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Perceived Posttraumatic Growth and Psychological Distress Three Years After the 2023 Earthquakes in Southern Türkiye: The Moderating Roles of Self-Compassion and Resilience

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Research Article

Keywords: Posttraumatic growth, Posttraumatic stress disorder, Earthquake survivors, Self-compassion, Resilience, Perceived social support, Trauma exposure

Posted Date: October 5th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10871707/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Posttraumatic growth (PTG) may coexist with persistent psychological symptoms after major disasters, but associated psychological factors remain unclear. This study examined the associations of PTG with posttraumatic stress disorder (PTSD) symptoms and general psychological distress among survivors of the 2023 Kahramanmaraş earthquakes, and tested whether self-compassion and resilience moderated these associations.

Methods

This cross-sectional study included adult earthquake survivors assessed approximately three years after the disaster. PTSD symptoms were assessed using the PTSD Checklist for DSM-5 (PCL-5), PTG using the Posttraumatic Growth Inventory (PTGI), and general psychological distress using the Depression Anxiety Stress Scales-21 (DASS-21) total score. Perceived social support, resilience, religious coping, and self-compassion were assessed using validated self-report measures. Spearman correlations, hierarchical linear regression analyses, and PROCESS Model 1 moderation analyses were performed.

Results

The study included 280 participants. PTGI scores were positively correlated with both PCL-5 and DASS-21 total scores. In adjusted hierarchical regression models, PTGI remained independently and positively associated with both PTSD symptoms and general distress. Higher self-compassion and perceived social support were associated with lower PTSD symptoms, whereas higher self-compassion, resilience, and perceived social support were associated with lower general distress. House loss, witnessing death, and positive religious coping were associated with higher general distress. Self-compassion and resilience moderated the PTG–general distress association, but not the PTG–PTSD symptom association.

Conclusions

PTG may coexist with persistent PTSD symptoms and general distress after earthquakes. The PTG–general distress association was weaker at higher levels of self-compassion and resilience, whereas the PTG–PTSD symptom association was not moderated.

Background

On February 6, 2023, two major earthquakes centered in Kahramanmaraş caused widespread destruction, mass displacement, and substantial loss of life across southern Türkiye. Large-scale earthquakes are associated with long-term psychiatric consequences, including posttraumatic stress disorder (PTSD), depression, anxiety, and other stress-related symptoms. Recent meta-analytic evidence on the psychological impact of the 2023 Kahramanmaraş earthquakes indicates a substantial burden of PTSD, depression, and anxiety among Turkish adult survivors, with reported risk factors including female gender, bereavement, home destruction, displacement, job loss, and low social support [1]. Among survivors living in temporary shelter areas, PTSD and depression were also frequent, with PTSD linked to socioeconomic vulnerability, bereavement, pre-existing psychiatric illness, substance use, and intense peritraumatic fear [2].

Trauma exposure may also be followed by posttraumatic growth (PTG), defined as perceived positive psychological change after highly challenging life circumstances. However, PTG does not necessarily indicate the absence of psychopathology. Earthquake studies show that PTG may coexist with PTSD symptoms and emotional distress, and that greater posttraumatic stress severity can be associated with higher PTG [3].

This coexistence challenges the assumption that PTG necessarily reflects recovery. PTG may arise from cognitive and emotional struggle after trauma, including rumination, meaning-making, and reconstruction of disrupted core beliefs. Network studies similarly suggest that posttraumatic stress symptoms and PTG are interconnected but partly distinct constructs [4, 5].

Psychosocial resources may help explain why some survivors report PTG alongside lower distress, whereas others report PTG together with persistent symptoms. Self-compassion has been associated with lower posttraumatic stress symptoms and may facilitate PTG, including among survivors of the Kahramanmaraş earthquakes [6, 7]. Resilience and perceived social support are also protective correlates of post-disaster distress, consistent with longitudinal evidence linking resilience to posttraumatic growth among adolescent earthquake survivors [8], whereas religious coping shows more heterogeneous associations and should be interpreted by distinguishing positive from negative religious coping [9–11].

Despite the growing literature on post-disaster psychopathology after the Kahramanmaraş earthquakes, most studies have focused on PTSD, depression, and anxiety, and few have examined the coexistence of PTG with these symptoms, the buffering role of self-compassion and resilience in this relationship, or longer-term adjustment beyond the acute and early recovery phases.

The present study therefore examined associations between PTG, PTSD symptoms, and general psychological distress among survivors of the 2023 Kahramanmaraş earthquakes approximately three years after the disaster, evaluating self-compassion, resilience, perceived social support, and religious coping, and testing whether these two resources moderated the associations of PTG with PTSD symptoms and general distress.

Methods

Study design and participants

This cross-sectional analytical study was conducted among survivors of the February 6, 2023, Kahramanmaraş earthquakes. Participants were recruited through community and survivor networks using a non-probability convenience sampling strategy. Eligible participants were individuals who were aged 18–65 years at the time of the earthquakes and who had directly experienced the disaster. Data were collected between January and May 2026, approximately 35 to 39 months after the February 6, 2023 earthquakes.

