

## → Research Article



# Structural Equation Modeling of Adherence to Treatment on Emotional Regulation Mediated by Coping Strategies by in Women with Breast Cancer Undergoing Chemotherapy

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## Abstract

**Background:** Cancer is a complex, debilitating, and common disease with many dimensions, consequences, and psychological, biological, and social complications. We aimed to investigate the structural equations of treatment adherence based on emotional, cognitive regulation mediated by coping styles in women with breast cancer undergoing chemotherapy.

**Methods:** The present study was a correlational study using structural equation modeling. The statistical population included patients with breast cancer referred to specialized cancer clinics in Tehran between October and February 2018. The sample consisted of 250 patients with breast cancer who were selected by convenience sampling. Data were obtained using the Folkman and Lazarus Coping Strategies Questionnaire, the Cognitive Emotion Regulation Questionnaire (CERQ), and Morisky Medication Adherence Scale (MMAS-8). Data were also analyzed using correlation coefficients, Pearson's correlation matrix, multiple regression, and structural equation modeling. Also, all statistical calculations were performed using Amos 22 and SPSS 22 software.

**Results:** Emotion regulation had a direct effect on coping strategies ( $\beta=0.48$ ,  $P<0.001$ ) and adherence to treatment ( $\beta=0.63$ ,  $P<0.001$ ). Coping strategies had a mediating role in the relationship between emotion regulation and adherence to treatment (AGFI=0.98, RMSEA=0.067).

**Conclusion:** There is a relationship between emotion regulation and adherence to treatment and coping strategies has a mediating role in women with breast cancer undergoing chemotherapy.

**Keywords:** Emotional regulation, Coping strategies, Breast cancer, Women

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## Background

Cancer is a complex, debilitating, and common disease with many dimensions, consequences, and psychological, biological, and social complications. In many countries, including Iran, this disease is the second bio-medical cause of death after cardiovascular diseases (1). Cancer patients suffer from various psychological problems, including fatigue, anxiety, hopelessness, and clinical signs of depression. According to the American Cancer Society, more than 25% of people with various cancers in the United States show clinical signs of depression, and depressed patients suffer more pain, discomfort, and physical complaints (2). Cancer is a disease in which the body's cells become malignant in a tumor known medically as a neoplasm. There is a possibility of cancer at different ages, but the probability increases with age. Cancer causes 13% of deaths. According to the American

Health Association, in 2016, 7.6 million people died of cancer (3).

On the other hand, there is a close relationship between psychological states and cancer. Among the various types of cancer, breast cancer accounts for 23% of all cancers in women. It is the most common cancer and the deadliest malignancy among women and is one of the most important factors in women's health in the world (4). Breast cancer is defined as an abnormal growth change in cells in the breast tissue that occurs abnormally in the mammary glands (lobules) or in the ducts that connect the lobules to the nipple (duct) (5).

Personal functioning and the level of medical advice in patients with cancer are factors associated with adherence to treatment. On the other hand, the degree of each person's desire to follow treatment instructions are one of the factors that can play a role in improving

cancer. In 2016, O'Byrne et al and colleagues published an important standard paper. Today, treatment is still an important issue in chronic diseases and is seen in cancer (6). Nonacceptance of medication and treatment regimens is often seen in patients with cancer. This inability to follow treatment, decision-making and cognitive function may lead to death in patients with cancer (2). Several factors influence the follow-up of treatment, which can be based on the bio-psycho-social pattern and the pattern of medical and psychological integration, which are known to be the dominant patterns of health psychology. Several psychological factors affect treatment, including the physician-patient relationship, memory error, and health control center (6).

On the other hand, emotion is a psychological factor that plays an important role in the health of patients with cancer. Emotion plays an important role in various aspects of life, such as adapting to life changes and stressful events. Hence, emotion regulation is a basic principle in initiating, evaluating, and organizing adaptive behavior and preventing negative emotions and maladaptive behaviors (7). The term emotion regulation includes strategies that reduce, maintain, or increase emotion and refers to processes that affect a person's current emotions and how they experience and manifest them (8).

Also, cancer in the family somehow affects all family members and puts them under a lot of psychological and financial pressure. In such situations, people use strategies to reduce stress and pressure. A person uses a general coping strategy when faced with complications such as cancer in himself or a family member, including problem-oriented coping strategy and emotion-focused coping strategy (9). Usually, when people feel that they can do something about a problem, they use problem-oriented coping strategies. If they see the situation beyond their capabilities, they turn to emotion-oriented confrontation. However, they often use a combination of these two methods to get a more reliable result (10).

