

# Psychometric Properties of the Farsi Version of Posttraumatic Growth Inventory for Children-Revised in Iranian Children with Cancer

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## ABSTRACT

**Objective:** Coping with childhood cancer, as a stressful incident, can lead to a growth in various aspects of the child's life. Therefore, this study aims to validate Posttraumatic Growth Inventory for Children-Revised (PTGI-C-R) in children with cancer. **Methods:** This methodological research was carried out in referral children hospitals in Tehran. PTGI-C-R was translated and back-translated. Content and face validity were assessed. Confirmatory factor analysis (CFA) was performed on 200 children with inclusion criteria, using LISREL V8.5. Due to the rejection of the model, an exploratory factor analysis (EFA) was done, using SPSS V21. The correlation of posttraumatic growth (PTG) with the variables, i.e., age and gender, was investigated. **Results:** Some writing changes were made in phrases in the sections concerning face and content validity. CFA rejected the five-factor model due to the undesirable fit indices.

Therefore, an EFA was used and the three-factor model was not approved, either despite the statistical appropriateness or due to the lack of similarity between the items loaded on factors. The results also indicated a significant relationship between PTG and age ( $r = 0.13, P = 0.05$ ). There is no significant relationship between PTG and gender ( $z = -1.35, P = 0.83$ ). **Conclusions:** PTGI-C-R does not have desirable psychometric properties in Iranian children with cancer and may not be able to reflect all the aspects of PTG experienced by them. Therefore, it cannot be used as an appropriate scale, and it is necessary to develop and validate a specific tool through a qualitative study.

**Key words:** Children with cancer, Iran, Posttraumatic Growth Inventory, psychometric properties

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## Introduction

As one of the most common childhood chronic diseases, cancer is slowly increasing and is the third leading cause of death in Iranian children between 1 and 14 years of age.<sup>[1]</sup>

Cancer is a chronic physical–psychological condition that can make the child and the family face challenges in their lives, leading to various psychological distresses in them.<sup>[2,3]</sup> At the time of diagnosis and during the course of the disease, children with cancer face contradictions in regard with the philosophy of the disease, as well as challenges concerning the hope for the future and their relationship with God or a superior being, and experience fear, anxiety, and aggression.<sup>[4]</sup> Therefore, their psychological resources change positively or negatively under the influence of psychological distresses caused by cancer, which can result in redefining the events.<sup>[5]</sup>

Facing stressful situations can lead to emotional issues such as posttraumatic stress disorder, anxiety, depression, and somatization; however, due to the increased psychological capacity of the child as a result of experiencing difficult challenges in life, he/she may also experience positive experiences such as resiliency and posttraumatic growth (PTG).<sup>[6,7]</sup> PTG is a positive result of psychological changes caused by difficult living conditions.<sup>[8]</sup> Studies show that in 60%–95% of children who survive cancer, perceived growth is observed following cancer diagnosis and its treatment.<sup>[9]</sup> In children with cancer, PTG also has a direct relationship with coping. Studies show that children with a higher level of PTG also have better coping abilities. On the other hand, PTG has a negative correlation with burden, and it also seems to have a relationship with the survival rate. In other words, children with cancer who had a higher level of PTG experienced a lower burden and had higher survival rates.<sup>[10–13]</sup> Moreover, a higher level of PTG is associated with a higher quality of life in<sup>[14]</sup> children with cancer and their families. In this regard, measuring PTG enables researchers to evaluate the outcomes of their actions and interventions to achieve a better management of the challenges caused by the disease, a better coping with the situation, and a higher quality of life in children and their families.<sup>[8]</sup>

So far, several tools have been presented for measuring PTG.<sup>[15–17]</sup> In 1996, Tedeschi and Calhoun developed a questionnaire titled Posttraumatic Growth Inventory (PTGI) with 21 items, to measure PTG in adults,<sup>[15]</sup> which has been translated and validated in different languages and for various cultures.<sup>[18–21]</sup> The Farsi version was also validated in 2018 by Heidarzadeh *et al.* in adult patients with cancer.<sup>[22]</sup>

To measure PTG in children, Park and Peterson developed a questionnaire that investigates parents' views regarding this concept.<sup>[23]</sup> By using the data collected from

semi-structured interviews, Kazak *et al.* presented the Impact of Traumatic Stressors Interview Schedule (ITSIS), which was designed for adults, in the form of Perceptions of Changes in Self Scale, with the aim of measuring PTG in children.<sup>[24,25]</sup>

