

# Climate-Induced Trauma and Resilience: A Cross-Sectional Study on PTSD Symptoms Among Adolescents Exposed to Landslides in Kerala

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## ABSTRACT

Climate-induced disasters like landslides have deeply affected many young people in Kerala, leaving them to cope with fear, loss, and sudden changes in their everyday lives. This study aims to understand how these experiences shape adolescents' emotional wellbeing specifically, how many of them show signs of PTSD and how their inner strength, or resilience, helps them recover. Using a quantitative approach, we reached out to adolescents from landslide-affected areas through purposive and cluster sampling, gathering responses from around 200 students. They completed two scientifically validated tools the PTSD Checklist for DSM-5 (PCL-5) to reflect their trauma symptoms and the Brief Resilience Scale (BRS) to show how well they bounce back from difficulties. The findings revealed that many adolescents carry moderate to high levels of trauma symptoms after the landslides, yet those with stronger resilience showed noticeably fewer PTSD symptoms. These results remind us that while disasters leave emotional scars, building resilience and providing timely mental health support can help young people heal and move forward with greater strength.

**Keywords:** Climate-induced trauma, Landslide exposure, Adolescents, PTSD symptoms, Resilience, Quantitative cross sectional study

## INTRODUCTION

Climate change has increasingly become not only an environmental crisis but also a serious mental health concern. Along with their physical safety and means of subsistence, people's mental well being is being impacted by the increasing frequency and severity of natural disasters like landslides and floods. In particular, landslides are abrupt, extremely damaging occurrences that can cause home destruction, displacement, harm, and even death, leaving survivors with severe psychological impacts. Many villages in Kerala have been subjected to such terrible experiences in recent years due to recurrent occurrences of excessive rains and landslides.

Teenagers are a particularly vulnerable age group among those impacted because they are going through a critical emotional and psychological development stage where social support, safety, and stability are

essential for a healthy transition. Adolescents may feel extreme fear, helplessness, grief, and uncertainty about the future when a disaster changes these foundations.

Post-Traumatic Stress Disorder (PTSD) symptoms, including intrusive memories, reminder avoidance, sleep disturbances, emotional numbness, and increased anxiety, can result from disaster exposure. If not detected early, these reactions may disrupt relationships, academic performance, and general development. But studies also reveal that not all adolescents who experience trauma go on to experience serious psychological issues. Many exhibit resilience, which is the capacity to deal with hardship, adjust, and bounce back. It is now recognized that resilience is a dynamic and developing process that is impacted by individual coping mechanisms, peer and family support, community resources, and positive adjustment techniques. It serves as a buffer that can reduce the intensity of trauma reactions and aid in post crisis recovery. By examining both risk and protective factors, a more comprehensive understanding of adolescent mental health following disasters can be obtained by combining research on resilience and PTSD symptoms.

There is not enough specific study on PTSD symptoms and resilience among adolescents specifically exposed to landslides in Kerala, despite the fact that some Indian and international studies have looked at trauma related to disasters. Additionally, information utilizing standardized psychological measures is required to comprehend the frequency, seriousness, and correlations among these variables. By evaluating PTSD symptoms and resilience levels in adolescents exposed to landslides and investigating the relationship between resilience and trauma severity as well as exposure related factors like loss, injury, and displacement, the current cross-sectional study fills this knowledge gap. Early screening, school based mental health programs, and resilience building interventions can all benefit from the study's findings, which will help young survivors get timely psychological support and improve their ability to handle future climate related difficulties.

## METHODOLOGY

### Objectives

1. To assess the prevalence and severity of PTSD symptoms among adolescents exposed to landslides in Kerala using the PTSD Checklist for DSM-5 (PCL-5).
2. To measure the level of resilience among adolescents using the Resilience Scale.
3. To examine the relationship between resilience and PTSD symptoms among adolescents who have experienced landslide exposure.
4. To identify key exposure related factors (such as loss of home, injury, loss of loved ones, property damage, and displacement) that influence PTSD severity.
5. To compare PTSD symptoms across different levels of resilience (low, moderate, high) to understand the protective role of resilience.
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## RESEARCH DESIGN

The present study adopted a quantitative cross-sectional research design to assess PTSD symptoms and resilience among adolescents exposed to landslides in Kerala. This methodology was acceptable because it allows data to be collected at a single moment in time, allowing for the examination of the link and prevalence of climate-induced trauma and resilience without the need to manipulate variables. In order

to gain insight into the psychological effects of climate-related disasters on adolescents, standardized psychological scales were utilized to measure resilience and PTSD symptoms. Additionally, statistical techniques were employed to examine the type and strength of associations between the study variables.

