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RESEARCH ARTICLE

Daily stressors and mental health following disaster: A school-based assessment of adolescent disaster survivors in China and Nepal

Elizabeth A. Newnham[1,2,3] | **Xue Gao**[1] | **Bhushan Guragain**[4] | **Feng Jiao**[5] | **Elizabeth Nathan**[6,7] | **Mark Boyes**[1,3] | **Jennifer Leaning**[2]

[1]School of Population Health, Curtin University, Perth, Australia

[2]FXB Center for Health and Human Rights, Harvard University, Boston, Massachusetts, USA

[3]Curtin enAble Institute, Curtin University, Perth, Australia

[4]Centre for Victims of Torture, Kathmandu, Nepal

[5]Public Health School, Kunming Medical University, Kunming City, China

[6]Women and Infants' Research Foundation, Perth, Australia

[7]Division of Obstetrics and Gynaecology, The University of Western Australia, Perth, Australia

Correspondence
Elizabeth A. Newnham, School of Population Health, Curtin University, GPO Box U1987, Perth, 6845, Australia.
Email: Elizabeth.newnham@curtin.edu.au

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Abstract

Postdisaster daily stressors, the economic and social challenges caused or exacerbated by disasters, have significant consequences for mental health but are rarely investigated in child and adolescent populations. We assessed post-traumatic stress symptoms (PTSS), depression, and anxiety among adolescents affected by disasters in China and Nepal and examined the specific contributions of disaster-related trauma exposure and daily stressors across mental health outcomes. A school-based, cross-sectional study was conducted with a stratified random sampling design. Adolescents living in disaster-affected areas of southern China and Nepal (N = 4,215, 52.7% female, age range: 15–19 years) completed translated, validated measures. Mixed effects logistic regression analyses were conducted using a priori risk factors. PTSS were reported by 22.7% of participants and were higher among Nepali adolescents but did not differ between genders. Depressive symptoms were reported by 45.2% of the sample and were higher among Nepali adolescents and girls in both countries. Across all settings, disaster-related trauma exposure was a significant risk factor for PTSS, depressive, and anxiety symptoms, China: odds ratios (ORs) = 1.44–2.06, Nepal, ORs = 1.21–2.53. High levels of household and interpersonal daily stressors further improved the models and contributed significantly to all mental health difficulties, China: ORs = 1.77–1.98, Nepal: ORs = 1.49–1.90.

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survivors of disasters. The authors declare no other conflicts of interest.

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Postdisaster economic insecurity and interpersonal stressors are thus, likely to worsen adolescent mental health outcomes. Programs that identify and address structural inequalities for adolescents in disaster-affected settings will have cascading effects for mental health.

Disasters have significant potential to exacerbate inequalities in mental health (Berry et al., 2018). Exposure to severe hazards elevates the risk of posttraumatic stress disorder (PTSD), depression, anxiety, and grief (Beaglehole et al., 2018; Bryant et al., 2018) and can disrupt developmental trajectories in children and adolescents (Fernando et al., 2010; Gibbs et al., 2019). Few studies have extensively addressed the role that the postdisaster environment plays in posttraumatic mental health difficulties. Daily stressors, defined as the economic and social conditions worsened or caused by a traumatic event (Miller & Rasmussen, 2010), have been consistently linked with ongoing psychological distress after exposure to war, forced migration, and pandemics (Cénat et al., 2020; Hou et al., 2019; Miller & Rasmussen, 2017; Newnham, Pearson, et al., 2015), but are less often investigated in the aftermath of natural hazards (Fernando et al., 2010). Housing insecurity, shortages of clean water and food, safety and security risks, caregiver separation, illness, unemployment, altered parenting, and exposure to domestic and family violence each have the potential to elevate the risk of long-term mental health difficulties for children and adolescents exposed to disasters (Cobham et al., 2016; Cohen et al., 2019; Molyneaux et al., 2020; Wang et al., 2020) and, in combination, are likely to worsen the effects of trauma exposure (Newnham, Pearson, et al., 2015). However, to date, research on daily stressors has focused largely on adult mental health in postconflict and resettlement settings (Hou et al., 2019) and, thus, little is known about the associations between disaster exposure, daily stressors, and mental health among adolescent disaster survivors.

