

Association of Torture and Other Potentially Traumatic Events With Mental Health Outcomes Among Populations Exposed to Mass Conflict and Displacement

A Systematic Review and Meta-analysis

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MASS CONFLICT AND DISplacement continue to affect large numbers of people worldwide.¹ In 2007, the United Nations High Commissioner for Refugees documented 16 million refugees, 26 million internally displaced persons, and 12 million stateless persons.² Yet controversy about the mental health needs of conflict-exposed populations persists,³ a problem that is magnified by the wide variability in rates of the most commonly studied psychiatric conditions among affected populations, namely, posttraumatic stress disorder (PTSD) and depression. Prevalence rates for PTSD have ranged from 0% in a conflict-affected region of Iran⁴ to 99% in Sierra Leone⁵ and between 3% and 86% for depression across surveys.^{6,7} Identifying the potential methodological and substantive factors that are associated with this variation is vital to determining with any accuracy rates of mental health problems of conflict-affected populations.

Methodological factors, particularly the approach used for sampling and diagnosis, appear to exert a large influence on the prevalence rates yielded by surveys.⁸ An outstanding question, how-

Context Uncertainties continue about the roles that methodological factors and key risk factors, particularly torture and other potentially traumatic events (PTEs), play in the variation of reported prevalence rates of posttraumatic stress disorder (PTSD) and depression across epidemiologic surveys among postconflict populations worldwide.

Objective To undertake a systematic review and meta-regression of the prevalence rates of PTSD and depression in the refugee and postconflict mental health field.

Data Sources An initial pool of 5904 articles, identified through MEDLINE, PsycINFO and PILOTS, of surveys involving refugee, conflict-affected populations, or both, published in English-language journals between 1980 and May 2009.

Study Selection Surveys were limited to those of adult populations ($n \geq 50$) reporting PTSD prevalence, depression prevalence, or both. Excluded surveys comprised patients, war veterans, and civilian populations (nonrefugees/asylum seekers) from high-income countries exposed to terrorist attacks or involved in distal conflicts (≥ 25 years).

Data Extraction Methodological factors (response rate, sample size and design, diagnostic method) and substantive factors (sociodemographics, place of survey, torture and other PTEs, Political Terror Scale score, residency status, time since conflict).

Data Synthesis A total of 161 articles reporting results of 181 surveys comprising 81 866 refugees and other conflict-affected persons from 40 countries were identified. Rates of reported PTSD and depression showed large intersurvey variability (0%-99% and 3%-85.5%, respectively). The unadjusted weighted prevalence rate reported across all surveys for PTSD was 30.6% (95% CI, 26.3%-35.2%) and for depression was 30.8% (95% CI, 26.3%-35.6%). Methodological factors accounted for 12.9% and 27.7% PTSD and depression, respectively. Nonrandom sampling, small sample sizes, and self-report questionnaires were associated with higher rates of mental disorder. Adjusting for methodological factors, reported torture (Δ total R^2 between base methodological model and base model + substantive factor [ΔR^2]=23.6%; OR, 2.01; 95% CI, 1.52-2.65) emerged as the strongest factor associated with PTSD, followed by cumulative exposure to PTEs (ΔR^2 =10.8%; OR, 1.52; 95% CI, 1.21-1.91), time since conflict (ΔR^2 =10%; OR, 0.77; 95% CI, 0.66-0.91), and assessed level of political terror (ΔR^2 =3.5%; OR, 1.60; 95% CI, 1.03-2.50). For depression, significant factors were number of PTEs (ΔR^2 =22.0%; OR, 1.64; 95% CI, 1.39-1.93), time since conflict (ΔR^2 =21.9%; OR, 0.80; 95% CI, 0.69-0.93), reported torture (ΔR^2 =11.4%; OR, 1.48; 95% CI, 1.07-2.04), and residency status (ΔR^2 =5.0%; OR, 1.30; 95% CI, 1.07-1.57).

