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Predicting Emotion Regulation Strategies of Coronary Heart Disease Patients by Reinforcement Sensitivity

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Abstract

Objective: Coronary Heart Disease (CHD) is a pathological process in the coronary arteries that deserves special attention. This cross-sectional descriptive study aimed to predict the emotion regulation strategies, i.e., cognitive reappraisal and expressive suppression, adopted by patients with Coronary Heart Disease (CHD) using reinforcement sensitivity components, namely Behavioral Approach System (BAS), Behavioral Inhibition System (BIS), fight, flight, and freeze.

Method: To this end, 322 patients with CHD were recruited from three medical centers in Tehran, Iran. Emotion Regulation Questionnaire and Jackson-5 scales of revised Reinforcement Sensitivity Theory were administered to the patients, and the data were analyzed by regression analysis.

Results: The results revealed that BAS significantly predicted cognitive reappraisal strategy and also made the strongest contribution to the explanation of expressive suppression strategy; furthermore, flight and freeze were both equally the second most significant predictors of expressive suppression.

Conclusion: Therefore, the interaction between emotion regulation and reinforcement sensitivity components should be considered in patients with CHD.

Keywords: Coronary Heart Disease (CHD), Emotion Regulation, Reinforcement Sensitivity, Patients, Behavioral Activation.

Introduction

Coronary Heart Disease (CHD) is a pathological process in the coronary arteries of the heart in which atherosclerotic plaque blocks the coronary arteries (Lemos & Omland, 2017). As a life-threatening disease, many risk factors influence the development of or predisposition to CHD, one of which is psychological factors. Individuals exposed continuously to psychological factors are at higher risk for CHD (Virtanen, Ferrie, Kivimäki, et al., 2018). One of the psychological factors is personality, which is related to the risk of heart disease, but the importance of personality in heart disease is still controversial (Lee et al., 2014). Personality shows the feeling (emotion), behavior, and mindset (cognition) of a person, all of which influence health conditions (Ati, Paraswati, Wihastuti, et al., 2020).

The mechanism of personality as a risk factor for CHD was understood through behavioral and biological processes (Kupper & Denollet, 2018), and different theories were proposed from the perspective of both processes. Reinforcement Sensitivity Theory (RST; Gray, 1982; Gray & McNaughton, 2000), which is the focus of the present study, was originally based on the association between biology and behavior (Corr, 2008). This theory presented a neurobiological framework where the behaviors additively develop an individual's personality are reinforced by particular neurobehavioral systems

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in charge of an individual's aversive and appetitive motivations (Corr & Cooper, 2016). According to Corr (2008), RST specifies three major systems of emotion (Corr, 2008).

The first one is the Fight–Flight–Freeze System (FFFS), responsible for mediating reactions to all aversive stimuli, both conditioned and unconditioned. FFFS mediates the emotion of fear, but not anxiety. It reduces the discrepancy between the immediate threats and the desired goal, and its associated personality factors are fear-proneness and avoidance. The Behavioral Approach System (BAS) is the second system and mediates reactions to appetitive stimuli, both conditioned and unconditioned, and its associated personality traits are optimism, reward-orientation, and impulsivity. The Behavioral Inhibition System (BIS), as the last system, is in charge of the resolution of goal conflict, and its associated personality factors are anxiety and the inhibition of conflicting behaviors. As emotions are highlighted in RST, emotional issues such as the type of emotion regulation strategies adopted by an individual can be included in RST studies (Corr, 2008; Shafir, 2015).

Emotion regulation is defined as the ability of individuals to control their emotional experience and expression, specifically controlling or responding to negative emotions (Cole, Michel, & Teti, 1994). It is a multi-dimensional process through which individuals might consciously or automatically scrutinize, appraise, and modify their emotional experiences to environmental demands, such as stressful events (Bargh & Williams, 2007). Roy, Riley, and Sinha (2018) reported that higher emotion regulation weakened the link between chronic stress and heart disease risk in young to middle-aged adults. As the authors believed that emotion regulation is a teachable skill, they concluded that emotion regulation might reduce heart disease incidence.