The Asia Pacific region experiences more disasters than any other region worldwide, accounting for 41% of disaster-related deaths and 64% of affected individuals globally in 2020, beyond the effects of the COVID-19 pandemic (United Nations Office for Disaster Risk Reduction [UNDRR], 2021). The region is also home to more than half the world's youth (UNICEF, 2017), who may face heightened vulnerability during and following disasters (Newnham et al., 2019). As half of all adult mental health difficulties begin in adolescence (Jones, 2013), addressing the factors that cause or maintain psychological distress among young people is critical to later functioning. Although adolescence is a largely social construct, with role expectations determined by culture and economic circumstances, the transition from childhood to adulthood is often considered a period of identity formation, biological and cognitive development, and the expansion of social networks (Sawyer et al., 2018). Economic insecurity, marginalization, interpersonal stressors, and environmental adversity during adolescence have the potential to play significant roles in shaping mental health into adulthood (Chaulagain et al., 2019). In Nepal, a significant proportion (41.6%) of children live in multidimensional poverty as measured across health, living standards, and education domains (National Planning Commission & Government of Nepal, 2018), with potential implications for long-term mental health difficulties (Chaulagain et al., 2019). Similarly, a recent investigation demonstrated that socioeconomic inequality was associated with higher levels of child mental health difficulties during the early stages of the COVID-19 pandemic in China (Li et al., 2021). The family environment plays a critical role in mediating stressors that arise during adolescence (Cobham & Newnham, 2019); however, the specific mental health effects of household economic stressors and interpersonal family stressors have yet to be determined for young people in the postdisaster environment.

The provision of psychological services varies within Asia, with fragmented accessibility and responsiveness of child and adolescent mental health services (Nambiar et al., 2017). The COVID-19 pandemic has highlighted gaps in funding for sustainable mental health care and the resulting difficulties in accessing services in both China (Li et al., 2020) and Nepal (Chaulagain et al., 2019; V. Sharma et al., 2020). Accordingly, it is important to determine whether adolescent mental health following disasters is associated with modifiable daily stressors, where prioritized attention can have significant health impacts. We first aimed to assess symptoms of posttraumatic stress, depression, and anxiety among adolescents affected by disasters in China and Nepal. Second, we aimed to examine the specific associations between economic and interpersonal daily stressors and multiple mental health outcomes, beyond the role of trauma exposure.

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METHOD

Participants and procedure

During September and October 2016, we conducted a school-based, cross-sectional study of adolescents (age range: 15–19 years) living in disaster-affected areas of China and Nepal. In China, participants were recruited from two counties in Yunnan Province: Changning and Yiliang. Changning was hit by a 5.1 magnitude earthquake on October 30, 2015, and on September 7, 2012, Yiliang was hit by two earthquakes with magnitudes of 5.6 and 5.3. Both counties are frequently affected by floods and landslides. In Nepal, participants were recruited from three sites, each affected by earthquakes that occurred in April 2015: Gorkha, the epicenter of a 7.9 magnitude earthquake on April 25, 2015; Sindhupalchowk, the epicenter of the largest aftershock, with a magnitude of 7.3 on May 12, 2015; and Lalitpur, a district heavily affected by the earthquakes. The Government of Nepal reported 8,510 deaths, 22,000 injuries, and more than 792,000 houses seriously damaged during the earthquakes (Guha-Sapir et al., 2016), with 1,700,000 children directly affected (Chaulagain et al., 2019).

We adopted a stratified random sampling design. In each Chinese county, two middle schools and three high schools closest to the epicenter of the earthquakes were selected. Within each school, classes were randomly selected from eligible grades (i.e., Grades 9–11), and all students in the class were invited to participate in the study. Students in their final grade at all schools except a vocational high school were excluded from participation due to the proximity to final exams. In some schools, class selection was restricted by availability on the day of testing. Each participant completed a questionnaire in simplified Chinese within the classroom setting during a time that would have minimal impact on the curriculum. One or two research assistants were present in each class to coordinate the process. In total, 2,390 students participated in China (51.5% female, age range: 15–17 years).

In Nepal, a list of all secondary schools within each district was obtained from the Education Bureau, and 20 schools, stratified by school type (i.e., government or private) according to the proportion of each in a given district, were randomly selected and invited to participate in the study. If the selected school declined or was deemed inaccessible due to road or weather conditions, the next closest school was chosen as a replacement. The study included 19 government schools and one private school in Gorkha, 19 government schools and one private school in Sindhupalchowk, and eight government schools and 12 private schools in Lalitpur. Within each participating school, 30 students were selected at random from class lists and invited to participate in the study. Each participant completed a self-report questionnaire in Nepali in a group of five to seven total students, facilitated by one research assistant. Questionnaires were completed during lunch or a noncurriculum class to minimize the impact on students' education. The total number of participants in Nepal was 1,825 (54.9% female, age range: 15–17 years). Local referrals to psychological services were arranged for any participant who reported psychological distress or the potential risk of harm during the study ($n = 1$ in China).

The assessment battery comprised standardized measures that were forward- and back-translated from English to simplified Chinese or Nepali. The cultural adaptation of items was conducted in consultation with colleagues and community members in China and Nepal, and the survey instrument was refined after pilot testing in both settings.

