 30 minutes before and up to two hours after the exact beep times to fill out the tablet-administered questionnaires. Average response times were close to the pre-scheduled times (first to sixth beep at 7:10, 10:06, 13:09, 16:10, 19:07, and 21:09, respectively), and mean time intervals (standard deviations in brackets) were 2.94 (1.18), 3.03 (0.48), 3.03 (0.51), 2.96 (0.52), and 2.05 (0.47) hours between subsequent beeps 1 to 6, respectively. Overall, valid daily life assessment data for 1,165 days and 6,686 beeps were obtained. On average, young old adults participated on 6.95 days (*SD* = 0.38 days) out of the seven days and responded to an average of 5.81 beeps (*SD* = 0.53 beeps) out of the six beeps per day. Very-old adults' average participation was 6.60 days (*SD* = 1.38 days) and 5.55 beeps (*SD* = 0.87 beeps) per day. Data were collected between March 2018 and August 2019.

Measures

Use of Emotion Regulatory Strategies

At each beep, participants were asked whether in the two to three hours since the last interview they had experienced any situation in which they felt stressed or burdened. If there were multiple, they were asked to concentrate on the most stressful one. After specifying the stressor (see below), the participants were asked to report how they regulated their emotions by indicating for each of ten emotion regulation strategies (see Table 1) how much they had used it in the situation. Participants used a slider to respond on a scale from 0 (*I did not use this strategy at all*) to 100 (*I used this strategy a lot*). Table 3 and OSM Table 5 provide descriptive statistics (intercorrelations among strategies are depicted in OSM Tables 3 and 4).

Effectiveness of Emotion Regulatory Strategies

We measured self-reported emotion regulation success with a single item (see Table 1). Participants completed this item by using a slider on a 0-100 scale (0 = *not at all*, 100 = *extremely*; OSM Table 5 presents descriptive statistics, intercorrelations of the overall success item and other study variables are depicted in OSM Tables 3 and 4). The effectiveness of each strategy was quantified by the strength of its association with overall regulation success.

Variability of Emotion Regulatory Strategies

As mentioned above, we computed two different types of variability following Blanke and colleagues (Blanke et al., 2020). A first was within-strategy variability, calculated by (a) computing the standard deviation across stressor situations for each of the ten emotion regulation strategies, and (b) aggregating the ten standard deviations across the emotion regulation strategies for each participant. This score, thus, indicates the average amount of variability in the use of strategies across different stressor situations. In all analyses that used the within-strategy variability values, we statistically controlled for mean endorsements for each participant. As described above, within-strategy variability is high when a person uses a given strategy intensely in some occasions, but not at all in others. In contrast, within-strategy variability

is low when a person uses a given strategy in a comparable manner across different situations. Eldesouky and English (2018) labeled this type of variability temporal variability.

A second type of variability was between-strategy variability. The calculation was based on individuals' ratings of how much they had used each of the emotion regulation strategies for a specific stressor situation. Specifically, to compute between-strategy variability, we calculated the standard deviations across the ten emotion regulation strategies for each beep at which a stressor was reported. These standard deviations were then averaged across the stressor situations for each participant. The computation of the standard deviation is based on the mean. Therefore, we calculated the mean of the usage of the ten emotion regulation strategies for each stressor situation and controlled for the mean level endorsements for each participant in all models that included the between-strategy standard deviations by including the means as a control variable (Baird et al., 2006; Nestler et al., 2021). The resulting (mean level controlled) between-strategy variability coefficients indicate the extent to which people use only few emotion regulation strategies intensively and the remaining strategies significantly less or not at all (see also Figure 1). Notably, between-strategy variability is conceptually related to categorical variability (Eldesouky & English, 2018), but the computational basis is different (see OSM Tables 3, 4, and 5 for descriptive statistics and intercorrelations).[2]

Statistical Control Variables

Three stressor-related control variables were the number, diversity, and seriousness of stressors upon which young old and very old participants regulated their emotions. The number of stressors was assessed via a dichotomous item asking the participants whether or not had experienced a stressor since the last assessment.[3] Each time participants experienced a stressor, they reported the type of stressor by checking one of the following categories. (1) Health concerns (12.1% across all reported stressors), (2) financial problems and concerns (1.1%), (3) worries about the future (1.6%), (4) worries about other people's well-being (9.4%), (5) interpersonal tensions (12.3%), (6) responsibilities and duties (15.2%), (7) adversities of daily life

(27.6%), (8) problems in society / societal development (6.7%). In addition, participants had the option to check off an "other topic" category (this category was used in 14% of all cases).

The list of different stressor types was based on the daily inventory of stressful events (DISE; Almeida et al., 2002) and, as to be expected, participants did not use the other topic category very often. However, we might have received more reports if our list had included more stressors. In addition, fewer participants might have reported no stressor at all. That is, nine young old and three very old persons did not report a single stressor for the entire week and were, thus, excluded from the analyses. We quantified stressor diversity as the number of unique stressor types across all stressors reported.

Stressor severity was assessed by a single item, "How severe are the themes and problems that occurred in the situation for you personally?" and by using a response format that ranged from 0 (*not at all severe*) to 100 (*extremely severe*).

