EUROPEAN JOURNAL OF PSYCHOTRAUMATOLOGY
2019, VOL. 10, 1558709
https://doi.org/10.1080/20008198.2018.1558709

EUROPEAN JOURNAL OF PSYCHO-TRAUMATOLOGY
THE OFFICIAL JOURNAL OF THE EUROPEAN SOCIETY FOR TRAUMATIC STRESS STUDIES

Taylor & Francis
Taylor & Francis Group

BASIC RESEARCH ARTICLE

The association between disaster exposure and media use on post-traumatic stress disorder following Typhoon Hato in Macao, China

Brian J. Hall [a,b], Ying Xin Xiong[a], Paul S. Y. Yip[a], Chao Kei Lao[a], Wei Shi[a], Elvo K. L. Sou[c], Kay Chang[a], Li Wang [d,e] and Agnes I. F. Lam[f,g]

[a]Global and Community Mental Health Research Group, Faculty of Social Sciences, The University of Macao, Macao (SAR), People's Republic of China; [b]Department of Health, Behavior and Society, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA; [c]Student Affairs Office, The University of Macao, Macao (SAR), People's Republic of China; [d]Laboratory for Traumatic Stress Studies, CAS Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences, Beijing, People's Republic of China; [e]Department of Psychology, University of Chinese Academy of Sciences, Beijing, People's Republic of China; [f]Centre for Macau Studies, The University of Macao, Macao (SAR), People's Republic of China; [g]Department of Communications, The University of Macao, Macao (SAR), People's Republic of China

ABSTRACT

Background: Direct exposure to natural disasters and related losses are associated with post-traumatic stress disorder (PTSD). It is less clear whether indirect media exposure is associated with PTSD.

Objective: This study investigated key exposure-related risk factors for PTSD and examined the effect of media exposure on the prevalence of disaster-related PTSD.

Method: Typhoon Hato directly hit Macao on 23 August 2017. It was one of the most serious natural disasters ever to strike southern China. One month after the event, 1876 Chinese university students in Macao were recruited into a cross-sectional study (mean age 20.01 years, *SD* = 2.63; 66.2% female). Self-reported typhoon exposure, media use and exposure to disaster-related content, and PTSD symptoms were collected using an electronic survey. Univariable analyses assessed associations between risk factors and PTSD, which were then included in a series of multivariable logistic regressions.

Results: The prevalence of PTSD was 5.1%. Adjusted models demonstrated that being male (vs female) [adjusted odds ratio (aOR) = 1.68, 95% confidence interval (CI) 1.07–2.63], home damage (aOR = 2.86, 95% CI 1.71–4.78), witnessing people injured (aOR = 2.33, 95% CI 1.36–4.00), and almost drowning during the storm (aOR = 8.99, 95% CI 1.92–41.99) were associated with PTSD. After adjusting for direct exposure, indirect exposure to disaster-related social media content, including information related to drowning victims (aOR = 1.29, 95% CI 1.00–1.67) and residents' emotional reactions (aOR = 1.98, 95% CI 1.44–2.72), was associated with PTSD. Viewing more information about the storm itself (aOR = 0.37, 95% CI 0.28–0.49) and images of heroic acts (aOR = 0.72, 95% CI 0.55–0.94) were significantly associated with lower odds of PTSD.

Conclusion: These findings add to the literature demonstrating that some types of media use and certain media content following a natural disaster are associated with PTSD.

ARTICLE HISTORY
Received 4 November 2018
Revised 26 November 2018
Accepted 30 November 2018

KEYWORDS
Disaster; PTSD; typhoon; social media; media use

PALABRAS CLAVE
desastre; TEPT; tifón; medios sociales; uso de medios

关键词
灾难; 创伤后应激障碍; 台风; 社交媒体; 媒体使用

HIGHLIGHTS

- PTSD prevalence was 5.1% 1 month following Typhoon Hato.
- Radio use was the only type of media use associated with PTSD.
- Media exposure to drowning and emotional reactions was associated with PTSD.
- Media exposure to heroic acts and information about the typhoon was associated with less PTSD.

La asociación entre la exposición a desastres y el uso de los medios de comunicación en el trastorno de estrés postraumático después del tifón Hato en Macao, China

Antecedentes: La exposición directa a desastres naturales y las pérdidas relacionadas se asocian con el trastorno de estrés postraumático (TEPT). Lo que está menos claro es si la exposición indirecta a través de los medios está también asociada con el TEPT.

Objetivo: Este estudio investigó los factores de riesgo clave relacionados con la exposición para el TEPT y examinó el efecto de la exposición en los medios de comunicación sobre la prevalencia del TEPT relacionado con el desastre.

Método: El tifón Hato golpeó directamente a Macao el 23 de agosto de 2017. Fue uno de los desastres naturales más graves de la historia del sur de China. Un mes después del evento, se reclutó una muestra de 1876 estudiantes universitarios chinos en Macao, China en un estudio transversal (edad M = 20.01; SD = 2.63; 66.2% mujeres). El auto-reporte de exposición al tifón, el uso de medios y la exposición a contenidos relacionados con el desastre, y los síntomas del TEPT se recopilaron mediante una encuesta electrónica. Los análisis univariantes evaluaron las asociaciones entre los factores de riesgo y el TEPT, que luego fueron incluidos en una serie de regresiones logísticas multivariantes.

Resultados: La prevalencia de trastorno de estrés postraumático fue del 5,1%. Los modelos ajustados demostraron que ser hombre (en comparación con mujer) aOR = 1.68, IC del 95% (1.07–2.63), daño en el hogar aOR = 2.86, IC del 95% (1.71–4.78), ser testigo de personas lesionadas aOR = 2.33, IC del 95% (1.36–4.00) y casi ahogarse durante la tormenta aOR =

CONTACT Brian J. Hall brianhall@umac.mo Global and Community Mental Health Research Group, Faculty of Social Sciences, The University of Macao, Macao (SAR), People's Republic of China

8.99, el 95% de IC (1.92–41.99) se asoció con TEPT. Después de realizar el ajuste por exposición directa, la exposición indirecta a contenido de redes sociales relacionadas con desastres, incluyendo información relacionada con víctimas de ahogamiento aOR = 1.29, IC del 95% (1.00–1.67) y reacciones emocionales de los residentes aOR = 1.98, IC del 95% (1.44–2.72), se asoció con TEPT. Ver más información sobre la tormenta en sí aOR = 0,37, IC del 95% (0,28 a 0,49) y ver imágenes de personas siendo heroicas aOR = 0,72, IC del 95% (0,55 a 0,94) se asociaron significativamente con probabilidades más bajas de TEPT.
Conclusiones: estos hallazgos se agregan a la literatura que demuestra que algunos tipos de uso de los medios y cierto contenido de los medios después de un desastre natural están asociados con el TEPT.