Because this was a field-based cross-sectional study conducted among earthquake survivors, no formal a priori power analysis was performed. The sample size was determined by the number of eligible participants who could be reached and agreed to participate during the study period. The smallest analytic sample in the moderation models included 244 participants.

Data were collected in person using paper-and-pencil questionnaires rather than online surveys to facilitate participation in field settings and reduce the potential exclusion of survivors with limited or unreliable access to online survey platforms.

Participants with available data on the relevant variables were included in each analysis; therefore, sample sizes varied slightly across descriptive, correlation, regression, and moderation analyses. Descriptive analyses were based on valid cases for each variable, whereas multivariable regression and moderation analyses were performed using cases with complete data for the variables included in the relevant model.

Ethical considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Ümraniye Training and Research Hospital Ethics Committee (Approval No: 311, Date: 11.09.2025). All participants were informed of the study's purpose and procedures, and written informed consent was obtained from each participant prior to participation.

Sociodemographic, clinical, and earthquake-related variables

Data were collected using a structured sociodemographic and clinical information form. The form included age, gender, education level, marital status, employment status, living arrangement, current residence, smoking status, alcohol use, family psychiatric history, and psychiatric treatment history. Psychiatric treatment history was assessed separately for the pre-earthquake period, post-earthquake period, and current treatment status.

Earthquake-related variables included being trapped under rubble, house loss, witnessing death during the earthquake, physical injury during the earthquake, and loss of a significant other. Current residence was categorized as living in a house/apartment or in a

tent/container.

Psychological measures

Posttraumatic stress symptoms, PTG, general psychological distress, perceived social support, resilience, religious coping, and self-compassion were assessed using the validated Turkish versions of the PCL-5 [12], PTGI [13], DASS-21 [14], MSPSS [15], BRS [16], Brief RCOPE [17], and SCS-SF [18], respectively. The DASS-21 total score was used as the primary indicator of general psychological distress. Positive and negative religious coping were analyzed as separate dimensions. All instruments were scored according to standard procedures. Higher scores indicate greater levels of the assessed construct: PTSD symptom severity for PCL-5, perceived posttraumatic growth for PTGI, general psychological distress for DASS-21, perceived social support for MSPSS, resilience for BRS, positive and negative religious coping for Brief RCOPE, and self-compassion for SCS-SF.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were presented as mean ± standard deviation, and categorical variables were presented as n/N and percentage. Percentages were calculated based on valid cases.

Because several psychological variables were not normally distributed, bivariate associations among the main study variables were examined using Spearman's correlation analysis. Correlations were calculated between PCL-5, PTGI, DASS-21 total score, MSPSS, BRS, positive religious coping, negative religious coping, and SCS-SF.

Hierarchical linear regression analyses were conducted separately for PCL-5 and DASS-21 total scores. In Model 1, sociodemographic and earthquake-related variables were entered, including age, gender, education, current residence, pre-earthquake psychiatric treatment, house loss, witnessing death during the earthquake, and loss of a close person. In Model 2, PTGI was added to evaluate the independent contribution of PTG. In Model 3, psychosocial resources and coping-related variables were added, including MSPSS, BRS, positive religious coping, negative religious coping, and SCS-SF. Regression results were reported using unstandardized coefficients, standard errors, standardized beta coefficients, 95% confidence intervals, and p values. Model fit was evaluated using R^2, adjusted R^2, change in R^2, F change, and corresponding p values.

Moderation analyses were performed using the PROCESS macro for SPSS, version 5.0 [19]. PTGI was entered as the independent variable, PCL-5 or DASS-21 total score as the dependent variable, and either SCS-SF or BRS as the moderator. All moderation models were adjusted for age, gender, education, current residence, pre-earthquake psychiatric treatment, house loss, witnessing death during the earthquake, and loss of a close person. Heteroskedasticity-consistent standard errors were used. PTGI and moderator variables were mean-centered before analysis. Interaction effects were evaluated using the interaction coefficient, standard error, t value, 95% confidence interval, change in R^2, F value for change in R^2, and p value. Because four moderation models were tested, a Bonferroni-adjusted threshold of $p < 0.0125$ (0.05/4) was applied to the interaction terms; both significant interactions remained significant under this correction.

Missing data were handled using available-case analysis for descriptive statistics and bivariate correlations, and listwise deletion for multivariable regression and moderation analyses. A two-tailed p-value < 0.05 was considered statistically significant.

Use of AI-assisted technologies

During manuscript preparation, the author used ChatGPT (OpenAI) for language editing, improving readability, and adapting the manuscript to journal formatting requirements. The tool was not used to generate or analyze study data or to make scientific decisions. The author reviewed and edited all AI-assisted output and takes full responsibility for the final content.