People with cancer may develop mood swings that lower their quality of life. However, stronger psychological resources such as secure attachment and an adaptive coping strategy may be able to accompany them on a calmer course of treatment in order to experience higher mental health (11). Coping with stress reduces the pressure of illness and maintains balance and mental health. Using optimal coping methods, the person will maintain his or her adaptation, while inefficient methods will increase stress, unsatisfied vital needs, and emotional instability (12). According to research, people who respond to life stresses with optimism and resilience, use constructive coping strategies, take control of life events, have a better immune system function, and cope better with illness. These people also have higher mental health (13). The conceptual model of the study is presented in Figure 1.

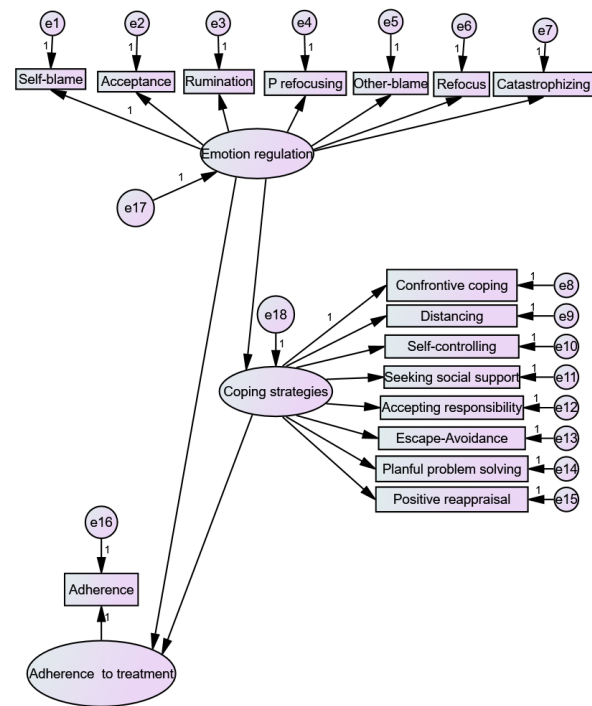


Figure 1. Conceptual Model of Research.

### Objectives

We aimed to investigate the structural equations of treatment adherence based on emotional, cognitive regulation mediated by coping styles in women with breast cancer undergoing chemotherapy.

### Methods

The present study was a correlational study using structural equation modeling. The statistical population included patients with breast cancer referred to specialized cancer clinics in Tehran between October and February 2017. The sample consisted of 250 patients with breast cancer who were selected by voluntary sampling. After selecting the statistical population and preparing the research tool, the researcher selected people from the oncology ward of these centers according to the research criteria (patients with diagnosis Breast cancer and other conditions listed in the inclusion criteria) during the days when the specialized cancer clinic in Tehran was established. After explaining the research objectives and obtaining the patients' consent to participate, the researcher gave them the questionnaires simultaneously. To comply with ethical principles, the researcher emphasized that their information would be kept confidential and analyzed as a group.

Inclusion criteria were: diagnosis of breast cancer by a specialist, patients undergoing chemotherapy for at least one session, age range of 18 to 50 years, willingness to participate, having sufficient literacy to complete the questionnaire, and lack of acute mental disorder (mania or severe depression) based on psychiatrist's diagnosis. We excluded patients whose information were incomplete.

The ethical considerations of the present study were as follows: 1) All participants received information about the research orally and participated in the research if they wished and gave informed consent, 2) The patients were assured that all information is confidential and will be used for research purposes, 3) In order to protect privacy, the names and surnames of the participants were not registered, and 4) To ensure the work process, all questionnaires were administered by the researcher.

### ***Coping Strategies Questionnaire***

The questionnaire was developed by Lazarus and Folkman and consisted of 66 items that measure eight problem-oriented and emotion-oriented coping methods. Folkman (14) reported internal stability of 0.79 to 0.66 for each coping method. In Najafianzadeh and colleague's (15) study, using Cronbach's alpha coefficient, the internal stability of the whole scale and its subscales were obtained (0.76 for the total scale, 0.75 for the problem-oriented dimension and 0.72 for the emotion-oriented dimension, respectively).

