

Original Research

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Latent Profiles of Posttraumatic Growth: 17 years After the Bam Earthquake in Iran

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Abstract

Objective: Posttraumatic growth (PTG) is a positive psychological change after challenging life events. The purpose of this study was to investigate the effects of positive and long-term psychological changes in people who experienced the Bam earthquake.

Methods: A total of 916 adolescents were surveyed 17 years after the earthquake. Self-report questionnaires were administered to participants. A latent profile analysis (LPA) was conducted to extract the subgroups of adults.

Results: The LPA identified 5 meaningful profiles that were characterized based on the pattern of PTG dimensions. The common profile was profile, which perceived very low “relating to others” dimension and medium for other PTG dimensions. Also, the results showed significant differences among gender and age and nonsignificant differences in marital status and education level among the profiles of PTG.

Conclusions: For stressful situations, the different dimensions of PTG change indirectly in every person. In Bam, some patterns are seen according to PTG after 17 y. Among these dimensions, the part of “relating to others”, has the greatest change. Another conclusion is that according to a relatively high profile for 5 clusters, it seems the impact of 17 y should be less on PTG as the number of extractive patterns is approximately high for the case.

According to the United Nations Office for the Coordination of Humanitarian Affairs, Iran is a disaster-prone country, is dealing with a very wide range of natural disasters, and is exposed to various types of those every year.¹ The Bam earthquake occurred on Friday December 26, 2003, in this historical city and affected a population of 97,000. The earthquake with a magnitude of 6.3 on the Richter scale led to the death of 25,000 and the injury of 50,000 people.² Following the Bam earthquake, more than 30,000 residential and commercial units, many government buildings, and 2 hospitals were partially or completely collapsed.²

Natural disasters such as earthquake not only cause financial loss and fatalities but also induce psychological damage.^{3–5} These disasters are considered a great source of stress for the survivors and leave long-term negative psychological consequences, including depression, anxiety, and posttraumatic stress disorder. Posttraumatic stress disorder is one of the most important and common mental health problems,^{6,7} which occurs in response to a stressful and hazardous event.⁸ It is characterized by re-experiencing the memories or feelings of trauma or attempts to avoid them, as well as avoiding environmental reminders even related to them.⁹

Traditionally, most of the research has been focused on the negative consequences of traumatic events, such as posttraumatic stress disorder.^{10,11} But in recent years, according to the theoretical framework of positive psychology, which considers health as a continuum from positive to (lack of) negative results, researchers have also drawn attention to positive consequences,¹² since human beings are active, growth-oriented organisms and tend to mix their psychological experiences into a fused sense of self.¹³ These positive psychological changes, which have produced an unused perception of life after stressful life events, is called posttraumatic growth (PTG)¹⁴ and is suggested as a common and representative result after natural disasters.^{15,16} Unlike psychological resilience, which refers to the ability to maintain the levels of psychological well-being after continuing a traumatic event, PTG refers to positive psychological changes and growth further than previous levels of performance due to the challenging crises of life, which through cognitive reconstruction, lead to adaptation to the new reality.¹⁷

When confronting life-threatening events, through struggling with traumatic experiences, traumatized survivors re-assess their goals and priorities; therefore, positive changes following

the trauma focus on the five aspects: “Recognizing Personal Strength” occurs when a greater sense of self-reliance is recognized; “Finding Unknown Possibilities and Opportunities” is experienced when people improve a new path that would have not been available if they did not experience the life emergency in the first place; The “Experiencing Positive Changes in Relationships” domain involves developing a greater sense of kindness or closeness to others; “Appreciation of Life” simultaneously appears to possess a greater appreciation for each new day of life; and finally the “Spiritual and Existential Change” domain indicates personal growth associated with a far better understanding of spiritual issues and, then, developing a greater sense of harmony with the planet.^{18–20}