After the available tools, developed for the assessment of PTG, were examined using the COSMIN checklist,<sup>[26]</sup> the tool developed by Kilmer *et al.*<sup>[27]</sup> was selected for translation and psychometric evaluation in Iranian children with cancer. In 2009, Kilmer *et al.* proposed the Posttraumatic Growth Inventory for Children-Revised Questionnaire (PTGI-C-R), by revising PTGI-C and selecting the items focusing on the concept of growth.<sup>[27]</sup> Compared to other available tools, this scale has advantages such as the ease of use, having a short answering time, and being specific and sensitive to the desired situation and has also been translated and validated in other cultures and countries such as China,<sup>[28]</sup> Spain,<sup>[29]</sup> and Chile.<sup>[30]</sup>

The concept PTG depends on the social and cultural context of the research population,<sup>[31]</sup> and one's perception of events and his/her definition of stress and life challenges greatly influence his/her beliefs and capacity in different cultures. Therefore, this capacity can be utilized to fight the disease and increase individuals' hope and improve their quality of life. Thus, it is important to assess the post cancer growth in Iranian children. Therefore, the present study was conducted to evaluate the psychometric properties of the Farsi version of PTGI-C-R in Iranian children with cancer. Therefore, the current study is conducted to determine whether the factorial structure of the instrument fits the data collected from the Iranian children with cancer.

## Methods

### Research design

The present study is a methodological research in which the translation and validation of the Farsi version of PTGI-C-R was performed in children with cancer from June to September 2019.

This research is designed based on the classic theory test (CTT). CTT is a branch of psychometrics predicting the results of tests. The basis of this theory is the fact that a score obtained by an individual consists of a set of actual responses and psychometric errors. The factor structure and internal consistency of items are important in his/her approach, and since the focus is on the total score of the instrument, data such as the difficulty and discriminant validity are practically not calculated for each item.<sup>[32,33]</sup>

### Participants and setting

The research population consisted of children with cancer being hospitalized or visiting the referral centers

across Iran, including the Oncology Clinic of Mofid Hospital affiliated with Shahid Beheshti University of Medical Sciences, Mahak Hospital affiliated with the Charitable Society to Support the Children with Cancer, Children's Medical Center affiliated with Tehran University of Medical Sciences, and Ali Asghar Children's Hospital affiliated with Iran University of Medical Sciences.

### Study instruments

In the current study, the research tools consisted of two questionnaires. The clinical and demographic characteristic questionnaire included age, gender, the number of siblings, birth order, the level of education, the type of the disease and the age of onset, family type, family's economic status, parents' level of education, and occupation. This questionnaire was developed and used after being approved by the research team based on reviewing the literature and similar studies.

The other tool was Posttraumatic Growth Inventory for Children (PTGI-C-R) with 10 items and five subscales, including new possibilities, relating to others, personal strength, appreciation of life, and spiritual change, which was developed in 2009 by Kilmer *et al.* It evaluates the concept of PTG specifically in schoolchildren and is scored based on a 4-point Likert scale ranging from "no change" to "a very great degree of change." The internal consistency of the instrument was calculated, with a Cronbach's alpha of  $\alpha = 0.77$ .<sup>[27]</sup>

Flowchart of translation and validation process of PTG-C-R in children with cancer is shown in Figure 1.

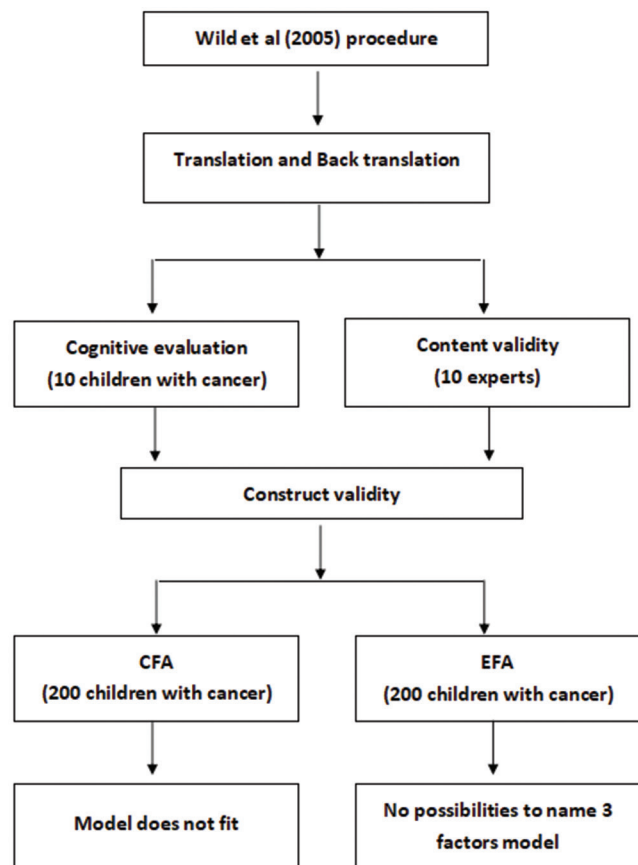
### Translation of PTG-C-R: Farsi Translation

