

Original Paper

Investigation of Structural Relationships of Factors Affecting Posttraumatic Growth in Women With Breast Cancer



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ABSTRACT

Introduction: It is necessary to identify the factors affecting the posttraumatic growth of cancer patients to minimize the consequences of its psychological trauma.

Objective: This study aimed to determine the structural relationships of coping styles, the collapse of core beliefs, social support, spirituality/religious coping with posttraumatic growth variables, and the mediating role of positive reassessment and deliberate mental rumination within a causal pattern.

Materials and Methods: This cross-sectional study was performed using path analysis and structural equation modeling (SEM) by convenience sampling method on 213 patients with breast cancer in Mashhad, Iran, in 2019. The pattern of variables relationships was tested in a conceptual model by SEM and used the partial least squares regression method to test the measurement pattern and research hypotheses. In the measurement model section, three convergent validity indices, i.e., Average Variance Extracted (AVE), Composite Reliability (CR), and the Cronbach α , and in the structural model section, two indicators of coefficient of determination (R^2) and Stone-Geisser coefficient (Q^2).

Results: The Mean \pm SD age of the patients was 52 \pm 16 years. The standardized coefficients of the overall effect of core beliefs pathways, positive religious coping, search for meaning, presence of meaning, deliberate rumination over positive re-evaluation were 0.953, 0.386, -0.250, 0.248, and 0.238, respectively ($P=0.001$). The direct coefficient of the positive reassessment path to posttraumatic growth was 0.085 ($P=0.01$). Also, the coefficient of collapse path of core beliefs to intrusive rumination was 0.687, which was significant at the level of $P=0.0001$. Finally, the standardized coefficients of the overall effect of all paths for negative religious coping, the collapse of core beliefs, presence of meaning, problem-based coping style, search for meaning, deliberate rumination, social support, positive religious coping, emotion-based coping, intrusive rumination over posttraumatic growth were -0.481, 0.227, 0.182, 0.146, -0.136, 0.066, 0.060, 0.059, 0.056, and -0.043, respectively ($P=0.0001$).

Conclusion: The results of the present study showed that in addition to confirming the direct paths of independent variables to the posttraumatic growth, positive reassessment had a mediating role between pathways of the presence and search of meaning, conscious rumination, religious coping, and the collapse of core beliefs in posttraumatic growth.

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Highlights

- It seems necessary to study the factors affecting the posttraumatic growth of patients with cancer to minimize the consequences of its psychological trauma.
- The most positive and direct effects on posttraumatic growth belonged to disturbances in core beliefs, presence of meaning, problem-based coping, positive reassessment, and deliberate rumination.
- The present study results can help design psychotherapy-based protocols to promote posttraumatic growth in patients with breast cancer.

Plain Language Summary

High levels of Posttraumatic Growth (PTG) are associated with low levels of depression, anxiety, and high levels of quality of life. The positive cognitive reassessment of the trauma may support positive consequences after it by reinforcing posttraumatic growth. The positive reassessment relationship as a coping method of cognitive emotion regulation, on the one hand, is linked to deliberate mental rumination, disturbances of core beliefs, social support, spirituality, and religion, and on the other hand, to more extensive posttraumatic growth. This study examined the relationship between these structures in a sample of 213 women with breast cancer in two hospitals in Mashhad City, Iran, and finally determined the relationship between the structures. Investigating the mediating relationships of positive reassessment between spirituality, religious coping, and on the other hand, mental rumination and core beliefs with posttraumatic growth increased the explanatory power of the posttraumatic growth model and introduced new paths to the existing paths around the basic model of the posttraumatic growth.

Introduction

Recently, the positive growth associated with cancer injury has been considered in the research literature of trauma [1, 2]. High levels of Posttraumatic Growth (PTG) may be associated with low levels of depression, anxiety, and high quality of life [3, 4].