Previous studies have shown that PTG can occur for a long time after disasters as well as after chronic diseases.^{21,22} Previous studies also have demonstrated that PTG changes for a long time after an event such as an earthquake.²¹ However, there are several gaps in this topic. First, there is no study to examine the association between PTG and an extended period of time after an earthquake in Iran. Second, in the previous study, often the PTG changes after long exposure to an earthquake are reported by the total score of PTG without the PTG dimensions or each dimension of the PTG was considered as an independent variable, while the PTG dimensions occur simultaneously in individuals who experience a stressful event.²³ Thus, using the person-centered approach such as latent profile analysis (LPA) considers overlapping the PTG dimensions and present PTG patterns. LPA is an appropriate method for determining and evaluating different patterns of PTG based on its various dimensions. The basic premise of this analysis method is that individuals of a heterogeneous population can be grouped into subgroups that indicate certain characteristics. In other words, LPA would minimize the intra-class variances and maximize the variances between the subgroups.²⁴ On other hand, this method can be justified by investigating the nature of PTG. One such way is a positive change in schemas about ourselves and the world, and the other is developing an avoidance defense that could prevent any attempts to cope with injuries.²⁵ Therefore, PTG contains structural and self-deceptive aspects, the structural aspect of which is related to greater compatibility and fewer symptoms of PTSD, whereas the self-deceptive nature is a cognitive defense that increases the experience with PTSD symptoms, PTG, according to the self-deceptive aspect, may indicate a coping technique of diversion—a positive skewed belief. This is not always linked to posttraumatic stress symptoms. Rather, it could be linked to concepts such as optimism, self-consolidation, and palliation.²⁶ Paying attention to this issue is effective in the detailed examination and long-term explanation of the subject of the present research. The previous study¹⁵ showed that most adolescents, 1 y after the Wenchuan earthquake, were categorized in the high PTG group (76.9%), which was characterized by initially higher and, subsequently, increasing PTG.

Finally, considering that the changes caused by PTG are often cognitive, the issue that has been less addressed so far is the long-term examination of such changes in people. The literature review represented that few studies have investigated the long-term effects of events such as earthquakes on this issue, and most of these works have covered a period of 1 to 10 y.²⁷ In comparison with short-term unstable effects, long-term exposure has considerably greater effects.²⁸

The Current Study

About the mentioned gaps above, the present research examined, by LPA, the patterns of PTG in exposed people, 17 y after the

Bam earthquake, compared with nonexposed people and also investigated the association between the extracted patterns and socio-demographic variables.

Methods

In 2003, a severe earthquake in Bam in southeast Iran in December occurred. Our data, 17 y after the Bam earthquake have been collected from a historical cohort study. The multi-stage cluster sampling method was used to collect data, the number of clusters was 45 and the number of participants was 917. Subjects were examined in 2 groups of exposed and unexposed. The exposed group included people who were in Bam or Barwat at the time of the earthquake on December 26, 2003, and the basis for joining the unexposed group was that they had lived in Bam for a maximum of 2 y after the earthquake and had been living in Bam until the study (with the aim of relative similarity in terms of understanding the cultural context of life in Bam).

To eliminate the evaluation bias of the results, in addition to age and sex, level of education, occupation, location at the time of the earthquake, the severity of possible PTSD, questions about substance use before the earthquake, age and marital status, substance use in first-degree relatives were asked. Neutralizing the memory bias, people with mental illness who were unable to concentrate and respond were excluded from the study. Because the study was a historical cohort study, there was no follow-up bias. In referring to the cluster, each adult was randomly selected according to the inclusion criteria. After greeting the adult and stating the objectives of the study, each adult was asked to complete the questionnaire on their own; if they agreed, they completed the questionnaire without adding their name in the box on the form. In the case of illiteracy, the questionnaire was completed by the interviewer. The protocol of the study was approved by The Ethics Committee of Kerman University of Medical Sciences (approval no. IR.KMU.REC.1398.404).

The measures used include the following.

Exposure and Demographic Variables

To examine people's exposure, the following question was asked at the beginning of the questionnaire: “Were you in Bam or Barwat at the time of the earthquake on December 26, 2003?” If the answer was no, they were asked “Since when did you live in Bam?”