The translation and validation of PTGI-C-R were done based on the method proposed by Wild *et al.*<sup>[34]</sup> The scale was first separately translated into Farsi by the researchers as well as a third person fluent in English. Then, the three translated versions were reviewed by other experienced translators who had no part in the first translation. After comparing the translated versions with each other and making minor changes, the final version was prepared. The final version of the scale was back-translated from Farsi into English by two people, one of whom was a native English speaker. The two versions translated from the target language into the original one were reviewed by two expert English-Farsi translators.

### Testing psychometric properties of the PTG-C-R: Farsi translation

#### Content validity and cognitive evaluation

To measure the content validity, the translated scale was provided to ten experts in the fields of clinical psychology, medical care, and nursing in pediatric



**Figure 1:** Flowchart of translation and validation process of PTG-C-R in children with cancer

oncology, as well as scale development professionals to comment on the content of the scale. To assess formal validity and cognitive evaluation, the scale was also given to ten children with cancer meeting the inclusion criteria to express their views on the ease of use and the understandability of phrases and items or any possible ambiguity in the meaning of words.

#### Construct validity

Convenience sampling method was used in this study. The inclusion criteria included the age of 6–12, 6 months having passed from the diagnosis, not being at the end-of-life stages, being aware of the disease, the ability to understand and speak Farsi, and the lack of other chronic diseases.

To perform a more accurate analysis of CFA, at least 200 samples are required. With this number of samples, a power of 0.80 for the close test using the root mean square error of approximation for a model with a degree of freedom of 100 in structural equation modeling is achievable. Therefore, 209 samples were selected for the current research. None of the children with cancer participating in the research whose parents have signed the informed consent form withdrew from the study.

### Confirmatory factor analysis

CFA was performed using LISREL V8.5, to examine the construct validity as well as the model fit. CFA is a technique used to determine the goodness-of-fit between a hypothetical model and the data obtained from research samples.<sup>[35]</sup> The maximum likelihood algorithm was used to evaluate the fit of the model. There are several fit indices for deciding whether the model is appropriate or not, and it is best to use several different indicators.<sup>[36,37]</sup>

### Exploratory factor analysis

Exploratory factor analysis (EFA) can be used to achieve the appropriate model if, after performing CFA, no fitness is observed between various developed models and the data.

EFA examines the internal consistency of a large number of variables and finally categorizes and explains them as a few general factors. Therefore, the purpose of performing EFA is to obtain dimensions that are latent in a wide range of variables but are not easily visible.<sup>[35]</sup> In this study, due to the model's not being fit, the EFA was performed using IBM SPSS statistic for Windows, Version 22.0. Armonak, NY: IBM Crop Data Analysis software (IBM).

EFA was performed to determine the number of factors. To this end, a factor loading above 0.4 was set for keeping the items. Then, the obtained factor structure was examined through Velicer's minimum average partial (MAP) test combined with the parallel analysis to approve the number of factors obtained in the PTGI.

To identify factors, the eigenvalues were calculated and the scree plot was used. In addition, orthogonal rotation was applied and the varimax approach was used, in which maximum variance between the factors is produced.

### Data collection

To collect data, after selecting the samples and explaining the research objectives and methods to them, informed consent was obtained from their parents. The questionnaires were handed out by the researcher after being completed by the subjects. To maintain the children's peace, the questionnaires were collected from the hospitalized children within 24 h, and from those visiting the outpatient clinics of the mentioned medical centers, at the time of admission. Regarding younger children, the items of the questionnaires were read to them by the researcher and their responses were marked. The time of completion ranged from 5 to 15 min.

