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MENTAL HEALTH

Post-traumatic stress reactions among Rwandan children and adolescents in the early aftermath of genocide

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Background Epidemiological investigations of post-traumatic stress reactions in Sub-Saharan Africa, where atrocious violence against civilians is endemic, are rare. This article is the first complete report of the key community-based findings of a 1995 psychiatric epidemiological survey of young survivors of the 1994 Rwandan Genocide.

Methods The National Trauma Survey (NTS) of Rwandans aged 8–19 measured traumatic exposures using an inventory of possible war time experiences and post-traumatic stress reactions with a checklist of symptoms of Post-traumatic stress disorder (PTSD). Individuals meeting assessed PTSD diagnostic criteria are classified as cases of 'probable PTSD'. The NTS interviewed youth residing in the community and others institutionalized in unaccompanied children's centres; the former ($n = 1547$) are the subject of the present report. Instrument change midway into the study divides respondents into two samples.

Results Among respondents, over 90% witnessed killings and had their lives threatened; 35% lost immediate family members; 30% witnessed rape or sexual mutilation; 15% hid under corpses. In Sample 1, 95% of respondents reported one or more re-experiencing symptom, 95% reported three or more avoidance/blunting symptoms and 63% reported two or more arousal symptoms; in Sample 2, these figures were 96%, 95% and 56%, respectively. The overall rate of 'probable PTSD' was 62% and 54% in Samples 1 and 2, respectively, and exhibited a dose–response relationship with exposure. Among the most heavily exposed individuals the rate was 100%. Rates of 'probable PTSD' were higher among females than among males. Results for age were inconsistent.

Conclusion In industrialized societies, most survivors of traumatizing violence experience symptoms only transiently. In the Rwanda survey, symptom levels and rates of 'probable PTSD' were exceptionally elevated, suggesting that at the limits of catastrophic man-made

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violence, psychological resilience among youth is all but extinguished.

Keywords PTSD epidemiology Rwanda violence genocide

Introduction

The introduction of post-traumatic stress disorder (PTSD) in the 1980 DSM-III[1] stimulated a wealth of epidemiological research on this condition among war veterans. Work on children exposed to natural disasters and on adults and children experiencing civilian interpersonal violence in industrialized societies has also gained considerable momentum.[2–4] Most recently, the Oklahoma City bombing and the attack on the World Trade Center contributed additional impetus to this work[5–8] and expanded the focus to include terrorism.

PTSD research on groups from low-income countries traumatized by violence has been slower to develop. Among these studies, most are devoted to refugees granted asylum in industrialized nations. Norwegian, British, Canadian, Australian–New Zealand and US studies of PTSD among refugees from Southeast Asia, the Balkans, Ethiopia, and Central America mirror the major areas of war and armed conflict in the second half of the 20th century and of countries hospitable to asylum seekers.[9–12]

A number of epidemiological investigations have examined traumatized adults and children in refugee settings or in their country of origin.[13] Mollica and colleagues have pioneered work in refugee camps, including studies of Cambodian adults and adolescents housed on the Thai–Cambodian border and Bosnian adults settled temporarily in Croatia.[14,15] Among works in country, Thabet and Vostanis investigated Palestinian children in Gaza, reporting moderate to severe PTSD reactions among 40% of study participants.[16] Equally or more elevated rates of marked PTSD reactions have been described by Nader and colleagues working among children in Kuwait after the Iraqi invasion[17] and by Kuterovac and coworkers among Palestinian children in Gaza.[18]

Work on war-traumatized communities in sub-Saharan Africa, however, remains sparse, despite the endemicity of violence in this region. For example, only four studies have investigated PTSD in the aftermath of the Rwandan genocide. Two epidemiological studies of adults have appeared, one of Rwandans living in refugee camps in 1995[19] and the other, a large-scale study linking post-traumatic stress symptoms (PTSS) with attitudes towards justice and reconciliation in 2002.[20] Two studies of children and adolescents have been published, one, an early report of the survey reported here in detail,[21] and a second of Rwandan adolescents residing in an orphanage.[22]

In the spring of 1994, the small, densely populated African nation of Rwanda was convulsed by a cataclysmic genocide directed by members of the Hutu majority against the minority Tutsi population. During 100 days, civilian Tutsi men, women and children, as well as moderate Hutu, were massacred primarily by other civilians. Most killing occurred in April and May. When the killing was halted in July of 1994, half of the Tutsi population of Rwanda, 600 000–800 000 people, had been slaughtered at a pace and with a visibility unequaled in modern history.[23,24]

In October 1994, UNICEF and the new Rwandan Ministry of Rehabilitation, in collaboration with several non-governmental organizations (NGOs), instituted a Trauma Recovery Program (TRP). This programme included capacity building for relief of post-traumatic symptoms at the community level and creation of a National Trauma Center in Kigali offering outpatient services for severely traumatized children and families. In 1995, the programme also launched a National Trauma Survey (NTS),[21,25] designed and implemented by UNICEF consultants, to estimate the extent of children's exposure to wartime violence and the scale and severity of their post-traumatic stress reactions.

Consistent with its national scope and concern for children in especially difficult circumstances, the survey sampled children and adolescents from communes located throughout Rwanda, both those attending school and those residing in unaccompanied children's centres (UCCs), the latter being institutions caring for displaced and orphaned children.

Details of the survey design, together with preliminary findings on 60% of the sample, have been reported previously.[21] NTS data, initially reserved for use by the original investigators, were recently made available to other researchers. The NTS represents the first and, to date, only population-based study of the mental health of children and adolescents in the early aftermath of catastrophic political and ethnic violence in the developing world.

This article investigates (i) the types and frequency of violence reported by survey participants; (ii) whether a dose–response relationship exists between exposure to violence and post-traumatic stress reactions assessed both dimensionally and categorically and (iii) whether the levels of post-traumatic stress vary with respondents' age, gender and education among community-based respondents.