As presented in Table 2, young old individuals experienced fewer stressors over the week of assessment than very old individuals. However, there were age group differences in neither stressor diversity nor stressor severity (OSM Tables 3 and 4 show how the stressor-related variables correlated with each other as well as other study variables).

Finally, we controlled for gender, education, physical health, and study site. Table 2 depicts descriptive statistics of these variables (for intercorrelations with each other as well as other variables see OSM Tables 3 and 4). Table OSM5 depicts the means, standard deviations, and skewness of all study variables across both age groups.

Analytic Strategy

We examined Prediction Sets 1 and 2 by computing random intercept or random intercept-random slope multilevel models with measurement occasions (level 1) nested within participants (level 2; Bolger & Laurenceau, 2013). Specifically, for Prediction Set 1 we calculated a random intercept multilevel model in which age group (a level 2 variable) was in-

cluded as a predictor of the usage of an emotion regulation strategy. Furthermore, the intercept of the model was allowed to differ between persons implying that strategy use could differ between individuals

For Prediction Set 2, we first used a random intercept model to regress overall emotion regulation success (as assessed by a single item) on the (level 2) age group variable. Again, the intercept of the model was allowed to differ between persons. Subsequently, to test for the effectiveness of specific strategies, we used a random intercept-random slope model and examined whether the usage of each emotion regulation strategy was predictive for participants' self-reported emotion regulation success. In this model, the person-mean centered strategy use variable (a level 1 variable) and the person means of strategy use (a level 2 variable) were included as predictors.

We included the person-mean centered strategy use and the person means of strategy use in the model, because strategy use is a level 1 predictor variable that varies both within- and between-subjects (Raudenbush & Bryk, 2002). Hence, by person-mean centering this variable (i.e., computing participants' mean in this variable and by subtracting the mean from the raw variable), and by including the centered variable and the means as predictors in the model, we can examine the within-person and the between-person effect of strategy use for regulation success. Thus, we can test whether an individual was more successful in situations where they used a particular strategy more intensively than usual (i.e., within-person effects) and whether individuals who reported to use the strategy very intensively on average were more effective on average than individuals who reported to use the strategy less intensively (i.e., between-person effect).

Furthermore, to examine age differences in the effectiveness of each emotion regulation strategy use, we used a random intercept - random slope model, in which the person-mean centered strategy use variable (level 1), the person means of strategy use (level 2), age group (level 2), and the (cross-level) interaction effect between the person-mean centered strategy

use variable and age group were included as predictors of emotion regulation success (as assessed by a single item). We also included the interaction of the age group variable and the person means of strategy use. In both models, the intercept of emotion regulation success and the slope for the person-mean centered strategy use variable were allowed to differ between individuals.

Age-group differences in the two types of variability, that is, Prediction Set 3, were examined with a linear regression model, because there was only a single variability value of each type (i.e., within-strategy and between-strategy variability) per person (i.e., no nesting). We also conducted exploratory analyses examining whether situation-specific between-strategy variability and person-level within-strategy variability were related to emotion regulation success. Specifically, as between-strategy variability was available for each specific situation for each individual (i.e., it is a level 1 variable), we computed a multilevel random intercept-random slope model, in which emotion regulation success was regressed on person-mean centered between-strategy variability and the persons' between-strategy variability mean. The intercept of emotion regulation success and the slope for the centered between-strategy variability were allowed to vary between individuals. For within-strategy variability, because it is a person level or level 2 variable, we used a random intercept model in which within-strategy variability was included as a predictor of emotion regulation success. The random intercept of success was allowed to differ between individuals. We estimated all multilevel models in R using the lme4 package (Bates et al., 2015). Significance tests of the fixed effects were based on the Satterthwaite degrees of freedom approximation that is implemented in the lmerTest package (Kuznetsova et al., 2015).

Power Analysis

We did not determine the sample size by an a priori power analysis because the sample was part of a long-term longitudinal study. Assuming a small population effect size of d = .20, a small to moderate effect size of d = .35, and a moderate population effect size of d = .50, the

power to detect a significant mean difference between the two age groups in a regression model without any covariates is .31, .65, and .89 respectively.

In a multilevel random intercept model, assuming small, small to moderate, and moderate effect sizes, the power to detect a significant age group effect (as reflected in the weight of a dummy variable coding the two age groups with their respective sizes) is .42, .93, and .99 respectively. In these power analyses, we set the intraclass correlation to .30 and the number of measurements to seven. These population values were chosen, because an ICC of .35 is about the medium value found in literature reviews (see e.g., Arend & Schäfer, 2019) and it is approximately also the average intraclass correlation that we obtained in our study. Furthermore, seven corresponds to the lower value of the mean number of beeps available for a person for the analyses (M = 7.45, SD = 6.43). Note that this number does not correspond with the average number of beeps per day (see paragraph "General Procedure"), because we could only use those beeps/situations in the analyses in which a stressor was experienced.

In the random intercept-random slope model (in which the age group dummy is used to predict differences in the slopes of a Level 1 predictor), the power to detect a significant age group effect is .28 for a small, .63 for a small to moderate, and .93 for a moderate population effect size. Here, we assumed an ICC of .30, seven measurements or beeps, and a standardized random slope variance of moderate size (i.e., .09; see Arend & Schäfer, 2019). We used the program G*Power (Faul et al., 2009) and a simulation-approach implemented in R (see Arend & Schäfer, 2019, for an introduction; see also the OSF project accompanying this manuscript) for these calculations including syntax. We accounted for the unequal sample sizes of the two age groups in all power calculations.

