Original Article

Post-traumatic Growth in the Link with Resilience, Self-compassion, and the Personal and Clinical Characteristics in Adolescents with Life-threatening Disease: A Cross-sectional Correlational Study

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Abstract

Background: Post-traumatic growth (PTG) is a significant factor influencing health outcomes. This research aims to determine the status of PTG and its correlation with resilience, self-compassion (SC) and personal and clinical characteristics in adolescents with life-threatening diseases.

Methods: In this cross-sectional correlational study, 200 adolescents with life-threatening disease who were referred to clinics or hospitalized at Shohada Tajrish and children's Medical Center hospitals from June to October 2023 in Tehran, Iran, were selected through convenience sampling. Data was collected using personal and clinical characteristics form, PTG Inventory, resilience scale, and SC scale. Analysis was conducted using SPSS software version 20, employing descriptive statistics, Pearson's correlation coefficient, ANOVA, t-tests, and multiple linear regression analysis with a P value≤0.05.

Results: The study found that the mean total PTG score was 63.35±18.19, the resilience score was 82.39±13.62, and the SC score was 76.36±6.65. There was a significant difference between various treatment stages in the total PTG score (P=0.05), and PTG score was correlated with resilience (r=0.63, P<0.001) and SC score (r=0.20, P=0.04). The total resilience score was the sole predictor of the total PTG score. Higher resilience total scores during chemotherapy and radiotherapy (B=0.74, P<0.001), surgery (B=1.08, P<0.001), and drug treatment phases (B=0.89, P<0.001), were associated with higher PTG scores. While SC was positively correlated with PTG, it did not predict it (P>0.05).

Conclusion: The study suggests that enhancing resilience in adolescents with life-threatening diseases can improve PTG. Future studies are recommended to explore the impact of resilience strategies training on PTG in this population.

Keywords: Adolescents, Post-traumatic growth, Resilience, Self-compassion

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Introduction

Adolescence, a phase characterized by heightened risk and tension, becomes even more challenging when life-threatening diseases strike.[1] Approximately 429,000 individuals aged under 19 years are diagnosed with cancer annually, with reported cases ranging from 141 to 185 per million worldwide, underscoring the growing impact of these diseases on this age group.[2] A life-threatening disease is a disease with a high probability of early death due to the severity of the disease.[3] Cancer, hemophilia, thalassemia major, chronic kidney disease, and heart failure are among the life-threatening diseases.[4, 5]

Life-threatening diseases make adolescents face severe stress sources such as unexpected diagnoses, aggressive treatments, functional impairment, impairment in adolescent identity development and interactions, uncertainty about the outcome of treatment, and the possibility of disease recurrence; an increase in the occurrence of mental and physical problems leads to a decrease in the well-being of adolescents and, as a result, it can negatively affect the adolescent's view of himself/herself and his/her abilities in his/her daily life.[6, 7]

Although suffering from life-threatening diseases is considered a traumatic event, especially during adolescence, such stressful events can be the starting point of a process of emotional and behavioral reconstruction and lead to the improvement of an adolescent's potential to achieve growth.[8, 9]

Post-Traumatic Growth (PTG) is a concept that describes positive transformations following a traumatic event.[10] In high-risk adolescents, PTG can result in beneficial changes in emotional and cognitive well-being and potentially decrease distress levels among adolescents over time.[11, 12] Understanding and measuring factors associated with PTG is crucial. Studies have shown varying and sometimes contradictory results regarding the amount and factors related to PTG.[13, 14] For example, a study on individuals diagnosed with childhood cancer found weak and negative correlations between PTG and the time elapsed since diagnosis and completion of treatment, but a positive and weak correlation with the patient's age at the time of diagnosis.[15]