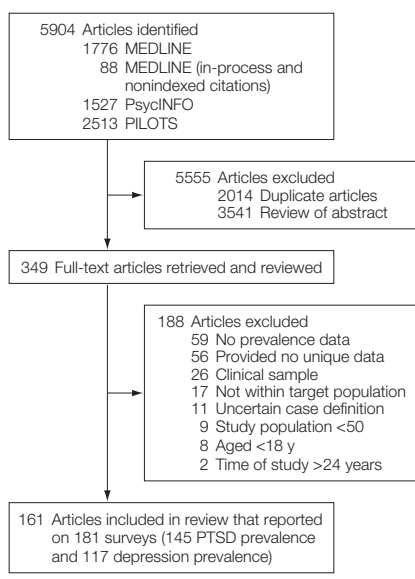
Conclusion Methodological factors and substantive population risk factors, such as exposure to torture and other PTEs, after adjusting for methodological factors account for higher rates of reported prevalence of PTSD and depression.

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Figure. Search Strategy and Article Review Process

PTSD indicates posttraumatic stress disorder.

ever, is whether exposure to torture accounts for a significant variation in prevalence, even when methodological factors are taken into account. Torture is a common form of human rights violation, being documented in more than 132 countries worldwide.^{9,10} Yet controversy persists as to the extent of the adverse psychological consequences of torture,^{11,12} a contentious issue that extends to other potentially traumatic events (PTEs).^{13,14} A small body of studies focusing specifically on torture survivors has observed high rates of PTSD and depression, but most of these investigations have been based on convenience samples and nonrandom case-control designs.^{9,15-17} There is value therefore in examining the larger body of epidemiologic surveys in which torture and other PTEs^{18,19} are included in the factors assessed to gauge the relative importance of the former type of abuse on mental health among populations exposed to mass conflict.

This study represents the first meta-regression focusing on the largest to date set of epidemiologic surveys in the refugee and postconflict mental health field. The study goals were (1) to assess the influence of methodological fac-

tors and substantive population risk factors in accounting for variation in rates of PTSD and depression across surveys and (2) to evaluate the importance of substantive factors on the prevalence of reported PTSD and depression, namely, levels of reported exposure to torture and other PTEs, sociodemographic characteristics, country of origin, time since conflict, security of residency, and the level of terror in the recovery environment, after controlling for methodological factors.

METHODS

Literature Search Strategy

We searched MEDLINE and PsycINFO to identify published articles reporting the prevalence of depression or PTSD among refugee, conflict-affected populations, or both.²⁰ Populations were identified as being from conflict-affected countries if the country was subject to armed conflict or widespread organized violence. The search applied optimum mental health search criteria by combining Medical Subject Headings (MeSH) with text-based search terms²¹ and followed the Meta-analysis of Observational Studies in Epidemiology reporting guidelines.²² Mental health content was identified using the MeSH headings for *mental health* and *mental disorders*; articles with refugees were identified using MeSH and text key words for *refugees*; MeSH headings were also used to identify articles indexed by *war*, *genocide*, *holocaust*, *terrorism*, or *torture*. Because of minor inconsistencies in database key words, we generated individualized search criteria for MEDLINE and PsycINFO. In addition, we searched PILOTS,²³ a bibliographic index providing a comprehensive list of articles and other publications on posttraumatic stress applying the following key words: *refugees*, *asylum seekers*, *displaced persons*, *internally displaced person*, *genocide*, *holocaust*, *persecution*, *torture*. Inclusion criteria were articles published between 1980 and May 2009 in the English language; surveys assessing the prevalence of PTSD, depression, or both among displaced, conflict-affected populations, or both; surveys of adults 18 years

or older; and a sample size of 50 or more. We excluded countries at war in which the main arena of combat was external to the national borders. We also did not include countries exposed to single or multiple (but geographically circumscribed) human-instigated disasters and terrorist attacks in high-income countries because in those settings the general civilian population is not exposed to a wide range of traumas associated with war and rates of torture are likely to be negligible. Some studies needed careful consideration in relation to our inclusion criteria. In particular, studies involving Palestinian populations residing in Gaza and other parts of Palestine were eligible given the high level of combat and organized violence that has occurred in civilian settings in those locations. Studies undertaken in Israel proper were excluded, however, because they focused primarily on members of the military or on a single category of trauma, usually exposure to terrorist attacks, affecting a minority of the population.²⁴ Other exclusion criteria were combatants in armed forces, clinic samples unless recruited by screening of the target population, and populations exposed to PTEs 25 years or more before the survey.