Related literature has generally focused on two strategies to regulate emotion: cognitive reappraisal and expressive suppression (Gross, 2002). The former denotes regarding a potentially emotion-provoking situation as a neutral, non-emotional one, and therefore results in cognitive change, and the latter denotes an inhibiting ongoing emotion-expressive behavior and thus results in response modulation. Research evidence (e.g., Gross & Levenson, 1997; Wolgast, Lundh, & Viborg, 2011) showed that while cognitive reappraisal reduces both experiencing and expressing emotions without side effects on memory or physiology, emotion suppression reduces emotion expression and is linked to memory and physiological responding impairment. Furthermore, expressive suppression, but not cognitive reappraisal, increases sympathetic cardiovascular activity (Harris, 2001).

The review of the theoretical background about the relationship between BIS, FFFS, BAS, and emotion regulation strategies shows that differences in reinforcement sensitivity may contribute to expanding emotion regulation strategies by affecting the way people respond to their emotions (Depue & Lacno, 1989). The sensitivity of BIS has a relationship with some emotion regulation problems, including suppression. BAS has little to do with suppression strategy, but it has a positive relationship with cognitive reappraisal strategy that has little to do with emotion regulation problems (Tull, Kim, Robert, et al., 2010)

To the best knowledge of the researchers, few studies have yet been conducted on personality from the perspective of RST and emotion regulation in patients with CHD; therefore, this study set out to predict the emotion regulation strategies adopted by patients with CHD using reinforcement sensitivity. It is expected that this study will contribute to a deeper understanding of emotional and personality factors that contribute to CHD.

Method

Participants

The participants of this cross-sectional descriptive study comprised 322 patients with CAD recruited

from Tehran Heart Center, Iran. The inclusion criteria were the diagnosis of coronary heart disease by a specialist and being literate. The exclusion criteria were having a history of psychological illnesses and using psychiatric medications or substance use. The demographic information of the participants is presented in Table 1.

Table 1. Demographic Information of Participants

Characteristic		N (%)
Age	25-35	105 (32.60)
	36-46	217 (67.39)
Gender	Male	214 (66.45)
	Female	108 (33.54)
Education	High school	24 (7.45)
	Diploma	198 (61.49)
	BA	62 (19.25)
	MA	34 (10.55)
	PhD	4 (1.24)
Marital Status	Married	262 (81.36)
	Single	60 (18.63)

Ethical statement

All procedures performed in studies involving human participants should be according to the ethical standards of the institutional and/or national research committee and with the 1989 revision of the Helsinki Declaration and its later amendments or comparable ethical standards. This study, thus, was approved by the Ethics Committee of Kharazmi University.

Measures

Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) was developed to evaluate individual differences in the habitual use of regulation strategies. It consists of 10 items and two subscales, namely cognitive reappraisal and expressive suppression, and the responses are rated on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The cognitive reappraisal scale assesses antecedent-focused strategies with six items, and the expressive suppression subscale assesses response-focused strategies with four items**.** Hasani and Kadivar (2013) reported that the reliability of this questionnaire ranged between 0.57 and 0.94, and confirmed the validity of this questionnaire in Iran. The reliability of the scale questionnaire estimated by Cronbach's alpha was 0.70 in the present study.

Jackson-5 scales of revised Reinforcement Sensitivity Theory (r-RST; Jackson, 2009) were developed as a test of revised Reinforcement Sensitivity Theory and comprised 30 items for measuring the five factors of the model, namely BAS, BIS, fight, flight, and freeze, each comprising six items. The responses are rated on a five-point Likert scale ranging from 1 (completely disagree) to 5 (completely agree). The author (2012) validated this test in Iran and the test-retest reliability of the factors ranged between 0.77 and 0.88. The reliability of the scale estimated by Cronbach's alpha was 0.82 for the present study.

Procedure

The procedure for conducting the study was approved by the ethics committee for research involving human participants at Kharazmi University, Tehran, Iran. After obtaining the participants' informed consent, they were asked to complete a packet, including ERQ and Jackson-5 scales of revised Reinforcement Sensitivity Theory. It took around 30 minutes for the participants to fill in the questionnaires. Regression analysis was conducted for data analysis.