In addition to understanding the factors related to growth, it is equally important to identify the factors that facilitate it. Experts suggest that resilience is a key factor in fostering PTG.[16] Resilience, which can result in enhanced adaptation and better health outcomes, demonstrates positive adjustment following life's challenges.[13] The correlation between PTG and resilience has yielded varying and at times conflicting findings in research. Some studies have indicated no direct link between resilience and PTG, or a weak positive relationship has been reported,[17, 18] while others have highlighted a significant positive association between these two concepts.[10, 19] On the other hand, the concept of Self-compassion (SC) has been introduced as an internal and individual source of resilience.[20] SC is a key factor associated with resilience. It is linked to positive mental and psychological well-being and life satisfaction. SC involves being kind to oneself, refraining from self-judgment regarding failures, and acknowledging one's experiences as part of the shared human experience.[21] Elevating levels of SC have been correlated with reduced levels of depression, anxiety, and stress, while simultaneously enhancing an individual's psychological well-being.[22]

The results of studies regarding the relationship between SC and PTG are varied. In some studies, especially in clinical samples, the existence of a relationship between these two concepts has been shown.[23, 24] However, the results of a study show that there is no relationship.[25]

Nurses play an important role in educating and supporting adolescents with life-threatening diseases. Providing comprehensive care and facilitating the promotion of PTG in adolescents with life-threatening diseases, who are different from

other age groups in many ways, is of particular importance because it can improve health and accelerate the healing process; also, providing quality nursing care should be effective. The aim of this study was to determine the status of PTG and its correlation with resilience, SC, and personal and clinical characteristics of adolescents with life-threatening diseases.

Materials and Methods

This cross-sectional correlational study examines adolescents aged 12-18 years old who were diagnosed with life-threatening illnesses. Participants were selected through convenience sampling from individuals receiving treatment at outpatient clinics or hospitalized at Shohada Tajrish and Children's Medical Center hospitals from June to October 2023 in Tehran, Iran. The sample size was determined 200 individuals based on the following formula.

$$n \geq \left[\frac{(Z_{1-\alpha/2}+Z_{1-\beta})}{0.5\times\ln[(1+r)/(1-r)]}\right]^2 + 3$$

$$r = 0.30$$

$$\alpha = 0.05 \Rightarrow Z_{1-\alpha/2} = 1.96$$

$$\beta = 0.10 \Rightarrow Z_{1-\beta} = 1.28$$

This research included adolescents who met the following criteria: 1) a definite diagnosis of cancer, hemophilia, major thalassemia, chronic kidney disease, and heart failure by a specialist physician recorded in their medical records; 2) at least 6 months passed since the diagnosis of their illness.; 3) no other stressful events such as parental divorce or the death of close relatives in the past 6 months; 4) lack of any mental disorders based on the documentation in their medical records; 5) the existence of only one life-threatening illness; 6) no other family member suffering from a life-threatening illness.; and 7) literacy in reading and writing and the ability to respond to questionnaire questions . If a participant failed to complete the questionnaires for any reason, he/she was excluded from the study. The researcher visited the selected hospitals with prior coordination and according to the schedule (Shohada Tajrish Hospital three days a week in the first month and Children's Medical Center Hospital four days a week in the second month). Before starting the sampling, explanations were given about the research objectives, and oral and written consent were obtained from the adolescents and their parents. After that, the participants were provided with information collection tools. They completed the tools in the researcher's presence with questions answered as needed. The tools were completed by adolescents in outpatient departments in a quiet environment in the same place and inpatient departments, on the patient's bed, or in a separate room. Six participants were excluded from the study due to not completing the questionnaire accurately.

The form of personal and clinical characteristics was developed by the authors, with input from experts. This form includes inquiries about the adolescent's age, gender, education level, birth order, number of siblings, type of disease, treatment stage, presence of physical disability, parent's education and occupation, adolescent's religion and ethnicity, family history of disease (Non-life-threatening), and adequacy of the family's monthly income.