PTG is based on cognitive processes, so it is necessary to address the factors affecting PTG cognitive processes [5, 6]. The two main cognitive elements that directly affect PTG are how a trauma (cancer in the present study) challenges a person's fundamental beliefs. The second element is how much this challenge leads to the initiation of cognitive processes that focus on the consequences of trauma [6, 7]. Radical revision in core beliefs and intrusive and deliberate posttraumatic rumination often has an essential role in extracting meaning and concepts from trauma [6-8]. The triple model is one of the best models explaining the relationship between posttraumatic rumination and PTG [9]. In this model, the relationship between intrusive ruminations, deliberate ruminations, and core beliefs disruptions were examined experimentally for the first time based on the Calhoun and Tedeschi theoretical model [9]. Then the Positive Re-evaluation (PR) variable was added to

this network. It is not only directly related to PTG but also is a mediator between deliberate rumination and PTG [10]. The meta-analysis studies in cancer patients showed that PR along with religious coping had the greatest effect on PTG. Also, the emotional regulation styles such as PR, acceptance, repression, spirituality, and religious orientation also affect PTG. Besides, PR and acceptance are associated with the highest levels of coping with cancer [4, 11, 12]. Factors such as religious coping and spirituality, meaning-based tasks, and social support have also had a positive and direct effect on PR [13-16]. Challenging core beliefs, social support, and active coping styles also directly affect PTG, and behavioral disengagement, denial, and self-blame have been directly and negatively associated with PTG [4, 11, 17].

Simultaneous examination of the relationships between effective independent variables and cognitive variables mediating the PTG core helps to improve policies in designing the most effective clinical interventions in cancer patients. Therefore, the purpose of this study was to determine the direct and indirect role of various coping styles, the collapse of core beliefs, social support, spirituality, religious coping (as independent variables) with posttraumatic growth variable (as dependent variable). Also, we intended to determine the mediating role of intrusive and deliberate rumination and positive

re-evaluation (as mediating variables) in a causal pattern in women with breast cancer.

Materials and Methods

This cross-sectional study was performed using path analysis and Structural Equation Modeling (SEM) methods. The relationship model of PTG, PR, mental rumination, social support, coping skills, spirituality, and religious coping were investigated in a conceptual model through SEM.

The statistical population consisted of women with cancer referred to cancer diagnosis and treatment centers in Mashhad City, Iran. In structural equation studies with the Partial Least Squares (PLS) method, the sample size is 10 times the number of links forming the structure with the highest number of pointers [18]. The highest number of pointers was in the posttraumatic growth structure (21 pointers), which was included in the present study tool. Therefore, we needed at least 210 samples that, because of the possibility of sample loss, 220 patients were selected by available sampling method from two oncology wards of two hospitals in Mashhad. The study was conducted over 6 months in 2019. The inclusion criteria included at least six months and at most four years passed from the diagnosis, full knowledge of the existence and severity of the disease and its treatment with complications and consequences, the experience of chemotherapy, surgery, and radiotherapy, and no history of mental disorders and severe emotional problems based on the contents of the medical record and the patient's statements.

The research tools included the following:

Clinical information including the patient's age, type of treatment, level of education, marriage, and occupation.

The Iranian version of the PTG inventory [19] included 21 items from the PTG scale and was first presented by Tedeschi and Calhoun [20]. In this study, the Cronbach α coefficient for this scale was found 0.91.

The Iranian version of the positive reappraisal subscale of the cognitive emotion regulation questionnaire [21] included 4 of the 36 items on this scale and was first presented by Garnefski [22]. Responses are scored on a 5-point Likert scale from 1= never to 5= always. In this study, the total Cronbach α coefficient for this subscale was found 0.76.

We also used the short form of the Iranian version of the cope operations preference enquiry [23], which consisted of 28 items and was first presented by Carver [24]. The Iranian version had 6 subscales, of which 5 subscales were used in this study. Also, two questions of the religion inclination subscale were omitted due to their overlap with the Pargament religious coping scale used in the present study.