In sum, according to these analyses, statistical power is low when we assume small population effect sizes, but is acceptable when the population effect size is larger than small to moderate, and this of course must be considered when interpreting the findings. To facili-

tate the interpretation of age group effects, we report the Bayes factor (BF_{01}). The Bayes factor indicates the relative evidence of a model without a variable (i.e., the coefficient of the age group variable is zero) versus a model with that variable. A BF_{01} in the interval between 1 and 3 means that the data provide weak evidence for the null hypothesis. A BF_{01} greater than 3 indicates moderate evidence, and values greater than 10 indicate strong evidence for the null hypothesis (Held, 2014). Because there is no simple approach to calculating the Bayes factor in the case of multilevel models, we used an approximation based on the BIC values of the two models (i.e., BF_{01} = exp[(BIC(model0) - BIC(model1)) /2]; see Held, 2014).

Results

First Set of Predictions: Age Differences in the Use of Ten Strategies

Table 3 reports means and standard deviations for the usage of the ten emotion regulation strategies for young old and very old individuals. Table 4 shows the results for the ten random intercept multilevel models in which a regulation strategy use was regressed on a dummy variable coding age group (0 = *young old*, 1 = *very old*). The coefficient of the age group variable was not significantly different from zero for seven strategies (all *ps* $\geq$ .15, 1.23 $\leq BF_{01} \leq$ 4.01) and significantly different from zero for three strategies (i.e., positive refocusing, attention to feelings, and thoughts about feelings, *p*s $\leq$ .03, $BF_{01} \leq$ .31). Unexpectedly, very old, as compared to young old, individuals used the three strategies more intensively.

Second Set of Predictions: Age Differences in the Effectiveness of Emotion Regulation

We first examined whether overall emotion regulation success varied across the two age groups. The results of the multilevel random intercept model showed that the mean difference between the two age groups was not significantly different from zero (b = -1.14, $t(129)$ = -0.32, p = .75, BF_{01} = 3.93, d = -0.06). We then examined the effects of the usage of each emotion regulation strategy on self-reported emotion regulation success. The results of the multilevel random intercept-random slope models in which the respective person-mean centered

emotion regulation usage variable and the persons' regulation usage variable means were included as predictors of the success variable are shown in Table 5. As seen, most strategies contributed to emotion regulation success. However, behavioral expression was unrelated to overall success and thoughts about feelings was negatively related to overall success, at least on the within-person level, suggesting that if individuals used this strategy more intensively than usual, they reported a lower overall emotion regulation success. All other strategies were positively related to overall success at the within-person and/or between-person levels.[4]

To test our prediction that the effectiveness of emotion regulation strategies would vary across the two age groups, we added the (cross-level) interaction of age group and the person-mean centered strategy variable to the multilevel model. We also included the interaction of the age group variable and the persons' regulation usage variable means. However, all models yielded no significant interaction effects (all *p*s > .098, all BF_{01} > 23.7, all *d*s < 0.45). There was only one exception, namely, the interaction effects for expression were significant (within-person $p = .027$, $d = 0.64$; between-person $p = .044$, $d = 0.33$). These effects, however, are small and negligible given that they are not Bonferoni corrected. Thus, we conclude that there were generally no significant age differences in the effectiveness of the strategies.

Together the results speak to the effectiveness of eight emotion regulation strategies in contributing to overall emotion regulation success. The age groups significantly differed in neither overall emotion regulation success nor strategy-specific success.

Third Set of Predictions: Age Differences in the Variability of Emotion Regulation

To test our third set of predictions, we examined age group differences in average between-strategy variability and within-strategy variability. Inspection of the means revealed that between-strategy variability was lower for very old ($M = 28.36$, $SD = 8.46$) compared to young old ($M = 32.27$, $SD = 8.07$) individuals. Within-strategy variability, by contrast, was similar across the two groups (very old: $M = 21.39$, $SD = 9.54$; young old: $M = 20.23$, $SD = 11.57$). This impression was supported by the results of a linear regression. The weight of the

age group variable was significantly different from zero for between-strategy variability (b = -4.06, $t(155) = -2.76$, $p < .01$, $BF_{01} = 0.29$, $d = -0.44$), suggesting less rather than more focus on certain strategies among very old participants. In addition, within-strategy variability did not vary by age group (b = -0.35, $t(155) = 0.62$, $p = .54$, $BF_{01} = 10.4$, $d = 0.09$).

Emotion Regulation Success and Between-Strategy Variability: Exploratory Analyses

In a multilevel random intercept-random slope model, we examined whether between-strategy variability predicted self-reported emotion regulation success for an assessment in which a stressor was present. Between-strategy variability significantly contributed to emotion regulation success, whereby the effects were significant and positive for the within-person (b = .38, 95% CI = [0.17, 0.59], $t(71.29) = 3.61$, $p < .01$, $d = 0.86$) and the between-person (b = .84, 95% CI = [0.48, 1.20], $t(160.1) = 4.56$, $p < .01$, $d = 0.72$) levels. Thus, when participants used selectively fewer strategies (rather than many strategies) than usual, they also perceived more success in regulating their emotions than usual. Likewise, participants who selectively used fewer strategies on average than others also perceived more success in regulating their emotions than others. Age differences in the effectiveness of between-strategy variability were not significant on both levels, that is, within- and between-persons; none of the interactions approached significance (ps > .34, $BF_{01} > 22.2$, ds < 0.15).