Results

Participant characteristics

A total of 280 participants had valid data for the main sociodemographic variables. The mean age was 39.28 ± 14.49 years. Of the 273 participants with available gender data, 159 were female (58.2%) and 114 were male (41.8%). Most participants were married

(58.2%), employed (65.0%), and living with family members (90.0%). Regarding education, 45.9% were university graduates, 29.0% were high school graduates, 10.8% had completed middle school, and 14.3% had completed primary school.

Most participants were living in a house or apartment at the time of assessment (77.5%), whereas 22.5% were living in a tent or container. Pre-earthquake psychiatric treatment was reported by 11.1% of participants, post-earthquake psychiatric treatment by 21.4%, and current psychiatric treatment by 17.5%. Regarding earthquake-related exposures, 19.1% had been trapped under rubble, 60.4% had experienced house loss, 66.9% had witnessed deaths during the earthquake, 31.7% had sustained physical injuries, and 83.8% had lost a close person. These characteristics are summarized in Table 1.

Table 1
Sociodemographic, clinical, and earthquake-related characteristics of participants

Variable	n/N (%) or Mean ± SD
Age (years)	39.28 ± 14.49
Gender	
Female	159/273 (58.2%)
Male	114/273 (41.8%)
Education	
Primary school	40/279 (14.3%)
Middle school	30/279 (10.8%)
High school	81/279 (29.0%)
University	128/279 (45.9%)
Marital Status	
Married	163/280 (58.2%)
Single	104/280 (37.1%)
Divorced/Widowed	13/280 (4.6%)
Employment status	
Not employed	98/280 (35.0%)
Employed	182/280 (65.0%)
Living arrangement	
Living alone	28/280 (10.0%)
Living with family	252/280 (90.0%)
Current residence	
House/apartment	217/280 (77.5%)
Tent/container	63/280 (22.5%)
Pre-earthquake psychiatric treatment	31/280 (11.1%)
Post-earthquake psychiatric treatment	60/280 (21.4%)
Current psychiatric treatment	49/280 (17.5%)
Family psychiatric history	55/280 (19.6%)
Smoking	77/280 (27.5%)
Alcohol use	107/280 (38.2%)
Trapped under rubble	53/278 (19.1%)
House loss	168/278 (60.4%)
Witnessing death during the earthquake	186/278 (66.9%)
Physical injury during the earthquake	88/278 (31.7%)
Loss of a close person	233/278 (83.8%)

Bivariate correlations among main study variables

Spearman correlation analyses showed that PTGI was positively correlated with both PCL-5 scores and DASS-21 total scores, indicating that higher PTG was associated with greater posttraumatic stress symptoms and higher general psychological distress. PCL-5 was strongly and positively correlated with DASS-21 total scores.

Self-compassion showed significant negative correlations with PCL-5 and DASS-21 total scores. Similarly, resilience was negatively correlated with PCL-5 and DASS-21 total scores. Perceived social support was weakly and negatively correlated with DASS-21 total scores but was not significantly correlated with PCL-5. Positive religious coping was positively correlated with PCL-5, PTGI, and DASS-21 total scores. Negative religious coping was positively correlated with PCL-5 and DASS-21 total scores, but not significantly correlated with PTGI. The correlation results are presented in Table 2.

Table 2
Spearman correlations of key psychosocial variables with PCL-5, PTGI, and DASS-21 total scores

Variable	PCL-5, rho	p	PTGI, rho	p	DASS-21 total, rho	p
PTGI	.425	**< 0.001**	—	—	.282	**< 0.001**
MSPSS	−.062	0.300	.231	**< 0.001**	−.145	**0.016**
BRS	−.314	**< 0.001**	−.056	0.373	−.430	**< 0.001**
Brief RCOPE-P	.336	**< 0.001**	.233	**< 0.001**	.307	**< 0.001**
Brief RCOPE-N	.343	**< 0.001**	.078	0.209	.545	**< 0.001**
SCS-SF	−.472	**< 0.001**	−.085	0.159	−.610	**< 0.001**

PCL-5: PTSD Checklist for DSM-5; **PTGI**: Posttraumatic Growth Inventory; **DASS-21**: Depression Anxiety Stress Scales-21; **MSPSS**: Multidimensional Scale of Perceived Social Support; **BRS**: Brief Resilience Scale; **Brief RCOPE-P**: positive religious coping; **Brief RCOPE-N**: negative religious coping; **SCS-SF**: Self-Compassion Scale–Short Form.

Hierarchical regression analyses for PCL-5

In the hierarchical regression analysis with PCL-5 as the outcome, the first model, including sociodemographic and earthquake-related variables was significant and explained 13.1% of the variance. Adding PTGI in the second step significantly increased the explained variance to 25.4%. In the final model, after adding psychosocial resources and coping-related variables, the explained variance increased to 48.1%.

In the final PCL-5 model, higher PTGI remained independently and positively associated with PCL-5 scores. Pre-earthquake psychiatric treatment was also associated with higher PCL-5 scores. Higher perceived social support and higher self-compassion were associated with lower PCL-5 scores. Positive religious coping was positively associated with PCL-5 scores. Negative religious coping showed a negative coefficient in the fully adjusted model despite its positive bivariate correlation with PCL-5, suggesting a possible suppression effect rather than a protective association. Model summaries and significant final predictors are shown in Table 3.

