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Citation

França, Alex Bacadini; Samra, Rajvinder; Vitorino, Luciano Magalhães and Schelini, Patrícia (2024). The Relationship Between Mental health, Metacognition, and Emotion Regulation in Older People. *Clinical Gerontologist*, 47(2) pp. 298–306.

URL

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Title page

Title: The relationship between mental disorders, metacognition, and emotion regulation in older people

Short running head: **Mental disorders, metacognition, and emotion regulation**

Abstract

Objectives: It is unclear if using emotion regulation strategies can help manage the effects of anxiety and depression on metacognitive strategies in older people. This study aimed to verify the capacity of emotion regulation strategies to mediate the relationship between mental disorders and metacognition in older people.

Methods: A mediation analysis was performed to verify the mediating role of emotion regulation in the interaction between mental disorders and metacognition in older people.

Results: Without mediator control, higher scores indicating mental disorder are associated with reduced metacognition scores. When mediators are added to the model, the mediation effect was significant. An indirect effect of anxiety and depression on metacognition was mediated by cognitive reappraisal to a greater extent than emotional suppression.

Conclusions: Cognitive reappraisal reduced the impact of anxiety and depression on metacognition in older adults.

Clinical implications: Including cognitive reappraisal techniques in anxiety and depression intervention plans can be beneficial for improving older people's metacognition functioning.

Keywords: older people, mental disorders, metacognition

Introduction

Metacognition is defined by Flavell (1979) as the thoughts and knowledge the individual has about their own thoughts and cognitive processes and their forms of operation. Recently, Frazier et al. (2021) illustrated the interplay of metacognitive monitoring and control processes, which encompass individuals' thoughts and beliefs about cognition, their emotions and experiences regarding cognition, and the strategies they employ to modify their cognition and behavior. Frazier et al. (2021) also highlighted the significance of self-regulation. Self-regulation refers to the processes individuals use to direct and control their thoughts, emotions, and behaviors toward achieving their goals (Frazier et al., 2021, p. 298). As such, metacognition can inform self-regulation to achieve goals or tasks (Frazier et al., 2021). However, neither metacognition is required for self-regulation, nor is self-regulation needed for metacognition (Frazier et al., 2021). Instead, they are both valuable and complementary should an individual want to achieve goal-directed behavior because they shape appropriate decision-making and action.

Wells and Matthews (1996) posit how metacognitions and self-regulatory dysfunction contribute to psychopathology in their Self-Regulatory Executive Function (S-REF) model. This model, proposed by Wells and Matthews (1996), demonstrates how negative metacognitive beliefs may promote psychopathology. Negative metacognitive beliefs relate to the negative interpretation of internal events (Wells, 2013). Negative metacognitions of control and danger increase anxiety and a sense of loss of cognitive control as they alter the meaning of internal events such as thoughts, feelings, and physical sensations (Cano-López et al., 2021).

Sun et al.'s (2017) meta-analysis shows that dysfunctional metacognitive beliefs and processes are present in various psychological disorders in the general population. Capobianco et al. (2020) provide evidence that links metacognitive beliefs to anxiety and

depression, even among non-clinical populations. Additionally, whilst older adults may suffer a decline in their cognitive, physical, and motor abilities due to aging, research suggests that emotional processing tends to get better as people age (Sardella et al., 2022).

The importance of emotional processing in older adults has been supported by various theoretical models, including the Emotion Regulation (ER) model (Sardella et al., 2022). Gross (1998) proposed an Emotion Regulation (ER) model that includes five processes: situation selection, situation modification, attention deployment, cognitive change, and response modification. Situation selection involves choosing situations based on the emotions they elicit, while situation modification involves changing the situation to alter one's emotional state. Attentional deployment allocates attention to specific aspects of a situation or different thoughts. Cognitive change involves reevaluating a situation to change its emotional impact. Finally, response modulation involves efforts to modify the emotion and its associated physiological, behavioral, and cognitive components after it has been entirely generated. The ER model also proposed that each regulatory process includes different strategies. Cognitive reappraisal and emotional suppression are two of the key strategies by which people can regulate their emotions (Allen & Windsor, 2019; Gross, 2013). Within Gross's (1998) model, cognitive reappraisal is considered a cognitive change strategy and emotional suppression is considered a response modulation strategy (see Webb, Miles & Sheeran, 2012).