The PTG Inventory was introduced by Tedeschi and Calhoun in 1996 to measure PTG.[26] The Persian version of this tool was psychometrically tested in the population of cancer patients in Iran by Heydarzadeh et al. in 2015; the confirmatory factor analysis demonstrated that the factor structure of the tool aligns with the original version, which consists of 5 factors. Additionally, the alpha coefficient for the whole tool was 0.87, and it was reported from 0.55 to 0.77 for its dimensions.[27] This questionnaire has 21 statements in 5 areas:new opportunities (5 items), communications with others (7 items), appreciation of life (3 items), personal strength (4 items), and spiritual changes (2 items). Its scoring is based on a

5-point Likert scale from 0 to 5. The total score of PTG varies from 0 to 105, and the higher the score, the higher the PTG.[27] To evaluate face validity, we administered the PTG inventory to 15 participants in the study. They were asked to assess the tools, share their understanding of the terms, and provide feedback. The internal consistency coefficient was 0.90.

The resilience scale was designed by Wagnild and Young in 1993 to measure resilience as an individual characteristic.[28] The original version of this tool has two subscales and 25 statements that measure the resilience construct on a 7-point Likert scale. The Persian version of this tool was psychometrically tested in the Iranian adolescent community by Nourian et al. in 2015, and its content and face validity were established through feedback from specialists and adolescents, respectively. Additionally, exploratory factor analysis identified five factors that accounted for 43.80% of the variance in total scores. The Cronbach's alpha coefficient of the entire instrument was 0.77, and the intraclass correlation coefficient between two administrations of the scale two weeks apart was reported as 0.9.[29] The Persian version of the tool consists of 23 statements categorized into five areas: stability of step (5 items), meaningful view of life (5 items), self-reliance (5 items), acceptance of self (5 items), and balanced view of life (3 items). Responses are scored using a 5-point Likert scale ranging from 1 to 5. The total score ranges from 23 to 115, with higher scores indicating greater endurance.[29] The face validity of this tool was evaluated and modifications were made. The internal consistency coefficient was found to be 0.86.

The SC scale which was developed by Neff in 2003 assesses the levels of SC.[30] This tool comprises 26 statements across six domains: self-kindness (5 items), self-judgment (4 items), mindfulness (5 items), over-identification (4 items), common humanity (4 items), and isolation (4 items). Responses are scored using a 5-point Likert scale ranging from 1 to 5, with reversed scoring in the areas of self-judgment, over-identification, and isolation. The SC score ranges from 26 to 130, with higher scores indicating greater SC.[30] The Persian version of this tool underwent psychometric testing among students by Momeni et al. in 2013, yielding a Cronbach's alpha coefficient of 0.70 and a correlation coefficient of 0.89 for its two applications. Factor analysis revealed four factors that accounted for 47% of the total variance. The convergent and divergent validity were assessed by significantly correlating SC scale scores with those of the Rosenberg's Self-Esteem Scale, Beck Depression Inventory, and Beck Anxiety Inventory.[31] The face validity of the SC scale was evaluated and the overall Cronbach's alpha was determined to be 0.80, indicating a satisfactory level of internal consistency.

Data were analyzed using SPSS version 20, employing descriptive statistics (mean, frequency, and percentage) and stepwise regression to evaluate the factors associated with PTG. Additionally, Pearson's correlation coefficient was used to determine the associations between variables, along with t-tests and ANOVA. The results of the Shapiro-Wilk test indicated that all variables were normally distributed. A P value ≤ 0.05 was considered.

This study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences with the code of IR.SBMU.PHARMACY.REC.1402.001. Permission was obtained to enter hospitals from the educational deputies of Shahid Beheshti University of Medical Sciences and Tehran University of Medical Sciences. The research objectives were explained to the participants, and they were informed about the right to leave the study at any time. All the participants were informed of the confidentiality of the data and they were all volunteers to participate in the study without any physical and financial harm. Oral and written consent froms were obtained from the adolescents and their parents.