The 5-question subscale of problem-based coping that measures planning, active coping, and acceptance. The 4-question subscale of coping based on social support, denial subscale, self-distraction subscale, and 4-question subscale of emotion-based coping. The answers are scored on a 4-point scale from 4= "I have used this method a lot" to 1= "I have not used this method at all". In this study, the Cronbach α coefficients for factors 1 to 5 were 0.91, 0.84, 0.79, 0.74 and 0.73, respectively.

The 9-item core beliefs inventory questionnaire was designed by Cann et al. [6]. Responses were scored on a 6-point scale from 0= "not at all" to 5= "very high". In this study, the Cronbach α coefficient of this tool was found 0.73.

The 20-question event-related rumination inventory questionnaire, designed by Cann et al., consists of two 10-question subscales of deliberate rumination and intrusive rumination. Responses are scored on a 4-point scale from 0= "not at all" to 3= "often". Researchers translated the original version, and its face validity was confirmed. Then 25 patients with cancer responded to both versions simultaneously, and its correlation (r) with the Persian version of the mental rumination questionnaire [25] was 0.87. In this study, the Cronbach α values were found 0.73 for deliberate rumination and 0.84 for intrusive rumination.

The Iranian version of the Pargament religious coping scale [26], which was first presented by Pargament [27], consists of two subscales of negative religious coping (7 questions) and positive religious coping scale (7 questions). Responses are scored on a 4-point scale from 0= "not at all" to 3= "very high". In this study, the Cronbach α coefficients were found 0.74 for positive religious coping and 0.71 for negative religious coping.

The Iranian version of the 10-question meaning in life questionnaire [28], first presented by Steger [29], consists of two subscales of the presence of meaning (5 questions) and search for meaning (5 questions). Answers are scored on a 7-point Likert scale from 1= "completely wrong" to 7= "completely right". In this study,

the Cronbach α coefficients were 0.72 for the presence of meaning and 0.74 for the search of meaning. For all instruments, the mean and standard deviation were calculated, and a higher score indicates an increase in the variable.

The participants entered the study after informing about the study objectives and confidentiality of their information and signing a written consent. Any questions or ambiguities were explained, and for some patients, because of their difficult physical conditions and the side effects of chemotherapy, the questions were read by the researcher. In this study, the information of 7 questionnaires was not analyzed due to incompleteness by participants.

In this research, the PLS method was used to test the measurement pattern and research hypotheses. SPSS software (version 16) and Smart-PLS (version 2) were used to analyze the data.

In the measurement model test, we evaluated the validity by the convergent validity and the Average Variance Extracted (AVE). Values of 0.4 or more for the AVE index indicate that the structure explains about 40% or more of the variance of its pointers. To evaluate the reliability, we used the composite reliability, and the Cronbach was used, which alpha values greater than 0.7 indicate acceptable reliability. Besides the Cronbach α , the composite reliability was measured using the PLS method; values above 0.7 indicate good internal reliability for the measurement models. In the structural model section, two indices of R^2 (0.19 weak; 0.33 average; 0.67 strong) and Q^2 (0.02 weak; 0.15 average; 0.35 strong), the Goodness of Fit (GOF) (0.01 weak; 0.25 average; 0.36 strong) test, Standardized Root Mean Square Residual (SRMR) (<0.05), and Normed Fit Index (NFI) (>0.9), were used to evaluate the good fit of the overall structure of the model. R^2 or determination of coefficient for dependent variables, indicates the degree of explanation of the variable by the model. The Q^2 index or Aston-Geisler coefficient 1- (sse/sso), which is the predictive relationship or quality index of the structural model, examines the ability of the structural model to predict.

Results

The results showed that the Mean \pm SD age of the patients was 52 \pm 16 years. About 57.9% had received all three treatments of surgical therapy, radiotherapy, and chemotherapy. Also, 27.4% had a university education, 69.6% were married, and 31.3% were employed.