Table 3
Hierarchical regression analyses for PCL-5 and DASS-21 total scores

Panel A. Model summary

Model	Outcome	Predictors entered	R^2	Adjusted R^2	ΔR^2	F change	p
1	**PCL-5**	Sociodemographic and earthquake-related variables	.131	.101	.131	4.355	**< 0.001**
2	**PCL-5**	Model 1 + PTGI	.254	.225	.124	38.360	**< 0.001**
3	**PCL-5**	Model 2 + psychosocial resources/coping variables	.481	.449	.227	19.759	**< 0.001**
1	**DASS-21 total**	Sociodemographic and earthquake-related variables	.192	.164	.192	6.843	**< 0.001**
2	**DASS-21 total**	Model 1 + PTGI	.218	.188	.027	7.840	**0.006**
3	**DASS-21 total**	Model 2 + psychosocial resources/coping variables	.511	.480	.293	26.931	**< 0.001**

Panel B. Significant predictors in the final models

Outcome	Predictor	B	SE	β	95% CI for B	p
PCL-5	Pre-earthquake psychiatric treatment	6.323	3.174	.101	0.068 to 12.578	**0.048**
PCL-5	PTGI	0.308	0.048	.339	0.214 to 0.402	**< 0.001**
PCL-5	MSPSS	−0.121	0.058	−.109	−0.235 to − 0.006	**0.038**
PCL-5	Brief RCOPE-P	0.680	0.176	.214	0.333 to 1.027	**< 0.001**
PCL-5	Brief RCOPE-N	−0.473	0.223	−.124	−0.913 to − 0.033	**0.035**
PCL-5	SCS-SF	−0.966	0.149	−.384	−1.260 to − 0.672	**< 0.001**
DASS-21 total	Pre-earthquake psychiatric treatment	10.967	4.389	.124	2.317 to 19.616	**0.013**
DASS-21 total	House loss	8.361	2.629	.162	3.180 to 13.542	**0.002**
DASS-21 total	Witnessing death during the earthquake	6.837	2.849	.127	1.222 to 12.451	**0.017**
DASS-21 total	PTGI	0.182	0.065	.144	0.055 to 0.310	**0.005**
DASS-21 total	MSPSS	−0.197	0.078	−.128	−0.352 to − 0.043	**0.013**
DASS-21 total	BRS	−0.698	0.265	−.140	−1.221 to − 0.175	**0.009**
DASS-21 total	Brief RCOPE-P	0.564	0.238	.128	0.094 to 1.033	**0.019**

Note. Panel A presents model summaries for the hierarchical regression analyses. Panel B shows only significant predictors from the final models.

PCL-5: PTSD Checklist for DSM-5; **DASS-21**: Depression Anxiety Stress Scales-21; **PTGI**: Posttraumatic Growth Inventory; **MSPSS**: Multidimensional Scale of Perceived Social Support; **BRS**: Brief Resilience Scale; **Brief RCOPE-P**: positive religious coping; **Brief RCOPE-N**: negative religious coping; **SCS-SF**: Self-Compassion Scale–Short Form; **R^2**: coefficient of determination; **adjusted R^2**: adjusted coefficient of determination; **ΔR^2**: change in R^2; **B**: unstandardized regression coefficient; **SE**: standard error; **β**: standardized regression coefficient; **CI**: confidence interval.

Panel A. Model summary							
Model	**Outcome**	**Predictors entered**	**R^2**	**Adjusted R^2**	**ΔR^2**	**F change**	**p**
DASS-21 total	SCS-SF	−1.254	0.202	−.359	−1.652 to − 0.856		**< 0.001**

Note. Panel A presents model summaries for the hierarchical regression analyses. Panel B shows only significant predictors from the final models.

PCL-5: PTSD Checklist for DSM-5; **DASS-21**: Depression Anxiety Stress Scales-21; **PTGI**: Posttraumatic Growth Inventory; **MSPSS**: Multidimensional Scale of Perceived Social Support; **BRS**: Brief Resilience Scale; **Brief RCOPE-P**: positive religious coping; **Brief RCOPE-N**: negative religious coping; **SCS-SF**: Self-Compassion Scale–Short Form; **R^2**: coefficient of determination; **adjusted R^2**: adjusted coefficient of determination; **ΔR^2**: change in R^2; **B**: unstandardized regression coefficient; **SE**: standard error; **β**: standardized regression coefficient; **CI**: confidence interval.

Hierarchical regression analyses for DASS-21 total scores

In the hierarchical regression analysis with DASS-21 total score as the outcome, the first model, including sociodemographic and earthquake-related variables was significant and explained 19.2% of the variance. Adding PTGI in the second step significantly increased the explained variance to 21.8%. In the final model, after adding psychosocial resources and coping-related variables, the explained variance increased to 51.1%.