Cognitive reappraisal involves transforming and reinterpreting a given situation by changing one's cognitions about it which then modifies its emotional implications to enable better emotional and social functioning. Emotional suppression relates to an individual's responses and involves hindering the expression of emotional behavior, although it does not prevent the experience of negative emotions (Freire & Tavares, 2011). Richards and Gross (1999) have found that there are negative consequences of

emotional suppression, including that it is a cognitively demanding emotional regulation strategy. Furthermore, the authors report that emotional suppression can impair memory and learning in task performance (Richards & Gross, 1999).

A recent systematic review has provided an assessment of emotion regulation strategies in older adults based on the theoretical model of emotion regulation proposed by Gross (1998). This systematic review found that older adults who employ reappraisal techniques experience less psychological distress, such as lower levels of depression and anxiety symptoms and decreased anxiety sensitivity (Sardella et al., 2022). Higher use of reappraisal has been longitudinally associated with better self-regulation over a five-year period (Reed, Combs & Segerstrom, 2020). In contrast, Reed et al. (2020) found that suppression was linked to reduced executive functioning in older adults. As such, an investigation into the possible mediating roles of reappraisal and suppression in managing the effects of anxiety and depression on metacognitive strategies in older people is warranted and is the focus of the present work.

Objectives

This study aimed to verify the mediating role of cognitive reappraisal and emotional suppression in the interaction between mood disorders (anxiety and depression) and metacognition in community-dwelling older individuals. We expect to see lower levels of metacognitive scores in individuals with higher depression and anxiety. However, this effect could be mediated by cognitive reappraisal and emotional suppression. Cognitive reappraisal is expected to have an association with higher metacognitive scores. The effects of anxiety and depression on metacognitive, controlled by cognitive reappraisal, are also expected to be significant.

Methods

Ethics

Ethical approval was granted by the [blinded for review] (number: [blinded for review]). The ethical procedures of the National Health Council - Brazilian Ministry of Health were rigorously followed.

Participants

The study used a non-probabilistic sample (by convenience) of 250 older individuals who agreed to participate. Forty-one percent of the sample were male, and 59% were female. The average age was 67 years (SD = 8.5 years), more than half were married (59%), with 71% reporting being retired or pensioners and 13% were still performing some form of work, and 16% did not report or declare receiving income from another source. Of the participants, 94% had formal education, attending at least four years of regular education, and 5% did not respond. Half of older adults had at least one chronic disease, 89% used one to three medications (with or without a prescription), 3% had polypharmacy conditions (the routine and concomitant use of four or more medications with or without a prescription), and 6% did not respond.

Measures

The Hospital Anxiety and Depression Scale (HADS), created by Zigmond and Snaith (1983), was used. The HADS scale is divided into two subscales: anxiety and depression, with seven items each, answered using a four-point Likert scale. The global score on each subscale ranged from 0 to 21. We adopted a cutoff score of ≥ 10 to identify proposed anxiety disorders. International studies confirm its validity in community and primary care settings (Faro, 2015; Snaith, 2003). In the Brazilian validation, the subscales showed good internal consistency (anxiety: $\alpha=0.68$ depression: $\alpha = 0.77$) (Botega et al., 1995).

The Metacognitive Scale – Senior (EMETA-S) was presented. França and Schelini (2019) designed this scale with 34 statements with a four-point Likert-type response scale ($\alpha =$

0.92). A higher score on this scale indicates a greater sense of control over cognitive functions or the use of compensation strategies (França & Schelini, 2018).

The Emotion Regulation Questionnaire (ERQ) (Gross & John, 2003) was used to verify the systematic use of emotion regulation. The ERQ consists of 10 items answered using a seven-point Likert-type scale, divided into two dimensions of emotion regulation strategies, entitled cognitive reappraisal ($\alpha = 0.75$) and emotional suppression ($\alpha = 0.69$) (Batistoni et al., 2013).

Procedure

Data collection was carried out in 2019 in a city in the interior of São Paulo with about 39,000 inhabitants over 60 years of age. Participants were approached in public places (for example, squares, streets, and local community centers) and invited to participate. The inclusion criteria were aged 60 years old or more. Participants who met the age restriction were invited to participate in the study. After obtaining informed consent from the participants, trained interviewers conducted face-to-face interviews in one session, either at respondents' homes or community centers. The questions were read and marked by the interviewer. The Mini-Mental State Examination (MMSE-2) was used to evaluate the current mental functioning of participants to exclude potential participants with cognitive impairment. Cutoff points for cognitive impairment were determined based on formal education: illiterates required 13 points, low/medium education individuals required 18 points, and those with high education required 26 points. (Bertolucci, Brucki, Campacci, & Juliano, 1994; Spedo, Pereira, Foss & Barreira, 2018). Another exclusion criterion was participants receiving mental health treatment. None of the participants disclosed receiving mental health treatment and therefore no-one was excluded based on this criteria.