Results

The study revealed that most adolescents were in the age range of 15-18 years, with a higher percentage being male. Most adolescents were at their first year of high school, with a significant portion diagnosed with cancer and undergoing drug treatment. Further details on the demographic characteristics of the adolescents are shown in Table 1.

The results showed that the mean and standard deviation of the total PTG score in adolescents were 63.35±18.19; the adolescents had the highest score in the dimensions of "communication with others" and "appreciation of life" and received the lowest in "new opportunities" dimension. The mean total scores of resilience and SC in adolescents were 82.39±13.62 and 76.36±6.65, respectively (Table 2).

Moreover, the total resilience score (P<0.001) and SC score (P=0.04) showed a significant correlation with the total PTG score (Tables 3 and 4). Among the personal and clinical variables examined, there was a significant difference only in the "treatment stage" according to the total PTG (P=0.05) (Table 5)

The variables of SC, resilience, and treatment stage that demonstrated a significant relationship with the total PTG score were selected and included in the regression analysis model. The result indicated that among the variables in the model, only the total score of resilience had the predictive

Table 1: Demographic and clinical characteristics of adolescents involved in the study

Variables	N(%)
Adolescent age (year)	
12-14	96(48)
15-18	104(52)
Adolescent sex	
Boy	101(50.50)
Girl	99(49.50)
Adolescent education	
Illiterate	29(14.50)
First high school	88(44)
Second high school	83(41.50)
Adolescent birth rank	
First	75(37.50)
Second	73(36.50)
Third	25(12.50)
Fourth and more	27(13.50)
Number of children in the family	
One	38(19)
Two	58(29)
Three	53(26.50)
Four and more	51(25.50)
Type of adolescent disease	
Cancer	90(45)
Major thalassemia	31(15.50)
Chronic kidney disease	50(25)
Heart failure	29(14.50)
Treatment stage	
Chemotherapy and radiotherapy	74(37)
Surgery	20(10)
Drug treatment	106(53)
Physical disability	
Yes	66(33)
No	134(67)
Father's education	
Illiterate	20(10)
Elementary	31(15.50)
Guidance	24(12)
Diploma	67(33.50)
University	58(29)
Mother's education	
Illiterate	24(12)
Elementary	40(20)
Guidance	22(11)
Diploma	77(38.50)
University	37(18.50)
Father's job	
Employee	73(36.50)
Freelance job	100(50)
Unemployed	5(2.50)
Retired	22(11)
Mother's job	
Employee	33(16.50)
Freelance job	8(4)
Housekeeper	155(77.50)
Retired	4(2)
Family ethnicity	
Fars	96(48)
Turk	69(34.50)
Kurd	15(7.50)
Lor	17(8.50)
Turkmen	3(1.50)
Family history of disease (Non-Life Threatening disease)	
Yes	95(47.50)
No	105(52.50)
Sufficient monthly income	
Yes	70(35)
No	130(65)

ability for PTG (P<0.001). Specifically, an increase of one unit in the resilience score led to a corresponding increase of 0.74 in the PTG score during the chemotherapy and radiotherapy phase, 1.08 in the surgical phase, and 0.89 in the drug treatment phase. The results suggested that the resilience total score had a significant impact on the outcomes in all three treatment stages, with varying degrees of influence. The SC total score, on the other hand, did not show a significant impact in these analyses (P>0.05) (Table 6).