All participants provided written informed consent to participate, and caregivers' consent was obtained for participants under 18 years. All participants were provided with an opportunity to ask questions and received debriefing. Research assistants received comprehensive training in ethics, risk assessment, and the referral processes. All procedures involving human participants were approved by the Harvard T.H. Chan School of Public Health Institutional Review Board (IRB16-0593), Kunming Medical University Research Ethics Committee, the Nepal Health Research Council (156/2016), The University of Western Australia Human Research Ethics Committee (RA/4/1/8268), and the Curtin University Human Research Ethics Committee (HRE2017-0692).

Measures

Posttraumatic stress symptoms

Symptoms of PTSD, based on criteria outlined in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association, 2013), were assessed using the 20-item, self-report PTSD Checklist for *DSM-5* (PCL-5; Weathers et al., 2013). Items are rated on a 0–4 Likert scale (possible range: 0–80), with higher scores indicative of higher PTSD symptom levels. A cutoff for probable PTSD was calculated according to the *DSM-5* criteria by considering symptom endorsement to be an item-level score of 2 (*moderately*) or higher and requiring the endorsement of at least one item from Criterion B (i.e., intrusions), one item from Criterion C (i.e., avoidance), two items from Criterion D (i.e., negative alterations in cognitions and mood), and two items from Criterion E (i.e., alterations in avoidance and reactivity). The PCL-5 has demonstrated strong psychometric properties in use with disaster-exposed children and adolescents in China

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(Liu et al., 2016) and earthquake-affected adults in Nepal (Jha et al., 2017). In the present study, the PCL-5 total score demonstrated strong internal consistency in the samples from both China, Cronbach's α = .94, and Nepal, Cronbach's α = .92.

Depressive and anxiety symptoms

The Hopkins Symptom Checklist (HSCL-25; Hesbacher et al., 1980) was used to assess depressive and anxiety symptoms. The HSCL comprises 25 items rated on a 4-point Likert scale ranging from 1 (*not at all*) to 4 (*extremely*), with higher scores indicating higher symptom levels. For the current study, we removed one item concerning sexual interest due to the age of the sample and cultural considerations. The Anxiety and Depression subscales were scored per scale recommendations, with a mean score of 1.75 or higher on either subscale considered symptomatic, as validated in studies investigating disaster-related mental health outcomes in China (Zhang et al., 2011) and Nepal (Kane et al., 2017). The scale has been found to have good reliability and validity in both Chinese and Nepali populations (Kane et al., 2017; Wang et al., 2011). In the present study, the HSCL-25 demonstrated high internal reliability for the Depression and Anxiety subscales in both the Chinese, Cronbach's αs = .91 and .89, respectively, and Nepali samples, Cronbach's αs = .91 and .90, respectively.

Disaster trauma exposure

We developed a disaster trauma checklist based on findings from qualitative data outlining the key disaster experiences reported by adolescents in both countries (Newnham et al., 2019). The questions specifically referred to disaster exposure, and participants were asked to respond "yes" or "no" relative to their exposure to 15 items, including natural hazard types, experiences of displacement, separation from parents during a disaster, experiencing wounds or injury, loss of family members, witnessing trauma, and deprivation. Potential scores ranged from 0 to 27, with higher scores indicating more severe disaster exposure.

Daily stressors

The Post-War Adversities Index (Layne et al., 1999) was adapted to reflect daily stressors identified as pertinent to adolescents in China and Nepal based on in-depth qualitative interviews conducted in both settings (Newnham et al., 2019, 2020). The 25 items aimed to examine issues related to housing, food and economic insecurity, caregiver absence, domestic conflicts, and exposure to alcohol and drugs. Participants rated each item's occurrence within the past 6 months for the first 17 items and the past 12 months for the last eight items, thus reflecting the postdisaster environment in both countries. Items were scored dichotomously (i.e., "yes" or "no"), and a summed total score was calculated, with higher scores indicating a larger number of daily stressors. The scale has demonstrated strong psychometric properties and construct validity in prior studies of trauma-affected youth (Betancourt et al., 2013).

Demographic characteristics

Participants' age, gender, educational attainment, and family socioeconomic resources were assessed using a demographic inventory, drawing from the UNICEF Multiple Cluster Indicator Survey Adolescent Module used previously in China and Nepal.

Data analysis

Missing data on the PCL-5 were managed using deductive reasoning methodology. The items on each incomplete questionnaire were summed to give a total incomplete score. The total number of missing items was multiplied by the total possible score for each item and added to the total incomplete score to give a maximum possible score. If the range of the total incomplete score and the maximum possible score fitted entirely within a category, the participant's score was allocated to that category; otherwise, the participant's score remained missing.