In the final DASS-21 total model, pre-earthquake psychiatric treatment, house loss, witnessing death during the earthquake, PTGI, and positive religious coping were independently associated with higher DASS-21 total scores. In contrast, higher perceived social support, higher resilience, and higher self-compassion were independently associated with lower DASS-21 total scores. These findings indicate that house loss and witnessing death were more strongly associated with general psychological distress than with posttraumatic stress symptoms after full adjustment. The regression results are summarized in Table 3.

Moderation analyses

Moderation analyses were conducted to examine whether self-compassion and resilience moderated the association between PTGI and psychological symptoms. Self-compassion did not significantly moderate the association between PTGI and PCL-5. However, self-compassion significantly moderated the association between PTGI and DASS-21 total scores. The negative interaction coefficient indicated that the positive association between PTGI and general psychological distress became weaker at higher levels of self-compassion.

Similarly, resilience did not significantly moderate the association between PTGI and PCL-5. However, resilience significantly moderated the association between PTGI and DASS-21 total scores. The association between PTGI and DASS-21 total scores was significant at low and moderate levels of resilience but became non-significant at higher resilience levels. These findings indicate that the PTG–general distress association was weaker at higher levels of self-compassion and resilience, whereas the PTG–PTSD symptom association was not moderated. Moderation estimates and conditional effects are presented in Table 4 and illustrated in Fig. 1.

Table 4
Moderation of posttraumatic growth–symptom associations by self-compassion and resilience

Panel A. Moderating (interaction) effects

Outcome	Moderator	Interaction term	B	SE	t	95% CI	ΔR²	F for interaction	p	N
PCL-5	Self-compassion (SCS-SF)	PTGI × SCS-SF	0.0044	0.0058	0.755	−0.0071 to 0.0159	0.0012	0.5693	0.451	264
DASS-21 total	Self-compassion (SCS-SF)	PTGI × SCS-SF	−0.0315	0.0075	−4.200	−0.0463 to −0.0167	0.0244	17.6420	**< 0.001**	263
PCL-5	Resilience (BRS)	PTGI × BRS	−0.0046	0.0076	−0.605	−0.0195 to 0.0103	0.0007	0.3664	0.546	245
DASS-21 total	Resilience (BRS)	PTGI × BRS	−0.0406	0.0130	−3.123	−0.0662 to −0.0150	0.0296	9.7503	**0.002**	244

Panel B. Conditional effect of PTGI on DASS-21 total at levels of the moderator

Outcome	Moderator	Moderator level	Effect of PTGI	SE	t	95% CI	p
DASS-21 total	Self-compassion (SCS-SF)	Low (16th pctile)	0.6679	0.1055	6.3321	0.4602 to 0.8756	**< 0.001**
DASS-21 total	Self-compassion (SCS-SF)	Moderate (50th pctile)	0.4789	0.0725	6.6068	0.3362 to 0.6217	**< 0.001**
DASS-21 total	Self-compassion (SCS-SF)	High (84th pctile)	0.1954	0.0636	3.0750	0.0703 to 0.3206	**0.002**
DASS-21 total	Resilience (BRS)	Low (16th pctile)	0.4725	0.1286	3.6737	0.2191 to 0.7260	**< 0.001**
DASS-21 total	Resilience (BRS)	Moderate (50th pctile)	0.3509	0.0976	3.5966	0.1587 to 0.5431	**< 0.001**
DASS-21 total	Resilience (BRS)	High (84th pctile)	0.0670	0.0702	0.9538	−0.0714 to 0.2053	0.341

Note: Model 1. PTGI was the independent variable; PCL-5 and DASS-21 total score were the dependent variables; SCS-SF (self-compassion) and BRS (resilience) were tested as moderators in separate models. Heteroskedasticity-consistent (HC3) standard errors were used, and PTGI and the moderators were mean-centered prior to analysis.

All models were adjusted for age, gender, education, current residence, pre-earthquake psychiatric treatment, house loss, witnessing death during the earthquake, and loss of a close person.

Sample size differs across models owing to listwise deletion of missing data. Conditional effects (Panel B) are reported at the 16th, 50th, and 84th percentiles of the moderator (PROCESS default) and are shown only for models with a statistically significant interaction; the PTGI × moderator interactions on PCL-5 were non-significant and therefore not probed.

Significant p values ($p < 0.05$) are shown in bold. **CI**: confidence interval; **PTGI**: Posttraumatic Growth Inventory; **PCL-5**: PTSD Checklist for DSM-5; **DASS-21**: Depression Anxiety Stress Scales-21; **SCS-SF**: Self-Compassion Scale–Short Form; **BRS**: Brief Resilience Scale.

Discussion

In this cross-sectional study of survivors of the 2023 Kahramanmaraş earthquakes assessed approximately three years after the disaster, PTG was positively associated with both PTSD symptoms and general psychological distress. In the hierarchical regression model, PTGI remained independently and positively associated with PCL-5 after adjustment for sociodemographic, earthquake-

related, and psychosocial variables. This finding supports the view that PTG should not be interpreted as the opposite of psychopathology or as a simple marker of recovery.