Results

To know which of the five components of reinforcement sensitivity, namely BAS, BIS, fight, flight, and freeze, might predict the two emotion regulation strategies, i.e., cognitive reappraisal and expressive suppression, a regression analysis was conducted whose results are presented below. It should be mentioned that the assumptions of the analysis were checked.

The correlation between the predicted values, i.e., BAS, BIS, fight, flight, freeze, cognitive reappraisal,

Table 2. Model Summary of Predicting Emotion Regulation Factors by Reinforcement Sensitivity Factors

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Cognitive reappraisal	.37	.14	.13	.71
Expressive suppression	.37	.14	.13	1.02

and expressive suppression, is 37%. These predicted values explain 14% of the variance of both cognitive reappraisal and expressive suppression (Table 2). To know whether the results are significant, we look at Table 3.

As Table 4 shows, the Behavioral Activation System (BAS) makes the strongest contribution to explaining the variance in the cognitive appraisal variable (β = 0.37, p =.00). Therefore, it can be concluded that BAS significantly predicts cognitive reappraisal.

Table 3. Results of Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	P
cognitive reappraisal	Regression	.24	5	5.44	10.56	.00
	Residual	162. 27	316	.51		
	Total	190.22	321			
expressive suppression	Regression	54.97	4	13.74	13	.00
	Residual	335.05	317	1.05		
	Total	390.02	321			

Table 3 shows that the predicted values can significantly predict both cognitive reappraisal and expressive suppression (cognitive reappraisal, F = 10.56, p =0.00; expressive suppression, F = 13, p = 0.00).

Considering expressive suppression, the Behavioral Activation System (BAS) makes the strongest contribution to its explanation (β =0.29, p =0.00). Furthermore, flight (β = 0.15, p =0.00) and freeze (β = -0.15, p =0.00) both are equally the second most

Table 4. Standardized and Unstandardized Coefficients of Model

Model B		Unstandardized Coefficients		Standardized Coefficients	t	P
		SE	β			
Cognitive reappraisal	(Constant)	3.38	.24		13.70	.00
	BAS	.38	.07	.37	5.25	.00
	BIS	-.05	.06	-.06	-.89	.37
	Fight	.05	.05	.06	1.04	.29
	Flight	.03	.05	.04	.70	.48
	Freeze	.05	.05	.05	.84	.39
Expressive suppression	(Constant)	1.28	.35		3.62	.00
	BAS	.43	.08	.29	5.39	.00
	BIS	-.04	.08	-.03	-.48	.62
	Fight	.17	.07	.13	2.25	.02
	Flight	.21	.07	.15	2.83	.00
	Freeze	-.22	.08	-.15	-2.64	.00

significant predictors of expressive suppression, though the beta value of the freeze factor is negative.

Discussion and Conclusion

This study was the first to examine whether the reinforcement sensitivity component can predict the emotion regulation strategies in patients with CHD. The regression analysis results revealed that BAS significantly predicted cognitive reappraisal strategy and made the strongest contribution to the explanation of expressive suppression strategy; furthermore, flight and freeze were equally the second most significant predictors of expressive suppression beta value of freeze factor in negative.

Cognitive reappraisal involves anticipating an emotion by evaluating one's thoughts and then regulating those thoughts to experience a preferred emotion (Gross & John, 2003). It is defined as the attempt to reinterpret an emotion-eliciting situation in a way that alters its meaning and changes its emotional impact (Gross & John, 2003). As CHD is a life-threatening disease that might negatively influence the patients' emotional states, they need to reappraise and alter the harmful ones. As the results of the study showed, BAS predicted the use of this strategy.

To explain this finding, we might refer to the mechanism of BAS. The activation of these systems arises against feelings of hope, joy, and optimism (Hundt, Brown, Kimbrel, et al., 2013). Previous studies (e.g., Ikeda et al., 2011) have shown that optimism is related to more normal levels of inflammatory cytokines, cortisol, and markers of endothelial function, all of which have been linked to the superior cardiac prognosis in patients with heart disease. Regarding the significance of hope for patients with heart disease, Schaufel, Nordrehaug, and Malterud (2011) reported that hope made it possible for these patients "to shift the perception of mortality from overwhelming horror toward suppression of peaceful acceptance, to foster reconciliation instead of uncertainty when adapting to the new phase of life, and to establish go-ahead spirit instead of resignation as their identity" (p. 1). In general, cognitive reappraisal strategy and BAS jointly help the patients with CHD to feel better and tolerate the disease consequences.