At the end of the questionnaire, in addition to demographic questions, questions were asked about deaths of first-degree relatives in the earthquake.

PTGI-SF

A Persian version of the short-form PTG inventory approved by Amiri et al. 2020 was used to measure PTG.²⁹ The questionnaire consists of 10 questions in 5 subscales (relating to others, new possibilities, personal strength, spiritual change, appreciation of life), in each subscale of 2 questions. A 6-point Likert is used for scoring.

An LPA was conducted to extract the subgroups of adults who were residents of Bam in Iran. Initially, we ran several latent profile models, with the beginning of 2 latent profile model to 7 latent profile. To obtain optimal profiles, we used data from model fit indexes in combination with empirical evidence and interpretability. The fit indexes used were the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC),³⁰ Sample Size Adjusted Bayesian Information Criterion (aBIC),³¹ and Bootstrapping

Table 1. Descriptive statistics for the study variables in sample

	Total
Total PTG	27.5 ± 8.1
PTG dimensions	
Relating to others	4.9 ± 1.7
New possibilities	4.6 ± 1.5
Personal strength	4.7 ± 1.6
Spiritual change	3.9 ± 1.8
Appreciation of life	4.9 ± 1.6
Gender	
Male	268 (43.37)
Female	350 (56.63)
Marital Status	
Single	104 (16.77)
Married	516 (83.23)
Education	
Less than college	485 (78.73)
College	131 (21.27)
Death relative	
Yes	463 (75.41)
No	151 (24.59)
Age	46.7 ± 12.7
PTSD	8.1 ± 3.2

Likelihood Ratio Test (BLRT). Low BIC, AIC, and aBIC values show a better model fit. Nylund et al., in a simulation study, showed that aBIC is a superior index compared with BIC and AIC.³² A significant BLRT *P*-value indicates that the latent profile model with *k* profiles was better than the simpler *k*-1 profile model. Also, the entropy value (0-1) was considered to assess the quality of the classification of individuals into profiles, and values closer to 1 showed more desirable classification.³³ Finally, the associations between the identified profiles and the independent variables were examined by analysis of variance (ANOVA) and chi-squared tests. All data analyses were performed using Mplus 7.4,³⁴ and missing data were treated using the full information maximum likelihood.

Results

Descriptive statistics for the study variables in sample is showed in Table 1. A succession of 2 through 6 latent profiles was extracted across the PTG domains. Model fit statistics for each latent model were presented in Table 2. Although there are reductions in BIC, aBIC, and AIC in the succession of 2 through 6 latent profile models, the LMR-LRT indicated that a 6-class model did not significantly improve in fit over the 5-profile model; therefore, with regard to the more parsimonious 5-class model, it was selected as the best fit to the data. The entropy of all latent profile models was acceptable and high.

Latent profiles were characterized based on the pattern of scores of PTG dimensions (Figure 1). Profile 1, consisting of approximately 48.1% of the sample, reported the lowest score of all PTG dimensions and called low PTG. Profile 2, consisting of approximately 26% of the sample that reported a medium score “relating to others” and low for other PTG dimensions. Profile 3, consisting of approximately 5% of the study sample that reported

a high score of all PTG dimensions and called high PTG. Profile 4, consisting of approximately 6% of the study sample that reported a low score of “relating to others” and the highest score for other PTG dimensions. Profile 5, consisting of approximately 15% of the study sample that reported a low score of “relating to others” dimension and medium for other PTG dimensions.

The association of latent profiles with total PTG, gender, marital status, education, death of relative, age, and PTSD are shown in Table 3. The total PTG score was varied in the 5 latent PTG profiles ($\chi^2 = 612.0$; $P < 0.001$); profile 4 had the lowest total PTG scores; and profile 1 had the highest total PTG scores. Mean PTSD varied significantly among the 5 PTGs, and participants of profile 2 reported significantly lower PTSD than the other profiles. The relationships of other variables such as marital status and education level, gender, death of relatives, and age were not significant with the profiles of PTG ($P > 0.05$) (Table 3).