### ***Cognitive Emotion Regulation Questionnaire (CERQ)***

This questionnaire is a multidimensional questionnaire developed by Garnefski and Kraaij (16) and is used to identify the cognitive coping strategies of individuals after experiencing negative events or situations. This questionnaire includes 36 five-point graded questions that assess the following seven factors in total: Positive re-focus or planning, positive evaluation/broader perspective, blaming others, self-blame, rumination, catastrophizing, acceptance. Garnefski and Kraaij (16) reported alpha coefficients of 0.71 to 0.81 for the subscales and validity coefficients of 0.48 to 0.61 by retesting with a time interval of 14 months. In Iran, Besharat and Bazzazian (17) obtained the alpha coefficients of 0.62 to 0.91 for the subscales and validity coefficients of 0.75 to 0.88 for these factors by retesting with a time interval of one week.

### ***Morisky Medication Adherence Scale (MMAS-8)***

The Treatment Adherence Scale is a self-report questionnaire designed by a research team in 2010 and contains eight items. This scale measures adherence to high treatment with a score of 8 out of 8, adherence to moderate treatment with a score of 6 out of 8, and adherence to low treatment with a score of less than 6 (18). The treatment adherence scale was constructed from a scale of four previously validated items and supplemented with other items consisting of conditions that include adherence to treatment. This scale was first translated into Persian by Moharamzad and et al (19), and then reviewed. The reliability of the Cronbach's alpha follow-up scale was 0.89, which indicates optimal reliability.

To analyze the collected data, descriptive statistics and inferential statistics were used. In the descriptive statistics

section and the description of the studied indicators, the standard deviation was used. In the inferential statistics section, to test the assumed relationships in the proposed model, the statistical method of structural equation modeling was used. For this purpose, model fit indices such as chi-square, comparative fit index (CFI), the goodness of fit index (GFI), adjusted goodness of fit index (AGFI), and root mean square error approximation (RMSEA) were calculated. The data were also analyzed using the correlation coefficient, Pearson correlation matrix, multiple regression, and structural equation modeling. Indirect path was calculated using bootstrap method. Also, all statistical calculations were performed using Amos (version 22) and SPSS (version 22) software.

### **Results**

The mean  $\pm$  SD age of the respondents was  $39.5 \pm 6.72$  (range: 23-50 years). Most participants had primary education ( $n=77$ , 30.8%), and the least had university education ( $n=16$ , 6.4%). Most participants were married ( $n=103$ , 41.2%), and the least were single ( $n=20$ , 8%). The highest duration of the disease was related to one to five years with 97 (38.8%) patients, and the lowest was related to the duration of more than ten years with 30 (12%) patients (Table 1).

Kolmogorov-Smirnov test was used to evaluate the normality of data distribution. The data were distributed normally and inferential data analysis could be performed. To investigate the conceptual model presented in the research, the initial model was analyzed according to the prediction of following the treatment in direct and indirect ways by the variables of cognitive emotion regulation strategies and coping strategies. Fit indices are presented in Table 2.

The values obtained from regression weight statistics were used to determine the effect values (B) according to the significance level obtained from the critical ratio, which showed the significant effect values of the subscales on the overall variable and the exogenous variable (cognitive regulation strategies).

Table 3 shows the standardized and non-standardized values of the prediction paths of the exogenous research variables on the endogenous variable together concerning the value of obtained in the model. In general, all values obtained are significant and represent a significant prediction. According to Table 3, cognitive function variables, cognitive emotion regulation strategies, and coping strategies directly affect adherence to treatment.

According to Table 4, the research model was approved through absolute, comparative, and economic indicators. In general, four variables can predict ( $R^2=0.56$ ) of the variable of treatment; 53% of the variance of adherence to treatment can be defined by cognitive emotion regulation variables and coping strategies in direct and indirect.