Emotion Regulation Success and Within-Strategy Variability: Explorative Analyses

Using a multilevel random intercept model, we tested whether within-strategy variability predicted mean levels in self-reported emotion regulation success across stressors. In this analysis, within-strategy variability did not contribute to overall regulation success (b = -.06, 95% CI = [-0.34, 0.23], $t(204.92) = -0.393$, $p = .69$, $d = -.05$). Age differences in the effectiveness of within-strategy variability were nonsignificant as well ($p = .64$, $BF_{01} = 37.2$, $d = .07$).

Statistical Control Analyses

Finally, we repeated all analyses and controlled for the person-level or level 2 variables number of stressors and the diversity of experienced stressors. We also controlled for the

time-varying (i.e., level 1 variable) severity of stressors and for a time variable that coded elapsed time since the start of the study. After statistical control of these variables, the pattern of findings remained largely unchanged with few exceptions in case of age difference in strategy use (see OSM chapter 1, Tables OSM1.1 and OSM1.2). Similarly, statistical control of the person-related covariates (i.e., gender, education, and physical health) did not significantly change most of the results (see OSM Chapter 2, Tables OSM2.1 and OSM2.2). There was at least one critical exception, however. The effect of age group on between-strategy variability became nonsignificant after statistical control of the person-related covariates.[5]

Discussion

What strategies do old and very old individuals spontaneously use when exposed to everyday stressors? How effective are these strategies in daily life and how variable is their use across different stressors? We addressed these questions in a daily life assessment study with old and very old individuals. Many very old individuals face age-related impairments in cognitive and physiological domains (e.g., Baltes & Smith, 2003) that may often counteract age-related strengths in motivation and emotion regulation expertise (e.g., Charles, 2010). Thus, we had thought it possible that there would be evidence for age deficits in emotion regulation. To begin, our findings must be interpreted with caution, and we again emphasize their preliminary nature, because we had restricted statistical power due to the relatively small subsample of very old people, at least if effect sizes in the population are small, which is currently unknown because of the limited research available. Nevertheless, we consider it noteworthy that the many individual models we ran revealed very few significant age differences. More specifically, with three exceptions, there were no age differences in the use of strategies. In addition, there were no age differences in the effectiveness of the strategies, and only one type of variability, between-strategy variability, was lower in very old, as compared to young old, individuals. After statistical control of the event-related variables, the pattern of findings remained largely unchanged. This was also true for the statistical control analyses of the person-

related variables with one exception: the previously significant age difference in between-strategy variability did not reach significance after control of the person-related variables.

Age Differences in the Use of Emotion Regulation Strategies

If daily stressors occurred, both old and very old individuals reported that they regulated their negative feelings. All ten strategies of emotion regulation were used to some degree. Age differences in strategy use were significant for only three strategies, that is, positive refocusing, attending to feelings, and thinking about feelings, the latter two being engagement strategies. Inconsistent with our prediction, very old, as compared to young old, individuals reported to use all three strategies more intensively. After the separate statistical control of the event- and person-related characteristics, age group differences remained significant for the two engagement strategies that involve confronting and processing negative emotions during exposure to stress. It is difficult to explain this unexpected age group difference. Socioemotional Selectivity Theory as well as many past findings would have suggested opposing age differences, namely, that individuals become less likely to use engagement strategies (e.g., Carstensen, 2006). There is, however, a growing body of research suggesting positive age differences in mindfulness (i.e., the awareness of present moment experiences regardless of their valence; Kabat-Zinn, 1990) and acceptance (i.e., defined as the process of deliberately and non-judgmentally engaging with negative emotions; Segal, Williams, & Teasdale, 2002). Although it remains open whether paying attention to and thinking about feelings during stressful events are actually associated with acceptance of them, our results are consistent with the idea that mindfulness continues to increase within old age (e.g., Rompilla et al., 2021; Wolfe & Isaacowitz, 2021). Future research would be desirable that further examines age differences in the processing and sense making of negative feelings during stress. Research on positivity effects and mindfulness could be integrated by clarifying under what circumstances older adults engage with their negative feelings and under what circumstances they tend not to do so.

In this regard, it should be noted that previous studies differ in whether they examined stressors in general and thus were interested in global affective outcomes such as negative affect or whether they analyzed specific stressors that typically elicit discrete negative emotions such as anger or sadness (e.g., Charles & Carstensen, 2008). It might well be that negative affect or stress in general are more tolerated as people age, but that this is not true for any negative emotion typically subsumed under these global affective dimensions. For example, there is robust evidence for an age-related decrease in the frequency and intensity of anger and related negative emotions (e.g., hostility, aggression), whereas the frequency and intensity of sadness remain stable or even increase with age (e.g., Kunzmann et al., 2013). This pattern of findings is consistent with the notion that as people age, some but not all negative emotions might become more embraced and tolerated.