Data analysis

Descriptive statistics were performed for sociodemographic and health characteristics, including anxiety and depression. The instrument scores were presented as means and standard deviations (SD). Multiple regression models were used to explore the associations between anxiety and depression scores, cognitive reappraisal, and emotional suppression with metacognition scores. The backward method was adopted to retain statistically significant variables ($p \leq 0.05$), and the variables' contribution level was evaluated using the standardized Beta. The adjusted coefficient of determination (r^2) was also calculated to reveal the amount of variance explained by the independent variables (Tabachnick, B. G., & Fidell, 2007). All assumptions of linearity, normality, homoscedasticity, and multicollinearity were checked. Commonly used cutoff points were used to determine the presence of multicollinearity (tolerance value less than 0.10 or VIF value greater than 10) (Tabachnick & Fidell, 2007).

A mediation analysis was performed to test the mediating role of the variables retained in the explanatory model in adopting metacognitive strategies. Mediation analysis is usually performed after finding an observed relationship $X \rightarrow Y$ (MacKinnon et al., 2007). In this study, the relationship was verified through multiple regression analysis. The parameters were estimated using the maximum likelihood estimator with a confidence interval of 95%. Reported coefficients were non-standardized, and confidence intervals for indirect effects were computerized across 5000 bootstrap samples. Data were analyzed using the Statistical Package for the Social Sciences software - 24 and the PROCESS v3.5 macro (Hayes, 2018) for mediation analysis.

Results

Sample characteristics

Regarding clinical manifestations of depression and anxiety, the mean score for men was 7.83 (SD = 5.52), with 37% having scores ≥ 10 points. For women, the mean score was 9.73, with 47% having scores ≥ 10 points. Cognitive self-regulation and knowledge measured using the Metacognitive Scale - Senior (EMETA-S) had a mean score of 118.75 (SD = 16.17) among men and 113.36 (SD = 15.72) among women. Emotion regulation strategies, measured through cognitive reappraisal, had a mean score of 34.83 (SD = 6.90) among men and 31.06 (SD = 7.68) among women. Emotional suppression had a mean score of 22.50 (SD = 4.94) among men and 19.04 (SD = 5.88) among women.

Multiple linear regression model

All assumptions were met for multiple regression, and no outliers were found. The multiple regression model Anxiety and Depression Scores (HADS), Cognitive Reappraisal, and Emotional Suppression (ERQ) significantly predicted the metacognition score, $F(3, 246) = 27.44$, $p \leq 0.001$, adjusted $R^2 = 0.24$. Regression coefficients and standardized errors can be shown in Table 1.

TABLE 1 HERE

The final prediction model proved to be statistically significant [$F(3, 246) = 27.44$, $p \leq .001$, adjusted $R^2 = 0.24$]. It is observed that the depression and anxiety score measured using the HADS scale [$b = -0.16$, $t(243) = -2.89$, $p \leq .001$], cognitive reappraisal scores [$b = 0.31$, $t(243) = 4.25$, $p \leq .001$] and emotional suppression scores [$b = 0.16$, $t(243) = 2.28$, $p = .02$] each made a unique and statistically significant contribution to the prediction of metacognition scores. However, the Beta value for cognitive reappraisal was higher (.31), indicating a single contribution more significant than the other variables in the model.

Mediation analysis

A parallel mediation analysis was performed, having as a predictor (X) the scores of the HADS scale, as an outcome (Y) the EMETA-S score was used, and as mediators (M) the scores of cognitive reappraisal and emotional suppression. The parameters and the model can be seen in Figure 1.

FIGURE 1 HERE

Anxiety and Depression significantly decrease Cognitive Reappraisal, $b = -.32$, 95% CI [-.48; -.16], $t(248) = -3.94$, $p \leq .001$; $R^2 = 0.06$ (6%), and also significantly decrease Emotional Suppression, $b = -.18$, 95% CI [-.30; -.06], $t(248) = -2.935$, $p = .003$; $R^2 = 0.03$ (3%). Both mediators (Cognitive Reappraisal and Emotional Suppression) significantly increased the outcome (Metacognition). Cognitive Reappraisal (M1) has a positive and significant association with Metacognition (Y), $b = .65$, 95% CI [.353; .963], $t(246) = 4.250$, $p \leq .001$. Additionally, Emotional Suppression (M2) has a positive and significant association with Metacognition (Y), $b = .45$, 95% CI [.063; .856], $t(246) = 2.284$, $p = .023$.