中国澳门台风哈托（Hato）后灾难暴露与媒体使用对创伤后应激障碍的关系

背景：直接暴露于自然灾害与其带来的损失与创伤后应激障碍（PTSD）有关。尚未清楚的是，间接媒体暴露是否也与创伤后应激障碍有关。
目的：本研究调查了PTSD的主要暴露相关危险因素，并考查了媒体暴露对灾难相关创伤后应激障碍患病率的影响。
方法：台风哈托于2017年8月23日直接袭击澳门。这是华南有史以来最严重的自然灾害之一。灾情发生后一个月后，中国澳门的1876名华人大学生样本被招募进行横断面研究（年龄M= 20.01; SD = 2.63;女性占66.2％）。使用电子问卷调查了自我报告的台风暴露、媒体使用和暴露于灾害相关内容以及创伤后应激障碍症状。单因素分析评估了风险因素与创伤后应激障碍之间的关联，然后将其纳入一系列多元logistic回归中。
结果：创伤后应激障碍的患病率为5.1％。调整后的模型显示，男性（与女性相比）aOR = 1.68，95％CI（1.07-2.63）；房屋损伤 aOR = 2.86，95％CI（1.71-4.78）；目击者受伤aOR = 2.33，95％CI(1.36–4.00)；暴风雨期间险些溺水 aOR = 8.99，95％CI（1.92-41.99）与创伤后应激障碍有关。在控制直接暴露后，间接暴露于与灾害相关的社交媒体内容，包括与溺亡者相关的信息 aOR = 1.29，95％CI（1.00-1.67）和居民的情绪反应 aOR = 1.98，95％CI（1.44-2.72），与创伤后应激障碍有关。查看有关风暴的更多信息aOR = 0.37，95％CI（0.28-0.49）和关于英雄事迹的影像 aOR = 0.72，95％CI（0.55-0.94），与PTSD的较低发病率显著相关。
结论：这些发现补充了现有文献，证实了自然灾害后的某些类型的媒体使用和媒体内容与 PTSD有关。

1. Introduction

Natural disasters such as earthquakes, floods, and hurricanes may lead to a wide range of negative psychological consequences, including post-traumatic stress disorder (PTSD) (American Psychiatric Association [APA], 2013). To better understand the aetiology of PTSD, and promote well-being, it is critical to investigate exposure-related correlates of PTSD following traumatic events. One area of potential interest and increased relevance is the use of media, especially social media, following natural disasters. The current study aims to identify whether types of media use and specific media content are associated with PTSD following a community-wide natural disaster.

1.1. Media use and disasters

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) clearly stipulates that non-professional indirect exposure to traumatic incident(s) via media, television, movies, or pictures does not apply to the A-4 PTSD criterion, 'experiencing repeated or extreme exposure to aversive details of the traumatic event(s)' (APA, 2013). This change aroused dispute about whether non-professional indirect exposure should be included in the DSM-5 criterion A (Pai, Suris, & North, 2017). For example, prior research has considered media exposure as a trauma when applying definitions from the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) and its Text Revision (DSM-IV-TR) (APA, 2000), and some have critiqued this approach suggesting that this would overestimate PTSD prevalence (McNally, 2009). However, media exposure has been associated with PTSD in several studies.

In studies on the 11 September 2011 terrorist attack in the USA, people who spent more time viewing television related to the event had a higher risk of PTSD (Ahern et al., 2002; Schlenger et al., 2002). In one of the few longitudinal studies on media exposure and PTSD, Hall et al. (2015) found that greater media exposure was associated with incident PTSD at 6 month follow-up among terrorism-exposed adults. Frequent exposure to distressing media imagery and unrest was found to be associated with PTSD symptoms for adolescents who survived the Wenchuan earthquake in 2008 (Yeung et al., 2018).

According to the report from the Pew Research Center, Americans aged 18–29 years were about twice as likely to obtain news online rather than from television (52% vs 23%) (Gottfried & Shearer, 2017). This trend was also found among Macao youth, with

62% (vs 30%) reporting getting their news online versus television (Lam, 2018). Compared to other populations, young adults and college students may be more vulnerable to psychological distress associated with media exposure since they frequently use both traditional and new forms of media (Jones, Garfin, Holman, & Silver, 2016). However, few studies have examined this association.

According to a study on media use during a hurricane, the internet was the main source for weather-related news for college students, and 76% of the participants reported that they preferred this news medium (Piotrowski, 2015). The increasing use of new media may be an original source of indirect trauma exposure. A study of Hurricane Sandy found that social media use predicts higher stress levels than traditional media use (Goodwin, Palgi, Hamama-Raz, & Ben-Ezra, 2013). Compared to traditional media that provide 'objective' information about disasters, social media may have a more direct and personal impact on people owing to the type of content being shared (Lemyre, Johnson, & Corneil, 2010). But is engagement with traditional and new media associated with PTSD following community-wide natural disasters? To answer this question, studies are needed to examine the link between media exposure and PTSD among populations exposed to natural disasters.

Most of the previous studies on media exposure and PTSD demonstrate that increased media use is associated with greater PTSD. A few studies reported a negative association between exposure and disaster-related mental health. In one exception, a study of Typhoon Haiyan in the Philippines reported that the use of Facebook facilitated collective coping strategies in the aftermath of the disaster (Tandoc & Takahashi, 2017). In that study, social media served as a platform for survivors to narrate and present their own experience, and this process helped them to manage feelings and memories about the disaster and encouraged coping with the crisis (Tandoc & Takahashi, 2017).

1.2. Aims of study

The current study had two aims. First, we examined the prevalence of PTSD among Macao university students 1 month after Typhoon Hato. Secondly, we examined key correlates of PTSD, including typhoon-related exposures, media exposure, and sociodemographic factors found previously to be associated with PTSD (Chan & Rhodes, 2014; Cieslak et al., 2009 Dai et al., 2016; Furr, Comer, Edmunds, & Kendall, 2010; Shigemura et al., 2014; Silvestre, Anacréon, Théodore, Silvestre, & Garcia-Dubus, 2014; Tural et al., 2004; Wilson, 2014). This study extends the previous literature by examining the impact of media use and specifically investigates the difference between traditional and new forms of media, and the differences in content of media exposure on PTSD in a disaster-exposed population.