Age Differences in the Effectiveness of Emotion Regulation Strategies

Although it may not be easy to determine the effectiveness of specific emotion regulation strategies on a general level and without considering their fit with situational affordances, it deserves note that most of the emotion regulation strategies were positively associated with self-reported regulation success. Of course, in this study, it is impossible to interpret these associations causally and because this is the first study to demonstrate such associations within a sample of old and very old individuals, the findings are clearly in need of replication.

Particularly important in terms of our predictions, young old and very old adults did not differ in how effective they rated their overall emotion-regulatory efforts. Similarly, there were no age differences in the association of each strategy with overall success. It deserves note that this evidence is inconsistent with our past evidence from a lab study with the same sample. As mentioned above, this sample not only took part in the present experience-sampling study, but also in a laboratory study in the context of which they were instructed to regulate their emotions on command while watching negative film clips (Kunzmann et al., 2022).

In this study, very old individuals were less able to down-regulate their negative feelings on command using three strategies: detached reappraisal, suppression, and positive reappraisal.

At least two factors could explain these contradictory results. First, in the experience sampling study, we captured emotion regulation success using global self-reports, which may have been biased by positivity effects, especially among the very old participants (e.g., Carstensen, 2006). In the laboratory, emotion regulatory success is captured more indirectly, namely as the extent to which emotions are of lower intensity in trials of instructed regulation than in trials of non-regulation. Moreover, emotional responses are recorded immediately after the end of an emotional stimulus rather than minutes or even hours after the occurrence of daily stressors. Therefore, the data on emotion regulation success obtained in the laboratory are presumably less susceptible to biases such as positivity effects.

Second, it may be easier to regulate one's emotions in everyday life than in the laboratory, where emotional stimuli are typically more unfamiliar and stronger (e.g., Kunzmann & Grühn, 2005). Because age-related deficits are generally most prevalent in difficult tasks (e.g., Verhaeghen, 1997), we may see stronger emotion regulation deficits in very old individuals in the laboratory than in the everyday survey. This fits with the evidence of Wrzus and colleagues (2013), who showed that, compared with younger adults, older adults experienced higher negative affect (possibly indicating deficits in emotion regulation) only when confronted with complex but not circumscribed daily stressors. Thus, it may well be that very old adults, despite their relatively limited resources, can successfully regulate their emotional responses to everyday stressors, at least when these are familiar, circumscribed, and low-stress, yet they have difficulty regulating them under laboratory conditions.

Age Differences in the Variability of Emotion Regulation Strategies

Our predictions proceeded from the idea that for very old people, because of their reduced internal resources, there may be a need to limit themselves to a few emotion regulation strategies and then use these consistently (i.e., we predicted lower within-strategy variability

and higher between-strategy variability in very old adults). However, within-strategy variability did not differ across age groups and between-strategy variability was lower rather than higher in very old, as compared with young old, individuals.

Regarding the variability between strategies, it deserves note that the difference between age groups was no longer significant after statistical control of person-related covariates. Separate follow-up analyses of the individual covariates revealed that poor physical health was responsible for the statistically controlled nonsignificant age difference. Previous empirical studies have focused on examining cognitive performance as a resource for emotion regulation (e.g., Opitz et al., 2014), however, it is possible that cognitive and health-related resources are positively associated (see OSM Tables 3 and 4 for supporting evidence) and both are relevant to different aspects of emotion regulatory efforts. With this in mind, future research should examine cognitive and physical health-related resources as predictors of individual and age-related differences in various facets of emotion regulation, ideally in the context of longitudinal studies that would allow examining mediation models.

Regardless, the question arises why the very old participants in our study used their strategies in a less rather than more focused manner than the young old individuals did. One possibility could be that strategy use is less successful in very old, as compared to young old, adults and therefore more strategies must be used in an attempt to achieve the same outcome. Within the limits of global self-report data, however, our analyses had shown that age differences in the effectiveness of individual strategies were nonsignificant. Another possibility is that very old people have the implicit theory that “more is better” because they often experience that they do not have enough resources to engage in means that would help reach their goals. This may have led them to report using a great many strategies. Whether this is actually the case and corresponds to their actual behavior should be investigated in future research.

It is also difficult to explain why variability within strategies did not show age group differences and did not appear to contribute to emotion regulation success. Based on two previous studies, one might have expected lower within-strategy variability among very old adults (Eldesouky & English, 2018; Benson et al., 2019), and one study suggested that this type of variability might be as adaptive as between-strategy variability (Blanke et al., 2020). Given the rather sparse past evidence, more future studies are needed that include a wide range of age groups and capture many different indicators of successful emotion regulation.

Limitations and Outlook

A first limitation refers to the sample. Particularly, the relatively small sample of very old individuals had limited statistical power to detect significant age differences. Thus, our findings are preliminary and should be replicated within a larger sample of very old individuals. A larger sample size would also be useful because the emotion-regulatory strategies were significantly albeit weakly associated (see OSM Tables 3 and 4). Thus, in future research it would be interesting to examine the unique and joint effects of the strategies. In this study, because of the small sample of very old individuals, we refrained from computing complex statistical models and instead limited ourselves to testing models for each emotion regulation strategy. In this regard, it is noteworthy that even with this "liberal" approach, with a few exceptions, no significant age differences were found (additionally supported by Bayes factors).