According to Table 5, coping strategies has a mediating

**Table 1.** Descriptive Statistics of the Research Variables

Variables	Components	M	SD	Min	Max
Coping Strategies	Confrontive coping	11.47	1.93	3	18
	Distancing	10.36	1.22	3	16
	Self-controlling	14.84	4.13	5	21
	Seeking social support	11.56	3.70	4	18
	Accepting responsibility	7.11	1.24	2	12
	Escape-avoidance	16.31	3.02	6	22
	Planful problem solving	11.30	2.85	3	17
	Positive reappraisal	12.53	3.15	3	21
Emotion Regulation	Positive refocusing	36.50	9.40	10	50
	Refocus	15.90	4.30	6	30
	Other-blame	12.30	3.60	4	20
	Self-blame	9.56	1.17	3	15
	Rumination	14.13	4.27	5	25
	Catastrophizing	12.96	3.32	4	20
	Acceptance	13.81	3.59	4	20
Adherence to treatment		3.94	1.83	0	8

**Table 2.** Fit Indicators From Data Analysis and Variables

The Goodness of Fit Index	$\chi^2/df$	RMSEA	AGFI	GFI	CFI
Path	1.90	0.067	0.98	0.98	0.95

role between emotion regulation and adherence to treatment.

## Discussion

This study aimed to model the structural equations of treatment adherence based on cognitive emotion regulation mediated by coping styles in women with breast cancer undergoing chemotherapy. Findings showed that modeling treatment adherence based on emotional and cognitive regulation mediated by coping styles in women with breast cancer undergoing chemotherapy was appropriate. These findings were consistent with the results of another study (11).

Explaining that there is a relationship between cognitive emotion regulation strategies and treatment adherence in women with breast cancer undergoing chemotherapy, it can be said that emotion regulation and health are two related concepts. Applying the skills necessary to regulate emotions when faced with stressful situations adaptively reduces negative emotions and stress, followed by a reduction in physiological stress responses,

including endocrine and autoimmune responses, which in turn helps improve mental and physical condition; Therefore, emotion regulation skills play an important role in preventive interventions and psychological therapies for a variety of physical problems, illnesses, and psychological disorders (20). The two main categories of emotion regulation, avoiding emotions, can have adverse consequences, such as increasing the likelihood of disease progression and acceptance. Expressing emotions can be associated with increased physical and mental health. Unresolved emotions, with repeated reflection or rumination about negative emotions without expressing them, can negatively affect a patient's health. For example, they cause a chronic increase in the activity of the sympathetic system. Also, holding back emotions when you need help causes procrastination in help-seeking behaviors because it prevents the recognition of symptoms. This inhibition can lead to the patient's failure to practice health-maintenance behaviors and adherence to treatment, followed by an exacerbation of the disease (21). Disabling and threatening complications affect all physical, psychological, and social aspects of patients' lives, and by creating numerous problems and limitations, they pave the way for the experience of negative emotions such as anxiety and depression in the patient. On the other hand, emotional disorders have a negative effect on

**Table 3.** Weight Regression Statistics and Critical Ratios of the Research Variables

Exogenous Variable	Direction	Endogenous Variable	b	$\beta$	t	P
Emotion regulation	→	Adherence to treatment	0.745	0.634	12.874	0.001
Coping Strategies	→	Adherence to treatment	0.620	0.518	7.486	0.001
Emotion regulation	→	Coping Strategies	0.535	0.480	5.987	0.001



**Table 4.** Direct Estimation of the Model With The Maximum Mean Level

Variable	b	$\beta$	R2
Emotion regulation to adherence to treatment	0.745	0.634	0.396
Coping strategies to adherence to treatment	0.624	0.518	0.260
Emotion regulation to coping strategies	0.535	0.480	0.230

**Table 5.** Indirect Estimation of the Model Using the Bootstrap Method

Variable	B	Low limit	High limit	Significance
Emotion regulation to adherence to treatment mediated by coping strategies	0.467	0.316	0.511	0.001

disease management, which can accelerate the progression of the disease (22). The experience of negative and distressing emotions has been common in patients with chronic illness, especially cancer. Decreased acceptance and completion of rehabilitation programs and lack of adherence to healthy behaviors that reduce the risk of disease, including drug use, as well as unhealthy behaviors such as smoking, excessive alcohol consumption, low physical activity, poor diet, and sleep disorders, all of which can increase the risk of cancer and its exacerbation.

Also, with respect to the relationship between coping strategies and adherence to treatment in women with breast cancer undergoing chemotherapy, it can be said that having cancer and requiring the patient to follow treatment cause many challenges in daily life. Coping is necessary for adaptation, and coping styles can play an important role in the course, control, and psychosocial adaptation of the patient. Various studies have shown that coping strategies are associated with control and adherence to treatment and are a strong predictor of adherence to treatment in patients with cancer (23).