### Ethical approval

This research is based on the proposal approved by the Committee for Ethics in Biomedical Research of Shahid Beheshti University of Medical Sciences (Approval No. IR.SBMU.PHARMACY.REC.1398.048). In this study, to address ethical considerations and protect the rights of

participants, the research is conducted based on the codes of ethics. After obtaining the necessary permits from Shahid Beheshti University of Medical Sciences and the selected hospitals, as well as introducing researchers and stating the objectives of the study and research methods, written informed consent was obtained from the parents of research subjects, to collect data. They were also informed of data confidentiality and the right of withdrawal at any stage of the research.

## Results

A total of 209 questionnaires were collected, nine of which were excluded due to not having answered most of the questions. The mean age of the patients in this study was  $11.45 \pm 2.21$  years. Other demographic and clinical characteristics of research subjects are presented in Table 1.

The findings of various stages of validation are orderly presented below.

### Content validity and cognitive evaluation

Expert opinions in the fields of clinical psychology, medical care, and nursing in pediatric oncology and scale development were used to assess qualitative content validity. Based on this survey, the word "as compared to before" was added to the phrases to make the items clearer (except for the items 1 and 10).

Besides, in item 7, "I have a chance to do things I couldn't," the word chance is deleted and the phrase is replaced by "now I know that I can do things I couldn't do before."

**Table 1: The clinical and demographic characteristics of participants**

Demographic profile	Frequency (%)
Duration of illness (year)	
1-3	6 (3.0)
4-6	15 (7.5)
7-9	92 (46.0)
10-12	87 (43.5)
Gender	
Female	102 (51.0)
Male	98 (49.0)
Education level	
Illiterate	80 (40.0)
The first elementary course	88 (44.0)
The second elementary course	32 (16.0)
Type of cancer	
Leukemia	97 (48.5)
Glioma	19 (9.5)
Neuroblastoma	15 (7.5)
Lymphoma	31 (15.5)
Osteosarcoma	8 (4.0)
Nephroblastoma	2 (1.0)
Rhabdomyosarcoma	8 (4.0)
Others	20 (10.0)



After applying expert opinions, the children were also given the opportunity to express their views on PTG-C-R. To this end, the items were read to them one by one, and since they understood the meaning of each item, no change was made.

**Construct validity**

**Confirmatory factor analysis**

CFA was performed to determine whether or not the items of PTGI-C-R are the indicators of PTG in Iranian children with cancer and whether the tool is approved for implementation in Iranian society.

To measure the discriminant validity in the five-factor model, the average variance extracted (AVE) was compared with the square of the correlation between the dimensions. According to the results, for most factors, AVE (0.07–0.56) was lower than the square of correlation with other dimensions (0.29–0.74), indicating that the square of the correlation between the factors is higher than AVE of the dimensions and there is an overlap between the dimensions [Table 2]. As a result, there is no discrimination between some dimensions, and therefore, the discriminant validity of the instrument is rejected. Moreover, the model was not approved according to the fit indices [Table 3].

The results of the estimate for 5-Dimensional Model are presented in Figure 2.

**Exploratory factor analysis**

EFA was done due to the fact that the standardized five-factor model was not confirmed. First, the Kaiser–Meyer–Olkin (KMO) test was carried out to ensure the adequacy of the sample size, and the value of KMO was reported to be 0.79. Bartlett’s test of sphericity was then performed to check whether or not the correlation between the variables is zero ( $P < 0.001$ ;  $df = 45$ ;  $\chi^2 = 467.11$ ).