Continuous data were summarized using median, interquartile ranges (IQRs), and ranges, and categorical data were summarized using frequency distributions. Univariate group comparisons were performed using Mann–Whitney *U* tests for continuous outcomes and chi-square and Fisher's exact tests for categorical outcomes, as appropriate. Bivariate Spearman correlations between posttraumatic stress symptoms (PTSS), depression, anxiety, trauma exposure, and daily stressor scores were calculated.

A principal-components analysis using a direct oblimin rotation method was conducted on the daily stressor responses. Factors retained for the multivariable analysis were considered plausible underlying constructs from a pragmatic perspective and had eigenvalues greater than 2. Cronbach's alpha reliability statistics were calculated to assess the degree to which items on each factor were consistent in their underlying dimension.

Mixed-effects logistic regression analysis was conducted to assess the impact of daily stressors on symptoms of

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PTSD, depression, and anxiety for each country. Models were assessed for random effects of region and school type within each country to account for clustering, and the random effect of region was retained in the models for Nepal. Models were constructed using a priori risk factors known to be associated with poor mental health outcomes in children following disasters, such as level of trauma exposure, age, gender, and daily stressors, including household and interpersonal stressors. All cutoffs for categories of exposure level, household stressors, and interpersonal stressors were based on the 25th and 75th percentile scores for the total sample. A total daily stressor score above the 75th percentile was considered to indicate a high stressor level. An interaction between age and gender was assessed in each model and retained if statistically significant. Multivariable models were presented with adjusted odds ratios (a*OR*s) and 95% confidence intervals. All analyses of data were performed using SPSS (Version 20) and Stata (Version 16). A p value of .05 or lower was considered statistically significant.

RESULTS

Sample characteristics

There were 4,215 adolescents in the total sample. Exclusions (n = 153) were made for reasons including no exposure to disaster (n = 111), an age greater than 19 years (n = 13), missing age (n = 5), and incomplete PCL-5 responses (n = 24), resulting in an analytic sample of 4,062 participants (China: n = 2,255, and Nepal: n = 1807). Overall, 87.7% of participants were 15–17 years old and 52.9% were female. Most participants in China (77.6%), but very few in Nepal (2.9%), lived at school, and the proportion was reversed for those living in the family home (China: 17.0%, Nepal: 84.4%).

Trauma exposure

Nepali participants reported exposure to more disaster types (China: Mdn = 2, range: 1–7 vs. Nepal: Mdn = 3, range: 1–7), p = .007, and had higher total exposure scores than Chinese participants (China: Mdn = 4, range: 1–17 vs. Nepal: Mdn = 6, range: 1–19), p < .001. Female adolescents had higher exposure scores than their male counterparts in both China (female: Mdn = 4, range: 1–17 vs. male: Mdn = 4, range: 1–16) p = .026, and Nepal (female: Mdn = 6, range: 1–19 vs. male: Mdn = 6, range: 1–18), p = .044. Among participants from China, the three most frequently endorsed disaster types were earthquakes (85.0%), landslides (57.5%), and storms (44.1%), and the three most common trauma experiences were feeling that the disaster could happen again (72.2%), witnessing others being injured (23.6%), and feeling unsafe in their current living situation (23.9%). In the Chinese sample, 39.8%, 42.1%, and 18.2% of participants, respectively, reported having experienced three or fewer, four to six, and seven or more types of trauma exposure. Among participants from Nepal, the three most common disaster types were earthquakes (98.0%), drought (41.9%), and landslides (41.1%), and the three most common trauma experiences were feeling that the disaster could happen again (54.1%), witnessing the death of other people in the disaster (45.4%), and witnessing others being injured (41.6%). In the Nepali sample, 22.4%, 33.2%, and 44.3% of participants, respectively, reported having experienced three or fewer, four to six, and seven or more types of trauma exposure.

Daily stressors

Total daily stressor scores did not statistically differ between countries, p =.447 (see Supplementary Table S1). Among Chinese participants, male adolescents had higher daily stressor scores than female adolescents, p =.031. In contrast, daily stressor scores were higher among Nepali female participants than their male counterparts, p =.004. The most common daily stressors among Chinese participants were a primary caregiver being unemployed (56.4%), serious conflicts between others in their place of living (48.6%), and sickness or injury of someone close (39.7%). Among Nepali participants, the most common daily stressors were accommodations that were overcrowded, unsanitary, or unfit to live in (43.9%); uncertainty over whether one would be forced to live in worse accommodations in the future (40.0%); and severe illness (38.0%).