Expressive suppression denotes attempts to suppress negative emotions after they have already occurred. In the case of patients with CHD, anxiety (Gu, Zhou, Zhang, & Cui, 2016) and depression (Konrad et al., 2016) are instances of negative emotions. Furthermore, Rasoolzadegan, Agah heris, and Karbalai Saleh (2020) reported that the dimensions of mental well-being were higher in healthy subjects than in myocardial infarction patients. Paradoxically, using expressive suppression to manage negative emotions, such as sadness or anxiety, has been shown to heighten the felt intensity of negative emotion (Gross, 2014; Kalokerinos, Greenaway, & Denson, 2015). Similarly, Gross (1998) suggested that although emotion suppression reduces emotion expression, it fails to reduce the feeling of emotion and is associated with memory and physiological responding impairment. In general, expressive suppression seems to be a maladaptive strategy, and its use by patients with CHD might worsen their problems.

As the results of the study revealed, BAS was related to this strategy in patients with CHD. To explain this finding, one can say that BAS might be used to downregulate this strategy since BAS is related to positive affect (Jorm, Korten, Jacomb, et al., 1999). As CHD might result in negative emotions such as depression mentioned above, BAS helps patients mitigate and neutralize those emotions' deleterious effects. Besides BAS, flight, and freeze were also predictors of expressive suppression.

According to Jackson et al. (2014, p. 86), the flight is defined as a "fast, action-oriented escape from threat in which slow cognitive executive functioning strategies are likely short-circuited and faster, immediate reactions are given priority." As Gross (2014) stated, expressive suppression has been

shown to heighten the felt intensity of negative emotion. Considering the definition of flight and the specification of expressive emotion, the positive association among them was predictable. Not to get overwhelmed by the negative emotions resulting from CHD, the patient decided to escape and find a way around the problem.

In line with the finding of the present study regarding the link between emotion regulation and flight, Cisler, Olatunji, Feldner, and Forsyth (2010) stated that compels a person to preemptively avoid threatening situations or control the level of emotional arousal when confronted with a threat so that normal behavioral competence is maintained using strategies such as disengagement.

Freezing is a defensive response that occurs on the detection of a relatively distant threat, which results in reduced heart rate and being highly vigilant towards the threatening stimulus (Bradley, Codispoti, Cuthbert, & Lang, 2001). One of the reasons that freezing was negatively related to the adoption of the expressive suppression might be justified by the focus on "distant threat" while the participants of the present study were those who were diagnosed with CHD and it was an imminent and immediate threat, not a distant one for them.

However, as Gladwin, Hashemi, van Ast, and Roelofs (2016) mentioned, freezing may not reflect a state of helpless anticipation, but to the contrary, a state of active preparation of a defensive response to a triggering stimulus or according to Schauer and Elbert (2010), ''stop-look-listen'' perception of the threat. Another reason for the negative link of freezing is that freezing necessitates active participation while the flight component implies escaping from the threat, which seems to contradict freezing from this perspective, and as was mentioned above, the flight was positively related to expressive suppression.

In general, the findings of this study provide a new understanding of the personality and emotion regulation strategies of patients with CHD. We do hope that clinicians, practitioners, or caregivers working with this group of patients find this study helpful in designing and conducting therapies for patients with CHD.

Regarding the limitations of the study, the participants were limited to patients with CHD in Tehran, so the findings might not be generalizable to other cities, countries, or other types of heart diseases. Furthermore, self-report measures were used for data collection. Therefore, future researchers are recommended to include patients with other types of heart diseases and also use the triangulation technique and other data collection measures to make stronger generalizations.

Declarations

Conflict of interest: The authors declare that they have no conflict of interest.

Consent to participate: Informed consent was obtained from all individual participants included in the study.

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