Methods

Sampling

In 1995, Rwanda was divided into 11 prefectures (see Figure 1) subdivided into 154 communes with

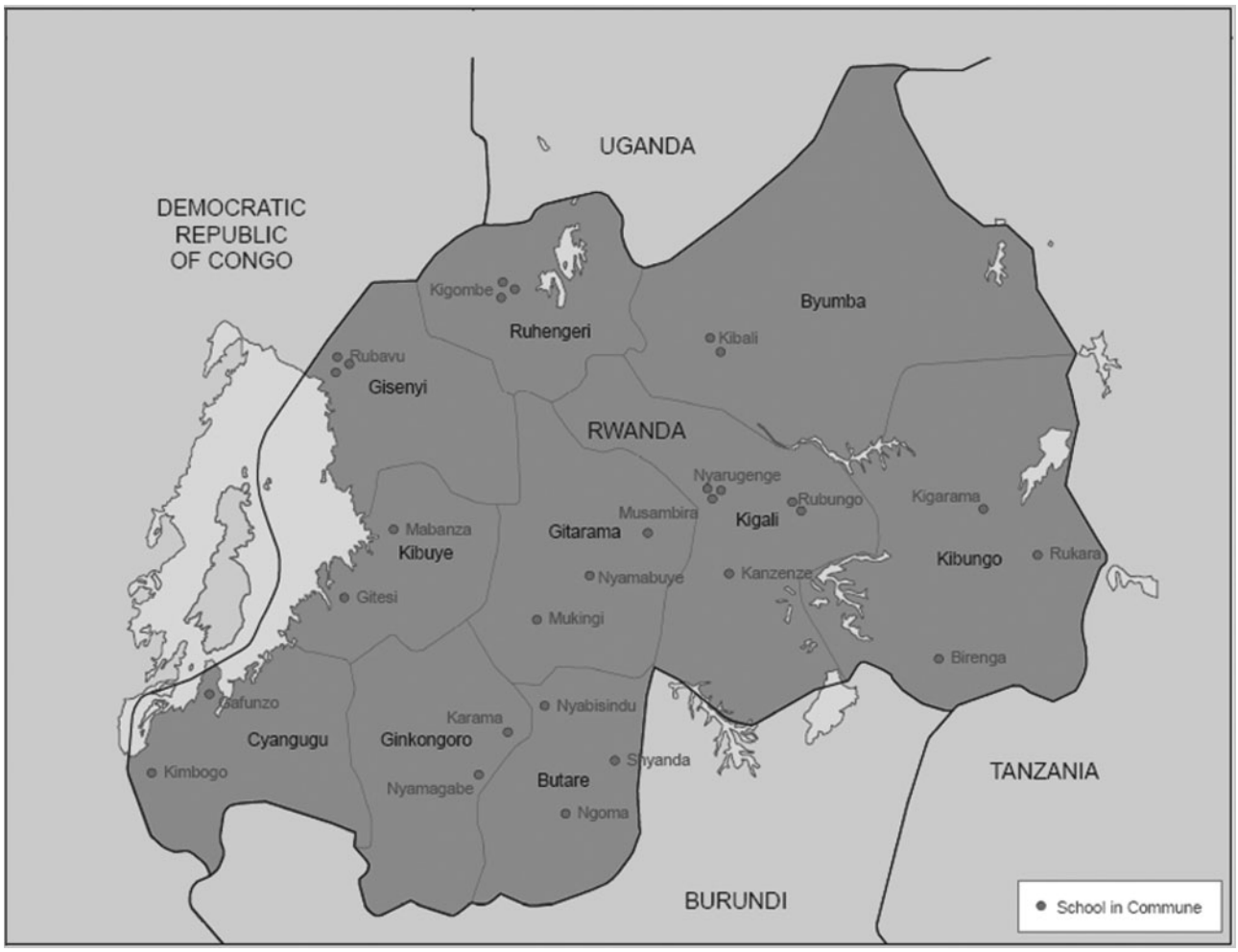

Figure 1 Location of communes and schools sampled in the NTS 1995. Kigali comprises two prefectures: Kigali civil and Kigali rural

approximately 1700 primary and secondary schools and 80 UCCs located throughout the country. The survey, limited to 8–19 persons, employed stratified quota sampling with a targeted sample size of roughly 3000 individuals. Strata comprised: 1. prefecture; 2. recruitment site (community school or UCC); 3. gender. The aim was recruitment of equal numbers of participants from each prefecture, with 50% of recruits per prefecture drawn from schools, and girls comprising 50% of recruits per institution. Random sampling of schools and UCCs was not possible since exact lists of intact schools and operating UCCs were not available. In addition, travel restrictions related to unstable security conditions precluded full recruitment of subjects from certain prefectures, e.g. Cyangugu. Operating within these constraints, schools and UCCs were generally drawn from the same communes. The survey was conducted from March to December 1995.

Thirty primary and secondary schools and 33 UCCs situated within 30 communes drawn from all 11 prefectures were selected for study. One headmaster and two centre directors declined participation, leaving a total of 29 schools and 31 UCCs contributing 1547 and 1483 survey participants, respectively.[21] Within the required age range and quotas, the centre directors and school headmasters randomly sampled the child participants.[26] (Specific procedures for achieving random selection are not described in UNICEF documentation of the NTS.) These children comprise a distinct subgroup of bereaved and traumatized individuals, confined in specialized facilities. They require a separate analysis. Accordingly, this article focuses on youth living in the community.

The study protocol was approved by UNICEF and Rwandan government ministries. Prefects received written notification of the survey's purpose; their authorization was required before the survey could proceed. Oral consent was obtained from each headmasters before their school could be enlisted in the study.

Four women, all high school graduates, served as interviewers. The 30–40 min interview was described to the selected children, administered only to those

assenting and was conducted in private. Interviewers offered emotional support to any child disturbed by the interview and noted the need for follow-up services from the UNICEF trauma team.

Training and supervision was conducted by the UNICEF Project Officer with previous clinical social work experience and a doctorate in health psychology. Training involved three 1 h practice interview sessions among these interviewers and with children of UNICEF staff. Instruction was conducted both in French and in Kinyarwanda to facilitate thorough understanding of the interview protocol. A UNICEF Project Assistant provided supervision in the field. A clinical psychologist with extensive treatment and research experience with traumatized and bereaved populations reviewed completed questionnaires and met weekly with interviews for purposes of quality control.[21]

UNICEF authorized analyses of these data subject to institutional review board (IRB) approval. Since neither the NTS database nor UNICEF itself possessed information identifying individual children, the IRB of New York State Psychiatric Institute exempted the study from review.

Measures

The survey recorded the prefecture, commune and school where the interview took place, the child's age in four categories (i.e. 8–10, 11–13, 14–16 and 17–19 years), gender and years of schooling followed by assessments of violent experiences during the genocide and of current post-traumatic stress symptoms. Ethnicity ('Tutsi' or 'Hutu') was not asked. Some changes in the symptom measure were introduced on 22 August, after completion of ~40% of interviews. For brevity, we refer to individuals interviewed through 23 August as 'Sample 1', the remainder, as 'Sample 2'; however, they do not comprise two separately drawn samples.