2. Method

2.1. Context

Super Typhoon Hato struck Macao, Special Administrative Region (SAR) of the People's Republic of China, on 23 August 2017. This was one of the strongest typhoons to impact the city in over 50 years. The storm resulted in 10 deaths, more than 200 people injured, and an economic loss of USD1.42 billion (Ng, 2017). More than half the population experienced water and electricity shortages after the storm, and the telephone service in the whole city was suspended for several hours. The storm caused massive damage to the University of Macau campus, and power, water, and food supplies took more than 3 days to restore.

2.2. Participants and procedure

A self-report questionnaire was distributed to all students in the University of Macau by email on 21 September 2017 and data collection continued until 6 December. A lottery with a cash prize of 100 Macao Patacas (approximately USD13.00) for 50 people was used as an incentive for study participation. All participants were informed of the study purpose and procedures, and provided consent to participate. The study was approved by the Research Ethics Committee of the University of Macau.

2.3. Measures

2.3.1. PTSD

The Chinese Version of the PTSD Checklist for DSM-5 (PCL-5) assessed PTSD (Weathers, et al., 2013). The PCL-5 is a 20-item self-report measure of PTSD with well-established psychometric properties (Bovin et al., 2016). Respondents were instructed to rate each item focusing on Typhoon Hato on a five-point Likert scale (ranging from 0 = none to 4 = extreme) which assessed the severity of PTSD symptoms over the past month, according to the DSM-5 (American Psychiatric Association, 2013). PTSD diagnosis was established by algorithmic scoring, summing symptoms that were rated 2 'moderately' or higher in severity within each symptom cluster (Weathers et al., 2013). This scoring method follows the DSM-5 diagnostic scoring rules, requiring at least one intrusion, one avoidance, two negative alterations in cognitions and mood, and two alterations in arousal and reactivity symptoms. We utilized the algorithmic scoring method since validated cut-off scores are not available for use in a mixed-gender

sample of Chinese young adults. The Chinese version of PCL-5 demonstrated excellent reliability (Cronbach's α ranging from 0.91 to 0.94) and validity in previous studies of disaster exposure among Chinese people (Liu et al., 2014; Wang et al., 2015). The scale reliability in the current study was excellent (Cronbach's $\alpha = 0.97$).

2.3.2. Typhoon exposure

Exposure was assessed in two ways. We assessed direct exposure and resource deprivation as a result of the typhoon. The exposure questions were developed from a meta-analysis (Chan & Rhodes, 2014) of risk factors from previous natural disasters. In the current study, 13 items were used to assess direct typhoon exposure, including injuries, death of loved ones, almost drowning in the flooding, witnessing traumatic events happening to others, being stranded or trapped during the storm, and home damage. Resource deprivation was assessed using eight dichotomous questions that measured experiences of lacking necessities such as water, electricity, food, and medical care.

2.3.3. Media use

Fifteen items were used to examine participants' exposure to media use during and 1 week after the typhoon. Seven questions assessed the amount of time spent accessing disaster-related information on various forms of media, including traditional media (e.g. newspaper, radio, television) and new media (e.g. online news, social media). For example, 'In the week following the Typhoon, how many hours in total did you spend watching TV about the Typhoon?' (range from 0 h to > 12 h). Seven questions asked about the content that participants viewed. For example, 'How often do you view images of people suffering?' (range from 0 = never to 4 = often). One dichotomous question asked whether participants shared information related to the storm on social media.

2.3.4. Participant characteristics

Information included age, gender, and place of birth.

2.4. Statistical analysis

Independent *t*-tests, Pearson's chi-squared tests, and Fisher's exact tests were used to examine the univariable relationship between direct exposure, resource deprivation, media exposure, participant characteristics, and PTSD. Correlates significant at $p < 0.25$ were then included in adjusted multivariable logistic regression analyses. According to Hosmer, Lemeshow, and Sturdivant (2013), traditional significance levels (such as 0.05) often fail to identify variables known to be important predictors or confounders, and a higher significance threshold is recommended to select covariates for inclusion in adjusted models.

The analyses for the current study were conducted in a stepwise sequence of three multivariable logistic regression models. In Model 1, the association between participant characteristics and PTSD was evaluated. Then in Model 2, direct typhoon-related exposures were added to Model 1. In Model 3, typhoon-related deprivation was added to Models 1 and 2. Finally, in Model 4 we added media exposure to Models 1, 2, and 3. The type of media use and the contents of this media exposure were analysed separately (Model 4a, 4b). This sequence of model testing allowed for the examination of the adjusted effects of typhoon exposures on PTSD, the unique contribution of disaster-related deprivation, and, subsequently, the adjusted association between media exposure and PTSD, thereby enabling an evaluation of whether media exposure is associated with PTSD above and beyond established correlates (Chan & Rhodes, 2014). Significance in the adjusted models was set at < 0.05. Data analysis in this study was conducted using Stata 15.0 (StataCorp, 2017).

3. Results

3.1. Participant characteristics

At the time of the study there were 9782 Chinese students studying at the university, of whom 1876 participated in the current study (19.2%). Most students were from Macao (66.0%) and mainland China (29.3%). Among the participants, 634 (33.8%) were men and 1242 (66.2%) were women, with a mean age of 20.0 years ($SD = 2.63$). No significant differences were observed between the total student population and the study population by age, gender, and place of origin, suggesting that our study is representative.

3.2. Prevalence of PTSD

The prevalence of PTSD was 5.1%. The mean score on the PCL-5 was 5.9 ($SD = 9.9$). The prevalence of PTSD was 6.5% among local Macao (SAR)-born students, 5.6% among Hong Kong (SAR)-born students, and 2.3% among students born in mainland China.

3.3. Univariable analyses

Table 1 displays the results of univariable analyses. The results of the *t*-test indicated that students with PTSD were younger than those who did not have PTSD. Chi-squared tests showed that men, compared to women, were more likely to experience PTSD. Home damage, property loss, flooding, and not being able to live in the home, injury, witnessing

Table 1. Participant characteristics and typhoon exposure.