Two plausible underlying themes, household stressors and interpersonal stressors, were identified using factor analysis and explained 28% of the variance. Items 3–10, 20, and 21 on the daily stressor questionnaire reflected household stressors, Cronbach's α = .72, and Items 11–19, 22, and 23 reflected interpersonal stressors, Cronbach's α = .65. Other items were excluded from further analysis. Among Chinese participants, 20.8%, 59.1%, and 20.1% of participants, respectively, reported having zero, one to three, and four more or more household stressors, and 16.0%, 37.0%, and 47.0% reporting having zero, one to two, and three or more interpersonal stressors, respectively. Among Nepali participants, 10.5%, 45.7%, and 43.9%, respectively, reported having zero, one to three, and four more or more household stressors, and 34.0%, 43.2%, and 22.8% zero, one to two, and three or more interpersonal stressors, respectively. In total, 26.2% of participants in China and 31.3% in Nepal reported experiencing

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a high number (i.e., more than seven) of total daily stressors.

Psychological symptoms

In the full sample, 22.7% of participants had PCL-5 total scores indicative of probable PTSD; the proportion was higher among Nepali adolescents compared with Chinese adolescents (26.8% vs. 19.4%), $p < .001$, but did not differ between genders in either China (male: 20.3% vs. female: 17.8%), $p = .087$, or Nepal (males: 26.3% vs. female: 27.1%), $p = .758$. No difference between age groups was evident in China; however, older adolescents were at higher risk of meeting the cutoff for probable PTSD in the overall Nepali sample (18–19 years: 34.1% vs. 15–17 years: 25.4%), $p = .002$, as well as among male Nepali (18–19 years: 33.6% vs. 15–17 years: 25.1%), $p = .049$, and female Nepali participants (18–19 years: 34.6% vs. 15–17 years: 25.6%), $p = .019$.

Regarding depressive symptoms, 45.2% of the total sample reported symptoms at a level above the threshold for symptomatic depression. The proportion of participants who scored above the cutoff was higher among Nepali participants in general (China: 39.4% vs. Nepal: 50.3%), $p < .001$, and among female participants in both the Chinese (male: 38.4% vs. female: 45.5%), $p = .001$, and Nepali subsamples (male: 40.7% vs. female: 55.6%), $p < .001$. No difference between age groups was evident in China; however, among female Nepali participants, older adolescents had a higher likelihood of reporting depressive symptoms at a level above the threshold than younger adolescents (18–19 years: 67.5% vs. 15–17 years: 53.3%), $p = .001$.

In the total sample, 46.6% of participants reported anxiety symptoms above the threshold. The proportion of participants who scored above the threshold was higher in the Nepali subsample compared to the Chinese subsample (53.0% vs. 39.3%), $p < .001$, as well as among female compared with male participants in both the Chinese (males: 39.1% vs. female: 47.4%), $p < .001$, and Nepali subsamples (males: 39.5% vs. female: 59.2%), $p < .001$. We did not observe a difference between age groups in the Chinese subsample; however, among female Nepali participants, older adolescents reported higher levels of anxiety than their younger counterparts (18–19 years: 70.0% vs. 15–17 years: 57.1%), $p = .002$.

In the Chinese subsample, 10.0% of participants reported PTSS, depressive, and anxiety symptom comorbidity, with 32.8% experiencing at least two mental health outcomes. In the Nepali subsample, 16.8% of participants experienced all three outcomes, and 43.2% reported at least two mental health outcomes. Correlations between each of the mental health outcomes, disaster trauma exposure, and daily stressors indicated significant positive associations between all variables (see Supplementary Table S2).

Role of trauma exposure and daily stressors in mental health status

In both countries, increased trauma exposure was a significant risk factor for PTSD, depressive, and anxiety symptoms, China: a*OR*s = 1.44–2.06, Nepal: a*OR*s = 1.21–2.53. In addition, reporting a high level of daily stressors (i.e., seven or more) was significantly associated with PTSD, depressive, and anxiety symptoms, China: a*OR*s = 1.77–1.98, Nepal: a*OR*s = 1.49–1.90, and improved the fit of the model (see Tables 1 and 2).

Among Chinese participants, PTSD symptoms were associated with high numbers of household stressors (i.e., four or more) and interpersonal stressors (i.e., three or more). Gender and age were not associated factors. Female participants were more likely to report both depressive and anxiety symptoms than their male counterparts, and symptoms were significantly associated with any interpersonal stressors (i.e., one or more) among female adolescents, with an increase in odds as the number of interpersonal stressors increased (i.e., three or more). Depressive symptoms were also associated with high numbers of household stressors (i.e., four or more). In the total Chinese subsample, age was not a significant risk factor for any outcome nor was there a significant interaction between age and gender (see Table 1).