Discussion

This is the first study that examines the latent profiles of PTG among 917 survivors in the Bam earthquake after 17 y. To assess PTG profiles, a person-centered approach was used. Among the adolescents following exposure to the Bam earthquake, the model with 5 profiles showed a better fit than other latent profiles. This result was supported by the findings of the previous study among adults suggesting that there were 5 significant profiles of PTG in a sample consisting of women.³⁵ In our study, profile 1, consisting of approximately 23% of the population, perceived medium PTG dimensions. Also, profile 2, consisting of approximately 20% of the population, perceived very low “relating to others” dimension, and medium to upper for other PTG dimensions. Profile 3, consisting of approximately 39% of the study population, perceived very low “relating to others” dimension and medium for other PTG dimensions. Profile 4, consisting of approximately 7% of the study population, perceived high PTG dimensions.

Profile 5, consisting of approximately 11% of the study population, perceived very low “relating to others” dimension and high for other PTG dimensions. According to these profiles, the prevalence of PTG has been supported by previous studies. Jin et al.³⁶ measured 51.1% prevalence for PTG among the participants. They also reported a positive association between PTG and PTSD and concluded that PTG occurs when the trauma is upsetting enough to promote engagement in a positive outlook about the event, but taking care of the survivors is not too difficult. Those findings suggest that PTG and PTSD possibly have a shared psychological “engine” that sets them in motion. Hence, from this perspective, PTG may reflect a cognitive adjustment process among those who develop PTSD in response to a disaster (a positive reinterpretation).

Although the present work was not aimed to investigate the correlation between PTSD and PTG, considering the explained nature of PTG and that the changes caused by PTG are mainly cognitive and the point that results of the previous research by Rzeszutek and Gruszczyńska³⁷ revealed these people have an innate motivation for positive growth and look for different ways to achieve positive results in the face of harm and injury. It can be concluded that positive changes in disaster exposure have long-term implications. Also, for all profiles, the percentage reporting “yes” for death was relatively higher than “no.” One potential explanation is that most of the Iranian believing in Islam normally hold strong religious beliefs and are inspired by them, which might develop

Table 2. Fit statistics of the LPA

N class	AIC	BIC	aBIC	LMR	BLRT	Entropy
2 class	10885.4	10956.3	10905.5	1121.3***	1150.3***	0.95
3 class	10620.5	10717.9	10648.1	269.9***	276.9***	0.896
4 class	10183.06	10307.1	10218.2	438.1	449.4***	0.944
5 class	9965	10115.6	10007.6	224.2***	230.0***	0.914
6 class	9808.1	9985.3	9858.3	164.5	168.8***	0.92

Note: The bolded solution was determined to be the final model.
 ***P-value < 0.001.

Table 3. Exposure with the Bam earthquake and other independent variables across Latent Profiles of PTG

	Profile1 (48.1%)	Profile2 (26.0%)	Profile3 (4.8%)	Profile4 (5.8%)	Profile5 (15.3%)	Test Statistics	Groups comparison
Total PTG	23.5 ± 3.8	24.4 ± 2.6	43.6 ± 6.4	48.3 ± 3	32.6 ± 3.6	612.0 ^{2***}	4>3>5>2>1
Gender						5.2 ^a	NA ^c
Male	129(43.43)	76(47.5)	11(36.67)	10(27.78)	42(44.21)	3.0	NA
Female	168(56.57)	84(52.5)	19(63.33)	26(72.22)	53(55.79)	2.2	NA
Marital status						7.3 ^a	NA
Single	42(14.09)	36(22.36)	6(20)	8(22.22)	12(12.63)	6.1	NA
Married	256(85.91)	125(77.64)	24(80)	28(77.78)	83(87.37)	1.2	NA
Education						1.6 ^a	NA
Less than college	237(79.8)	125(78.62)	21(70)	28(77.78)	74(78.72)	0.3	NA
College	60(20.2)	34(21.38)	9(30)	8(22.22)	20(21.28)	1.3	NA
Death of relative						7.4 ^a	NA
Yes	223(75.59)	129(81.13)	23(76.67)	23(63.89)	65(69.15)	1.8	NA
No	72(24.41)	30(18.87)	7(23.33)	13(36.11)	29(30.85)	5.6	NA
Age	46.7 ± 12.1	48 ± 14.6	45.3 ± 10.2	43.5 ± 11	46.6 ± 12.2	1.1 ^b	NA
PTSD	8.4 ± 3.1	7.1 ± 3.2	9.0 ± 3.6	8.7 ± 2.5	8.4 ± 2.9	6.3 ^{2**}	1>2; 3>2; 5>2