	Total		No PTSD		PTSD			
	N = 1876		*N* = 1780		*N* = 96			
Variable	*n*	%	*n*	%	*n*	%	χ^2	*p*
Sociodemographic characteristics								
Gender								
Men	634	33.8	588	92.7	46	7.3	9.02	0.003
Women	1242	66.2	1192	96.0	50	4.0		
Region								
Macao	1239	66.0	1160	93.6	79	6.4	Fisher's exact	0.005
Hong Kong	54	2.9	51	94.4	3	5.6		
Mainland China	550	29.3	537	97.6	13	2.4		
Taiwan	24	1.3	23	95.8	1	4.2		
Others	9	0.5	9	100.0	0	0.0		
Direct experience								
Injured								
No	1845	98.3	1755	95.1	90	4.9	13.16	< 0.001
Yes	31	1.7	25	80.7	6	19.3		
Almost drowned in the flooding								
No	1861	99.2	1771	95.2	90	4.8	37.89	< 0.001
Yes	15	0.8	9	60.0	6	40.0		
Stranded during the storm								
No	1252	66.7	1183	94.5	69	5.5	1.20	0.273
Yes	1398	33.3		95.7	27	4.3		
Trapped during the storm								
No	1398	74.5	1328	95.0	70	5.0	0.14	0.711
Yes	478	25.5		94.6	26	5.4		
Someone close being injured								
No	1791	95.5	1707	95.3	84	4.7	14.85	< 0.001
Yes	1622	4.5	73	85.9	12	14.1		
Witnessed people injured								
No	1622	86.5	1557	96.0	65	4.0	30.39	< 0.001
Yes	254	13.5	223	87.8	31	12.2		
Saw someone almost drown								
No	1824	97.2	1735	95.1	89	4.9	7.67	0.006
Yes	52	2.8		86.5	7	13.5		
Saw someone drown								
No	1860	99.1	1768	95.1	92	4.9	Fisher's exact	0.007
Yes	16	0.9	12	75.0	4	25.0		
Saw a dead body								
No	1863	99.3	1770	95.0	93	5.0	Fisher's exact	0.026
Yes	13	0.7	10	76.9	3	23.1		
Home damaged								
No	1489	79.4	1434	96.3	55	3.7	30.12	< 0.001
Yes	387	20.6	346	89.4	41	10.6		
Home flooded								
No	1625	86.6	1554	95.6	71	4.4	14.00	< 0.001
Yes	251	13.4	226	90.0	25	10.0		
Home uninhabitable after the typhoon								
No	1665	88.8	1590	95.5	75	4.5	11.45	0.001
Yes	211	11.2	190	90.1	21	9.9		
Personal or family loss of property								
No	1402	74.7	1338	95.4	64	4.6	3.49	0.062
Yes	474	25.3	442	93.2	32	6.8		
Resource deprivation								
No access to drinking water								
No	689	36.4	657	96.2	26	3.8	3.80	0.051
Yes	1193	63.6	1123	94.1	70	5.9		
No access to food								
No	1249	66.6	1197	95.8	52	4.2	7.00	0.008
Yes	627	33.4	583	93.0	44	7.0		
No access to running water from a tap								
No	309	16.5	292	94.5	17	5.5	0.11	0.737
Yes	1507	83.5	1488	95.0	79	5.0		
No access to electricity								
No	96	5.1	86	89.6	10	10.4	5.85	0.016
Yes	1780	94.9	1694	95.2	86	4.8		
No access to internet								
No	201	10.7	184	91.5	17	8.5	5.17	0.023
Yes	1675	89.3	1596	95.3	79	4.7		
No access to needed medication								
No	1800	95.9	1720	95.6	80	4.4	41.43	< 0.001
Yes	76	4.1	60	79.0	16	21.0		
No access to medical attention								
No	1812	96.6	1728	95.4	84	4.6	25.36	< 0.001
Yes	64	3.4	52	81.3	12	18.7		
Not able to communicate with loved ones								
No	905	48.2	855	94.5	50	5.5	0.60	0.439
Yes	971	51.8	925	95.3	46	4.7		

PTSD, post-traumatic stress disorder.

injury, injury to loved ones, seeing a dead body, and almost drowning, or seeing someone almost drowning or actually drowning in the flooding were all associated with PTSD. In addition, lack of food, water, electricity, internet, needed medication, and necessary medical attention during the typhoon period were all significantly associated with PTSD.

As shown in Table 2, *t*-tests showed that those with PTSD reported higher average time spent watching television, listening to radio programmes, watching online videos, viewing online news, and viewing videos on social media that were captured by people in the community about the storms, compared with those without PTSD. In terms of media exposure, people with PTSD spent higher average time viewing information on drowning victims and interviews with government officials, and less time viewing information related to the storm itself, and images of people being heroic.

3.4. Multivariable analyses

The result of logistic regression Model 1 (Table 3) indicated that men and students from Macao had higher odds of having PTSD than women and students from outside Macao. In Model 2, students who experienced home damage, whose home was uninhabitable after the typhoon, who witnessed people injured, and witnessed someone almost drown, had higher odds of PTSD than those who did not experience these exposures. In Model 3, incorporating resource deprivation, only lacking needed medication was significantly associated with PTSD. In Model 4a (Table 4), which explored the type of media used, the results showed that the amount of time spent listening to radio programmes and whether participants shared posts on social media were associated with PTSD. In Model 4b, incorporating media exposure content, the amount of time viewing information related to drowning victims and residents' emotional reactions was significantly associated with increased odds of PTSD. The amount of time viewing information related to the storm itself and the images of people being heroic were significantly associated with lower odds of PTSD.

Table 2. Average reported media use 1 week after Typhoon Hato.

Total	No PTSD		PTSD			
N = 1876	*N* = 1780		*N* = 96			
Variables	*M*	*SD*	*M*	*SD*	*t*-test	*p*
Types of media use						
Watching TV about the storm	2.15	2.93	2.82	3.21	−2.19	0.029
Listening to radio programmes about the storm	1.07	2.25	2.24	2.81	−4.87	< 0.001
Reading newspaper about the storm	2.26	2.87	2.64	2.05	−1.24	0.216
Viewing online news about the storm	3.57	3.62	3.52	3.70	0.13	0.894
Watching videos about the storm	2.99	3.44	3.83	3.81	−2.34	0.019
Viewing news updates on social media about the storm	3.88	3.85	4.60	3.98	−1.79	0.074
Viewing videos on social media that were captured by people in the community about the storm	3.55	3.74	4.58	3.86	−2.63	0.009
Media content						
The storm itself	2.86	1.15	2.07	1.25	6.47	< 0.001
The flooding	2.34	1.30	2.17	1.27	1.27	0.204
Drowning victims	1.83	1.26	2.13	1.30	−2.21	0.027
Residents' emotional reactions	2.27	1.26	2.44	1.19	−1.25	0.212
Interviews with government officials	1.74	1.26	2.07	1.26	−2.47	0.013
Images of people being heroic	2.78	1.17	2.43	1.26	2.90	0.003
Images of people being safe	2.26	1.23	2.17	1.28	0.75	0.451

PTSD, post-traumatic stress disorder.