The total effect, that is, without the control and presence of mediators [Cognitive reappraisal and Emotional suppression], was $b = -.76$, 95% CI [-1.09; -.42], $t(246) = -4.416$, $p = .000$; $R^2 = .07$ (7%). The results show that, without controlling the mediators, the increase of one more unit in the HADS scale impacts the decrease of $-.76$ in the metacognition scale. The direct effect of the model was $b = -.46$, 95% CI [-.779; -.147], $t(246) = -2.89$, $p = .004$, $R^2 = .25$ (25%). By adding the mediators to the model, and keeping them constant, an increase of one unit on the HADS scale results in a decrease of $-.46$ on the metacognition scale. The mediation effect (indirect effect) was significant $b = -.30$, (95% BCa IC [-.524; -.109]). Anxiety and depression's indirect effect on metacognition was mediated only by Cognitive Reappraisal was $b = -.21$ (95% BCa CI [-

.416; -.062]). The indirect effect of anxiety and depression on metacognition mediated only by Emotional Suppression was $b = -.09$ (95% BCa IC [-.225; -.001]), which indicates a null effect when considering the effect of Emotional Suppression.

Discussions

This study aimed to explore the mediating role of cognitive reappraisal and emotional suppression in the interaction between mood disorders (anxiety and depression) and metacognition in older individuals. This study found that anxiety and depression had a negative direct effect on metacognition. Our results also demonstrated that this negative direct effect on metacognition was mediated by cognitive reappraisal and not by emotional suppression. This is in line with previous work supporting the beneficial impact of reappraisal for older people (Webb et al., 2012; Reed et al., 2020). The direct link between levels of depression and anxiety and metacognition supports previous work on the negative impact on metacognitive factors (e.g. Faissner et al., 2018). According to the authors, depression leads the individual to biased metacognitive beliefs, emphasizing rumination and threat, directing the individual to opt for unsuccessful coping strategies. Similarly, Cano-López et al. (2021) suggest that symptoms of depression and anxiety have detrimental effects on self-regulation and emotional control processing, influencing the daily behaviors of individuals.

Moreover, maladaptive emotion regulation strategies promote early maladaptive schema formation and increase negative emotions (Cheng et al., 2020; Sroykham & Wongsawat, 2019). Research suggests that older adults who use maladaptive strategies (e.g., rumination and blaming others) and less frequently use positive reappraisal may be more likely to suffer from depression and anxiety (Sun et al., 2020). A sample of older individuals found that emotion regulation strategies (cognitive reappraisal and expressive suppression) mediated about 13% of the total effect of the relationship between resilience

and insomnia. The authors outline that positive cognitive reappraisal strategies negatively predicted insomnia, whereas other emotion regulation strategies (such as rumination) positively predicted insomnia (Cheng et al., 2020).

In the present study, cognitive reappraisal was relevant when testing the mediating power of emotion regulation strategies, decreasing the magnitude of the relationship between anxiety and depression on metacognition. By controlling their emotions through reappraisal, older adults can likely affect their experience of depression and anxiety. Batistoni and colleagues (2013) suggest that the use of cognitive reappraisal was indicative of better emotional health in older adults. John and Gross (2004) advocate a similar view, stating that cognitive reappraisal can be understood as a healthier pattern of emotional regulation. The cognitive reappraisal process could change the emotional impact of a stressful situation, as it is an attempt by the subject to think differently in the face of the situation, which provokes an emotional response or reaction (John & Gross, 2004). Especially cognitive reappraisal seems to alleviate stressors (Larcom & Isaacowitz, 2009) since individuals seek to decrease negative emotions and increase positive emotions (Gross & John, 2003). Therefore, when performing this thinking style, these individuals would have a more significant positive experience and less negative emotion (Gross & John, 2003). This could explain the attenuation of the impact of anxiety and depression on metacognitive processes, as observed in this study. In addition, it can be understood that older adult participants who use cognitive reappraisal could also use metacognitive strategies more, as they present greater positive expression during adverse events as a coping strategy.