Note: ANOVA Test for continues variables and chi-squared test for categorical variables.
^aChi-squared test with freedom degree 4;
^bF test for ANOVA;
^cNot applicable.
 **P-value < 0.01.
 ***P-value < 0.001.

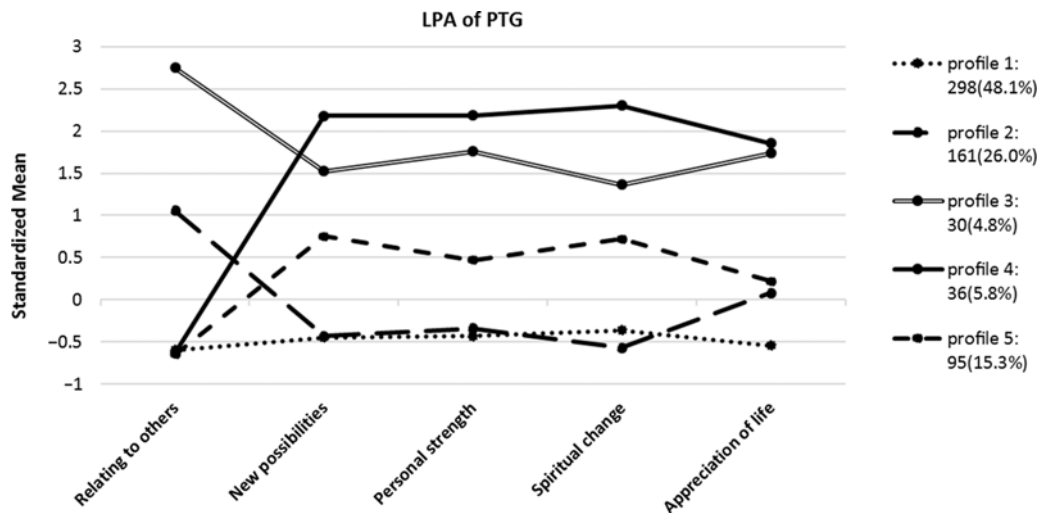


Figure 1. Standardized mean scores for each PTG domain among the 5 profiles of exposed people with the Bam earthquake after 17 y.

benefits following a disaster, contribute to their positive attitude following a disaster or negative life events, and create new frontiers for them. This has been proven by various studies.³⁸

Another result of this study is that the part of “relating to others” has the greatest change of all dimensions. Real life-changing discomfort can produce the loss and further the destruction of relationships.¹³ Previous studies have shown that social support, coping styles, and personality affect relating to others.^{13,39,40} Anyway, different reasons can change this dimension through these years for people. So, this needs to be surveyed in future research.

Another finding of this study was that, for all profiles, the percentage of females was higher. This result was in agreement with that of other studies.^{16,37,41} Wang et al.⁴² claimed that women, in terms of family and friends, receive more emotional support than men because their perception of emotion is more sensitive, they have closer relationships with others and they may be more willing or better able to express their personal growth experiences, which would result in long-term positive psychological adjustment. Also, these results showed the opposite association with some of the prior studies.^{43,44} According to their results, these differences may be partly due to cultural factors. This is because females in traditional societies such as China and Iran have a greater emotional attachment to their families than males.