Table 2: The total score of post-traumatic growth, resilience, and self-compassion and their dimensions in adolescents participating in the study (N=200)

Variables	Dimensions	Mean±SD	Minimum	Maximum	Average for the number of items in each dimension
PTG[a]	New opportunities	14.03±5.10	0.00	25.00	2.80
	Communication with other	22.45±6.61	0.00	35.00	3.20
	Personal strength	11.51±4.46	0.00	20.00	2.87
	Appreciation of life	9.61±3.39	0.00	15.00	3.20
	Spiritual change	5.72±3.07	0.00	10.00	2.86
	PTG total score	63.35±18.19	0.00	102.00	
Resilience	Stability of step	18.16±3.69	0.00	25.00	3.63
	Meaningful view of life	18.28±3.64	0.00	25.00	3.64
	Self-reliance	14.10±3.36	0.00	25.00	3.49
	Acceptance of self	18.62±4.61	0.00	25.00	3.72
	Balanced view of life	13.22±3.47	0.00	15.00	3.02
	Resilience total score	82.39±13.62	0.00	113.00	
SC[b]	Self-kindness	16.07±3.72	0.00	25.00	3.21
	Self-judgment	11.06±2.97	0.00	18.00	2.76
	Mindfulness	15.14±3.57	0.00	24.00	3.02
	Over identification	10.91±3.19	0.00	20.00	2.72
	Common humanity	12.17±3.59	0.00	20.00	3.04
	Isolation	11.00±3.27	0.00	20.00	2.75
	SC total score	76.36±6.65	0.00	101.00	

[a]PTG: Post-traumatic growth; [b]SC: Self-Compassion

Table 3: The relationship between post-traumatic growth and its dimensions with resilience and its dimensions in adolescents participating in the study

PTG[a] and its dimensions		Resilience and its dimensions					
		Stability of step	Meaningful view of life	Self-reliance	Acceptance of self	Balanced view of life	Resilience total score
New opportunities	r	0.36	0.58	0.54	0.40	0.31	0.60
	P value*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Communication with other	r	0.35	0.48	0.40	0.34	0.21	0.49
	P value*	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001
Personal strength	r	0.42	0.55	0.53	0.44	0.35	0.63
	P value*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Appreciation of life	r	0.34	0.48	0.32	0.38	0.21	0.48
	P value*	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001
Spiritual change	r	0.24	0.23	0.1	0.09	0.07	0.22
	P value*	<0.001	<0.001	0.009	0.19	0.29	0.02
PTG[a] total score	r	0.44	0.60	0.52	0.43	0.30	0.63
	P value*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]PTG: Post-traumatic growth; *Pearson correlation test

Table 4: The relationship between post-traumatic growth and its dimensions with self-compassion and its dimensions in adolescents participating in the study

PTG[a] and its dimensions		SC[b] and its dimensions						
		Self-kindness	Self-judgment	Mindfulness	Over identification	Common humanity	Isolation	SC total score
New opportunities	r	0.48	0.01	-0.05	-0.36	-0.16	-0.39	-0.21
	P value*	<0.001	0.85	0.45	<0.001	0.01	<0.001	0.03
Communication with other	r	0.35	-0.19	0.10	-0.37	0.01	-0.32	-0.16
	P value*	<0.001	0.005	0.15	<0.001	0.84	<0.001	0.01
Personal strength	r	0.46	0.04	-0.30	-0.41	-0.18	-0.44	-0.25
	P value*	<0.001	0.55	0.58	<0.001	0.01	<0.001	<0.001
Appreciation of life	r	0.32	-0.09	0.10	-0.32	0.04	-0.29	-0.07
	P value*	<0.001	0.19	0.13	<0.001	0.49	<0.001	0.27
Spiritual change	r	0.19	-0.18	0.19	-0.26	0.07	-0.15	-0.02
	P value*	0.005	0.01	0.005	<0.001	0.28	0.02	0.71
PTG total score	r	0.47	-0.10	0.06	-0.44	-0.06	-0.41	0.20
	P value*	<0.001	0.13	0.34	<0.001	0.35	<0.001	0.04

[a]PTG: Post-traumatic growth; [b]SC: Self-Compassion; *Pearson correlation test

Table 5: Comparing the total post-traumatic growth score of adolescents participating in the study according to their personal and clinical characteristics