The sample of very old adults was not only small, but it was also positively selective. Our results may thus not generalize to older individuals who cannot take part in intensive daily life assessments because of health-related or cognitive limitations. It also deserves note that the present two age groups were socialized in different political systems. There were no significant main or interaction effects involving study site, however, it remains to be seen if the present findings will generalize to future cohorts socialized in the reunified Germany.

A second limitation refers to the design of our study. First, it is only within longitudinal study designs that we can examine how aging processes unfold within persons. Second, future

research that combines experience sampling and laboratory methodology would be desirable. Evidence for age differences in emotion regulation that is consistent across both methods, we consider particularly critical for further theory building. However, inconsistent evidence is also of interest. Such discrepancies could be due to a variety of factors within the person as well as the context, the investigation of which would in turn benefit theory building as well.

A third limitation is that our measure of regulation effectiveness was based on self-reports. Operationalizing strategy-specific effectiveness may be particularly problematic because the strength of associations between specific strategies and overall emotion regulation success could be partly due to third variables such as the severity the stressor. Although our findings remained unchanged after statistical control of three stressor-specific variables, we cannot rule out other potentially relevant variables that were not tested. Moreover, at least in some situations, the overall success of emotion regulation may be determined by emotion regulation strategies that we had not assessed. Thus, our results clearly need replication.

Finally, one direction for future research is to test the interplay of emotion regulation strategies in specific situations. For example, frequent alternation of opposing strategies could be indicative of mature emotion regulation. In particular, when stressors are of longer duration and coping is thus a resource-intensive process, alternating between engaging and disengaging emotion regulation strategies may be useful. The sole use of disengagement strategies would not contribute to sustained coping with stressors; the sole use of engagement strategies would likely lead to overexertion and exhaustion. Seen in this light, the higher use of both disengagement (positive refocusing) and engagement (e.g., attention to feeling) strategies in our subsample of very old people could be a sign of maturity. A study design with an even tighter clocking of the measurement time points than was the case in our study (e.g., several times during a stressful situation) would be ideally suited to address such questions.

Conclusions

Age differences in emotion regulation have rarely been examined in previous research in old and very old age. Our goal was to fill this gap, the preliminary conclusion being that age differences in the facets of emotion regulation examined are small, if at all existent. We can largely rule out medium and large age effects in the use, effectiveness, and variability of ten emotion regulation strategies. An important advantage of this study was that we examined young old and very old individuals' emotion regulation attempts while they navigated their everyday lives and dealt with stressors that were meaningful and relevant to them. Replicating the present evidence with a larger sample of very old individuals would be an important direction for future research.

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Footnotes

[1] We are not in a position to make data publicly available. As part of our ILSE assessments (the parent sample our study sample is drawn from), we have more than 25 years of detailed health, medical, and medication information from our participants and it has always been of our utmost interest to protect their privacy. We have thus not asked our participants to share data and they have not provided explicit informed consent for data sharing. As a consequence, German data security laws do not allow to publicly share the data used in the current analyses via a repository. However, we have established data sharing procedures in the ILSE study over the past 20 years that we have successfully implemented numerous times. In line with transparency of research data and analytic methods, the relevant data will thus be made available upon request for verification purposes after a completed data sharing procedure in a case-by-case manner.

[2] To operationalize categorical variability, the authors dichotomized the response scales of each emotion regulation item and counted the number of strategies independently of the intensity in which they were used (a rating of 1 [not at all] was coded as not having used a strategy, and ratings greater than 1 were coded as having used a strategy). In contrast, the calculation of between-strategy variability rests on information about the intensity of strategy usage and, thus, more differentiated information about the entire response scale. In addition, the resulting scores refer to the relative prioritization of certain strategies over others, with larger scores indicating that few rather than many strategies have been used intensively.

[3] Our decision to not include filler tasks may have led participants to report fewer stressors than actually experienced in order to finish the task more quickly and could also explain why 12 individuals never reported a stressor. Notably, however, our findings were largely consistent with those of previous studies, for example, in terms of the average number of stressors (e.g., Wrzus et al., 2013).

[4] Given the relatively large coefficients for positive reappraisal, we tested whether they were significantly larger than the within- and the between-coefficient, respectively, of the other nine strategies. To this end, we tested whether the difference between the two coefficients was significantly different from zero using a *z*-Test; this was indeed the case for all 9 strategies (all zs > 3.32, ps $\leq .001$).

[5] The analyses of study site yielded no significant effects on the dependent variables. There was only one exception, the use of two (out of ten) strategies was significantly stronger in the Leipzig subsample; otherwise, there were significant main or interaction effects on neither the effectiveness of the strategies nor the variability measures. The authors will provide further information upon request.

Table 1

Items to Assess Ten Emotion Regulation Strategies and Emotion Regulation Success

	Strategy name	Item wording
1)	Situation modification	I did all I could to improve the situation for me.
2)	Problem solving	I thought about how I could best cope with the situation.
3)	Distraction	I distracted myself.
4)	Positive refocusing	I thought about something that was pleasant and unrelated.
5)	Attention to feelings	I paid attention to my feelings.
6)	Thoughts about feelings	I thought about my feelings.
7)	Positive reappraisal	I adopted an optimistic attitude.
8)	Detached reappraisal	I adopted a detached and unemotional attitude.
9)	Expression	I clearly showed others how I felt on the inside.
10)	Suppression	I did not let my feelings show.
Overall success		Finally, we would like to know how successfully you think you were in regulating your feelings. Did you manage to regulate your feelings the way you wanted?