In Nepali participants, PTSD symptoms were associated with increased age and exposure to any household stressors (i.e., one or more) and less correlated with interpersonal stressors. Gender was not an associated factor. Depressive symptoms were more likely in older female adolescents and were significantly associated with high numbers of interpersonal stressors (i.e., three or more). Depressive symptoms were not associated with household stressors. Anxiety symptoms were more likely in female than male Nepali adolescents and were associated with high levels of household (i.e., four or more) and interpersonal stressors (i.e., three or more). In the overall Nepali subsample, age was not a significant risk factor for anxiety nor was there a significant interaction between age and gender (Table 2).

DISCUSSION

To our knowledge, this is the first study to demonstrate the differential mental health effects of postdisaster household and interpersonal daily stressors, beyond the effects of trauma exposure, for young people affected by disasters.

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TABLE 1 Multivariable models adjusted for the effect of daily stressors while accounting for other predictors of posttraumatic stress symptoms (PTSS), depression, and anxiety in Chinese adolescents exposed to disaster

Predictor	PTSS (n = 2,024)			Depressive symptoms (n = 1,880)			Anxiety symptoms (n = 1,933)		
	OR	95% CI	*p*	*OR*	95% CI	*p*	*OR*	95% CI	*p*
Female gender	0.91	[0.72, 1.16]	.455	1.63	[1.33, 1.99]	< .001	1.63	[1.34, 1.98]	< .001
Age	1.01	[0.90, 1.14]	.840	1.07	[0.96, 1.18]	.206	1.05	[0.95, 1.16]	.313
Female gender x Age	0.85	[0.68, 1.06]	.144	1.56	[0.96, 1.39]	.125	1.04	[0.87, 1.24]	.694
Trauma count									
≤ 3 (Ref.)	1.00			1.00			1.00		
4–6	1.79	[1.33, 2.42]	< .001	1.45	[1.16, 1.82]	.001	1.44	[1.16, 1.79]	.001
≥ 7	2.06	[1.45, 2.93]	< .001	1.50	[1.10, 2.04]	.010	1.66	[1.23, 2.23]	.001
Household stressors									
None (Ref.)	1.00			1.00			1.00		
1–3	1.38	[0.92, 2.06]	.115	1.09	[0.83, 1.42]	.541	1.13	[0.87, 1.45]	.355
≥ 4	2.02	[1.23, 3.33]	.006	1.57	[1.06, 2.32]	.025	1.33	[0.91, 1.95]	.141
Interpersonal stressors									
None (Ref.)	1.00			1.00			1.00		
1–2	1.34	[0.80, 2.24]	.259	1.53	[1.10, 2.14]	.012	1.64	[1.20, 2.24]	.002
≥ 3	2.85	[1.71, 4.74]	< .001	3.29	[2.33, 4.66]	< .001	2.44	[1.75, 3.40]	< .001
Total daily stressors									
< 7 (Ref.)	1.00			1.00			1.00		
≥ 7	1.90	[1.33, 2.71]	< .001	1.77	[1.28, 2.45]	.001	1.98	[1.44, 2.72]	< .001
Overall model statistics	$\chi^2(9, N = 2{,}024) = 246.94$, $p < .001$			$\chi^2(9, N = 1{,}880) = 275.17$, $p < .001$			$\chi^2(9, N = 1.933) = 222.30$, $p < .001$		

Note: *OR* = odds ratio; Ref. = reference group.

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TABLE 2 Multivariable models adjusted for the effect of daily stressors while accounting for other predictors of posttraumatic stress symptoms (PTSS), depression, and anxiety in Nepali adolescents exposed to disaster

Predictor	PTSS (n = 1,778)			Depressive symptoms (n = 1,764)			Anxiety symptoms (n = 1,772)		
	OR	95% CI	*p*	*OR*	95% CI	*p*	*OR*	95% CI	*p*
Female gender	0.87	[0.69, 1.10]	.255	0.09	[0.01, 1.41]	.086	2.24	[1.82, 2.75]	< .001
Age	1.15	[1.04, 1.27]	.006	0.93	[0.82, 1.06]	.281	1.00	[0.92, 1.10]	.921
Female gender x Age	0.94	[0.78, 1.14]	.544	1.21	[1.02, 1.44]	.033	1.12	[0.94, 1.32]	.203
Trauma count									
≤ 3 (Ref.)	1.00			1.00			1.00		
4–6	1.21	[0.81, 1.81]	.354	1.30	[0.98, 1.72]	.066	1.50	[1.13, 1.99]	.005
≥ 7	2.02	[1.35, 3.03]	.001	1.98	[1.47, 2.66]	< .001	2.53	[1.88, 3.41]	< .001
Household stressors									
None (Ref.)	1.00			1.00			1.00		
1–3	2.45	[1.33, 4.54]	.004	0.99	[0.70, 1.41]	.962	1.30	[0.91, 1.88]	.154
≥ 4	2.35	[1.21, 4.54]	.011	1.13	[0.75, 1.71]	.563	1.70	[1.11, 2.60]	.014
Interpersonal stressors									
None (Ref.)	1.00			1.00			1.00		
1–2	1.03	[0.76, 1.38]	.857	1.21	[0.95, 1.53]	.121	1.12	[0.88, 1.43]	.347
≥ 3	1.47	[0.99, 2.17]	.052	2.26	[1.61, 3.16]	< .001	2.01	[1.43, 2.82]	< .001
Total daily stressors									
<7 (Ref.)	1.00			1.00			1.00		
≥ 7	1.77	[1.22, 2.56]	.003	1.90	[1.36, 2.65]	< .001	1.49	[1.06, 2.08]	.022
Overall model statistics	$\chi^2(9, N = 1{,}778) = 115.95$, $p < .001$			$\chi^2(9, N = 1{,}764) = 243.09$, $p < .001$			$\chi^2(9, N = 1{,}772) = 279.76$, $p < .001$		