4. Discussion

This study aimed to examine the prevalence and predictors of PTSD related to Typhoon Hato among university students in Macao, China, and to study the effects of media exposure on PTSD. To our knowledge, this is the first large-scale study examining typhoon-related PTSD in southern China. The prevalence of PTSD related to Typhoon Hato was 5.1%, and the prevalence of PTSD was higher among local than non-local students.

This prevalence is lower than the 7.3% reported among adolescents 6 months after Hurricane Andrew (Garrison et al., 1995). It is also low compared with the reported prevalence of 9.4% among disaster-exposed volunteers 1.5–4 months after Super Typhoon Haiyan (Chan, Tang, Hall, Yip, & Maggay, 2016). This variation in prevalence may be due to many factors, including the difference in assessment methods, characteristics of the population, and the severity of disasters.

According to the uncertainty reduction theory, in the aftermath of disaster, people tend to seek information about the potential threat to reduce anxiety (Boyle et al., 2004), but instead they are exposed to distressing content on the media which may increase their stress. Consistent with the relative risk appraisal model, we might expect that the magnitude and rarity of a typhoon such as Hato may have signalled a high level of threat, which would be worsened by media exposure (Marshall et al., 2007. Although the revised DSM-5 PTSD criteria removed media exposure as a Criterion A event, the current study adds to previous studies (e.g. Hall et al., 2015; Horesh, 2016; North, Hong, & Downs, 2018; Otto et al., 2007) showing that media exposure was associated with PTSD. The more restrictive definition of trauma will reduce the prevalence of PTSD in populations,

Table 3. Multivariable logistic regression Models 1 and 2.

	Model 1			Model 2			Model 3		
Variables	aOR	95% CI	*p*	aOR	95% CI	*p*	aOR	95% CI	*p*
Participant characteristics									
Age	0.90	0.81–1.00	0.061	0.89	0.79–0.99	0.035	0.86	0.76–0.97	0.012
Gender									
Women (ref. men)	0.56	0.37–.084	0.006	0.61	0.40–0.93	0.023	0.60	0.38–0.93	0.024
Region									
Macao	1.00			1.00			1.00		
Hong Kong	0.93	0.28–3.06	0.902	1.05	0.32–3.47	0.940	0.78	0.22–2.80	0.704
Mainland China	0.40	0.22–0.73	0.003	0.39	0.21–0.72	0.003	0.33	0.17–0.63	0.001
Taiwan	0.68	0.09–5.09	0.703	0.84	0.11–6.27	0.865	0.49	0.06–3.98	0.501
Direct exposure									
Injured				1.23	0.34–4.39	0.754	0.40	0.10–1.63	0.200
Witnessed people injured				2.81	1.69–4.67	< 0.001	2.33	1.36–4.00	0.002
Someone close being injured				1.39	0.60–3.22	0.443	1.48	0.60–3.63	0.395
Almost drowned in the flooding				10.30	2.49–42.59	0.001	8.99	1.92–41.99	0.005
Saw someone almost drown				0.82	0.27–2.53	0.733	0.65	0.20–2.14	0.481
Saw someone drown				2.24	.38–13.15	0.371	1.68	0.30–9.39	0.554
Saw a dead body				0.44	0.05–4.33	0.485	0.89	0.11–7.07	0.913
Home damaged				3.14	1.90–5.21	< 0.001	2.86	1.71–4.78	< 0.001
Home flooded				1.40	0.79–2.46	0.247	1.27	0.70–2.27	0.431
Home uninhabitable after the typhoon				3.21	1.83–5.61	< 0.001	2.59	1.45–4.64	0.001
Personal or family loss of property				0.69	0.41–1.16	0.164	0.74	0.44–1.25	0.263
Resource deprivation									
No access to drinking water							1.25	0.72–2.15	0.430
No access to food							1.48	0.90–2.44	0.121
No access to electricity							0.45	0.17–1.24	0.123
No access to internet							0.69	0.31–1.54	0.363
No access to needed medication							3.61	1.45–9.01	0.006
No access to medical attention							1.32	0.47–3.70	0.597

aOR, adjusted odds ratio; CI, confidence interval.

Table 4. Multivariable logistic regression Model 4.

	Model 4a			Model 4b		
Variables	aOR	95% CI	*p*	aOR	95% CI	*p*
Participant characteristics						
Age	0.84	0.75–0.96	0.007	0.87	0.77–1.00	0.05
Gender						
Men	1.00			1.00		
Women	0.56	0.35–0.90	0.017	0.76	0.49–1.30	0.367
Region						
Macao	1.00			1.00		
Hong Kong	0.91	0.24–3.39	0.887	0.90	0.22–3.53	0.859
Mainland China	0.33	0.17–0.64	0.001	0.40	0.21–0.84	0.014
Taiwan	0.43	0.05–3.57	0.433	0.56	0.07–4.97	0.639
Direct exposure experience						
Injured	0.45	0.11–1.85	0.267	0.40	0.10–1.62	0.200
Witnessed people injured	2.12	1.21–3.70	0.008	2.32	1.36–4.00	0.002
Someone close being injured	1.55	0.63–3.82	0.342	1.48	0.60–3.63	0.395
Almost drowned in the flooding	8.24	1.82–37.34	0.006	8.99	1.92–41.99	0.005
Saw someone almost drown	0.61	0.19–1.92	0.399	0.65	0.20–2.14	0.481
Saw someone drown	1.45	0.27–7.65	0.661	1.68	0.30–9.39	0.554
Saw a dead body	0.99	0.14–7.15	0.990	0.89	0.11–7.07	0.913
Home damaged	3.04	1.79–5.17	< 0.001	2.86	1.71–4.78	< 0.001
Home flooded	1.18	0.65–2.13	0.592	1.27	0.70–2.27	0.431
Home uninhabitable after the typhoon	2.52	1.40–4.54	0.002	2.59	0.44–4.64	0.001
Personal or family loss of property	0.74	0.43–1.26	0.264	0.74	0.44–1.25	0.263
Resource deprivation						
No access to drinking water	1.28	0.73–2.21	0.387	1.25	0.72–2.15	0.430
No access to food	1.43	0.86–2.36	0.166	1.48	0.90–2.44	0.121
No access to electricity	0.35	0.12–0.97	0.043	0.45	0.17–1.24	0.123
No access to internet	0.74	0.33–1.65	0.458	0.70	0.31–1.54	0.363
No access to needed medication	3.42	1.33–8.80	0.011	3.61	1.45–9.01	0.006
No access to medical attention	1.67	0.58–4.77	0.339	1.32	0.47–3.70	0.597
Types of media use						
Watching TV	0.99	0.88–1.10	0.82			
Listening to radio programmes	1.20	1.08–1.33	0.001			
Reading newspaper	0.92	0.82–1.03	0.14			
Watching videos	1.00	0.90–1.12	0.95			
Viewing news updates on social media	0.93	0.82–1.05	0.25			
Viewing videos on social media that were captured by people in the community	1.11	0.98–1.27	0.09			
Sharing posts on social media	1.75	1.09–2.81	0.02			
Media content						
The storm itself				0.37	0.28–0.49	< 0.001
The flooding				1.00	0.74–1.33	0.98
Drowning victims				1.29	1.00–1.67	0.05
Residents' emotional reaction				1.98	1.44–2.72	< 0.001
Interviews with government				1.21	0.97–1.54	0.09
Images of people being heroic				0.72	0.55–0.94	0.02