The FIGURE shows the relevant articles extracted from MEDLINE, PsycINFO, and PILOTS, yielding a total of 3541 non-duplicate articles. After an initial screen of the titles and abstracts and a subsequent screen of text of remaining eligible articles, 161 articles remained, providing data for 181 surveys (eTable 1, available at <http://www.jama.com>; eTable 2 presents reasons for exclusion of omitted articles; and eTable 3 provides bibliographical references for all articles). For prospective surveys, the baseline data set was used except in 2 instances²⁵⁻²⁷ in which superior assessment tools were applied in the second survey. Where nonconflict affected populations were included as comparison groups, only data from the conflict-affected sample were extracted.

Data Extraction

Data extraction included methodological factors and population risk factors

(or substantive factors). The methodological data extracted from each survey included sample size, sampling method (probability survey in which every member of the target population had a known likelihood of inclusion; census survey in which all members of the target population were surveyed either by consecutive recruitment or by total population survey; special population survey in which participants were identified because they shared a common feature, such as having been a political prisoner; and mixed sampling survey including partially representative sampling, linkage sampling, convenience sampling, or volunteer samples), response rate, time period of symptoms (point prevalence [current-1 month]; period prevalence [6-12 months or lifetime]), and type of measure (self-report questionnaire or diagnostic interview). We corresponded with the authors of 19 surveys to obtain additional data, with information being provided by 15 authors. The substantive factors extracted included reported prevalence of PTSD, depression, or both; sex (% female); source country, country in which the survey was undertaken; the year(s) of data collection; time since resettlement in another country or since the cessation of major hostilities as determined by information provided by the study authors or by reference to the Political Terror Scale (PTS)²⁸; and residency status (not displaced, displaced internally or externally to the source country, living in a refugee camp, or resettled in a high-income country).

Where data were available, we recorded the percentage of respondents who reported torture. Because the list of other PTEs assessed varied across surveys, we derived an adversity ratio (the average number of PTEs endorsed divided by the total number of PTEs assessed). Level of political violence in a source country was based on the PTS.²⁸ PTS provides an annual assessment of the level of state terror and political violence on a 5-point rating scale based on data collected by Amnesty International

and the US State Department country reports. Scores of 4 or higher designate countries in which violence has been rated as affecting large sections of the population, and where reports of murders, disappearances, and torture are common. PTS data were available from 1976 onwards.

Data Analysis

We used SAS version 9.1.3²⁹ to conduct the meta-regression analyses, examining sequentially the association of methodological factors and substantive factors with reported rates of PTSD and depression. The rates of PTSD and depression were transformed into logits. The Delta method was applied to compute within-study variance, namely, $\text{var}(\text{logit}) = 1/\text{case} + 1/\text{non_case}$.³⁰ Interstudy heterogeneity was examined using the Cochran Q test and I^2 index.³¹ We applied a mixed model with fixed and random-effects components. For the PTSD model, we identified 69% power (based on $n=144$, $t=2.21$; odds ratio [OR], 1.62; $P<.01$) to generate a minimally significant OR (1.48 or $P<.05$); for depression, 87% power (based on $n=117$, $t=2.93$; OR, 1.91; $P<.001$) was identified for a minimally significant OR (1.51 or $P<.05$). The within-study variance was specified using the "parms" statement.²⁹ Tables present the additive variance for each model and the Wald-based ORs and 95% confidence intervals (CIs). Regression logits were back-transformed and expressed as absolute prevalence estimates (ie, they were not relative to the reference group). Adjusted prevalence rates have only been reported for variable strata with 5 or more surveys. Population attributable risk (PAR) percentages were calculated according to the formula:

$$\text{PAR\%} = \frac{\sum_{i=1}^n [pi(OR_i - 1)]}{\left[1 + \sum_{i=1}^n pi(OR_i - 1)\right]} \times 100$$

where pi = proportion of population in n categories (i), OR_i = odds ratio in each n category (i), and (l) = low exposure category. The PAR% can be interpreted as

the percentage of the observed difference of PTSD or depression between the high and low categories that is attributable to the designated methodological or substantive risk factor.