The mean and correlation coefficients of the study variables are presented in Table 1. In this study, in the test section of the measurement model, to evaluate the validity, we used the convergent and AVE, the values of which are reported in Table 2. Based on the results of this Table, it can be said that the proposed model could explain 90% of the PTG variance, 90% of the cognitive PR variance, 72% of the deliberate rumination variance, and 47% of the intrusive rumination variance. According to the values obtained, the fit of the structural model was strongly confirmed. Also, the Q^2 index was 0.45 for the PTG variable, 0.41 for PR, and 0.40 for deliberate rumination, which indicates the appropriate prediction capability of the structural model. The GOF or overall goodness index in this study was 0.63; also, the values of NFI and SRMR indices were 0.91 and 0.045, respectively. Table 3 presents the direct effect, which is the direct coefficient of the path of each variable over the dependent variables, as well as the indirect effect obtained from the sum of the product of the indirect paths and the coefficients of the direct paths, and finally the total effect obtained from the sum of direct and indirect effects.

Also, the structural model of the research has been reported in two ways: in the case of standard coefficients (PLS algorithm) and significant coefficients (bootstrapping). Path coefficients (Beta) were used to determine the contribution of each predictor variable in explaining the variance of the criterion variable, and t statistic values were calculated to evaluate the significance of path coefficients (Figure 1).

Accordingly, the values of t statistic for the paths of core beliefs, positive religious coping, presence of meaning, deliberate rumination, and negative religious coping to PR, showed that these variables have a positive and significant effect ($P=0.001$) and search for meaning has a significant, direct, and negative effect on cognitive PR. On the other hand, PR had a significant effect on PTG. After removing PR and re-implementing the model, all these variables significantly affected PTG ($P=0.001$). Therefore, the PR variable was a mediator between PTG and core beliefs, positive and negative religious coping, presence and search for meaning, and deliberate rumination. The t statistic values were significant ($P=0.001$) for the intrusive ruminations to the deliberate ruminant path, the deliberate ruminations to PR, and the deliberate ruminations to PTG. Since the direct correlation of this variable was also significant with the removal of mediators, both the deliberate rumination variable and PR mediated the relationship between intrusive rumination and PTG. The values of t were significant ($P=0.001$) for the path of core beliefs with intrusive rumination,

Table 1. Mean, standard deviation, and correlation coefficients of the main research variables

Numbers	1	2	3	4	5	6	7
1	1						
2	0.499**	1					
3	0.126**	0.250**	1				
4	-0.134**	-0.110*	0.532**	1			
5	0.162**	0.650**	0.596**	0.68**	1		
6	0.225**	0.126	0.138*	0.029	0.058	1	
7	0.040	0.209**	0.142*	0.051	0.012	0.21**	1
8	-0.255**	-0.252**	-0.23*	0.30**	0.30**	-0.19**	-0.25**
9	-0.176**	0.365**	-0.13*	0.28**	-0.10	0.11	-0.17**
10	0.454**	0.536**	0.111	-0.31**	-0.16**	0.12*	0.28**
11	0.386**	0.426**	0.112	0.08	0.039	0.45**	0.35**
12	0.045	-0.007	0.28**	0.32**	0.25**	0.146*	0.066
13	-0.135**	0.159*	-0.001	0.019	0.062	0.23**	0.21**
14	0.007	-0.238**	0.035	0.10	0.18**	-0.001	-0.059
Mean±SD	84.36±18.86	14.13±3.93	32.65±8.49	33.74±10.08	30.58±9.95	10.95±2.80	24.34±3.40

Numbers	8	9	10	11	12	13	14
1							
2							
3							
4							
5							
6							
7							
8	1						
9	0.12*	1					
10	-0.48**	0.38**	1				
11	-0.31**	0.07	-0.371**	1			
12	0.38**	0.06	-0.18**	0.25**	1		
13	-0.19**	0.17**	-0.21**	0.39**	0.15*	1	
14	0.34**	-0.021	-0.25**	-0.07	0.32**	0.07	1
Mean±SD	10.82±3.95	25.2±6.57	26.85±6.16	17.86±3.54	6.89±2.10	5.05±1.65	3.94±1.75

1. Posttraumatic growth; 2. Cognitive reassessment; 3. Deliberate rumination; 4. Intrusive rumination; 5. Disruption of core beliefs; 6. Social support; 7. Positive religious coping; 8. Negative religious coping; 9. Search for meaning; 10. Presence of meaning; 11. Problem-solving coping; 12. Emotion-based coping; 13. Self-distraction; 14. Denial.