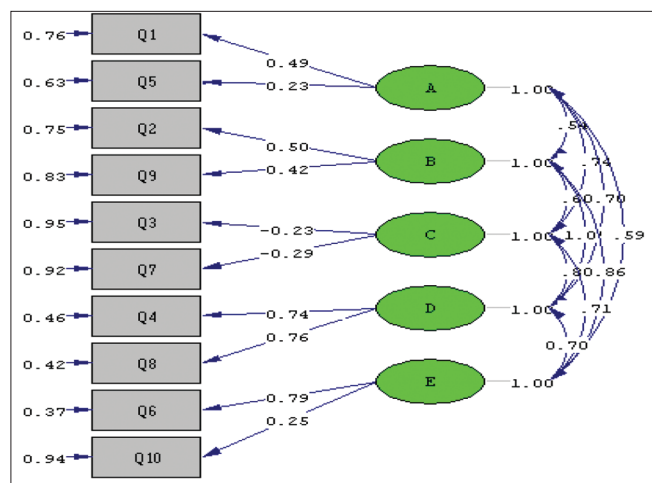


Figure 2: Standardized parameter estimates for 5-Dimensional Model

In this analysis, after applying varimax rotation, three factors were obtained with eigenvalues of higher than 1 and loading factors above 0.4. In this analysis, items 6, 4, 5, 8, and 9 were loaded on in the first factor; items 1, 2, and 3 on the second factor, and items 7 and 10 on the third one. The three factors accounted for 59.78% of the whole variance, with 32.97%, 15.03%, and 11.78% explained by each, respectively. The scree plot confirms the above three factors [Figure 3].

Velicer’s MAP test was performed combined with the parallel analysis to further investigate the factors. The results of parallel analysis approved the three factors obtained in EFA. The results of this section showed that the above three

Table 2: Average variance extracted and some parameters of Posttraumatic Growth Inventory for Children-Revised Questionnaire in children with cancer (n=200)

Dimension of PTGI-C-R	Mean ±SD	Cronbach’s α	λ coefficient range	t value range	AVE
A (1, 5)	4.22±1.39	0.37	0.23-0.49	5.03-5.21	0.15
B (2, 9)	4.13±1.30	0.26	0.42-0.50	4.58-5.02	0.21
C (3, 7)	4.31±1.07	0.10	0.23-0.29	2.42-3.71	0.07
D (4, 8)	4.27±1.58	0.70	0.74-0.76	10.03-10.87	0.56
E (6, 10)	4.60 ± 1.17	0.11	0.25-0.79	3.89-5.10	0.34
PTGI-C-R	21.55±4.77	-	-	-	-

AVE: Average variance extracted, PTGI-C-R: Posttraumatic Growth Inventory for Children-Revised Questionnaire, SD: Standard deviation

Table 3: The fit indices of the confirmatory factor analysis model for Posttraumatic Growth Inventory for Children-Revised Questionnaire in the 5-factor models

Fit indices	Optimal values	The values obtained in this study
$\chi^2/df$	1-5	3.88
NFI	≥0.90	0.86
NNFI	≥0.90	0.80
CFI	≥0.95	0.89
IFI	≥0.90	0.89
RFI	≥0.90	0.75
RMSEA	≤0.05	0.12
SRMR	≤0.05	0.09

NFI: Normed fit index, NNFI: Nonnormed fit index, CFI: Comparative fit index, IFI: Incremental fit index, RFI: Relative fit index, RMSEA: Root mean square error of approximation, SRMR: Standardized root mean square residual

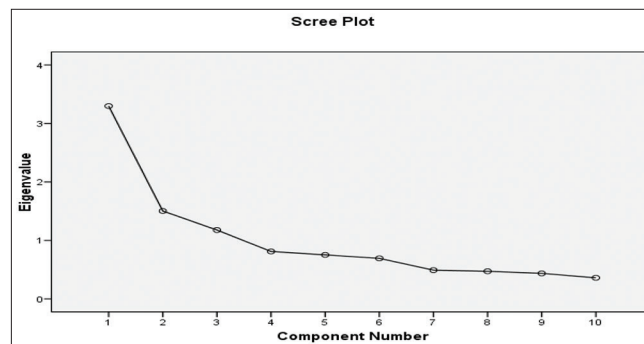


Figure 3: Scree plot in PTGI-C-R (Three-Dimensional Model)

factors with the same items obtained in EFA accounted for 59.78% of the total variance with eigenvalues of 3.30, 1.50, and 1.18, respectively. Therefore, the three-factor model and 10 items were considered for further investigation.

However, it was not conceptually possible to name the factors and there was no significant relationship between the items loaded on each factor. Therefore, the three-factor model obtained by EFA was not acceptable, either.

## Discussion

Cancer is a life-threatening disease whose diagnosis and treatment can be a stressful experience for the child. However, this experience does not necessarily lead to negative psychological effects, and many cancer survivors may also experience positive psychological changes known as PTG.<sup>[6]</sup> This study aims to determine the psychometric properties of PTGI-C-R in Iranian children with cancer.