aOR, adjusted odds ratio; CI, confidence interval.

and may prevent 'bracket creep', but the influence of media exposure should also be considered (Lavenda, Grossman, Ben-Ezra, & Hoffman, 2017; Levin, Kleinman, & Adler, 2014; Marshall et al., 2007).

Among various forms of media, only listening to radio programmes was significantly associated with PTSD in multivariable analyses. This is counter-intuitive, as youth do not mainly use the radio. However, according to the Macao Government report (Shan, 2018), there were 250,000 households left without power, and with no access to the internet. The radio was the only source of information during the disaster, and in some districts, the electricity supply and internet service only resumed 1 week after the typhoon. Therefore, people most affected by the typhoon relied on radio to obtain access to media reports about the storm and recovery efforts since other forms of media were not available.

The amount of exposure to some media content, including viewing drowning victims and residents' emotional reactions, was associated with PTSD. These results were consistent with prior studies following the 11 September 2011 terror attacks in the USA showing that excessive media exposure was associated with psychological distress (Ford, Adams, & Dailey, 2007), as well as a longitudinal study after the Wenchuan earthquake showing that frequent exposure to distressing disaster images predicted PTSD (Yeung et al., 2018). Information supplied by the media may increase community stress, and some authors suggest that media exposure may act as a collective trauma, as revealed in a study of the 2004 Indian Ocean tsunami (Lau, Lau, Kim, & Tsui, 2006). This is also similar to findings from adults exposed to terrorism in Israel. Media exposure was associated with PTSD only when the media source was perceived as stressful (Palgi, Shira, & Hoffman, 2017). Sharing posts on social media was significantly associated with PTSD among college students, which indicates that students who reported higher psychological distress actively participated in social media use.

Another notable finding was that viewing more information related to the storm itself (i.e. objective information) and viewing images of people being heroic were protective factors for PTSD. These results suggest a positive effect of media following disasters. This supports previous studies which found that media framing of a disaster influences people's interpretation of the event, which may potentially improve community resilience (Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008). A study on the aftermath of Typhoon Haiyan in the Philippines provided evidence that collective coping strategies can be facilitated by Facebook (Tandoc & Takahashi, 2017). Future studies are needed to better understand the role of positive messages (e.g. heroic images and stories) on people's psychological well-being after disasters. The non-significant association between the type of media use and PTSD in the current study highlights the importance of the substance over form: the effect of media exposure on PTSD, either negative or positive, is associated with the exposure content, while the form of media used was largely not relevant.

PTSD is strongly associated with gender and age (Derivois, Cénat, Joseph, Karray, & Chahraoui, 2017; Hsu, Chong, Yang, & Yen, 2002; Silvestre et al., 2014; Yang et al., 2011). In the present study, younger students reported significantly higher PTSD symptom severity. Compared to students who came from other regions, Macao students had a higher prevalence of PTSD. This is to be expected since these students are more vulnerable to disaster-related stressors, such as home damage and loss, and injury to loved ones.

Contrary to previous research, being male was associated with higher odds of PTSD (Tolin & Foa, 2008). There are several possible explanations for this. One is that men were involved more in rescue efforts, and therefore may have been more directly exposed to traumatic events. This is largely anecdotal, and based on campus reports. Since Macao is a traditional society that follows traditional gender norms, men are expected to act to support friends and family following a calamity. The second possible explanation is that male students may be more affected by the media content emphasizing the casualties and tragedies involving men. Eight of the 10 people killed during the typhoon were men (Shan et al., 2018). In addition, one powerful video people that were sharing on social media featured a son crying for help to rescue his missing father in front of the entrance of an underground car park that was heavily flooded, and where people had died.

Consistent with previous studies, the univariable analyses revealed that home damage, life-threatening events, witnessing other people experiencing traumatic events, and lack of necessities were all significant correlates of PTSD (Chan & Rhodes, 2014; Paul et al., 2014; Ursano et al., 2014). Financial loss was identified as a consistent predictor of PTSD in previous literature (Galea, Tracy, Norris, & Coffey, 2008; Silvestre et al., 2014), but was not significant in this study. The present sample are college students, and adolescent and young adults may be less affected by economic losses compared with older age groups.

4.1. Limitations

There are several limitations to the current study. First, the data were collected from a self-report survey and PTSD diagnosis was made by screening rather than clinician diagnosis. Owing to the limited length of the survey, this study may not cover all potential

risk factors of PTSD identified in previous literature. We were also not able to assess for all possible trauma exposures occurring alongside the typhoon exposures in the present study. We also measured relatively few positive media messages and images. Our findings suggest that these may be protective, and should therefore be considered in future work. The data collection was not prospective, so we cannot determine whether psychological distress experienced before the typhoon influenced the current results. In addition, the study was cross-sectional, which limits causal inference. We adjusted for the effects of typhoon exposure and deprivation to understand the association between media exposure and PTSD. However, it should be noted that the entire sample was exposed to the typhoon, so the effects of media exposure could not be entirely separated from the effects of overall exposure to the typhoon. Finally, the data were collected 1–3 months after the typhoon, so it is possible that retrospective reports of media use may be biased. Compared to other factors related to direct disaster exposure, people may report less accurately regarding the amount of time spent using certain types of media or viewing certain types of media content. Given that this is a cross-sectional study, it is possible that people who experienced more distress may have reported greater exposure to distressing media content. Future longitudinal studies are needed to attempt to address this issue.