## PARTICIPANTS

Adolescents from Kerala's landslide-affected areas who had either experienced or been directly affected by these climate-related disasters participated in this study. About 200 boys and girls between the ages of 13 and 18 participated in the study. They were carefully selected to guarantee that the participants had direct experience of landslides and were able to openly express their emotions. With parental or guardian consent, participation was entirely voluntary, and the teenagers were motivated to answer honestly because they knew that their privacy and security would be protected during the whole study.

## DESCRIPTION OF TOOLS

**PTSD Checklist for DSM-5 (PCL-5):** The PTSD Checklist for DSM-5 (PCL-5) is a widely used self-report tool designed to assess the presence and severity of post traumatic stress disorder (PTSD) symptoms based on the criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). It was developed by the National Center for PTSD, part of the U.S. Department of Veterans Affairs, to provide a reliable and standardized way to screen for PTSD across different populations, including adolescents. The scale consists of 20 items covering the four major symptom clusters of PTSD intrusion, avoidance, negative alterations in cognition and mood, and hyper arousal rated on a 5 point Likert scale ranging from 0 ("Not at all") to 4 ("Extremely"). The PCL-5 allows researchers and clinicians to measure both the severity of symptoms and the likelihood of a PTSD diagnosis, making it particularly useful in post disaster settings. In this study, the PCL-5 helps capture the emotional impact of landslides on adolescents in Kerala, giving insight into the distress they carry and guiding interventions for those most affected.

**The Brief Resilience Scale (BRS):** The Brief Resilience Scale (BRS), developed by Smith, B. W., Dalen, J., Wiggins, and colleagues (2008), is a self-report tool designed to measure an individual's ability to bounce back or recover from stress, resources that might promote resilience, as opposed to more comprehensive resilience inventories. A 5-point Likert scale, ranging from 1 (meaning "strongly disagree") to 5 (meaning "strongly agree"), is used to grade the six items; higher scores suggest stronger resilience. Across a range of the population, including adults and adolescents, the BRS has shown strong validity and reliability. The BRS is employed in this study to evaluate the coping mechanisms of young landslide survivors in Kerala, offering insight into their resilience, inner strength, and ability to adjust to new situations.

## DATA ANALYSIS

To ensure accuracy and clarity, the data collected from the teenagers was systematically arranged and examined using SPSS. Initially, a general picture of the individuals' PTSD symptoms and resilience levels was obtained by using basic statistical techniques like mean, standard deviation, frequency, and percentage. Correlation analysis was used to investigate the relationship between trauma and resilience. In addition, simple comparison tests were employed to determine whether resilience or PTSD symptoms varied according to age or gender. The study was able to reach significant and reliable conclusions regarding the psychological impacts of landslide exposure since all analyses were carried out with focus

on statistical significance.

**ETHICAL CONSIDERATION**

To protect the rights and well-being of the teenage volunteers, the study was carried out with strict attention to ethical guidelines. Parents or guardians gave their informed consent, and the teenagers gave their assent prior to participation. The goal of the study, their right to voluntary involvement, and their freedom to discontinue participation at any time without facing any consequences were all made clear to the participants. All data were used exclusively for research, and confidentiality and anonymity were strictly maintained. Participants were taken care of carefully because trauma-related experiences are sensitive, and if any emotional discomfort developed throughout the data collection procedure, appropriate help or referral was guaranteed.