Another interesting finding in the current study was that mean age significantly varied among the five PTGs, and participants of profile 5 were significantly younger than those in the other profiles. Our result was similar to several previous studies^{44,45} but was different from the one by Zhou et al.,¹³ which found that PTG scores were significantly higher for the older people. Adolescents, which include older people, in their study were 12-19 y old. Therefore, older people are equivalent to younger people in our study. So, although the results of these 2 works seem to contradict each other, a deeper investigation would represent that the results confirmed each other. Considering this explanation and that adolescents had an unrestricted age range may explain the significant differences in cognitive and emotional regulation capacities by age, younger adolescents in the study had established more pliable cognitive schemata in the long-term that may be challenged positively when faced with an uncontrollable traumatic event and cause the individual to perceive more distress. This is the reason younger individuals might be more likely to experience the growth of PTG in the wake of traumatic events.

In addition, we found that, in terms of trauma exposure, non-significant differences were found in marital status and education level among the 5 profiles of PTG. This finding was inconsistent with several previous studies.^{27,38,46} When interpreting this finding, one possible explanation could be that, in long-term exposure, these dependent variables do not make a significant difference in cognitive beliefs.

The present study had several limitations, including the cross-sectional design for the study, which could not explain causation, and the self-reported scale for PTG, which needs to be validated using data from clinical interviews. The study was also conducted with a sample of adolescents after the Bam earthquake in Iran, which could have reduced the generalizability of the finding to other people with other traumatic experiences. Considering that the sample of this study was selected from 1 city, it should be generalized to other cultures with caution. Therefore, future studies should be more varied in terms of sample selection.

The main limitation of this study is that other environmental variables were not considered, including family or social support that can be very effective.

Conclusions

For stressful situations, like an earthquake, the different dimensions of PTG change indirectly in every person. As a special example, in an earthquake in Bam, Iran, some patterns are seen according to PTG after 17 y. Among these dimensions, the part of “relating to others” has the greatest change of all. As a whole, among all these 5 patterns of the participants, all the scores of these PTG patterns were approximately the same in clustered people except for the “relating to others” part. This finding means this part may have been changing through these years for people and different reasons. So, this needs to be surveyed. These changes represent a new framework of development for the part “relating to other” in PTG.

Another conclusion is that, according to a relatively high profile for a population of thousand (5 clusters), it seems the impact of all these 17 y should be less on PTG as the number of extractive patterns is approximately high for the case. This shows a kind of heterogeneity among the participants according to PTG. The previous studies indicate a more homogeneous situation among the participants in a stressful event during a shorter period.

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Conflict(s) of Interest. The authors declare no conflicts of interest.

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References

1. Naderi N, Mohammadi J. Locating temporary housing after the earthquake, using GIS and AHP Techniques (a case study: 15 districts of Isfahan City). *J Soc Issues Human*. 2015;3:71-75.
2. Eivazi A, Nourbala A, Meysami A. A comparative study of post-traumatic stress disorder prevalence among survivors of BAM earthquake eighteen months after the event in BAM and KERMAN cities. *JORAC*. 2016;8(1,2):55-67.
3. Sheikhbardsiri H, Yarmohammadian MH, Khankeh H, et al. An operational exercise for disaster assessment and emergency preparedness in south of Iran. *J Public Health Manag Pract*. 2020;26(5):451-456.
4. Aminizadeh M, Saberinia A, Salahi S, et al. Quality of working life and organizational commitment of Iranian pre-hospital paramedic employees during the 2019 novel coronavirus outbreak. *Int J Healthc Manag*. 2021. doi: 10.1080/20479700.2020.1836734
5. Sheikhbardsiri H, Doustmohammadi MM, Mousavi SH, et al. Qualitative study of health system preparedness for successful implementation of disaster exercises in the Iranian context. *Disaster Med Public Health Prep*. 2020. doi: 10.1017/dmp.2020.257
6. Rezaei F, Maracy MR, Yarmohammadian MH, et al. Hospitals preparedness using WHO guideline: a systematic review and meta-analysis. *Hong Kong J Emerg Med*. 2018;25(4):211-222.
7. Khademipour G, Nakhaee N, Anari SMS, et al. Crowd simulations and determining the critical density point of emergency situations. *Disaster Med Public Health Prep*. 2017;11(6):674-680.
8. Molavi-Taleghani Y, Ebrahimpour H, Sheikhbardsiri H. A proactive risk assessment through healthcare failure mode and effect analysis in pediatric surgery department. *J Compr Ped*. 2020. doi: 10.5812/compreped.56008
9. Black DW, Grant JE. *DSM-5® Guidebook: The Essential Companion to the Diagnostic and Statistical Manual of Mental Disorders*. American Psychiatric Publishers; 2014.
10. Sheikhbardsiri H, Afshar PJ, Baniasadi H, et al. Workplace violence against prehospital paramedic personnel (city and road) and factors related