Mean: Mean; SD: Standard Deviation.

*P<0.05; **P=0.01; ***P=0.001 (the Pearson correlation test).

Pearson product-moment (r) correlation coefficient test was used.

Table 2. Research model indicators and their acceptable values

Research Model Indices	AVE	CR	Cronbach α	R ²	Q ²	GOF	NFI	SRMR
PTG	0.53	0.95	0.94	0.90	0.47		0.91	0.045
Positive re-evaluation	0.50	0.84	0.77	0.90	0.43			
Deliberate mental rumination	0.51	0.82	0.80	0.72	0.41			
Intrusive mental rumination	0.50	0.83	0.82	0.47	0.34			
Core beliefs	0.51	0.81	0.74					
Social support	0.61	0.89	0.86					
Positive religious coping	0.59	0.82	0.72			0.63		
Negative religious coping	0.52	0.79	0.73					
Search for meaning	0.58	0.81	0.74					
Presence of meaning	0.54	0.80	0.73					
Problem-based coping	0.58	0.89	0.81					
Emotion-based coping	0.48	0.82	0.74					
Self-distraction	0.47	0.80	0.70					
Denial	0.57	0.84	0.72					

AVE: Average Variance Extracted; CR: Composite Reliability; GOF: The Goodness of Fit; PTG: Posttraumatic Growth; NFI: Normed Fit Index; SRMR: Standard Root Mean Square Residual.

deliberate rumination, and PR. Also, after eliminating these three mediators, the relationship between core beliefs disruptions and PTG was significant ($P=0.01$), so all three mediated the role of core beliefs with PTG. Considering the t values and path coefficients, the variables of problem-based coping, emotion-based coping, core beliefs, social support, presence of meaning, and deliberate rumination had a positive and significant effect on PTG. Also, the intrusive rumination, negative religious coping, and meaning search had a negative and significant effect on PTG. Finally, denial and self-distraction had no significant effect on PTG.

Discussion

This study aimed to determine integratively the direct and indirect role of various coping styles, the collapse of core beliefs, social support, spirituality, religious coping with PTG in women with breast cancer, considering the mediating role of cognitive reassessment and rumination.

Surprisingly, the results of this study showed that the collapse of core beliefs, besides its most significant positive effect on PTG, had the greatest positive and direct impact on PR. Therefore, based on this finding, a severe

challenge and disruption in core beliefs, after facing injury will eventually lead to a more positive re-evaluation of cancer. In positive evaluation style theory, the positive flexibility evaluation after trauma is done in three ways: habitual positive evaluation style, positive reappraisal in the face of moderate adversity, which does not require much cognitive effort and is often unconscious; and interference inhibition, which is specific to PR, and is performed in the face of high-intensity stressors and requires the inhibition of rival negative evaluations [30]. Cognitive emotion regulation theory [31, 32] also states that unlike the previous two styles, which occur mainly in subcortical and subconscious neural circuits, this PR style is consciously managed in the prefrontal cortex. It coincides with the inhibition of negative evaluations where reassessments that are less negative or completely positive ultimately and collaboratively lead to a positive cognitive reassessment of the event [30-32].