Perceived growth can instead accompany persistent trauma-specific symptoms, especially among survivors who continue to struggle cognitively and emotionally with the event. Previous earthquake studies report the same pattern, with PTSD symptoms and PTG co-occurring and greater PTSD severity tracking higher PTG scores. In Wenchuan earthquake survivors, PTSD symptom severity was positively associated with PTG, and PTSD with moderate PTG coexisted in nearly one-fifth of survivors; similarly, PTSD symptoms, particularly intrusion and hyperarousal, were reported as predictors of PTG one year after the Sichuan earthquake [3, 20]. Person-centered studies have also identified subgroups characterized by both high PTSD and high PTG among earthquake survivors, further supporting the coexistence model [21, 22].

Mechanistically, this pattern may reflect that PTG is not generated by trauma exposure alone, but by the cognitive and emotional struggle that follows trauma. Intrusive memories, hyperarousal, and trauma-related emotional activation may promote repeated cognitive processing, meaning-making, and reappraisal of life priorities. These processes may increase perceived growth, while persistent trauma-specific symptoms indicate that such growth does not necessarily imply psychological recovery. Network evidence also supports this interpretation by showing that posttraumatic stress symptoms and PTG may be connected through bridge nodes such as changed priorities, stronger religious faith, and being easily startled [4]. Longitudinal evidence from older disaster survivors further suggests an inverse U-shaped association, in which moderate levels of posttraumatic stress may be more strongly related to PTG than either very low or very high symptom levels [23].

The PTGI may also capture perceived rather than actual positive change. Because it asks survivors to retrospectively evaluate how much they have changed as a result of the earthquake, PTGI scores may not necessarily correspond to prospectively measured change. In a prospective study, self-reported PTG was largely unrelated to measured pre- to post-trauma change, and perceived growth predicted increased distress, whereas actual growth predicted decreased distress [24]. Methodological reviews have similarly emphasized that retrospective, cross-sectional PTG reports may be influenced by self-enhancement, coping, and meaning-making processes [25]. From this perspective, the positive PTG–symptom association observed in the present study may reflect the coexistence of perceived growth with ongoing cognitive and emotional processing rather than recovery itself. This interpretation is also consistent with evidence linking rumination to PTG in earthquake survivors [26] and showing that PTG may accompany inadequate disaster recovery rather than offset it [27].

The positive association between PTGI and DASS-21 total scores extends this coexistence pattern beyond trauma-specific symptoms to broader emotional distress. In our sample, higher perceived growth was accompanied not only by higher PCL-5 scores but also by greater depressive, anxious, and stress-related symptoms. Previous earthquake research has similarly suggested that depressive distress and PTSD symptoms may coexist with, or contribute to, perceived growth [28, 29]. Clinically, this finding suggests that higher PTG should not be assumed to indicate recovery, because perceived growth may coexist with clinically relevant emotional suffering.

Self-compassion and resilience both moderated the association between PTGI and general psychological distress. Specifically, the positive association between PTGI and DASS-21 total scores was strongest among survivors with lower self-compassion or resilience and became weaker at higher levels of these psychological resources. Thus, survivors with higher self-compassion or resilience may still report PTG, but this appears to be less closely linked to depressive, anxious, and stress-related symptoms.

This interpretation is consistent with trauma research showing that self-compassion may shape posttraumatic adjustment beyond its direct association with lower distress. In a three-wave study of adolescents after the Jiuzhaigou earthquake, positive self-compassion prospectively predicted lower PTSD and higher PTG, whereas negative self-compassion predicted later PTSD [30]. Similarly, a recent study of trauma-exposed adults found that self-compassion moderated the relationship between posttraumatic symptoms and PTG, suggesting that self-compassion may support adaptive growth even in the presence of distress [31].

Importantly, neither self-compassion nor resilience significantly moderated the association between PTGI and PCL-5. This distinction suggests that these intrapersonal resources may primarily buffer general emotional distress rather than the trauma-specific symptom processes linked to intrusive memories, avoidance, negative trauma-related cognitions, and hyperarousal. These findings suggest that self-compassion and resilience may be particularly relevant to general emotional distress and warrant further evaluation in longitudinal and intervention studies.

Resilience showed a similar but somewhat less robust protective pattern. Higher resilience was independently associated with lower DASS-21 total scores and moderated the PTGI–DASS relationship, but it was not an independent predictor of PCL-5 in the final model. Resilience therefore appears tied more to the regulation of general distress than to the trauma-specific processes linked with PTG. This is consistent with evidence from the Jiuzhaigou earthquake suggesting that resilience was associated with lower PTSD symptoms indirectly through lower anxiety and depression [32]. Among Türkiye earthquake survivors, resilience has also been associated with higher PTG and lower posttraumatic depreciation [33].