*Note*s. To respond to the emotion regulation strategy items, participants used a slider on a scale from 0 (*I did not use this strategy at all*) to 100 (*I used this strategy a lot*). Participants completed the overall emotion regulation success item by using a slider from 0 (*not at all successful*) to 100 (*extremely successful*).

Table 2

Sample Characteristics

Characteristic	Young old	Very old	Difference
Participants (n)	123	47	
Residence [a]	53%	55%	$\chi^2(1, N = 123) = 0.08, p = .772, d = 0.05$
Gender [b]	47%	60%	$\chi^2(1, N = 123) = 2.10, p = .147, d = 0.26$
Age in years [c]	66.68 (1.01)	86.11 (1.42)	
Education [c,d]	14.62 (2.45)	13.91 (2.70)	$t(151) = 1.43, p = .153, d = 0.29$
Health limitations [c,e]	2.58 (1.12)	3.09 (0.98)	$t(134) = 2.34, p = .010, d = 0.47$
Life satisfaction [c,f]	3.95 (0.90)	4.11 (0.73)	$t(165) = 1.06, p = .288, d = 0.18$
Positive affect [c,g]	3.74 (0.46)	3.65 (0.47)	$t(165) = .1.09, p = .277, d = 0.19$
Negative affect [c,g]	2.16 (0.55)	2.16 (0.50)	$t(165) = 0.02, p = .980, d = 0.00$
Total stressors [c,h]	6.51 (5.6)	9.83 (7.86)	$t(64.70) = 2.65, p = .002, d = 0.53$
Unique stressors [c,i]	2.88 (1.76)	3.40 (2.07)	$t(168) = 1.66, p = .099, d = 0.28$
Stressor severity [c,j]	37.88 (23.86)	44.21 (20)	$t(156) = 1.56, p = .121, d = 0.28$

[a] Percentage of participants residing in the Leipzig (vs. Heidelberg) area.

[b] Percentage of female (vs. male) participants.

[c] Values are means, standard deviations in brackets.

[d] Number of years spent at school.

[e] Single item ("Which school grade would you give your health?") from 1 (*very good*) to 6 (*insufficient*). Thus, the higher a score the more health limitations are present.

[f] Single item ("When you think of your current life as a whole, how satisfied are you at the moment?") from 1 (*not satisfied at all*) to 5 (*completely satisfied*).

[g] Subscale of the Positive and Negative Affect Schedule (Watson et al., 1988).

[h] Number of stressors reported over the course of one week.

[i] Number of stressors from different categories, reported over the course of one week.

[j] Individual mean of the severity of stressors, reported over the course of one week on a single item ("How severe are the themes and problems that occurred in the situation for you personally?"), response scale ranged from 0 (*not at all severe*) to 100 (*extremely severe*

Table 3

Means and Standard Deviations of Emotion Regulation Strategy Use

	Young old		Very old	
Strategy	*M*	*SD*	*M*	*SD*
Situation modification	59.94	32.09	60.55	29.70
Problem solving	69.41	30.46	65.14	29.66
Distraction	35.03	35.38	40.43	33.72
Positive refocusing	29.77	33.06	39.75	32.71
Attention to feelings	38.98	31.49	54.13	30.47
Thoughts about feelings	32.18	32.58	46.62	30.76
Positive reappraisal	60.96	29.12	65.97	25.89
Detached reappraisal	35.62	31.86	42.31	30.93
Expression	33.35	33.35	31.70	33.50
Suppression	45.07	33.83	50.08	33.39

Note. The response scale ranged from 0 (*does not apply)* to 100 (*perfectly applies*).

Table 4

Age Differences in Emotion Regulation Strategy Use in Young Old and Very Old Individuals

	Intercept			b_{Group}					
Strategy	Est.	95% CI	*p*	Est.	95% CI	*p*	BF_{01}	*d*	*ICC*
Situation modification	60.38	[50.80, 69.96]	< .01	-0.93	[-7.87, 6.01]	0.79	3.89	-0.05	*0.28*
Problem solving	72.40	[62.420, 82.38]	< .01	-4.44	[-11.67, 2.79]	0.23	1.87	-0.21	*0.34*
Distraction	27.94	[16.83, 39.05]	< .01	5.91	[-2.17, 13.99]	0.15	1.23	0.24	*0.34*
Positive refocusing	19.67	[9.03, 30.31]	< .01	8.76	[1.04, 16.48]	0.03	0.31	0.38	*0.34*
Attention to feelings	27.42	[16.09, 38.75]	< .01	11.09	[2.82, 19.36]	0.01	0.11	0.45	*0.46*
Thoughts a. feelings	12.92	[1.69, 24.15	< .01	16.38	[8.21, 24.55]	< .01	0.01	0.65	*0.44*
Positive reappraisal	62.16	[52.71, 71.61]	< .01	0.53	[-6.35, 7.41]	0.88	4.01	0.03	*0.38*
Detached reappraisal	31.92	[21.77, 42.07]	< .01	4.98	[-2.39, 12.35]	0.19	1.57	0.23	*0.32*
Expression	35.13	[25.68, 44.58]	< .01	-2.01	[-8.81, 4.79]	0.56	3.46	-0.10	*0.22*
Suppression	41.48	[31.70, 51.26]	< .01	3.03	[-4.03, 10.09]	0.40	2.76	0.15	*0.24*

Notes. Findings of a multilevel random intercept model that examined age differences in each of the ten emotion regulation strategies. Est. = Estimate, CI = Confidence interval, ICC = Intraclass correlation. BF_{01} is the Bayes factor indicating the relative evidence of a model without the age group variable over a model that included this variable.