Wartime Violence Checklist. A 28-item Wartime Violence Checklist, modelled on an inventory used to interview children exposed to the 1980s' Lebanese civil war, was employed to assess traumatic exposures during the genocide.[27] The checklist itemized children's possible experiences of witnessing or being the direct target of violence and of bereavement. Items from the Lebanese measure pertaining to bereavements, for example, death of mother, death of father, were retained unaltered (except of course for translation) in the Rwandan Checklist. With input from the local Rwandan staff drawing on their own experiences and knowledge of the genocide, other items were deleted, replaced/reworded or supplemented to correspond to the circumstances and weaponry of the Rwandan conflict. For example, references to being arrested or held in detention *by uniformed armed forces* were excluded as inapplicable; mention of destruction by 'air raids' and 'bombs' was replaced by items such as 'have you witnessed killings or injuries with machetes' and 'have you witnessed people being beaten with sticks'. Two items were added: rape/sexual mutilation and hiding under dead bodies. All items referred exclusively to the period of the genocide. After each item was read, the respondent was asked to indicate 'no' (0) or 'yes' (1) to signal whether he or she had witnessed such violence or loss. No additional details were obtained about the experience(s). The use of similar checklists, including the binary response options, represent current practice in studies of natural and man-made disasters.[14,20,28,29]

To convey the extent of exposure to different types of wartime violence and loss, we grouped the checklist items into six categories: 1. bereavement, 2. witnessing violence against people, 3.witnessing violence against property, 4. direct victimization. The frequency of 5. witnessing rape/sexual mutilation, a matter of special importance,[30] and of 6. hiding under dead bodies, is also presented (Table 1).

Employing a systematic weighting of governmental and non-governmental databases, a US National Science Foundation[31] funded project ranked Rwandan communes by estimated number of genocidal killings. We used this ranking as an external criterion against which to evaluate the ranking of communes based on children's responses to the Wartime Violence Checklist. Thus, the NTS communes were ranked according to the overall mean number of exposures to violence reported by the children and adolescents drawn from schools in that commune. The association between the two rankings, assessed with Kendall's tau-b, was .43, $P \leqslant 0.001$, thereby affords some evidence of the checklist's criterion validity. This evidence of criterion validity did not vary appreciably by sociodemographic characteristics, namely, age, gender or years of education.

The grouping of checklist items into these six qualitative categories is solely descriptive in nature. For analytic purposes, we index exposure to wartime violence in two ways: (a) the simple arithmetic sum of the 28 item scores (possible range 1–28) and (b) the summed score divided so as to classify respondents into five subsamples of approximately equal size exposed to increasing levels of violence, starting with one exposure. Using the former approach, we characterize the samples in terms of mean number of exposures. The latter approach, based on quintiles (or in some studies, quartiles), is common in investigations using this type of checklist in the wake of complex emergencies.[15,16,19,29] Among other virtues, it enhances the interpretability of results from logistic regression and facilitates cross-study comparisons.

PTSS and 'Probable PTSD'

A DSM-IV PTSD diagnosis comprises six criteria: A–F. Criterion A1, the stressor, requires the occurrence of an event involving actual or threatened death to the respondent or to others, a criterion clearly met by items on the Wartime Violence Checklist. Criterion

Table 1 General exposure categories, sample checklist items and frequency of exposure to wartime violence reported among children in the NTS ($N = 1482$)

General exposure category (number of items)	Sample checklist items by general exposure category	Respondents exposed (%)
1. Bereavement (5)	Death of mother, father, siblings.	34.3
2. Victim of threat of violence (4)	Had to hide for protection; Had to hide alone; Believed he/she would die; someone threatened to kill him/her.	96.1
3. Witnessing violence against people (13)	Saw killings/injuries with machetes; dead bodies/parts of bodies; people beaten with sticks; family member(s) killed.	93.5
4. Witnessing violence against property (3)	Respondent saw destruction/looting of houses; shelling or mortar fire; landmine explosions.	86.6
5. Physical injury (1)	Physical injury	11.4
6. Witnessing rape/sexual mutilation (1)	Respondent witnessed rape or sexual mutilation	27.1
7. Hiding under corpses (1)	Hid under corpses	14.2

Sixty-five individuals' missing information on exposure to wartime violence are excluded from these analyses.

A2, that the person's immediate response to the event involves intense fear, helplessness or horror (not yet widely known in 1995) was not assessed. Also required is the presence of three cardinal symptom groups: re-experiencing (Criterion B) one or more symptom; avoidance/numbing (Criterion C), three or more symptoms; arousal (Criterion D) two or more symptoms. Criterion E requires symptom duration exceeding 1 month; Criterion F, that the symptoms be clinically significant or interfere with functioning.[32]

The NTS measure of post-traumatic stress reactions covered the three DSM-IV cardinal symptom groups required for a PTSD diagnosis. The core of the measure is Horowitz's 15-item Impact of Events Scale (IES) (1979), originally developed for adults and limited to intrusion and avoidant symptoms.[33] Dyregov, Yule and colleagues identified psychometric difficulties, particularly with reference to factor loadings, with the IES when administered to war-traumatized children.[21,34,35] On the basis of this field work, these investigators dropped suboptimal items and also introduced items pertaining to hyperarousal. The NTS employed this new measure, denoted here as the 'Rwandan PTSS Scale'.

Two different versions of the Rwandan PTSS Scale were used in the NTS. The initial version contained 17 items (hereafter 'Rwandan PTSS Scale-17'). For each item, respondents indicated how often they had experienced the symptoms in the preceding 2 weeks. This 17-item measure was administered to survey participants ($n = 604$) interviewed from March through 22 August 1995 ('Sample 1'). At some point during this period, the investigators realized that they had not fielded the finalized version of the symptom measure. On 23 August, the correct version of the PTSS was introduced and administered to the remaining 942 survey participants. It contained 21 items (hereafter 'Rwandan PTSS-21'), of which 12 were identical to those in the PTSS-17.

Both versions of the PTSS provided adequate to excellent coverage of PTSS as described in DSM-IV. PTSS-17 items mapped directly onto >70% of the symptoms in DSM-IV; PTSS-21, onto >94% of these symptoms, with 80%, 100% and 100% coverage of Criteria B, C and D symptoms types, respectively. The correspondence between symptom wording in Kinyarwanda and the English DSM-IV was also excellent. (For complete details, see Table 2 which aligns both the PTSS-17 and PTSS-21 items with DSM-IV symptoms.)

Despite this satisfactory coverage of DSM-IV symptom groups, the PTSS-17 and PTSS-21 differed in response options for symptom frequency. Following Horowitz's approach both in wording and scoring of response options, the Rwandan PTSS-21 asked respondents whether they had experienced the symptom: 'not at all' (0), 'rarely' (1), 'sometimes' (3) or 'often' (5) in the preceding 2 weeks. In contrast, the PTSS-17 asked respondents whether they had experienced the symptom 'not at all' (1), 'sometimes' (2) or 'often' (3) in the preceding 2 weeks, thereby erroneously omitting the 'rarely' option. These differences in item number and particularly in options registering symptom frequency necessitated analysing the two samples separately. Consistent with previous practice with post-traumatic stress symptom checklists[20] only symptoms reported 'sometimes' or 'often' are counted towards the diagnosis. The absence of 'rarely' as an available choice for symptom frequency in PTSS-17 meant that individuals with rare symptoms could endorse 'sometimes' rather than 'not at all'. As a consequence, rates of 'probable PTSD' are marginally higher in Sample 1 than in Sample 2.