Perceived social support showed a modest but significant protective association in the final models. Although its bivariate association with PCL-5 was weak and non-significant, higher perceived social support was independently associated with lower PCL-5 and DASS-21 total scores after adjustment for sociodemographic, earthquake-related, and psychosocial variables. Social support thus shows no strong, simple link with trauma-specific symptoms but appears to lower overall symptom burden within a broader psychosocial context. Wenchuan earthquake studies provide complementary support for this interpretation, linking perceived social support with higher PTG and suggesting that its role in posttraumatic adaptation may involve coping- and rumination-related processes [26, 34, 35].

The findings regarding religious coping require cautious interpretation. Positive religious coping was positively associated with PCL-5 and DASS-21 total scores in the adjusted models. This should not be interpreted as evidence that positive religious coping is harmful; rather, survivors with greater trauma-related symptoms and emotional distress may be more likely to turn to religion as a culturally available source of comfort and meaning-making. This interpretation is supported by recent evidence from Kahramanmaraş earthquake survivors with chronic diseases, in whom higher trauma levels were associated with higher positive religious coping, whereas negative religious coping was not significantly related to trauma levels [36]. Similarly, among women exposed to the 2023 Syrian earthquake, positive religious coping was positively associated with PTSD [37]. Network evidence from Wenchuan earthquake survivors and findings from a trauma-exposed Muslim sample further suggest that religious meaning and coping may be linked to PTG and may function as part of posttraumatic meaning-making processes [4, 10]. However, coping-focused evidence after the Kahramanmaraş earthquakes indicates that religious coping–PTSD associations are small and heterogeneous, suggesting that religious coping should not be interpreted as uniformly protective across samples [9].

Negative religious coping showed a more clearly distress-related but statistically complex pattern. At the bivariate level, it was positively correlated with both PCL-5 and DASS-21 total scores, consistent with the view that spiritual struggle, punishment beliefs, or religious discontent may accompany greater psychological distress. This is supported by evidence from women exposed to the 2023 Syrian earthquake, in which negative religious coping was strongly associated with PTSD, depression, and anxiety [37], and by Turkish data showing that higher negative religious coping was associated with lower resilience among women earthquake survivors living in temporary shelters [38]. However, in the fully adjusted PCL-5 model, the coefficient changed direction. Given its overlap with positive religious coping, self-compassion, and other distress-related variables, this reversal is best interpreted as a possible suppression effect rather than as evidence of a protective association. Therefore, the bivariate and multivariable findings should be interpreted together, with emphasis on the instability of the unique adjusted effect.

Disaster-related variables also yielded clinically meaningful findings. Pre-earthquake psychiatric treatment history was associated with greater symptom burden, supporting the role of premorbid psychiatric vulnerability in long-term post-disaster adjustment. This finding is consistent with evidence from Hatay temporary shelter areas, where pre-existing psychiatric diagnosis was identified as a significant PTSD risk factor among earthquake survivors [2]. House loss and witnessing death were more strongly associated with general psychological distress than with PCL-5 after full adjustment. This may reflect that disaster-related losses are not only acute traumatic exposures but also persistent stressors involving displacement, economic insecurity, disruption of daily routines, grief, and loss of perceived safety. Long-term evidence from Wenchuan earthquake survivors similarly indicates that inadequate livelihood and social ties recovery are associated with higher PTSD and depressive symptoms [27]. Earlier Sichuan earthquake research also highlights the relevance of housing status, exposure level, income, and social support for post-disaster depression severity [39].

These findings have several clinical implications. First, long-term post-disaster follow-up should assess both negative and positive posttraumatic responses. Focusing only on PTSD symptoms may overlook adaptive resources, whereas interpreting PTG as a marker of recovery may underestimate persistent distress. Second, survivors reporting high PTG should still be evaluated for PTSD symptoms, depression, anxiety, and functional impairment. Future intervention studies could examine whether combining symptom-

focused treatment with approaches targeting self-compassion, resilience, and social connectedness improves longer-term adjustment.

Several limitations should be acknowledged. The cross-sectional design precludes causal inference, and the direction of associations between PTG and symptoms cannot be determined. The non-probability convenience sample may limit representativeness. Psychological variables were assessed using self-report measures and do not establish clinical diagnoses. Relevant mechanisms such as rumination, shame, guilt, sleep disturbance, functional impairment, and ongoing socioeconomic stressors were not assessed. The PTGI captures retrospectively perceived growth rather than measured change, so the growth reported here need not reflect actual positive change. Internal consistency could not be computed because the dataset included composite scale scores rather than item-level responses; however, all instruments were administered in validated Turkish versions. Finally, findings may not generalize to all earthquake survivors, particularly those with severe psychiatric illness, those who migrated from the region, or those with limited access to care.

Conclusions

This study shows that PTG, PTSD symptoms, and general psychological distress can coexist approximately three years after the 2023 Kahramanmaraş earthquakes. Higher PTG was independently associated with greater PTSD symptoms and general distress, so perceived growth should not be read as a straightforward sign of recovery. Self-compassion and resilience moderated the association between PTG and general distress, but not the association between PTG and PTSD symptoms, suggesting that these resources may be more relevant to general emotional distress than to trauma-specific symptom processes. These findings highlight the need for long-term post-disaster mental health programs that address both persistent symptoms and modifiable psychological resources.