Variables	N (%)	Total score of PTG[a] Mean±SD	P value
Adolescent age (year)			
12-14	96(48)	63.44±18.13	0.95*
15-18	104(52)	63.27±18.33	
Adolescent sex			
Boy	101(50.50)	64.69±17.61	0.32*
Girl	99(49.50)	62.13±18.79	
Adolescent education			
Illiterate	29(14.50)	64.8±17.76	0.40**
First high school	88(44)	64.82±16.93	
Second high school	83(41.50)	61.28±19.57	
Adolescent birth rank			
First	75(37.50)	66.62±16.40	
Second	73(36.50)	59.90±18.32	0.10**
Third	25(12.50)	60.60±16.69	
Fourth and more	27(13.50)	66.03±22.40	
Number of children in the family			
One	38(19)	65.55±14.63	
Two	58(29)	64.50±17.35	0.45**
Three	53(26.50)	60.00±17.84	
Four and more	51(25.50)	63.92±21.58	
Type of adolescent disease			
Cancer	90(45)	63.07±19.63	
Major thalassemia	31(15.50)	60.77±17.48	0.74**
Chronic kidney disease	50(25)	64.02±17.61	
Heart failure	29(14.50)	65.82±15.61	
Treatment stage			
Chemotherapy and radiotherapy	74(37)	65.52±21.33	0.05**
Surgery	20(10)	54.60±17.61	
Drug treatment	106(53)	63.57±15.61	
Physical disability			
Yes	66(33)	60.90±17.61	0.18*
No	134(67)	64.57±18.41	

Variables	N (%)	Total score of PTG[a] Mean±SD	P value
Father's education			
Illiterate	20(10)	64.40±22.47	
Elementary	31(15.50)	86.90±15.80	0.37**
Guidance	24(12)	60.86±18.34	
Diploma	67(33.50)	61.25±17.97	
University	58(29)	63.44±17.92	
Mother's education			
Illiterate	24(12)	63.45±20.45	
Elementary	40(20)	66.07±19.41	0.87**
Guidance	22(11)	61.95±19.55	
Diploma	77(38.50)	61.50±16.72	
University	37(18.50)	62.94±18.11	
Father's job			
Employee	73(36.50)	64.41±18.62	
Freelance job	100(50)	62.72±18.03	0.85**
Unemployed	5(2.50)	63.80±17.03	
Retired	22(11)	61.75±18.87	
Mother's job			
Employee	33(16.50)	60.51±17.51	
Freelance job	8(4)	51.37±14.00	0.17**
Housekeeper	155(77.50)	64.60±18.50	
Retired	4(2)	62.75±10.43	
Family ethnicity			
Fars	96(48)	63.37±17.00	
Turk	69(34.50)	66.02±19.06	0.11**
Kurd	15(7.50)	64.06±22.38	
Lor	17(8.50)	54.35±16.21	
Turkmen	3(1.50)	49.66±5.85	
Family history of disease			
Yes	95(47.50)	61.87±17.23	0.27*
No	105(52.50)	64.71±19.00	
Sufficient monthly income			
Yes	70(35)	61.56±18.50	0.31*
No	130(65)	64.30±18.02	

[a]PTG: Post-traumatic growth; *Independent sample T test; **One-way ANOVA, P≤0.05 was statistically significant

Table 6: Regression analysis of predicting post-traumatic growth in adolescents participating in three stages of treatment

Treatment stage	Model	Non-standard coefficients		Standard coefficients	T statistic	P value*
		Unstandardized beta coefficient	Standard deviation			
Chemotherapy and radiotherapy	Resilience total score	0.74	0.15	0.53	4.79	<0.001
	Self-compassion total score	0.19	0.34	0.06	0.56	0.57
Surgery	Resilience total score	1.08	0.20	0.80	5.20	<0.001
	Self-compassion total score	0.16	0.58	0.04	0.27	0.78
Drug treatment	Resilience total score	0.89	0.10	0.67	8.43	<0.001
	Self-compassion total score	0.09	0.19	0.04	0.51	0.61