Translation of symptom measure. The English symptom items were translated into Kinyarwanda, then back-translated into English by five Rwandan professionals and paraprofessionals in the fields of teaching,

Table 2 DSM-IV PTSD symptom criteria, item wording in the PTSS scales in the NTS

DSM-IV symptom criterion		Item wording[a]	Sample 1	Sample 2
B. Reexperiencing: The traumatic event is persistently reexperienced in one (or more) of the following ways:				
B1.	Recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions	1. Think about the event when you don't want to[b]	✓	✓
		2. Pictures/memories of event suddenly pop into your mind[b]	✓	✓
		3. Heard or saw things that make you think of the event[b]	✓	✓
B2.	Recurrent distressing dreams of the event	4. Had dreams about what happened	✓	
		5. Woke up at night because of thoughts/ memories	✓	
B3.	Acting/feeling as if the traumatic event were recurring.	6. Felt as if the event were happening again		✓
B4.	Exposure to internal/external cues resembling an aspect of the traumatic event trigger –intense psychological distress	7. Waves of strong feelings about the event[b]		✓
B5.	–physiological reactivity	8. Bodily reactions caused by reminders		✓
C. Avoidance/Numbing: Persistent avoidance of stimuli associated with the trauma/numbing of general responsiveness, as indicated by three (or more) of the following:				
C1.	Efforts to avoid –thoughts, feelings, or conversations associated with the trauma	1. Try to remove the event from your memory[b]	✓	✓
		2. Try not to talk about the event[b]	✓	✓
		3. Try not to think about event[b]	✓	✓
C2.	–activities, places, or people that arouse recollections of the trauma	4. Stay away from reminders of the event[b]	✓	✓
C3.	Inability to recall an important aspect of the trauma	5. Difficulty remembering what happened		✓
C4.	Markedly diminished interest/participation in significant activities	6. Less interested in activities that you used to enjoy	✓	✓
C5.	Feeling of detachment/estrangement from others	7. Feel other people don't understand how you feel	✓	✓
C6.	Restricted range of affect	8. Trouble experiencing feelings, e.g., happiness		✓
		9. Feeling numb about what happened	✓	
C7.	Sense of a foreshortened future (e.g. does not expect to have a job, marriage, children, or normal life span)	10. Worry that you may not live to become an adult	✓	✓
		11. Waste of time to plan for future		✓
D. Arousal: Persistent symptoms of increased arousal, as indicated by two (or more) of the following:				
D1.	Difficulty falling asleep or staying asleep	1. Sleeping problems at night		✓
		2. So distressed had problems falling asleep	✓	
D2.	Irritability or outbursts of anger	3. Get irritable easily		✓
D3.	Difficulty concentrating	4. Difficulty concentrating	✓	✓
		5. Difficult for you to complete things	✓	
D4.	Hypervigilance	6. Alert/watchful when there is no need to be		✓
D5.	Exaggerated startle response	7. Startle more easily because of loud noises	✓	✓

[a]The symptom checklist used for Sample 2 contained a 22nd item regarding feeling guilt about what happened. The item was excluded since guilt is not a feature of PTSD symptoms in DSM-IV.
[b]Items comprising the brief eight-item version of the IES measures of intrusion and avoidance.

psychology, social work and medicine. Working with the primary UNICEF investigator, each item was evaluated for linguistic equivalence, contextual meaning and cultural appropriateness and altered when necessary. The final Kinyarwanda version was then translated into English by two professional translators. Exact word for word matching was achieved for virtually all of the items.

Internal consistency reliability. The internal consistency reliability (Cronbach's α) of the symptom scales used in Samples 1 and 2 overall—0.73 and 0.76, respectively—and within each age (0.72–0.80), gender (0.71–0.79) and educational subgroup (0.73–0.83) considered separately was satisfactory.

We created two indices of post-traumatic stress reaction for each sample: (i) the mean item score, representing the sum of all item scores divided by the number of items; and (ii) the application of the DSM-IV PTSD algorithm to participants' symptom reports to identify cases of 'probable PTSD'. We emphasize, however, that placement of individuals in the 'probable PTSD' category is not considered equivalent to a diagnosis of PTSD in part because information on Criterion E and F was not obtained. It indicates only that persons so classified are judged more likely to meet full criteria for DSM-IV PTSD if assessed clinically as compared with those not so classified.

During the reporting of symptoms, the child is asked to 'keep in mind the worst event that occurred to you during the fighting between April and June 1994'. Symptom questions then pertain to this 'worst' event. Unfortunately, the specific wartime event so designated was not recorded in the database, precluding comparisons of traumatogenicity among types of events.

Data analysis

First, we present the sociodemographic distribution of study participants and the mean score on the Wartime Violence Checklist overall and for Samples 1 and 2 separately. Distributional differences for categorical variables are tested with the chi-squared statistic; for continuous variables, using analysis of variance (ANOVA). Frequencies of exposure to the six categories of wartime violence are also presented, together with the proportions of respondents in each sample meeting each of the three PTSD symptom criteria.

The association of exposure to violence, divided into quintiles, with mean item scores and rates of 'probable PTSD', is examined for evidence of a dose–response relationship. Next, we test whether age, gender and years of schooling are associated with post-traumatic stress reactions. Both sets of analyses exclude persons ($n=5$) who did not report any traumatic experiences since such reporting is required for classification of symptoms as part of a post-traumatic reaction.

Examination of these associations was conducted in each sample with PTSD reactions represented as a continuous variable, namely, mean item score on the two symptom measures, and as a categorical variable, 'probable PTSD'. Analyses involving the continuous outcome are accomplished with ordinary least squares linear regression; the binary outcome, with maximum likelihood logistic regression.[36] Since results from these two sets of analyses generally concur (with one exception), for parsimony, we opted to report the results only from the 'probable PTSD' analyses. (The exception pertains to the association of age with post-traumatic stress reactions. For this association, both the results for 'probable PTSD' and for mean item score are presented with age treated as an ordinal variable.) Both unadjusted and adjusted odds ratios (ORs) together with 95% confidence intervals (CIs) are reported, with selection of control variables (i.e. age, gender, education and number of endorsed exposures) determined by whether their inclusion in the model changed the parameter estimate of interest by more than 10% (see notes to Tables 4 and 5 for enumeration of control variables.)

Variance estimates in all analyses are adjusted for clustering of survey participants in schools, with schools treated as fixed effects. Respondents missing six or more items on the pertinent symptom measures ($n=8$) are excluded from relevant analyses; respondents with five items or less ($n=85$) are assigned a prorated score based on completed items.

Results

Sample

A total of 1547 individuals aged 8–19 years were surveyed (Table 3). All selected respondents assented to the interview. The great majority of the participants were 14 years of age and older. As designed, half of the participants were female; approximately two-thirds had 7–12 years of education. Samples 1 and 2 differed somewhat by age, gender and years of education. (The presence of 19-year olds among secondary school attendees probably represents young adults returning to complete an education interrupted by war.)