5. Conclusion

The current study found that the prevalence of PTSD after Typhoon Hato was 5.1%. Exposure to disaster-related media content was an important correlate of PTSD, and different methods used to access this information appeared to be related to PTSD. This study also revealed potential positive effects of media use on communities following a disaster, and future studies may explore the benefit of certain media content in preventing or reducing PTSD. Future studies should investigate the long-term psychological consequences following Typhoon Hato, college students' resilience, and barriers and facilitators of psychological treatment to guide mental health services and facilities.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the Macao Government RSKTO [MYRG-2015-111].

ORCID

Brian J. Hall http://orcid.org/0000-0001-9358-2377
Li Wang http://orcid.org/0000-0002-1459-3412

References

Ahern, J., Galea, S., Resnick, H., Kilpatrick, D., Bucuvalas, M., Gold, J., & Vlahov, D. (2002). Television images and psychological symptoms after the September 11 terrorist attacks. *Psychiatry*, *65*(4), 289–300.

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association..

American Psychiatric Association (2013). Trauma- and stressor-related disorders. *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.

Bovin, M. J., Marx, B. P., Weathers, F. W., Gallagher, M. W., Rodriguez, P., Schnurr, P. P., & Keane, T. M. (2016). Psychometric properties of the PTSD checklist for diagnostic and statistical manual of mental disorders-fifth edition (PCL-5) in veterans. *Psychological Assessment*, *28*(11), 1379–1391.

Boyle, M. P., Schmierbach, M., Armstrong, C. L., McLeod, D. M., Shah, D. V., & Pan, Z. (2004). Information seeking and emotional reactions to the September 11 terrorist attacks. *Journalism & Mass Communication Quarterly*, *81*(1), 155–167.

Chan, C. S., & Rhodes, J. E. (2014). Measuring exposure in Hurricane Katrina: A meta-analysis and an integrative data analysis. *PloS One*, *9*(4), 1–15.

Chan, C. S., Tang, K. N. S., Hall, B. J., Yip, S. Y. T., & Maggay, M. (2016). Psychological sequelae of the 2013 Super Typhoon Haiyan among survivor-responders. *Psychiatry: Interpersonal and Biological Processes*, *79*(3), 282–296.

Cieslak, R., Benight, C., Schmidt, N., Luszczynska, A., Curtin, E., Clark, R. A., & Kissinger, P. (2009). Predicting posttraumatic growth among Hurricane Katrina survivors living with HIV: The role of self-efficacy, social support, and PTSD symptoms. *Anxiety, Stress & Coping*, *22*(4), 449–463.

Dai, W., Chen, L., Lai, Z., Li, Y., Wang, J., & Liu, A. (2016). The incidence of post-traumatic stress disorder among survivors after earthquakes: A systematic review and meta-analysis. *BMC Psychiatry*, *16*, 188.

Derivois, D., Cénat, J. M., Joseph, N. E., Karray, A., & Chahraoui, K. (2017). Prevalence and determinants of post-traumatic stress disorder, anxiety and depression symptoms in street children survivors of the 2010 earthquake in Haiti, four years after. *Child Abuse and Neglect*, *67*, 174–181.

Ford, J. D, Adams, M. L, & Dailey, W.F. (2007). Psychological and health problems in a geographically proximate population time-sampled continuously for three months after the September 11th, 2001 terrorist incidents. *Anxiety, Stress, & Coping*, *20*(2), 129-146. doi:10.1080/10615800701303215

Furr, J. M., Comer, J. S., Edmunds, J. M., & Kendall, P. C. (2010). Disasters and youth: A meta-analytic examination of posttraumatic stress. *Journal of Consulting and Clinical Psychology*, *78*(6), 765–780.

Galea, S., Tracy, M., Norris, F., & Coffey, S. F. (2008). Financial and social circumstances and the incidence

and course of PTSD in Mississippi during the first two years after Hurricane Katrina. *Journal of Traumatic Stress*, *21*(4), 357–368.

Garrison, C. Z., Bryant, E. S., Addy, C. L., Spurrier, P. G., Freedy, J. R., & Kilpatrick, D. G. (1995). Posttraumatic stress disorder in adolescents after Hurricane Andrew. *Journal of the American Academy of Child & Adolescent Psychiatry*, *34*(9), 1193–1201.

Goodwin, R., Palgi, Y., Hamama-Raz, Y., & Ben-Ezra, M. (2013). In the eye of the storm or the bullseye of the media: Social media use during Hurricane Sandy as a predictor of post-traumatic stress. *Journal of Psychiatric Research*, *47*(8), 1099–1100.

Gottfried, J., & Shearer, E. (2017). News use across social media platforms 2017. *Pew Research Center*. Retrieved from https://internet.psych.wisc.edu/wp-content/uploads/532-Master/532-UnitPages/Unit-05/Shearer_PewResearch_2017.pdf

Hall, B. J., Murray, S. M., Galea, S., Canetti, C., & Hobfoll, S. E. (2015). Loss of social resources predicts incident posttraumatic stress disorder during ongoing political violence within the Palestinian authority. *Social Psychiatry and Psychiatric Epidemiology*, *15*, 561–568.

Horesh, D. (2016). The reconstruction of criterion A in DSM-5: Is it a true incorporation of secondary traumatization into the PTSD diagnosis? *Journal of Loss and Trauma*, *21*(5), 345–349.

Hosmer, D. W., Jr, Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression*. Hoboken, NJ: John Wiley & Sons.

Hsu, C. C., Chong, M. Y., Yang, P., & Yen, C. F. (2002). Posttraumatic stress disorder among adolescent earthquake victims in Taiwan. *Journal of the American Academy of Child and Adolescent Psychiatry*, *41*(7), 875–881.

Jones, N. M., Garfin, D. R., Holman, E. A., & Silver, R. C. (2016). Media use and exposure to graphic content in the week following the Boston Marathon bombings. *American Journal of Community Psychology*, *58*, 47–59.

Lam, I. F. A. (2018). *The 2017 media usage report in Macau*. Macao (SAR), People's Republic of China: University of Macau.

Lau, J. T. F., Lau, M., Kim, J. H., & Tsui, H. Y. (2006). Impacts of media coverage on the community stress level in Hong Kong after the tsunami on 26 December 2004. *Journal of Epidemiology & Community Health*, *60* (8), 675–682.

Lavenda, O., Grossman, E. S., Ben-Ezra, M., & Hoffman, Y. (2017). Exploring DSM-5 criterion A in acute stress disorder symptoms following natural disaster. *Psychiatry Research*, *256*, 458–460.