*Multiple liner regression, P≤0.05 was statistically significant

Discussion

The findings of the current study on the mean score of PTG in adolescents were consistent with those of several previous studies.[32, 33] Conversely, some studies have reported lower scores of PTG compared to the present study, possibly due to different age ranges among

the study participants.[18, 34] This discrepancy in findings highlights the importance of considering various demographic and basic factors, such as age, when interpreting and comparing research results related to PTG. On the other hand, comparing PTG results across studies is complex due to variations in factors like disease type and severity. Previous research has predominantly examined PTG scores in patient communities affected by cancer or life-threatening illnesses, which differs from the focus of the present study.[35]

In the current study, adolescents showed more PTG in the dimensions of "communication with others" and "appreciation of life" compared to other dimensions. Facing a serious disease prompts individuals to recognize the importance of their relationships, appreciate the support of loved ones, and consequently, spend more time with them.[36] The findings related to the dimensions of "communication with others" are consistent with previous research.[33] In contrast to the findings of the current study, research conducted on the long-term disease–free cancer survivors in Italy found that PTG in this specific area was the lowest among all dimensions. Furthermore, the overall score of PTG was considerably lower than those reported in the present study.[37] This difference may be attributed to the unique characteristics of the studied population and the age variations. It appears that adolescents experience PTG differently. Comparing and contrasting the findings of different studies can provide valuable insights into the subtle nature of PTG among adolescents and help advance knowledge in this area.

Appreciation of life is a fundamental dimension in Tedeschi and Calhoun's PTG theory.[38] PTG leads to the exploration of new values, interests, and pathways in life, a reassessment of life goals, and an individual's endeavor to make better use of life's moments, and ultimately enhancing mental well-being and reducing anxiety symptoms.[39] The study results on the dimensions of "appreciation of life" are in the same line with previous research findings.[37, 40] The consistency in results across studies underscores the importance of recognizing and understanding the unique impact of trauma on adolescents' appreciation of life, suggesting a potential focus area for interventions and support strategies aiming at promoting PTG in this population.

The participants in the study had the lowest score in the dimension of "new opportunities", which aligns with findings from previous studies,[37, 40] indicating a potential area of weakness for participants in terms of perceiving new opportunities for growth following a traumatic experience. Researchers can develop targeted interventions to support individuals in enhancing their perception and pursuit of new opportunities for PTG. New opportunities involve identifying new possibilities for life or choosing a different path.[26] Research in gastrointestinal cancer patients indicates that social support, along with "relationship with others" and "personal strength", is closely related to "new opportunities".[41] Effective social support can enhance this area and is crucial in determining how individuals respond to traumatic situations, fostering a sense of security and belonging while reducing tension and protecting against harm.[42] Nurses can play a key role in facilitating social support to improve this aspect and aid in PTG.[33]

Among the personal and clinical variables, only the adolescent's treatment stage had a significant relationship with the total PTG score. The average score of total PTG during chemotherapy and radiotherapy stage was higher compared to other treatment stage, possibly due to the increased difficulty experienced during these phases. Specifically, adolescents undergoing drug treatment tend to experience more physical and mental peace than in other stages. Understanding the impact of treatment stages on PTG scores can provide valuable insights into the factors influencing PTG in adolescent patients, guiding future research and interventions in this area. While some studies align with our findings by

reporting no significant relationship between demographic variables and PTG,[25, 33] others have found significant associations with variables like age, education level, and income level.[32] This disparity may be attributed to the complexity of the PTG concept and variations in participant's characteristics.