- to this type of violence in Iran. *J Interpers Violence*. 2020. doi: [10.1177/0886260520967127](https://doi.org/10.1177/0886260520967127)
11. Calhoun LG, Tedeschi RG. *Handbook of Posttraumatic Growth: Research and Practice*. Routledge: 2014.
 12. Du B, Ma X, Ou X, et al. The prevalence of posttraumatic stress in adolescents eight years after the Wenchuan earthquake. *Psychiatry Res*. 2018; 262:262-269.
 13. Zhou X, Zhen R, Wu X. Trajectories of posttraumatic growth among adolescents over time since the Wenchuan earthquake. *J Adolesc*. 2019;74: 188-196.
 14. Tedeschi RG, Calhoun LG. The posttraumatic growth inventory: measuring the positive legacy of trauma. *J Trauma Stress*. 1996;9:455-471.
 15. Wu X, Kaminga AC, Dai W, et al. The prevalence of moderate-to-high posttraumatic growth: a systematic review and meta-analysis. *J Affect Disord*. 2019;243:408-415.
 16. Amiri H, Nakhaee N, Nagyova I, et al. Posttraumatic growth after earthquake: a systematic review and meta-analysis. *Int J Soc Psychiatry*. 2021;67(7):867-877.
 17. Whealin JM, Pitts B, Tsai J, et al. Dynamic interplay between PTSD symptoms and posttraumatic growth in older military veterans. *J Affect Disord*. 2020;269:185-191.
 18. Britton M, LaLonde L, Oshio A, et al. Relationships among optimism, pessimism, and posttraumatic growth in the US and Japan: focusing on varying patterns of perceived stressfulness. *Pers Individ Differ*. 2019;151: 109513.
 19. Ajoudani F, Jafarizadeh H, Kazamzadeh J. Social support and posttraumatic growth in Iranian burn survivors: the mediating role of spirituality. *Burns*. 2019;45:732-740.
 20. Abdollahyar A, Baniyasi H, Doustmohammadi MM, et al. Attitudes of Iranian nurses toward spirituality and spiritual care. *J Christ Nurs*. 2019;36(1):E11-E16.
 21. Tang W, Wang Y, Lu L, et al. Post-traumatic growth among 5195 adolescents at 8.5 years after exposure to the Wenchuan earthquake: roles of posttraumatic stress disorder and self-esteem. *J Health Psychol*. 2020;26(13):2450-2459.
 22. Jansen L, Hoffmeister M, Chang-Claude J, et al. Benefit finding and posttraumatic growth in long-term colorectal cancer survivors: prevalence, determinants, and associations with quality of life. *Br J Cancer*. 2011;105(8):1158-1165.
 23. Greene T. Do acute dissociation reactions predict subsequent posttraumatic stress and growth? A prospective experience sampling method study. *J Anxiety Disord*. 2018;57:1-6.
 24. Yu M, Chasson GS, Wang M, et al. The latent profile analysis of Chinese adolescents' anxiety: examination and validation. *J Anxiety Disord*. 2018;59:74-81.
 25. Levi E, Bachar E. The moderating role of narcissism on the relationship between posttraumatic growth and PTSD symptoms. *Pers Individ Differ*. 2019;138:292-297.
 26. An Y, Yuan G, Zhang N, et al. Longitudinal cross-lagged relationships between mindfulness, posttraumatic stress symptoms, and posttraumatic growth in adolescents following the Yancheng tornado in China. *Psychiatry Res*. 2018;266:334-340.