This study had several limitations. The study population was limited to patients with breast cancer in Tehran. Therefore, the results should be generalized with caution. Also, the lack of sufficient research in this field, especially in the case of breast cancer in our country, made it difficult to study the variables. Also, the many research variables and their complexity and many questions resulted in fatigue and confusion in answering for some participants. It is suggested that combined research methods be used for data collection using methods such as interviews and observations along with questionnaires. It is suggested that similar research be conducted in other cities so that the results of this study could become comparable. Considering the importance of confirming the efficiency of interventional approaches to develop their application, it is suggested that this research be examined with a different society and also in the form of other research projects. Since psychological factors play a role in breast

cancer, these patients should be evaluated separately by psychiatrists and specialists. Providing psychological services and free counseling are other necessities in promoting the health of people with cancer. Establishing emotion regulation workshops in order to raise self-control levels and desirable tendencies and implementing programs and methods that regulate emotion, cognitive functions, coping styles in patients with breast cancer can also be helpful. Also, efficient methods should be taught to improve coping styles in these patient and methods that damage cognitive functions and adherence to treatment should be avoided.

## Conclusion

Based on the findings of this study, it can be said that modeling treatment adherence based on emotional, cognitive regulation (please check this throughout the article. I think cognitive emotion regulation is correct. If yes please change all) mediated by coping styles in women with breast cancer undergoing chemotherapy was appropriate.

## Authors' Contribution

All authors participated in the study concept and design, acquisition of data, data analysis and critical revision of the manuscript for important intellectual content.

## Conflict of Interests

None.

## Ethical Approval

The present study was approved by the Ethics committee by Hormozgan University of Medical Sciences (No. IR.HUMS.REC.1398.318).

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## References

1. Kuchenbaecker KB, Hopper JL, Barnes DR, Phillips KA, Mooij TM, Roos-Blom MJ, et al. Risks of breast, ovarian, and contralateral breast cancer for BRCA1 and BRCA2 mutation carriers. *JAMA*. 2017;317(23):2402-16. doi: 10.1001/jama.2017.7112.
2. Couch FJ, Shimelis H, Hu C, Hart SN, Polley EC, Na J, et al. Associations between cancer predisposition testing panel genes and breast cancer. *JAMA Oncol*. 2017;3(9):1190-6. doi: 10.1001/jamaoncol.2017.0424.
3. Sparano JA, Gray RJ, Makower DF, Pritchard KI, Albain KS, Hayes DF, et al. Adjuvant chemotherapy guided by a 21-gene expression assay in breast cancer. *N Engl J Med*. 2018;379(2):111-21. doi: 10.1056/NEJMoa1804710.
4. Goetz MP, Toi M, Campone M, Sohn J, Paluch-Shimon S, Huober J, et al. MONARCH 3: abemaciclib as initial therapy for advanced breast cancer. *J Clin Oncol*. 2017;35(32):3638-46. doi: 10.1200/jco.2017.75.6155.
5. Robson M, Im SA, Senkus E, Xu B, Domchek SM, Masuda N, et al. Olaparib for metastatic breast cancer in patients with a germline BRCA mutation. *N Engl J Med*. 2017;377(6):523-33. doi: 10.1056/NEJMoa1706450.
6. O'Byrne ML, Shinohara RT, Grant EK, Kanter JP, Gillespie MJ, Dori Y, et al. Increasing propensity to pursue operative