Note: *OR* = odds ratio; Ref. = reference group.

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In China, high levels of household stressors were associated with PTSS, depressive, and anxiety symptoms; in Nepal, household stressors were associated with PTSS and anxiety, but not depressive, symptoms. High levels of interpersonal stressors were associated with PTSS, depressive and anxiety symptoms in both countries. It is becoming increasingly recognized that instability caused and worsened by disasters—including unsafe housing, caregiver unemployment, exposure to drugs and alcohol, school cessation, and domestic violence—play a critical role in maintaining or exacerbating adolescent and adult mental health difficulties (Bryant et al., 2018; Ponnamperuma & Nicolson, 2018). Despite exposure to multiple trauma types during disasters, ongoing high levels of household and interpersonal stressors were observed to play a more substantial role in young people's psychological impairment.

Adolescents in both countries reported high levels of mental health difficulties, comparable with past assessments of postdisaster adolescent mental health in China (Wang et al., 2020) and Nepal (Silwal et al., 2018). In a study of 400 adolescents conducted 1 year after the 2015 Nepal earthquake, 43% of adolescents reported PTSS and 38% reported depressive symptoms; with PTSS significantly correlated with disaster related injury, experience of being trapped, and fear of death (A. Sharma & Kar, 2019). After the 2008 Wenchuan earthquake in China, 15.8% of adolescents reported PTSS, 40.5% reported depressive symptoms, and 24.5% reported anxiety symptoms six months later (Fan et al., 2011). The present findings indicate that levels of PTSS, depressive and anxiety symptoms were significantly higher in the Nepali subsample compared with the Chinese subsample, likely due to more severe trauma exposure among Nepali participants and differing economic contexts. The devastating effects of the earthquakes in Nepal were compounded by months of economic blockades, restricting the importation of fuel, food, housing materials, and medical supplies (Budhathoki & Gelband, 2016). Disasters have the potential to create or exacerbate social and material stressors by destroying critical infrastructure (e.g., roads, schools, electrical grids), depleting or overwhelming health care systems, undermining economic development, disrupting supply chains, and increasing unemployment (Botzen et al., 2019). Similarly, social stressors specific to the affected setting and culture are likely to exacerbate psychological difficulties in the postdisaster environment (Pfefferbaum et al., 2016).

The current findings augment recent studies that have highlighted the critical role that daily stressors have played in maintaining psychological distress among young people in postdisaster Sri Lanka (Fernando et al., 2010; Ponnamperuma & Nicolson, 2018), postconflict Sierra Leone (Newnham, Pearson, et al., 2015), refugee resettlement settings (Vervliet et al., 2014), and areas affected by the COVID-19 pandemic (Cénat et al., 2020). Findings from some studies assessing postmigration mental health suggest that the effects of daily stressors are stronger for children and adolescents than for adults (Hou et al., 2019), although the number of studies is small. The current findings extend prior literature by examining the specific roles of household and interpersonal stressors in postdisaster mental health. Families play a critical and dynamic role in facilitating mental health outcomes after mass trauma (Betancourt et al., 2013; Cobham et al., 2016; Wang et al., 2020) and likely mediate the effects of poverty (Yoshikawa et al., 2012). Supporting family reunification, parenting skills, and caregiver employment and economic empowerment will, thus, likely have important mental health benefits for adolescents (Cobham et al., 2016; Pfefferbaum et al., 2016).