Table 5

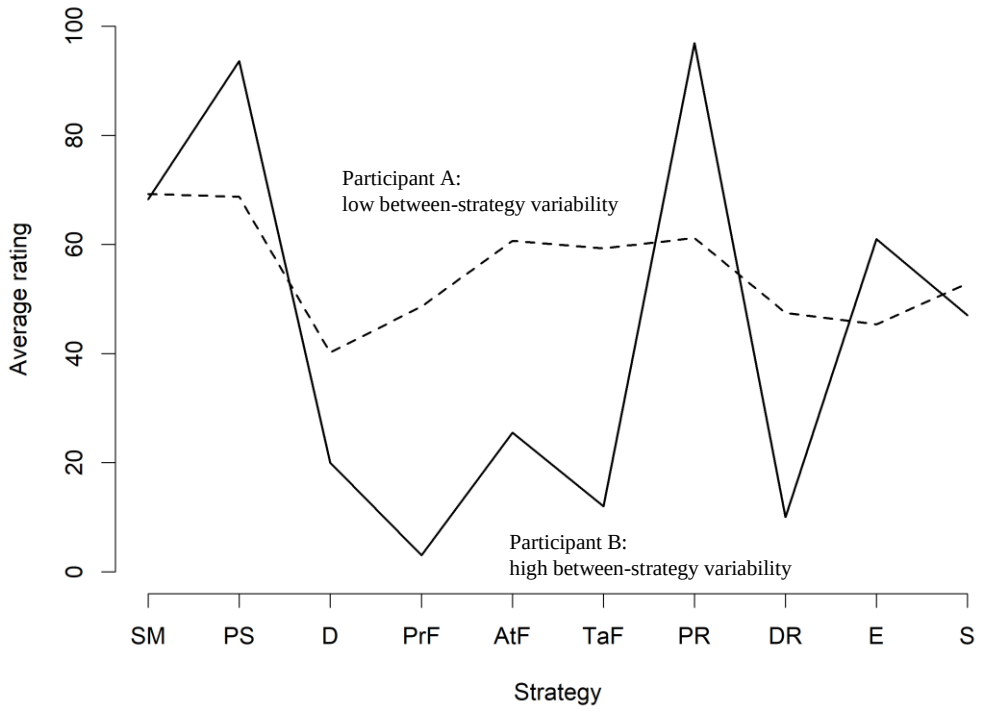
The Effectiveness of Six Emotion Regulation Strategies in the Entire Sample

	Within-person effect: b_{PM}				*Between-person effect:* b_{M}			
Strategy	Est.	95% CI	*p*	*d*	Est.	95% CI	*p*	*d*
Situation modification	0.15	[0.09, 0.21]	< .01	1.38	0.36	[0.22, 0.50]	< .01	0.80
Problem solving	0.05	[-0.03, 0.13]	.144	0.30	0.22	[0.08, 0.36]	< .01	0.50
distraction	0.06	[0.00, 0.12]	.049	0.44	0.20	[0.08, 0.32]	< .01	0.49
Positive refocusing	0.12	[0.06, 0.18]	< .01	0.91	0.29	[0.17, 0.41]	< .01	0.71
Attention to feelings	0.06	[0.00, 0.12]	.072	0.41	0.22	[0.10, 0.34]	< .01	0.59
Thoughts a. feelings	-0.08	[-0.14, -0.02]	.010	-0.65	0.07	[-0.05, 0.19]	.240	0.20
Positive reappraisal	0.33	[0.25, 0.41]	< .01	1.68	0.65	[0.53, 0.77]	< .01	1.69
Detached reappraisal	0.07	[0.01, 0.13]	.022	0.44	0.34	[0.20, 0.48]	< .01	0.79
Expression	-0.04	[-0.08, 0.00]	.096	-0.41	-0.04	[-0.20, 0.12]	.560	-0.09
Suppression	0.09	[0.03, 0.15]	< .01	0.58	0.22	[0.08, 0.36]	< .01	0.46

Notes. Findings of a multilevel random intercept-random slope model that examined whether the person-mean centered strategy usage variable (b_{PM}) and the means of this variable (b_{M}) are associated with emotion regulation success. Est. = Estimate, CI = Confidence interval. Positive values indicate greater effectiveness.

Figure 1

Graphical Presentation of Two Participants Differing in Between-Strategy Variability



Notes. As can be seen, Participant A (dotted line, low between-strategy variability) used all ten emotion regulation strategies to a similar degree, whereas Participant B (solid line, high between-strategy variability) used only some strategies intensively and others not. SM = Situation modification, PS = Problem solving, D = Distraction, PrF = Positive refocusing, AtF = Attention to feelings, TaF = Thoughts about feelings, PR = Positive reappraisal, DR = Detached reappraisal, E = Expression, S = Suppression