The results of this study showed that intrusive and often negative ruminations that are evoked immediately after encountering trauma (cancer) strongly, positively, and directly evoke deliberate mental rumination in connection with trauma (cancer). This finding is consistent with the results of some studies [5-7]. On the other

Table 3. Estimation of direct effect, indirect effect, and total effect coefficients

	Variables	Indirect Effect	Direct Impact	Total Effect
	Cognitive reassessment		0.085**	0.085**
	Deliberate mental rumination	0.02*	0.046***	0.066***
	Intrusive mental rumination	0.004	-0.047***	-0.043***
	The collapse of core beliefs	0.08**	0.147***	0.227***
	Social support	0.004	0.056***	0.06***
	Positive religious coping	0.032*	0.027	0.059*
On post traumatic growth	Negative religious coping	0.009	-0.49***	-0.481***
	Search for meaning	-0.021*	-0.115***	-0.136***
	Presence of meaning	0.021*	0.161***	0.182**
	Problem-based coping		0.146***	0.146***
	Emotion-based coping		0.056***	0.056***
	Self-distraction		-0.01	-0.01
	Denial		0.009	0.009
	Deliberate mental rumination		0.238***	0.238***
	Intrusive rumination	0.055*		0.055*
	The collapse of core beliefs	0.159**	0.794***	0.953***
	Social support		0.051	0.051
On positive cognitive reassessment	Positive religious coping		0.386***	0.386***
	Negative religious coping		0.116*	0.116*
	Search for meaning		-0.25***	-0.25***
	Presence of meaning		0.248***	0.248***
	Intrusive rumination		0.235***	0.235***
On deliberate rumination	The collapse of core beliefs	0.161**	0.672***	0.833***
On Intrusive rumination	The collapse of core beliefs		0.687***	0.687***

***P=0.0001; **P=0.001; *P<0.05.

the most associated variable with PTG was considered the most critical variable (e.g. social support and problem-based coping methods). In contrast, the present research studied all the variables affecting PTG in one structure. Second, because cancer fundamentally challenges all patient's assumptions about concepts such as controllability, justice, the extent and capacity of coping, the capacity of others to support and help, religious beliefs, and the concept of spirituality, it is possible to prepare the patient's growth by creating more profound concepts and expanding the patient's cognitive framework and the hypothetical world. So, according to the result obtained, it is suggested that challenging the core beliefs and imaginary world of the patient be included in the psychotherapy protocols of cancer patients to achieve the patient's growth as much as possible.

Also, the results of this study showed that social support had no significant effect on PR; this finding is not in line with the results of some studies [4, 11, 33]. In Iranian culture and the population of women with cancer, social support only provides a basis for emotional outpouring after suffering a trauma such as cancer.

The results also showed that problem-based and emotion-based coping positively affected PTG. Also, negative religious coping, search for meaning, and intrusive rumination had the most substantial negative, direct, and significant effects on PTG, respectively. This finding is consistent with the results of other similar studies [1, 4, 11, 12]. It can be said that those coping styles that focus on problem solving through cognitive processes, information gathering, and planning, or that lead to a cognitive readjustment of negative emotions caused by injury through cognition and expression of emotions will result in PTG. It is noteworthy that that religious coping had the most significant overall negative effect, which, of course, was in line with the results of previous research [4, 11, 12, 33] and shows that in the religious context of Iranian culture, lack of clear meaning and purpose, avoidance and non-acceptance coping styles not only will not help the PTG but will also deprive the individual of the opportunity to face, challenge, and evaluate the injury effectively.

Regarding the cross-sectional nature of the study design, causal inference between the studied variables cannot be made. To clarify the differences in the posttraumatic growth model in patients with breast cancer, we suggest that this model be compared with patients who have been exposed to different types of cancer or trauma.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the ethics committee of the Ferdowsi University and Medical Sciences (Code: IR.MUMS.REC.2019.101). To comply with ethical principles, we stated the general purpose of the research, took the participants' consent and assured them of the information confidentiality. All participants read and signed the informed consent form before starting the study.

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Author's contributions

Conceptualization: Hamidreza Aghamohammadian and Azam Hashemian Moghaddam; Research and sampling method: Azam Hashemian Moghaddam; Data analysis: Hossein Kareshki and Azam Hashemian Moghaddam; Drafting: Azam Hashemian Moghaddam; Editing and finalizing: Hamid Reza Aghamohammadian Sharbaf, Mohammad Saeid AbdeKhodaei, Hossein Kareshki and Azam Hashemian Moghadam.

Conflict of interest

The authors declared no conflict of interest.

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