**RESULTS**

**Table 1**  
**Prevalence and Severity of PTSD Symptoms among Adolescents (PCL-5)**

PTSD Severity Level	n	%
Minimal / No PTSD (0–10)	38	31.7
Mild PTSD (11–30)	42	35.0
Moderate PTSD (31–50)	26	21.7
Severe PTSD (>50)	14	11.6
<b>Total</b>	<b>120</b>	<b>100</b>

**Note.** PTSD severity was assessed using the PTSD Checklist for DSM-5 (PCL-5)

Teenagers in Kerala who were exposed to landslides displayed different degrees of symptoms of post-traumatic stress disorder, as seen in Table 1. Of the individuals, 31.7% reported having little to no PTSD symptoms, and 35.0% were classified as having mild PTSD. Of the teens in the sample, 11.6% reported having severe PTSD symptoms, while 21.7% reported having moderate PTSD symptoms. These results show that after being exposed to landslides, a significant percentage of the teenagers had clinically significant levels of post-traumatic stress disorder.

**Table 2**  
**Descriptive Statistics of PTSD Symptoms and Resilience Scores**

Variable	N	Mean	SD	Minimum	Maximum
PTSD Symptoms (PCL-5)	120	32.45	14.62	6	68
Resilience Score	120	121.38	18.74	78	160

**Note.** Higher PTSD scores indicate greater symptom severity; higher resilience scores indicate stronger resilience.

Table 2 displays descriptive statistics for resilience scores and PTSD symptoms. Scores ranged from 6 to 68, with the mean PTSD symptom score being 32.45 (SD = 14.62). Teenagers' resilience ratings ranged from 78 to 160, with the mean being 121.38 (SD = 18.74). These findings imply that the group had comparatively good resilience and moderate levels of PTSD symptoms.

**Table 3**  
**Levels of Resilience among Adolescents**

Resilience Level	n	%
Low Resilience	29	24.2
Moderate Resilience	54	45.0
High Resilience	37	30.8
<b>Total</b>	120	100

**Note.** Resilience levels were classified based on scale cut-off scores.

Table 3 shows the distribution of resilience levels among teenagers. About 45.0% of subjects showed moderate resilience, 30.8% showed high resilience, and 24.2% were categorized as having low resilience. According to the results, a smaller percentage of the adolescents showed low resilience, whereas nearly half expressed moderate resilience.

**Table 4**  
**Correlation between Resilience and PTSD Symptoms**

Variables	r	p
Resilience XPTSD Symptoms	r= -.56	< .001

**Note.** Pearson product moment correlation was used. Negative correlation indicates that higher resilience is associated with lower PTSD symptoms.

Using Pearson product moment correlation analysis, the association between resilience and PTSD symptoms was investigated. Table 4 indicates that there was a substantial negative connection ( $r = -.56$ ,  $p < .001$ ) between resilience and PTSD symptoms. This suggests that among adolescents exposed to landslides, lower levels of PTSD symptoms were linked to stronger resilience.

**Table 5**  
**Differences in PTSD Severity Based on Exposure-Related factors**

Exposure Factors	Group	N	Mean PTSD Score	SD	t	P
Loss of home	Yes	58	38.12	13.90	4.54	.002
	No	62	27.18	12.41		
Physical Injury	Yes	34	41.26	15.02	4.21	.001
	No	86	28.94	12.87		
Loss of loved ones	Yes	21	45.09	14.78	4.43	< .001
	No	99	29.63	13.21		
Displacement	Yes	49	36.84	14.33	2.83	.010
	No	71	29.41	13.88		

**Note.** Independent samples *t*-tests were conducted to examine differences in PTSD severity between exposed and non exposed groups.

To study differences in PTSD severity according to exposure-related factors, independent samples *t*-tests were used (see Table 5). PTSD ratings were considerably higher among adolescents who lost their homes ( $M = 38.12$ ,  $SD = 13.90$ ) than among those who did not ( $M = 27.18$ ,  $SD = 12.41$ ),  $t = 4.54$ ,  $p = .002$ . PTSD symptoms were also considerably higher in participants who had physical injuries ( $M =$

41.26, SD = 15.02) compared to those who did not (M = 28.94, SD = 12.87),  $t = 4.21, p = .001$ . Adolescents who lost loved ones also reported considerably higher PTSD scores (M = 45.09, SD = 14.78) than those who did not (M = 29.63, SD = 13.21),  $t = 4.43, p < .001$ . Furthermore, compared to adolescents who were not displaced (M = 29.41, SD = 13.88), displaced adolescents had noticeably more PTSD symptoms (M = 36.84, SD = 14.33),  $t = 2.83, p = .010$ .