In both countries, girls were at heightened risk of depression and anxiety relative to boys. Well-established evidence of gender effects on adolescent mental health has been recorded across 73 countries (Campbell et al., 2021), indicating that girls have a heightened risk of psychological distress regardless of culture or geographical location. For girls, the postdisaster environment increases the potential for threats of sexual assault and harassment, domestic violence, trafficking, and sanitation risks (Tearne et al., 2021; Thurston et al., 2021). Further, cultural expectations and inequities may reduce access to health care, education, and economic resources following disasters (Tearne et al., 2021), threatening mental health. Young people who identify as transgender or nonbinary are likely to experience even higher levels of postdisaster threat and psychological distress related to underlying societal issues of discrimination, violence, and marginalization (Dacles et al., 2017), although further evidence is needed to highlight the experiences of people with diverse gender identities in the disaster recovery space. Evidence-informed programs to address gender-specific threats to health and security following disasters are critically needed.

Several study limitations should be considered. First, data collection was limited to six disaster-affected districts across Nepal and Southwest China. The results may not generalize to young people living in different geographical, cultural, or economic circumstances and should not be considered a cross-country comparison. Second, although qualitative assessments conducted prior to the study indicated that the domains assessed were salient concerns for youth (Newnham et al., 2020), and extensive efforts were made to ensure that the questionnaires were culturally appropriate and translated accurately, local idioms of distress and culturally specific issues may have been missed in the survey. Third, the data presented are cross-sectional, and causal associations cannot be inferred.

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It is possible that worsened mental health contributes to the maintenance of toxic environments, with robust evidence indicating that social causation and social drift occur simultaneously (Lund & Cois, 2018). Future research should aim to utilize longitudinal methods that illuminate trajectories of adjustment as well as optimal points for clinical intervention.

Although disaster risk is increasing globally (UNDRR, 2021), there is a substantial capacity to address the economic insecurity and social stressors that are likely to worsen mental health outcomes in the aftermath of disaster. Programs that identify modifiable stressors for adolescents in disaster-affected settings and work to reduce poverty and violence will have cascading effects on mental health. For example, data modeling after Hurricane Sandy in 2012 demonstrated the potential for significant improvements to adult mental health following the restoration of residential and financial resources together with the delivery of psychological first aid (Cohen et al., 2019). Similarly, increases in remittances following the 2015 Nepal earthquake had significant buffering effects on both PTSD and depressive symptom severity reports among a sample of adults (Tachibana et al., 2019). In the future, it will be important to determine the effects of poverty reduction programs in supporting child and adolescent mental health in disaster-affected settings.

Psychological interventions will likely play an important complementary role in reducing the effects of complex adversity. Cognitive behavioral interventions that target improvements in emotion regulation, social skills training, and behavioral activation for trauma-affected youth were shown to demonstrate significant improvements in PTSS, depressive symptoms, and resilience following the 2018 major rain disaster in Hiroshima Japan (Sugiyama et al., 2020) and Hurricane Katrina in 2005 in the United States (Jaycox et al., 2010) and found to improve psychological outcomes, prosocial behaviors, and engagement in education in postwar Sierra Leone (Betancourt et al., 2014; Newnham, McBain, et al., 2015). Primary and secondary cognitive behavioral interventions have demonstrated significant improvements in reducing child and adolescent psychopathology when delivered in schools, community settings, and clinics following disasters, although uptake is varied (Jaycox et al., 2010). Young people often demonstrate a tremendous capacity for resilience and posttraumatic growth (Yuan et al., 2018), and building upon existing coping strategies and strengths in interventions will support sustainable change. In a qualitative study, adolescents in rural Nepal described managing their depressive symptoms via interpersonal coping strategies, such as identifying helpful people in their lives, increasing communication, and seeking practical support (Rose-Clarke et al., 2021). In contrast, individual coping styles have been investigated in disaster-affected adolescent populations in China, indicating that higher levels of exposure severity are associated with more maladaptive coping strategies (Zhang et al., 2010). In addition to the significant impacts of economic insecurity, it will be important to examine the specific roles of emotion regulation strategies and interpersonal skills in mediating the effects of trauma exposure and postdisaster hardship in future research and identify specific targets for psychological intervention.

Trauma exposure can play a disruptive role in adolescent psychological development. The current findings indicate that the effects of household and interpersonal stressors may exacerbate the psychological consequences of trauma exposure following disasters. These difficulties have potential to affect adolescents' longer-term engagement in education, their livelihoods, and healthy adult relationships (Betancourt et al., 2014; Meeus, 2016). Thus, it is critical that economic and social conditions be addressed in the immediate aftermath of disasters to support youth affected by the harmful combination of traumatic events and ongoing complex adversity.

OPEN PRACTICES STATEMENT

The data have not been made available on a permanent third-party archive. Requests for the data or materials should be sent via email to Dr. Elizabeth Newnham at Elizabeth.newnham@curtin.edu.au.

ORCID

Elizabeth A. Newnham https://orcid.org/0000-0001-5042-108X

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SUPPORTING INFORMATION

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