Prevalence of exposure to wartime violence and PTSS

The great majority of participants reported multiple exposures. On average, each child endorsed 14 items on the Wartime Violence Checklist (Table 3).

Level of exposure was directly associated with the age of the child but unassociated with either the child's gender or years of education. In terms of the specific types of trauma comprising these multiple exposures (Table 1), over 90% of respondents reported exposure to life threat and witnessing killings. One child out of every six spent time hiding under corpses;

Table 3 Sociodemographic characteristics, level of exposure to wartime violence and post-traumatic stress reactions among children in the NTS

Characeristic[a]	Sample 1 ($N=605$) N (%)	Sample 2 ($N=942$) N (%)	Total ($N=1547$) N (%)
Age groups[b,*]**			
8–10	48 (7.9)	8 (0.9)	56 (3.6)
11–13	139 (23.0)	119 (12.7)	258 (16.7)
14–16	214 (35.4)	470 (50.0)	684 (44.3)
17–19[c]	204 (33.7)	343 (36.5)	547 (35.4)
Gender (female)[b,**]	290 (47.9)	517 (54.9)	807 (52.2)
Education (school years completed)[b,*]**			
0–3	111 (18.4)	85 (9.1)	198 (12.9)
4–6	142 (23.5)	148 (15.8)	290 (18.9)
7–12	350 (58.0)	701 (75.1)	1051 (68.4)
Wartime exposure to violence:			
Mean number of endorsed items (SD)[b]	13.6 (5.7)	14.2 (6.0)	13.9 (5.9)
Symptoms of PTSD[c]			
Intrusion[c] one or more symptom (%)	95.2	95.9	–
Avoidance[c] three or more symptoms (%)	94.8	94.5	–
Arousal[c] two or more symptoms (%)	62.6	56.0	–

[a]Comparison of samples by age, gender and education are performed using chi-squared tests; comparison of mean level of wartime exposure to violence using ANOVA. All comparisons adjust standard errors for clustering of participants in schools.
[b]Missing data. The denominator forming the bases for calculation of percents varies somewhat across sociodemographic characteristics because of missing data. Two subjects lacked data on age, 10 on education; 65 on wartime exposure to violence.
[c]Calculations of percentage of individuals meeting each of the three symptom criteria exclude the five individuals reporting no events.
$^{**}P < 0.01$; $^{***}P = 0.001$.

roughly 30% of respondents had witnessed rape or sexual mutilations.

In Sample 1, 95.2% of respondents reported one or more re-experiencing symptom, 94.8% reported three or more avoidance/blunting symptoms and 62.6% reported two or more arousal symptoms. The parallel figures for Sample 2 were 95.9%, 94.5% and 56%, respectively.

Dose–response relationship of level of violence with rates of 'probable PTSD'

The overall rate of 'probable PTSD' in Sample 1 was 61.6%, in Sample 2, 53.9%. (Table 4) Among persons in the top exposure quintile (21–28 types of traumatic events) over 75% met criteria for 'probable PTSD' in both samples. In analyses based on adjusted odds ratios (AOR), the odds of a 'probable PTSD' diagnosis increased monotonically with increasing levels of exposure. Among persons in the top exposure quintile, the odds of 'probable PTSD' was between 4- and 5-fold that among persons in the lowest quintile. In both Samples, the rate of 'probable PTSD' was 100% among individuals scoring above 25 ($n=11$) on the Wartime Violence Checklist.

Sociodemographic correlates of 'probable PTSD'

In both samples, the rate of 'probable PTSD' is significantly higher among females than among males (Table 5). In adjusted analyses, the odds of a female having 'probable PTSD' was 2.6-fold that of a male in Sample 1; 1.8-fold in Sample 2. This gender effect did not increase or decrease systematically with increasing exposure levels.

To analyse 'probable PTSD' rates by age we collapsed the two youngest age groups because of the limited number of children in the 8–10–year age category. In both samples, the rate of 'probable PTSD' is highest among the 17–19-year olds but rates in the two other age groups did not differ (Table 5). In Sample 1, the symptom item means in each of the four original age groups are 1.72 (SD 0.79), 1.93 (SD 0.75), 2.14 (SD 0,75) and 2.21 (SD 0.71); in Sample 2 the corresponding values are 1.88 (SD 0.35), 1.92 (SD 0.31), 1.92 (SD 0.32) and 1.99 (SD 0.33). In adjusted analyses, age is directly and statistically significantly associated with mean symptom item score. In Sample 1, the mean item score increases 0.15 (SEM 0.02) $P=0.001$ with each increase in age group; in Sample 2, 0.06 (SEM 0.01) $P=0.001$.

Table 4 Association of wartime violence with 'probable PTSD' among children in the NTS

	Probable PTSD					
	Sample 1 ($N=596$)			Sample 2 ($N=878$)		
Exposures[a,b]	*N* (%)	OR (95% CI)	AOR (95% CI)[c]	*N* (%)	OR (95% CI)	AOR (95% CI)[c]
Overall	368 (61.6)			473 (53.9)		
***N* of endorsed checklist items**						
1[d]–9	75 (48.1)***	Reference	Reference	84 (37.8)***	Reference	Reference
10–13	84 (61.3)	1.69 (1.16–2.45)	1.69 (1.16–2.47)	71 (42.0)	1.18 (0.83–1.67)	1.20 (0.84–1.72)
14–16	69 (63.3)	1.85 (0.91–3.75)	1.91 (0.93–3.94)	87 (57.6)	2.23 (1.51–3.31)	2.24 (1.52–3.32)
17–20	82 (67.8)	2.39 (1.60–3.58)	2.48 (1.71–3.61)	117 (63.2)	2.83 (1.99–4.03)	2.68 (1.92–3.74)
21–28	58 (78.4)	3.95 (3.08–5.07)	4.02 (3.31–4.90)	114 (75.5)	5.30 (3.24–8.67)	5.16 (3.17–8.41)

[a]Comparison of proportion of persons meeting criteria for 'probable PTSD' across exposure levels and calculation of unadjusted and adjusted, ORs and AOR, respectively, and CIs adjust standard errors for clustering.
[b]Seventy-three individuals are excluded from this analysis: 65 missing information on exposure to wartime violence, five not reporting any wartime exposures; an additional three missing symptom data.
[c]These ORs are adjusted for age and gender.
[d]A diagnosis of PTSD requires reporting of one or more traumatic exposures. Therefore, persons who did not endorse any items on the Wartime Violence Checklist are excluded. Whether these individuals had experiences that were not itemized on the checklist, chose not to report their exposures or truly remained unexposed is not know.
***$P=0.001$.