After examining the face and the content validity of the tool developing a preliminary version, CFA was performed to check how much the theoretical model fits the real data.<sup>[38]</sup> According to the fit indices, the research data fit neither the factor structure nor the theoretical basis. As a result, the structures of the three-factor and the five-factor models of the Farsi version were not confirmed.

After rejecting the five-factor model, EFA was performed as a data-based approach to determine common items in each dimension and categorize the items.<sup>[38]</sup> By conducting exploratory factor analysis, the three-factor model was proposed, which required the removal of two items from the questionnaire, despite having good fit indices. In other words, if the item 7 “I now have a chance to do some things I couldn’t do before” and the item 10 “I have new ideas about how I want things to be when I grow up” were removed from the tool, the tool would be approved with eight items and two factors. The three-factor model was not approved due to the fact that the removal of these two items compromises the validity of PTGI-C-R and practically removes the dimensions *new possibilities* and *personal strength*. This change may limit the comparisons with other published studies which use 10 items for PTGI-C-R.

However, the five-factor model is approved for Hebrew, Chinese, and German versions of the instrument.<sup>[39-42]</sup> In a 2015 study, Lau *et al.* confirmed the single-factor structure of PTGI for measuring the PTG in adolescents for the first time, although in the revised version, two of the items associated with spirituality were removed.<sup>[28]</sup>

Research data presented by Lee *et al.* supported both the single-factor and the five-factor models.<sup>[43]</sup> The reason for the poor fit between the research model and the data may be the dependence of some fit indices on the sample size and the fact that indices are significant in large sample sizes. In the study by Lau *et al.*, the sample size consisted of

3256 subjects,<sup>[28]</sup> and in the study by Laufer and Solomon, a total of 2999 samples were examined.<sup>[44]</sup> Similarly, in the 21-item version of the PTG scale which is translated into Hebrew, the sample size consisted of 2999 subjects.<sup>[45]</sup>

Another reason for the rejection of the model is the differences between the samples participating in the study. Different studies investigated different populations such as cancer patients,<sup>[31,46]</sup> children affected by Hurricane Katrina and their caregivers,<sup>[27]</sup> adults after an earthquake,<sup>[39]</sup> 1<sup>st</sup> and 2<sup>nd</sup>-year students after an earthquake,<sup>[28]</sup> the youth after terror incidents,<sup>[44]</sup> soldiers who participated in Iraq and Afghanistan wars,<sup>[43]</sup> and students who experienced stressful conditions.<sup>[47]</sup> All of these studies approved the five-factor model. On the other hand, the PTGI has been translated and validated in many cultures with 21 items and five dimensions with the aim of measuring the PTG in adults,<sup>[20]</sup> in many of which the five-factor structure has not been approved. For instance, in the study on students with stressful childhood experiences,<sup>[42]</sup> the five-factor model was not confirmed after the psychometric evaluation of the Spanish version of the tool, and finally, a three-factor model was proposed.<sup>[27]</sup> Moreover, in the psychometric evaluation of the German version, a four-factor model was confirmed.<sup>[48,49]</sup>

Confirming the factor structure of a tool in a particular research population does not prove that it is comprehensive and sufficient for measuring a concept. For instance, although PTGI has been approved as a valid tool with five factors for measuring PTG and its dimensions in Iran<sup>[22]</sup> according to the mixed method study by Heidarzadeh *et al.*, this tool may not have been able to demonstrate all the aspects of PTG experienced by Iranian cancer patients, which indicates the need to develop new tools in Iran.<sup>[22]</sup>

Sometimes, despite the appropriate scientific foundation of a tool in some societies, the data collected from some research populations do not fit the model and the loading factors of items are low, confirming the need to develop a novel tool fitting the specific population.<sup>[50,51]</sup>

According to the results of studies, culture plays an important role in determining the dimensions of PTG. According to Calhoun *et al.*, culture can influence all dimensions of PTG, especially rumination and self-disclosure. It also plays an important role in shaping beliefs, determining ways to comprehend an incident, and thriving during the crisis.<sup>[52]</sup> Therefore, the rejection of PTGI-C-R can be a result of differences in the social and cultural contexts of the study population. In other words, many subcultures with various traditions, lifestyles, races, and languages exist in Iran, all of which greatly influence pain endurance, resilience, and PTG.<sup>[38]</sup>