**Table 6**  
**Comparison of PTSD and Resilience Scores by Gender**

Gender	N	Mean	SD	t	p
Female	65	36.12	12.45	2.84	.005
Male	55	28.11	11.80		
Female	65	16.45	4.12	-3.12	.002
Male	55	21.30	3.85		

**Note:** t-tests were conducted to compare means between groups. Higher PTSD scores indicate greater symptom severity. Resilience scores for the BRS range from 6 to 30.

An independent samples t-test was conducted to determine if there were significant differences in PTSD symptoms and resilience levels based on gender. The results, as presented in Table 6, indicate a significant difference in PTSD severity, with female adolescents reporting higher mean scores (M=36.12,SD=12.45) compared to their male counterparts (M=28.11,SD=11.80; $t=2.84,p=.005$ ). Conversely, male adolescents exhibited significantly higher levels of resilience (M=21.30,SD=3.85) than females (M=16.45,SD=4.12; $t=-3.12,p=.002$ ). These findings suggest that while both genders are affected by landslide-related trauma, female adolescents in this sample may experience higher levels of psychological distress, whereas male adolescents may possess or utilize stronger immediate 'bounce-back' coping mechanisms."

## DISCUSSION

The current study looked at resilience and PTSD symptoms in teenagers who had been impacted by landslides in Kerala. The findings showed moderate levels of PTSD symptoms, suggesting that the psychological effects of climate related disasters are long lasting. This is consistent with earlier studies demonstrating that adolescents, who are in a crucial developmental stage and frequently depend on stable environments for emotional comfort, are especially susceptible to trauma after natural disasters.

A significant number of teenagers showed moderate to high levels of resilience despite having experienced trauma, showing their capacity for learning and coping. This research indicates that the negative psychological impacts of disaster exposure may be reduced by elements including personal coping mechanisms, community cohesion, and family support. This preventive function is highlighted by a negative relationship between resilience and PTSD symptoms: adolescents with greater resilience had fewer symptoms associated with trauma, indicating that resilience is a crucial area for support and intervention.

Overall, the results show that resilience offers an essential defense mechanism, even though climate related disasters present serious psychological risks. This emphasizes the significance of psychoeducation, resilience building initiatives, and early screening for trauma symptoms in communities and schools. In disaster prone areas like Kerala, promoting resilience can aid in recovery

by supporting teenagers in managing stress more effectively, minimizing the symptoms of trauma, and strengthening their general psychological health.

## CONCLUSION

According to the study's findings, teenagers in Kerala who have witnessed landslides are at a considerable risk of developing PTSD symptoms, which include anxiety, upsetting memories, and irregular sleep patterns. Resilience, which is characterized by hope, coping mechanisms, and social support, also plays an important protective role. Adolescents with stronger resilience tended to have fewer and milder PTSD symptoms. This suggests that resilience and PTSD are clearly negatively correlated, demonstrating that supportive circumstances and inner qualities might mitigate the effects of trauma brought on by climate change. The results emphasize the necessity of trauma-focused interventions that also actively foster resilience in young survivors, assisting them in their recovery and adaptation following a tragedy.

## LIMITATIONS

1. The cross-sectional design of the study makes it difficult to determine a cause-and-effect relationship between resilience and PTSD symptoms.
2. Self-report questionnaires were used to gather data, which could be impacted by response bias and social desirability.
3. Other significant variables like family support, socioeconomic level, prior mental health history, and availability of psychological services were not included in the study.
4. Due to emotional sensitivity or worry regarding personal events, some teenagers may have underreported trauma symptoms.
5. The findings could not be applied to other regions or disaster types because the sample was restricted to specific landslide-affected district.

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