Lemyre, L., Johnson, C., & Corneil, W. (2010). Psychosocial considerations for mass decontamination. *Radiation Protection Dosimetry*, *142*(1), 17–23.

Levin, A. P., Kleinman, S. B., & Adler, J. S. (2014). DSM-5 and posttraumatic stress disorder. *Journal of the American Academy of Psychiatry and the Law*, *42*(2), 146–158.

Liu, P., Wang, L., Cao, C., Wang, R., Zhang, J., Zhang, B., … Elhai, J. D. (2014). The underlying dimensions of DSM-5 posttraumatic stress disorder symptoms in an epidemiological sample of Chinese earthquake survivors. *Journal of Anxiety Disorders*, *28*(4), 345–351.

Marshall, R., Bryant, R., Amsel, L., Suh, E., Cook, J., & Neria, Y. (2007). Relative risk appraisal, the September 11 attacks, and terrorism-related fears. *American Psychologist*, *62*(4), 304–316.

McNally, R. J. (2009). Can we fix PTSD in DSM-V? *Depression and Anxiety*, *26*(7), 597–600.

Ng, K. (2017). Macau suffers US$1.42 billion economic loss in wake of Typhoon Hato. Retrieved from http://www.scmp.com/news/hong-kong/economy/article/2110077/macau-suffers-us142-billion-economic-loss-wake-typhoon-hato.

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology*, *41*(1–2), 127–150.

North, C. S., Hong, B. A., & Downs, D. L. (2018). PTSD: A systematic approach to diagnosis and treatment: Accurate diagnosis and management depends on proper application of DSM-5 criteria. *Current Psychiatry*, *17*(4), 35–44.

Otto, M. W., Henin, A., Hirshfeld-Becker, D. R., Pollack, M. H., Biederman, J., & Rosenbaum, J. F. (2007). Posttraumatic stress disorder symptoms following media exposure to tragic events: Impact of 9/11 on children at risk for anxiety disorders. *Journal of Anxiety Disorders*, *21*(7), 888–902.

Pai, A., Suris, A., & North, C. (2017). Posttraumatic stress disorder in the DSM-5: Controversy, change, and conceptual considerations. *Behavioral Sciences*, *7*(1), 7.

Palgi, Y., Shrira, A., & Hoffman, Y. (2017). Negative and positive perceptions of media sources and PTSD symptoms among older adults exposed to missile attacks. *Personality and Individual Differences*, *119*, 185–188.

Paul, L. A., Price, M., Gros, D. F., Gros, K. S., McCauley, J. L., Resnick, H. S., … Ruggiero, K. J. (2014). The associations between loss and posttraumatic stress and depressive symptoms following Hurricane Ike. *Journal of Clinical Psychology*, *70*(4), 322–332.

Piotrowski, C. (2015). Mass media use by college students during hurricane threat. *College Student Journal*, *49*(1), 13–16.

Schlenger, W. E., Caddell, J. M., Ebert, L., Jordan, B. K., Rourke, K. M., Wilson, D., … Kulka, R. A. (2002). Psychological reactions to terrorist attacks: findings from the National Study of Americans' Reactions to September 11.*JAMA*, *288*(5), 581–588.

Shan, C.-C. Past-Hato Report: Review, Follow-up and Improvement of the Disaster Response Mechanism for Macau. March 2018

Shigemura, J., Tanigawa, T., Nishi, D., Matsuoka, Y., Nomura, S., & Yoshino, A. (2014). Associations between disaster exposures, peritraumatic distress, and posttraumatic stress responses in Fukushima nuclear plant workers following the 2011 nuclear accident: The Fukushima NEWS project study. *PloS One*, (2). doi:10.1371/journal.pone.0087516

Silvestre, G., Anacréon, P., Théodore, M., Silvestre, E., & Garcia-Dubus, E. (2014). Risk factors for posttraumatic stress disorder in Haitian students. *Psychology*, *5*(8), 849–858.

StataCorp. (2017). *Stata statistical software: Release 15*. College Station, TX: Author.

Tandoc, E. C., Jr, & Takahashi, B. (2017). Log in if you survived: Collective coping on social media in the aftermath of Typhoon Haiyan in the Philippines. *New Media & Society*, *19*(11), 1778–1793.

Tolin, D. F., & Foa, E. B. (2008). Sex differences in trauma and posttraumatic stress disorder: A quantitative review of 25 years of research. *Psychological Trauma: Theory, Research, Practice, and Policy, Special*, (1), 37–85. doi:10.1037/1942-9681.S.1.37

Tural, U., Coşkun, B., Onder, E., Corapçioğlu, A., Yildiz, M., Kesepara, C., … Aybar, G. (2004). Psychological consequences of the 1999 earthquake in Turkey. *Journal of Traumatic Stress*, *17*(6), 451–459.

Ursano, R. J., McKibben, J. B. A., Reissman, D. B., Liu, X., Wang, L., Sampson, R. J., & Fullerton, C. S. (2014). Posttraumatic stress disorder and community collective efficacy following the 2004 Florida Hurricanes. *PloS One*, *9*(2), 1–9.

Wang, L., Zhang, L., Armour, C., Cao, C., Qing, Y., Zhang, J., … Fan, G. (2015). Assessing the underlying dimensionality of DSM-5 PTSD symptoms in Chinese adolescents surviving the 2008 Wenchuan earthquake. *Journal of Anxiety Disorders*, *31*, 90–97.

Weathers, F. W., Litz, B. T., Keane, T. M., Palmieri, P. A., Marx, B. P., & Schnurr, P. P. (2013). The PTSD Checklist for DSM-5 (PCL-5). Scale available from the National Center for PTSD at www.ptsd.va.gov.

Wilson, L. C. (2014). Mass shootings: A meta-analysis of the dose-response relationship. *Journal of Traumatic Stress*, *27* (6), 631–638.

Yang, P., Yen, C., Tang, T., Chen, C., Yang, R., Huang, M., … Yu, H. (2011). Posttraumatic stress disorder in adolescents after Typhoon Morakot-associated mudslides. *Journal of Anxiety Disorders*, *25*, 362–368.

Yeung, N. C. Y., Lau, J. T. F., Yu, N. X., Zhang, J., Xu, Z., Choi, K. C., … Lui, W. W. S. (2018). Media exposure related to the 2008 Sichuan Earthquake predicted probable PTSD among Chinese adolescents in Kunming, China: A longitudinal study. *Psychological Trauma: Theory, Research, Practice, and Policy*, *10*(2), 253–262.