In this line, Alves (2019) compared older and younger adults' use of emotional regulation strategies. Their results indicated that the group of older individuals used cognitive reappraisal more than young adults. According to the author, older adults may

have learned to use cognitive reappraisal more frequently than emotional suppression due to maturity and later experiences. However, this does not mean that emotional suppression is not used or that other emotional regulation strategies learned by older adults could play a role and merit further investigation. A review by Allen and Windsor (2019) included other emotion regulation strategies like cognitive refocusing, thought suppression or acceptance, or distraction, which could be an exciting prospect for further research to explore.

The present study supports the finding that cognitive reappraisal may be a more adaptive strategy than emotional suppression for older adults at risk or suffering from depression and anxiety. Furthermore, the present work reinforces the importance and opportunity in learning self-regulatory strategies to support mental health and coping, as Frazier et al. suggested (2021). Although this study design cannot establish causality, evidence from prior studies indicates that targeting metacognitive processes may alleviate mood and anxiety disorders in older adults (Johnson & Hoffart, 2016) and benefit those with mild Alzheimer's disease (Cosentino et al., 2011). It is possible to speculate that utilizing cognitive reappraisal techniques may enhance the utilization of metacognitive strategies, thereby alleviating certain symptoms of depression and improving daily life for those with mild Alzheimer's disease.

Some limitations must be addressed. As this study did not aim to identify signs of depression or anxiety in older adults, the cut-off points were considered only for the sample description. Therefore, it does not allow the establishment of diagnoses (disorder and symptomatology in particular). Although we did not include the psychiatric history of the participants, none of the participants reported receiving mental health treatment. It is noted that most of the sample had a formal education which is not indicative of a wider population. Only two dimensions of emotion regulation strategies were studied: cognitive

reappraisal and emotional suppression. Other instruments based on different conceptions of emotion regulation strategies could be incorporated into future studies. The use of only one self-report scale (EMETA-S) (França & Schelini, 2018) to assess metacognition could also be understood as a limitation since the scale may not be the best technique to assess metacognitive judgment, the primary way of identifying the accuracy of the monitoring activity of a cognitive task. Considering that emotional regulation is also a key factor for the conceptualization of resilience in old age, future studies may include resilience and other social and biological variables, for example, chronic diseases, habits and lifestyles, and quality of life. Finally, the study of anxiety and depression on metacognition should be examined in clinical longitudinal samples to evaluate the clinical significance of any impact of emotional regulation strategies in mood disorders.

An important strength of the present work is that it took place in a Brazilian sample of older people, and thus in an international context outside of Anglophone countries such as the USA and UK, from which data on the subject are more common. The present study provides research evidence of the relevance of the link between older peoples' emotional regulation, metacognition, and depression and anxiety in a wider global context.

Conclusions

The present work provides a results model to underpin findings from other research on metacognition and mood disorders by statistically demonstrating the negative impact of anxiety and depression on metacognitive functioning in older persons. Cognitive reappraisal appears to be a more adaptive emotional regulation strategy than emotional suppression for older people with anxiety and depression. Moreover, assessing the use of emotional regulation strategies may be crucial when evaluating the metacognitive abilities of older individuals with anxiety and depression.

Clinical Implications

- Treating anxiety and depression has the potential to improve metacognitive functioning in older adults.
- Including cognitive reappraisal techniques in anxiety and depression interventions can potentially impact the use of metacognitive functioning in older adults.

Data availability statement

The data supporting this study's findings are available from the corresponding author.

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Table 1

Regression coefficients, t statistics, and collinearity statistics.

Model		Unstandardized Coefficients		<i>b</i> standardized	<i>t</i>	<i>p</i>	Collinearity diagnostics	
		<i>b</i>	Std. Error				Tolerance	VIF
1	(Intercept)	88.85	4.70		18.91	.001		
	Cognitive Reappraisal	0.66	0.15	0.31	4.25	.001	0.57	1.75
	Emotional Suppression	0.46	0.20	0.16	2.28	0.02	0.59	1.70
	HADS	-0.46	0.16	-0.16	-2.89	.001	0.94	1.06

Figure 1 Model of Anxiety and Depression (X) as a predictor of Metacognition (Y) mediated by Cognitive Reappraisal (M1) and Emotional Suppression (M2). The bootstrapping technique estimated the Bias-Corrected and Accelerated (BCa) confidence interval (5000 re-samplings). Note. Non-standardized coefficients