 27. Xu J, Wu W. Work satisfaction and posttraumatic growth 1 year after the 2008 Wenchuan earthquake: the perceived stress as a moderating factor. *Arch Psychiatr Nurs*. 2014;28:206-211.
 28. Zhou Y, Ma J, Wang B, et al. Long-term effect of personal PM2.5 exposure on lung function: a panel study in China. *J Hazard Mater*. 2020;393:122457.
 29. Amiri H, Rezapour M, Nagyova I, et al. Translation and adaptation of the Posttraumatic Growth Inventory-Short Form to Persian. *Open Psychol J*. 2020;13:326-332.
 30. Schwarz G. Estimating the dimension of a model. *Ann Stat*. 1978;6(2): 461-464.
 31. Sclove SL. Application of model-selection criteria to some problems in multivariate analysis. *Psychometrika*. 1987;52:333-343.
 32. Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study. *Struct Equ Modeling: J Multidiscip Res*. 2007;14(4):535-569.
 33. Clark SL. *Mixture* Modeling with Behavioral Data*. University of California; 2010.
 34. Muthén L, Muthén B. *Mplus User's Guide*. Los Angeles, CA; 1998-2015. Accessed March 3, 2022. https://www.statmodel.com/download/users_guide/Mplus%20user%20guide%20Ver_7_r6_web.pdf
 35. Taku K, McLarnon MJW. Posttraumatic growth profiles and their relationships with HEXACO personality traits. *Pers Individ Differ*. 2018;134: 33-42.
 36. Jin Y, Xu J, Liu H, et al. Posttraumatic stress disorder and posttraumatic growth among adult survivors of Wenchuan earthquake after 1 year: prevalence and correlates. *Arch Psychiatr Nurs*. 2014;28:67-73.
 37. Rzeszutek M, Gruszczynska E. Posttraumatic growth among people living with HIV: a systematic review. *J Psychosom Res*. 2018;114:81-91.
 38. Guo J, Fu M, Xing J, et al. Coping style and posttraumatic growth among adult survivors 8 years after the 2008 Wenchuan earthquake in China. *Pers Individ Differ*. 2017;111:31-36.
 39. Besharat MA. Relationship of alexithymia with coping styles and interpersonal problems. *Procedia Soc Behav Sci*. 2010;5:614-618.
 40. Sifneos PE. Alexithymia, clinical issues, politics and crime. *Psychother Psychosom*. 2000;69:113-116.
 41. Stutts L, Stanaland A. Posttraumatic growth in individuals with amputations. *Disabil Health J*. 2016;9:167-171.
 42. Wang W, Fu W, Wu J, et al. Prevalence of PTSD and depression among junior middle school students in a rural town far from the epicenter of the Wenchuan earthquake in China. *PLoS One*. 2012;7:e41665.
 43. Hafstad GS, Kilmer RP, Gil-Rivas V. Posttraumatic growth among Norwegian children and adolescents exposed to the 2004 tsunami. *Psychol Trauma*. 2011;3:130.
 44. Balfe M, O'Brien K, Timmons A, et al. What factors are associated with posttraumatic growth in head and neck cancer carers? *Eur J Oncol Nurs*. 2016;21:31-37.
 45. Pietrzak RH, Goldstein MB, Malley JC, et al. Posttraumatic growth in veterans of operations enduring freedom and Iraqi freedom. *J Affect Disord*. 2010;126:230-235.
 46. Yu X-n, Lau JTF, Zhang J, et al. Posttraumatic growth and reduced suicidal ideation among adolescents at month 1 after the Sichuan Earthquake. *J Affect Disord*. 2010;123:327-331.