- closure of atrial septal defects following changes in the instructions for use of the Amplatzer Septal Occluder device: an observational study using data from the Pediatric Health Information Systems database. *Am Heart J*. 2017;192:85-97. doi: [10.1016/j.ahj.2017.07.012](https://doi.org/10.1016/j.ahj.2017.07.012).
7. Xie X, Mulej Bratec S, Schmid G, Meng C, Doll A, Wohlschläger A, et al. How do you make me feel better? Social cognitive emotion regulation and the default mode network. *Neuroimage*. 2016;134:270-80. doi: [10.1016/j.neuroimage.2016.04.015](https://doi.org/10.1016/j.neuroimage.2016.04.015).
  8. Potthoff S, Garnefski N, Miklósi M, Ubbiali A, Domínguez-Sánchez FJ, Martins EC, et al. Cognitive emotion regulation and psychopathology across cultures: a comparison between six European countries. *Pers Individ Dif*. 2016;98:218-24. doi: [10.1016/j.paid.2016.04.022](https://doi.org/10.1016/j.paid.2016.04.022).
  9. Tierney S, Burns J, Kilbey E. Looking behind the mask: social coping strategies of girls on the autistic spectrum. *Res Autism Spectr Disord*. 2016;23:73-83. doi: [10.1016/j.rasd.2015.11.013](https://doi.org/10.1016/j.rasd.2015.11.013).
  10. Fox J, Tang WY. Women's experiences with general and sexual harassment in online video games: rumination, organizational responsiveness, withdrawal, and coping strategies. *New Media Soc*. 2016;19(8):1290-307. doi: [10.1177/1461444816635778](https://doi.org/10.1177/1461444816635778).
  11. Holton MK, Barry AE, Chaney JD. Employee stress management: an examination of adaptive and maladaptive coping strategies on employee health. *Work*. 2015;53(2):299-305. doi: [10.3233/wor-152145](https://doi.org/10.3233/wor-152145).
  12. Nipp RD, El-Jawahri A, Fishbein JN, Eusebio J, Stagl JM, Gallagher ER, et al. The relationship between coping strategies, quality of life, and mood in patients with incurable cancer. *Cancer*. 2016;122(13):2110-6. doi: [10.1002/cncr.30025](https://doi.org/10.1002/cncr.30025).
  13. Fares J, Saadeddin Z, Al Tabosh H, Aridi H, El Mouhayyar C, Koleilat MK, et al. Extracurricular activities associated with stress and burnout in preclinical medical students. *J Epidemiol Glob Health*. 2016;6(3):177-85. doi: [10.1016/j.jegh.2015.10.003](https://doi.org/10.1016/j.jegh.2015.10.003).
  14. Folkman S, Lazarus RS, Gruen RJ, DeLongis A. Appraisal, coping, health status, and psychological symptoms. *J Pers Soc Psychol*. 1986;50(3):571-9. doi: [10.1037//0022-3514.50.3.571](https://doi.org/10.1037//0022-3514.50.3.571).
  15. Najafianzadeh M, Khorsandi M, Mobarak Abadi A. Critical thinking skills and their association with stress coping strategies in the students of Arak University of Medical Sciences Iran. *Stride Dev Med Educ*. 2014;11(3):387-93.
  16. Garnefski N, Kraaij V. The cognitive emotion regulation questionnaire. *Eur J Psychol Assess*. 2007;23(3):141-9. doi: [10.1027/1015-5759.23.3.141](https://doi.org/10.1027/1015-5759.23.3.141).
  17. Besharat MA, Bazzazian S. Psychometri properties of the Cognitive Emotion Regulation Questionnaire in a sample of Iranian population. *Advances in Nursing & Midwifery*. 2014;24(84):61-70. [Persian].
  18. Tan XI, Patel I, Chang J. Review of the four item Morisky Medication Adherence Scale (MMAS-4) and eight item Morisky Medication Adherence Scale (MMAS-8). *INNOVATIONS in pharmacy*. 2014;5(3):5. doi: [10.24926/iip.v5i3.347](https://doi.org/10.24926/iip.v5i3.347).
  19. Moharamzad Y, Saadat H, Nakhjavan Shahraki B, Rai A, Saadat Z, Aerab-Sheibani H, et al. Validation of the Persian version of the 8-item Morisky Medication Adherence Scale (MMAS-8) in Iranian hypertensive patients. *Glob J Health Sci*. 2015;7(4):173-83. doi: [10.5539/gjhs.v7n4p173](https://doi.org/10.5539/gjhs.v7n4p173).
  20. Palmer CA, Alfano CA. Sleep and emotion regulation: An organizing, integrative review. *Sleep Med Rev*. 2017;31:6-16. doi: [10.1016/j.smrv.2015.12.006](https://doi.org/10.1016/j.smrv.2015.12.006).
  21. Brockman R, Ciarrochi J, Parker P, Kashdan T. Emotion regulation strategies in daily life: mindfulness, cognitive reappraisal and emotion suppression. *Cogn Behav Ther*. 2017;46(2):91-113. doi: [10.1080/16506073.2016.1218926](https://doi.org/10.1080/16506073.2016.1218926).
  22. Naragon-Gainey K, McMahon TP, Chacko TP. The structure of common emotion regulation strategies: a meta-analytic examination. *Psychol Bull*. 2017;143(4):384-427. doi: [10.1037/bul0000093](https://doi.org/10.1037/bul0000093).