Table 5 'Probable PTSD' following traumatic exposure by age, gender and education among children in the NTS

	Probable PTSD					
	Sample 1 ($N=604$)			Sample 2 ($N=940$)		
Factor[a,b]	Percentage	OR (95% CI)	AOR (95% CI)[b]	Percentage	OR (95% CI)	AOR (95% CI)[a]
Age, years[c,d]						
8–13	62.0	0.76 (0.49–1.20)	0.74 (0.51–1.09)[b]	46.5	0.69 (0.45–1.07)	0.75 (0.47–1.18)
14–16	55.6	0.61 (0.44–0.83)	0.61 (0.48–0.78)	55.0	0.95 (0.71–1.28)	0.96 (0.72–1.28)
17–19	67.0	Reference	Reference	55.6	Reference	Reference
Gender[e]						
Female	72.8***	2.57 (1.99–3.32)	2.64 (2.10–3.32)[c]	60.5***	1.76 (1.35–2.31)	1.75 (1.32–2.31)[c]
Male	51.0	Reference	Reference	46.5	Reference	Reference
Education, years[f]						
0–3	66.7	1.26 (0.79–2.01)	1.74 (1.18–2.55)[d]	57.6	1.24 (0.52–2.93)	1.21 (0.52–2.79)[d]
4–8	59.9	1.00 (0.65–1.52)	1.11 (0.70–1.75)	47.3	0.72 (0.50–1.05)	0.80 (0.45–1.42)
9–12	60.2	Reference	Reference	55.1	Reference	Reference

[a]Comparison of proportion of persons meeting criteria for 'probable PTSD' within sociodemographic characteristics and calculation of all unadjusted and adjusted ORs and AOR, respectively, and their CIs adjust standard errors for clustering.
[b]Seventy-three individuals are excluded from this analysis: 65 are missing information on exposure to wartime violence; five not reporting any wartime exposures and three missing symptom data.
[c]Age groups 8–10 and 11–13 are merged because of small numbers in the former group.
[d]Adjusted for gender and number of exposures.
[e]Adjusted for age and number of exposures.
[f]Adjusted for age, gender and number of exposures.
***$P=0.003$.

No association emerged between years of education and PTSS or 'probable PTSD'.

Discussion

Most children and adolescents surveyed suffered from the classic triad of DSM-IV PTSD symptoms—re-experiencing, avoidance/numbing and arousal. 'Probable PTSD' rates were exceedingly high and increased with ascending levels of exposure, a dose-response relationship that concurs with the majority of previous investigations.[19,20,28] The current finding that 100% of respondents at the highest level of exposure exhibited 'probable PTSD,' based on very

small numbers) would not warrant mention if it were exceptional. However, at least two other studies, one conducted among Bosnian children,[37] the other, among children in Iraqi Kurdistan,[38] using other measures of PTSS and disorder, reported overall rates exceeding 90%. These several results suggest that certain extreme conditions extinguish normal capacities for resilience,[39] at least among children and adolescents. In their study of 68 orphaned Rwandan adolescents interviewed using the CIDI[40] a decade after the genocide, Schaal and Elbert found that ~45% met criteria for PTSD.[22]

Previous studies of post-traumatic stress reactions among children and adolescents have generally employed symptom checklists. Adopting a screening model, summed symptom scores are dichotomized at a pre-established cut-point to identify individuals likely to meet clinical criteria for PTSD. This approach was infeasible here for two reasons. No previous work has developed a cut-point for the current measures; any cut-points developed in industrialized countries would first require recalibration in this Sub-Saharan setting.

That prevalence of 'probable PTSD' is higher among females than among males accords well with most prior studies[41–44] across a range of western and non-western societies suggesting that biological as well as psychological[44] and cultural factors contribute to this difference. The specific biological as well as psychosocial sources of this gender difference await elucidation.

The possible association of age at time of exposure with post-traumatic stress reactions has implications for intervention and developmental theory. However, previous research on age and post-traumatic stress reactions finds direct, inverse and no associations.[41–44] In the present study, the strong and direct association found between age and exposure in an analysis based on mean item score was absent in the analysis relying upon rates. Several mechanisms might explain these contradictions, e.g. the effect of age on post-traumatic stress reactions may vary with the type of event or the duration of time elapsed since exposure. Long-term cohort studies are capable of clarifying this issue.

Several studies report an inverse association of PTSD with years of education, measured IQ or cognitive performance.[45] The absence of this association in the current study is not surprising. The nature of education in a subsistence agricultural society, whether as social capital or proxy for cognitive ability, may not resemble its role in industrialized nations. Nonetheless, these null results warrant further study including a search for possible as yet unidentified confounding variables.

While exposure checklists using binary response options are a common feature of PTSD studies in the context of war and natural disasters their psychometric limitations are well established.[46] The exposure's contextual features are absent; single and multiple occurrences of a given type of event are not distinguished; several different items can be endorsed with reference to the same event. The current study is the first to evaluate the criterion validity of this type of checklist among children and adolescents in a catastrophic setting. The correspondence in ranking of communes by level of genocidal violence based, on the one hand, on children's reports and, on the other, independent statistical estimates affords impressive evidence of criterion validity of the survey reports, especially when we consider the youth of most respondents and the extremity of their circumstances.

The internal consistency reliability of both versions of the Rwandan scale was adequate for research purposes. Consistent with current theory and empirical research findings concerning post-traumatic stress, symptom levels on both versions of the Rwandan symptom measures were positively, monotonically and substantially associated with increasing levels of exposure to violence, thereby providing evidence of construct validity. That the association of exposure with symptoms was stronger for females than for males underscores the broad consistency of these findings with that from other cultures. The finding that post-traumatic stress symptom scales are reliable and valid in Rwandan samples concurs with a large body of work reporting similar findings with other war-affected populations[10,13,47] and with subsequent work in Rwanda.[20] Nonetheless, whether these PTSS cover all salient psychological and behavioural responses to trauma in Rwandan culture would require further study.

That Criterion A2 was not assessed in the NTS may mean that 'probable PTSD' here more closely approximates DSM-III than DSM-IV criteria. Whereas research on the contribution of peritraumatic emotional reactions to subsequent development of PTSD is rapidly expanding;[48] the impact on rates of 'probable PTSD' of including A2 is difficult to estimate with confidence at this time.[49]

Overall study findings of a dose–response relationship between exposure and symptoms and of the effect of gender on rates of 'probable PTSD' in controlled analyses were extremely robust. Alternative methods for indexing exposure to violence (dividing the exposure score into quartiles) and for indexing post-traumatic stress reactions (mean symptom levels, use of two different measures of symptoms) produced the same pattern of results as reported for quintiles.

Several final limitations warrant mention. Schools could not be selected at random since the sampling frame could not be defined. We do not know whether the children and adolescents resuming schooling in 1995 were representative of Rwandan youth generally. Only genocidal violence was recorded on the Wartime

Violence Checklist. A history of exposure to violence resulting in post-traumatic stress symptomatology is associated with greater reactivity to more proximal exposures.[50] Therefore, a child's exposure to pre-genocide violence might increase symptomatology reported at the time of the NTS with reference to genocidal violence. However, unless exposure to genocidal violence was highly associated with earlier violent exposures, directly or inversely, the parameter estimates for the association of genocidal exposure with symptom levels would not be appreciably affected. The contribution of exposures occurring after the genocide to symptom reports in NTS pertaining to genocidal violence is unclear. Finally, this article works exclusively with the DSM-IV algorithm for the cardinal symptoms of PTSD. However, it is altogether possible that certain post-traumatic stress reactions present differently in a post-genocide, predominantly subsistence agricultural society that privileges restrained expression of emotion. Therefore, a separate paper will compare the psychometric value of alternative factor structures and algorithms for representing post-traumatic stress reactions.