On contrary to the findings of the studies conducted in other countries, spiritual growth reaches its peak in the Iranian population and overshadows other dimensions of

growth.<sup>[31]</sup> In this field, no studies have been conducted on cancer children. However, the belief exists among Iranian adult cancer patients that not accepting pain and disease, and finally, not coping with the disease and the lack of PTG is seen as fighting against destiny and the divine will and wisdom. According to them, bearing this pain may be followed by God's mercy and attention.<sup>[22]</sup>

Due to being geographically located on the path of historical migrations, Iran's demographic structure has a great ethnic diversity, leading to the formation of multiple subcultures, each able to develop different attitudes during the process of coping and subsequently, in regard with PTG.<sup>[29]</sup>

Another finding of this study indicated a significant weak relationship between the age and the level of PTG in Iranian children with cancer. However, in addition to its significance, the intensity of the correlation is important. Thus, due to the low correlation coefficient, the weak relationship between these two variables can be ignored. The findings of Barakat *et al.* and Phipps *et al.*, in line with the current study, showed that the age at the time of data collection and PTG are not significantly correlated. However, there is a significant relationship between the age at the time of diagnosis and PTG, and it seems that at the time of cancer diagnosis, the older youth reported PTG more than other people did.<sup>[53,54]</sup> The youth find new interests and paths in their lives and try to make a better use of their lives. Moreover, younger people are more likely to experience PTG, which may be due to greater freedom to learn and change and an increased cognitive flexibility. In other words, with an increase in age and experience, subjects may learn important lessons of life.<sup>[38]</sup> Therefore, considering that in the present study, most subjects were 7–12 years old, and in their early adolescence, the insignificant relationship between age and growth may seem reasonable.

As another demographic variable in this study, gender had no significant correlation with PTG, which is in line with many previous studies.<sup>[27,44,54-56]</sup> However, by studying the correlation between gender and PTG, Kimhi *et al.* and Laufer *et al.* concluded that males show a higher level of PTG than women do<sup>[40,57]</sup> and stated that PTG increases in men after cancer diagnosis, since they, compared to women, feel more at risk and less supported by the family.<sup>[58]</sup> Yet, such an analysis does not apply to pediatric populations.

The findings of this study rely on self-report, so it may not reflect one's actual changes, but merely a clear view of the aftermath of a stressful situation.<sup>[59]</sup> In addition, PTG evaluation is a retrospective process in which participants are asked to estimate how much they have changed from different aspects, since the incidence of trauma. However, even if the patient's perception of a stressful incident is an

illusion, it helps him/her experience better situations and cope with the disease.<sup>[60]</sup> In this study, the research population consisted of children with cancer visiting a limited number of medical centers which may not have been a representative of the whole nation, despite being the referral centers for the whole country. In regard with this limitation, in future studies, it is recommended to validate the Farsi version of PTGI-C-R among various Iranian ethnicities and their specific subcultures, using large samples.

Given that this study is conducted based on the CTT, it is recommended to perform another study based on the item response theory to address some of the limitations of this study and evaluate indicators such as the items of difficulty and discriminant validity. As one of the approaches to measuring the construct validity, factor analysis is performed for the psychometric evaluation of the tool. Of course, it was also necessary to assess the convergent validity. However, the convergent validity was not calculated due to the limited number of studies conducted on PTG-related factors and the limited number of valid and reliable tools which can evaluate these PTG-related concepts. Thus, it is recommended to perform it in the psychometric evaluation of the tool in future researches.

Moreover, in this study, the five-factor model was not approved. Therefore, to identify a better model, the researchers performed an exploratory factor analysis. Due to the lack of access to other samples, the analysis was done on the data obtained from the research samples in the previous section.

### Limitations and recommendations

The results of this study show that PTGI-C-R does not have desirable psychometric properties among Iranian children with cancer and cannot be used as an appropriate scale in some research protocols and in various settings. Accordingly, there may have been different developmental structures in these children. Therefore, PTGI-C-R may not be able to show all the aspects of PTG experienced by patients, and it is necessary to design and validate a specific tool in Iran.

## Conclusions

Understanding the concept of PTG among children with cancer provides a lot of information for caregivers and helps them adapt to their stressful situation better. The results show that PTGI-C-R does not have desirable psychometric properties among Iranian children with cancer and cannot be used as an appropriate scale in some research protocols and in various settings.

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### Conflicts of interest

The corresponding author, Prof. Maryam Rassouli, is the Editorial Board Member of the journal.

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