The results indicated a positive and significant correlation between resilience and PTG, with resilience being able to predict PTG. Specifically, for every one-unit increase in resilience score, the PTG score increased by an average of 0.74 during chemotherapy and radiotherapy, 1.08 during the surgical phase, and 0.89 during drug treatment. The predictive strength of resilience varies across different treatment stages, with the surgical phase showing higher predictive power compared to other stages. These findings are consistent with previous research.[9, 19] Understanding this variation in predictive power can inform healthcare professionals about the importance of resilience at different points in the treatment process. High levels of resilience enhance an individual's self-control and ability to adapt to traumatic situations, leading to the experience of more positive emotions, which in turn fosters psychological adaption and sets the stage for PTG.[43] Achieving significant levels of PTG necessitates resilience and a return to healthy functioning before the trauma, enabling individuals to grow and progress toward more effective functioning. In contrast, results from a study in a different community indicated an inverse relationship between resilience and PTG, such that an increase in resilience was associated with a decrease in post-traumatic stress symptoms and a subsequent decrease in PTG.[18] Perhaps, as the authors of the mentioned study have also acknowledged, an increase in resilience over time may lead to a decrease in distress when facing life challenges such as chronic and threatening illnesses, potentially resulting in a reduction in PTG. However, the relationship between resilience and PTG as distinct variables appears complex and warrants further investigation. The role of individual coping strategies should not be disregarded in the relationship between these two concepts.[10]

The findings of this study demonstrate a positive and significant correlation between PTG and SC. However, it is important to note that SC alone cannot predict PTG. These findings are in the same line with previous studies.[23, 24] The experience of SC during the challenges of a life-threatening disease can lead to positive emotions and self-care, enhancing personal resources such as awareness, goals, capabilities, and symptom reduction.[44] In contrast to our study, a study on hemodialysis patients in Turkey did not find a relationship between PTG and SC.[25] This discrepancy underscores the complexity of the relationship between PTG and SC, highlighting the need for further exploration and analysis in this area to better understand the nuances of their interplay. It is possible that self-love and kindness alone may not be sufficient to foster growth, as clinical factors like disease severity and type, individual understanding of their condition, and non-clinical factors such as social support, hope and self-confidence may also play a role in this relationship. In situations where disease severity is high and individuals are in the advanced stages of treatment, SC alone may not lead to growth and positive change, despite self-love being present.

The research findings regarding the inability of SC to predict PTG are supported by a study that focused on individuals grieving the loss of a loved one due to drugs and found no predictive relationship between SC and PTG.[45] In contrast, another study in Turkey, involving individuals with breast cancer, demonstrated that SC could indeed predict PTG.[46] These differing results suggest that the predictive power of SC on PTG may vary depending on the specific population or circumstances being studied. Further investigation is warranted to better understand how SC may influence PTG.

The main strengths of this study were the participation of a large number of adolescents

with various life-threatening diseases and the use of specialized and validated tools for data collection. The present research focused on adolescents with life-threatening diseases in specific hospitals, cautioning against generalizing its findings. Given the adolescent's health status, self-reporting to multiple data collection tools could affect the accuracy of their responses.

Conclusion

The findings of the study revealed significant correlations between resilience, SC, and treatment stages with PTG. Notably, only resilience emerged as a predictor of PTG across all three treatment stages, while SC exhibited a positive correlation without predictive capability. Thus, it seems that offering holistic care and educational initiatives focused on bolstering resilience levels can positively influence the progression and enhancement of PTG in adolescents facing life-threatening illnesses. Future studies are recommended to explore the impact of resilience strategies training on PTG in adolescents with life-threatening diseases.

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Authors' Contribution

The study was designed by ZGH, MN (second author) and ASF. AH and ZGH conducted the literature review. ZGH carried out the data collection. MN (fourth author) performed the statistical analysis. MN (Second author) drafted the initial manuscript and together with AH revised it. All authors approved the final version. All authors are accountable for the accuracy of the data analysis. The corresponding author confirms that all authors listed meet the criteria for authorship and that no other eligible individuals have been excluded.

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Declaration on the use of AI

The authors of this manuscript declare that artificial intelligence (AI) was used only for editing and enhancing the clarity of the text.

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