Under pressure of time, circumstance and given the research concerns of the original investigators, the NTS focused almost exclusively on post-traumatic stress symptoms. Other anxiety disorders and depression were not addressed. Nor was there opportunity to devote attention to developmental issues, the impact of the genocide on empathy, capacity for trust and prosocial behaviours.[51] Identifying the full nature and extent to which children are deformed by exposure to cataclysmic violence, as well as by endemic low-intensity civil wars, requires and merits investigations that address wider developmental and life-cycle issues, as well as broader coverage of psychopathologies in the longer term.

While the psychiatric toll of previous genocides—the Jewish Holocaust, the Cambodian 'killing fields'—has been researched, most studies were undertaken some years after the historical events in question[52,53] with the youngest respondents being older adolescents or adults. Furthermore, study samples were typically drawn from refugees, often those seeking mental health services in countries of asylum. In contrast, the NTS is an epidemiological investigation conducted on site within a year and a half after the genocide based partly on samples comprising children and adolescents residing in the community at large.

Conclusions

The Rwandan genocide subjected the civilian population to unthinkable acts of violence and cruelty. Consistent with studies in industrialized societies, child and adolescent survivors reported experiencing intrusive, unbidden thoughts and images of what they had seen, avoidance, emotional numbing and arousal. The reliability of the NTS's symptom measures and their dose–response relationship to exposure level in this largely agrarian, low-income Sub-Saharan society argues for the cross-cultural validity of this trauma-related constellation of symptoms. However, whereas, in industrialized societies, most trauma survivors experience symptoms only transiently, symptom levels and rates of 'probable PTSD' were exceptionally elevated a year after the genocide. These findings suggest that at the extremes, psychological resilience is all but extinguished at least among youth in the early aftermath of catastrophic man-made violence.

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KEY MESSAGES

- In a nation-wide survey of children's exposure to violence during the Rwandan genocide and their post-traumatic stress reactions, over 90% of survivors reported witnessing killings and had their lives threatened; 35% lost immediate family members; 30% witnessed rape or sexual mutilation; 15% hid under corpses for protection.
- Overall, 54–62% of respondents met criteria for 'probable PTSD'.
- A substantial, monotonic dose–response relationship exists between degree of exposure to genocidal violence and rates of 'probable PTSD'
- Girls are at a greater risk for developing 'probable PTSD' than boys, at each level of exposure.
- Rates of 'probable PTSD' were 100% among the most highly exposed survivors, suggesting that extreme catastrophic man-made violence extinguishes psychological resilience.

References

[1] American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 3rd edn. Washington, DC: American Psychiatric Association, 1980.

[2] Lipkin JO, Blank AS, Parson ER, Smith J. Vietnam veterans and posttraumatic stress disorder. *Hosp and Comm Psychiatry* 1982;**33:**908–12.

[3] Ozer EJ, Best SR, Lipsey TL, Weiss DS. Predictors of posttraumatic stress disorder and symptoms in adults: a meta-analysis. *Psychol Bull* 2003;**129:**52–73.

[4] Thienkrua W, Cardozo BL, Somchai Chakkraband ML *et al*. Symptom of posttraumatic stress disorder and depression among children in Tsunami-affected areas of Southern Thailand. *JAMA* 2006;**296:**549–59.

[5] Neria Y, Gross R, Marshall R (eds). *9/11: Mental Health in the Wake of Terrorist Attacks*. New York: Cambridge University Press, 2006.

[6] Ahern J, Galea S, Resnick H *et al*. Television images and psychological symptoms after the September 11 terrorist attacks. *Psychiatry* 2002;**65:**289–300.

[7] Norris FH, Friedman MJ, Watson PJ, Byrne CM, Diaz E, Kaniasty. 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981-2001. *Psychiatry* 2002;**282:**755–62.

[8] Wilson JP, Keane TM (eds). *Assessing Psychological Trauma and PTSD*. 2nd edn. New York: Guildford Press, 2004.

[9] Carlson EB, Rosser-Hogan R. Trauma experiences, post-traumatic stress, dissociation, and depression in Cambodian refugees. *Am J Psychiatry* 1991;**148:**1548–51.

[10] Hauff E, Vaglum P. Vietnamese boat refugees: the influence of war and flight traumatization on mental health on arrival in the country of resettlement: a community cohort study of Vietnamese refugees in Norway. *Acta Psychiatr Scand* 1993;**88:**162–68.

[11] Kinzie JD, Boehnlein JK, Leung PK, Moore U, Riley C, Smith D. The prevalence of posttraumatic stress disorder and its clinical significance among Southeast Asian refugees. *Am J Psychiatry* 1990;**147:**913–17.

[12] Papageorgiou V, Frangou-Garunovic A, Iordanidou R, Yule W, Smith P, Vostanis P. War trauma and psychopathology in Bosnian refugee children. *Eur Child Adolesc Psychiatry* 2000;**9:**84–90.

[13] De Jong JTVM, Komproe IH, Ommeren MV *et al*. Lifetime events and posttraumatic stress disorder in 4 postconflict settings. *JAMA* 2001;**286:**555–62.

[14] Mollica RF, Donelan K, Tor S *et al*. The effect of trauma and confinement on functional health and mental health status of Cambodians living in Thailand-Cambodia border camps. *JAMA* 1993;**270:**581–86.

[15] Mollica RF, McInnes K, Sarajlie N, Lavelle J, Sarajlic I, Massagli MP. Disability associated with psychiatric comorbidity and health status in Bosnian refugees living in Croatia. *JAMA* 1999;**282:**433–39.

[16] Thabet AA, Vostanis P. Post-traumatic stress reactions in children of war: A longitudinal study. *Child Abuse Negl* 2000;**24:**289–90.

[17] Nader KO, Fairbanks LA, Al-Ajeel M, Al-Asfour A. A preliminary study of PTSD and grief among the children of Kuwait following the Gulf crisis. *British J Clin Psychol* 1993;**32:**407–41.

[18] Kuterovac G, Dyregrov A, Stuvland R. Children in war: a silent majority under stress. *Br J Med Psychol* 1994; **67:**363–75.

[19] De Jong JP, Scholte WF, Koeter MW, Hart AA. The prevalence of mental health problems in Rwanda and Burundese refugee camps. *Acta Psychiatr Scand* 2000; **102:**171–77.