Abbreviations

BRS
Brief Resilience Scale
DASS-21
Depression Anxiety Stress Scales-21
MSPSS
Multidimensional Scale of Perceived Social Support
PCL-5
PTSD Checklist for DSM-5
PTG
Posttraumatic growth
PTGI
Posttraumatic Growth Inventory
PTSD
Posttraumatic stress disorder
SCS-SF
Self-Compassion Scale–Short Form

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Ümraniye Training and Research Hospital (Approval No: 311, Date: 11.09.2025). All participants were informed of the study's purpose and procedures, and written informed consent was obtained from each participant prior to participation.

Consent for publication

Not applicable.

Competing interests

The author declares that she has no competing interests.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. No funding body played any role in the design of the study, in the collection, analysis, or interpretation of data, or in writing the manuscript.

Author Contribution

S.C.H. is the sole author. S.C.H. conceived and designed the study, acquired and curated the data, performed the statistical analysis, interpreted the findings, drafted and critically revised the manuscript, and read and approved the final manuscript.

Acknowledgement

The author thanks all the earthquake survivors who generously gave their time to take part in this study.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available because they contain information that could compromise the privacy of the earthquake survivors who took part, but are available from the corresponding author on reasonable request in de-identified form.

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Figures

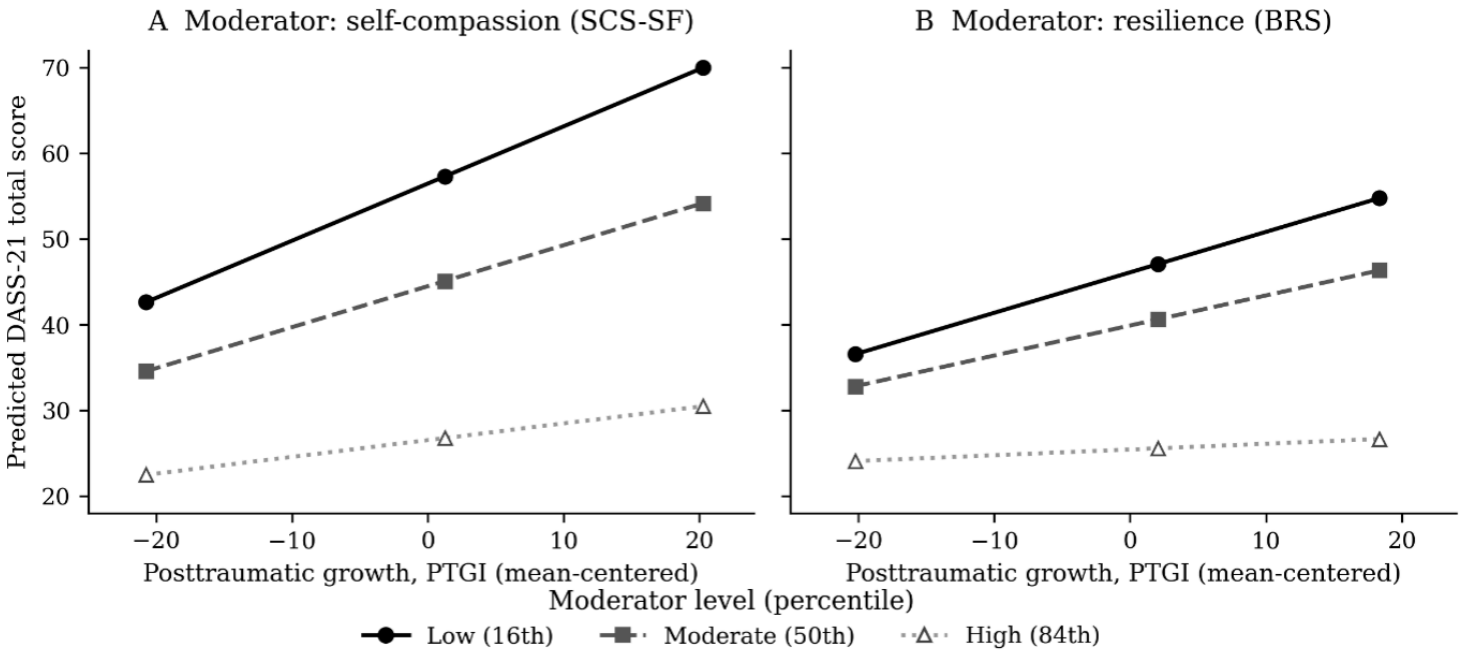


Figure 1

Conditional effects of posttraumatic growth on psychological distress by self-compassion and resilience. Predicted DASS-21 total scores are shown across mean-centered PTGI values at low, moderate, and high levels of the moderators, corresponding to the 16th, 50th, and 84th percentiles. Panel A shows the moderating effect of self-compassion (SCS-SF), and Panel B shows the moderating effect of resilience (BRS). All models were adjusted for age, gender, education, current residence, pre-earthquake psychiatric treatment, house loss, witnessing death during the earthquake, and loss of a close person.