[20] Pham PN, Weinstein HM, Longman T. Trauma and PTSD symptoms in Rwanda: implications for attitudes toward justice and reconciliation. *JAMA* 2004;**292:**602–12.

[21] Dyregrov A, Gupta L, Gjestad R, Mukanoheli E. Trauma exposure and psychological reactions to genocide among Rwandan children. *J Traumatic Stress* 2000;**13:**3–21.

[22] Schaal S, Elbert T. Ten years after the genocide: trauma confrontation and posttraumatic stress in Rwandan adolescents. *J Traumatic Stress* 2006;**19:**95–105.

[23] Prunier G. *The Rwandan Crisis*. Columbia University Press, 1995.

[24] DesForge A. *Leave None to Tell the Story: Genocide in Rwanda*. Human Rights Watch, 1999.

[25] Jensen SB, Neugebauer R, Marner R, George S, Ndahiro L, Rurangwa E. *The Rwandan Children and Their Families: Understanding, Prevention and Healing of Traumatization: An Evaluation of the Government of Rwanda and UNICEF Trauma Recovery Program (1995-1997)*. New York, NY: UNICEF Evaluation Unit, 1997.

[26] Gupta L. *Exposure to War Related Violence Among Rwanda Children and Adolescents: A Brief Report on the National Baseline Trauma Survey*. UNICEF Trauma Recovery Programme. Kigali, Rwanda, Typescript Report, 1996, 6 pp.

[27] Macksoud MS. Assessing war trauma in children: a case study of Lebanese children. *J Refugee Studies* 1992;**5:**1–15.

[28] Cardozo BL, Lilukha OO, Gotway Crawford CA *et al*. Mental health, social functioning and disability in postwar Afghanistan. *JAMA* 2004;**292:**575–84.

[29] Lopes Cardozo B, Vergara A, Agani F, Gotway CA. Mental health, social functioning and attitudes of Kosovar Albanians following the war in Kosovo. *JAMA* 2000;**284:** 569–77.

[30] Shanks L, Ford N, Schull M, de Jong K. Responding to rape. *Lancet* 2001;**357:**304.

[31] Davenport C, Stam AC. *Mass Killing and the Oases of Humanity: Understanding Rwandan Genocide and Resistance*. Retrieved from: http://www.bsos.umd.edu/gvpt/davenport/genodynamics/research.htm. Accessed 7 March 2007.

[32] American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 4th edn. Washington, DC: American Psychiatric Association, 1994.

[33] Horowitz M, Wilner N, Alvarez W. Impact of event scale: a measure of subjective stress. *Psychosom Med* 1979;**41:** 209–18.

[34] Yule W, Bruggencate ST, Joseph S. Principal component analysis of the impact of events scale adolescents who survived a shipping disaster. *Personality Individual Differ* 1994;**16:**685–91.

[35] Dyregrov A, Kuterovac G, Barath A. Factor analysis of the impact of event scale with children in war. *Scand J Psychol* 1996;**37:**339–50.

[36] Hosmer DW, Lemeshow SL. *Applied Logistic Regression*. New York: Wiley-InterScience, 1989.

[37] Goldstein RD, Wampler NS, Wise PH. War experiences and distress symptoms of Bosnian children. *Pediatrics* 1997;**100:**873–78.

[38] Ahmad A, Sofi MA, Sundelin-Wahlsten V, von Knorring AL. Posttraumatic stress disorder in children after the military operation ''Anfal'' in Iraqi Kurdistan. *Eur Child Adolesc Psychiatry* 2000;**9:**235–43.

[39] Bonanno GA, Galea S, Bucciarelli A, Vlahov D. Psychological resilience alter disaster: New Cork City in the aftermath of the September 11th terrorist attack. *Psychological Science* 2006;**17:**181–86.

[40] World Health Organization (1997). *Composite International Diagnostic Interview (CIDI)* Version 2.1. Geneva.

[41] Yule W, Bolton D, Udwin O, O'Ryan D, Nurish J. The long-term psychological effects of disaster experienced in adolescence; I. The incidence and course of PTSD. *J Child Psychology Psychiatry Allied Disciplines* 2000; **41:**503–11.

[42] Galea S, Nandi A, Vlahov D. The epidemiology of posttraumatic stress disorder after disasters. *Epidemiol Rev* 2005;**27:**78–91.

[43] Green BL, Korol M, Grace MC, Vary MG. Children and disaster: age, gender, and parental effects on PTSD symptoms. *J Am Acad Child Adolesc Psychiatry* 1991;**30:**945–51.

[44] Pfefferbaum B. Posttraumatic stress disorder in children: a review of the past 10 years. *J Am Acad Child Adolesc Psychiatry* 1997;**36:**1503–11.

[45] Breslau N, Lucia VC, Alvarado GF. Intelligence and other predisposing factors in exposure to trauma and posttraumatic stress disorder. *Arch Gen Psychiatry* 2006; **63:**1238–45.

[46] Dohrenwend BP. Inventorying stressful life events as risk factors for psychopathology: Toward resolution of the problem of intracategory variability. *Psychol Bull* 2006; **132:**477–95.

[47] Weine SM, Vojvoda D, Becker DF *et al*. PTSD symptoms in Bosnian refugees 1 year after resettlement in the United States. *Am J Psychiatry* 1998;**155:**562–64.

[48] Lawyer SR, Resnick HS, Galea S, Ahern J, Kilpatrick DG, Vlahov D. Predictors of peritraumatic reactions and PTSD following the September 11th terrorist attacks. *Psychiatry* 2006;**69:**130–41.

[49] Creamer M, MFarlane AC, Burgess P. Psychopathology following trauma: the role of subjective experience. *J Affect Dis* 2005;**86:**175–82.

[50] Pynoos R, Frederick C, Nader K *et al*. Life threat and posttraumatic stress in school-age children. *Arch Gen Psychiatry* 1987;**44:**1057–63.

[51] Macksoud SM, Aber JL. The war experiences and psychosocial development of children in Lebanon. *Child Development* 1996;**67:**70–80.

[52] Eitinger L. Pathology of the concentration camp syndrome. *Arch Gen Psychiatry* 1961;**5:**371–79.

[53] Savin D, Sack WH, Clarke GN, Meas N, Richart IM. The Khmer Adolescent Project: III. A study of trauma from Thailand's Site II refugee camp. *J Am Acad Child Adolesc Psychiatry* 1996;**35:**385–91.

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Commentary: Explaining enormous variations in rates of disorder in trauma-focused psychiatric epidemiology after major emergencies

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There has been a surge of interest in the last 20 years in the mental health effects of conflict and other major disasters in low- and middle-income countries (LAMIC). In particular, post-traumatic stress disorder (PTSD) and major depression have received substantial attention. It has become evident that there are large, unexplained variations in prevalence rates identified through trauma-focused psychiatric epidemiology in such settings. For example, Mollica *et al*.'s[1] classic study found prevalence rates of PTSD of 15% among genocide-exposed Cambodians, while

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