Meta-regression models were calculated as follows. Step 1: For estimates of PTSD and depression, univariable mixed-effects models were calculated to identify methodological determinants of between-study variance. Next, a forward selection procedure including all statistically significant methodological variables was used to construct a multivariable mixed-effects methodological model. This was used as the base methodological model in examining substantive predictor models. Step 2: Meta-regression models examining the association between interstudy variance in PTSD and depression and each substantive factor were next calculated adjusting for the base multivariable methodological model. Step 3: A series of regression models were then calculated to provide average weighted prevalence estimates for PTSD and depression associated with the stratification of methodological and substantive factors.

To ensure adequate power, we dichotomized all variables to produce a series of 2×2 cross classifications as follows: (a) methodological: (i) sampling method by sample size; (ii) sampling method by measure; and (iii) measure by sample size; (b) methodological and substantive: (i) torture by sampling method; (ii) torture by sample size; (iii) PTE ratio by sampling method; and (iv) PTE ratio by sample size; and (c) substantive: (i) torture by time since exposure; (ii) torture by PTS level; (iii) PTE ratio by time since exposure; and (iv) PTE ratio by PTS level. As with the substantive factors examined in step 2, all of the substantive models listed in (c) were adjusted for the baseline methodological model identified in step 1.

RESULTS

The 161 articles yielded diagnostic information for 181 surveys that included 81 866 persons from 40 source

countries. Study characteristics are shown in eTable 1. A total of 122 surveys (n=62 069) were undertaken in low- and middle-income countries and 59 surveys (n=19 797) with refugees and asylum seekers residing in high-income countries. Twenty-five surveys (n=9856) were undertaken during the 1980s, 73 (n=29 684) in the 1990s, and 83 (n=42 326) in the 2000s. Sample sizes ranged from 50 to more than 4000 (median, 201). Reported response rates ranged from 27% to 100% (median, 90.3%); 56 surveys did not report response rates. Reported prevalence rates for PTSD and depression varied widely, from 0% to 99% for PTSD and 3% to 85.5% for depression.

The population prevalence of reported torture was recorded in 84 surveys (n=42 626), with an estimated prevalence of 21% (95% CI, 17%-26%), an estimate that remained unchanged after excluding surveys specifically targeting torture survivors (n=7). Population exposure to 1 or more other PTEs was recorded in 120 surveys (n=55 101), with a weighted average adversity ratio of 0.29 (interquartile range [IQR], 0.16-0.42) (on average, 29% of the total number of PTEs assessed were endorsed across surveys). PTS scores were available for 125 surveys (n=66 862), with an average weighted PTS score of 4.0 (IQR, 3.0-5.0) for source countries at the time each survey was undertaken. Forty-six surveys (37%; n=22 582) had PTS scores higher than 4.0, indicating that political violence and terror were pervasive, affecting the majority of the population; 36 surveys (29%; n=17 715) had PTS scores between 3.1 and 4.0, indicating reports of extensive civil and political rights violations directed against large sections of the population; and 43 surveys (34%; n=16 528) had a PTS score of 3.0 or lower, indicating reports of political violence and imprisonment targeted against specific subsections of the population.

Weighted Prevalence and Factors Associated With PTSD

A total of 145 surveys (n=64 332) reported PTSD prevalence estimates based

on 21 different measures (eTable 4), with the Harvard Trauma Questionnaire³² the most commonly used instrument, followed by the Composite International Diagnostic Interview³³ and the PTSD Checklist.³⁴ Rates of PTSD showed large intersurvey variability (0%-99%) and heterogeneity ($Q=6119$, $df=144$, $P<.001$; $I^2=97.6\%$), necessitating the use of random-effect regression models.³¹ The eFigure provides a funnel plot of prevalence by sample size indicating a pattern of asymmetry, with the largest survey samples returning the most conservative prevalence estimates.³⁵ The funnel plot does not support the likelihood of publication bias with the distribution of prevalence estimates across smaller surveys showing no evidence of reduced reporting in the low-prevalence spectrum. The random-effects model returned an overall weighted prevalence of reported PTSD across the 145 relevant surveys of 30.6% (95% CI, 26.3%-35.2%) (TABLE 1).

PTSD Meta-regression

Methodological Factors. Table 1 shows the methodological factors associated with PTSD prevalence. Sample size accounted for 9.1% of the variance across surveys. The 17 surveys sampling 1001 or more persons produced the lowest PTSD prevalence estimates (15.7%; 95% CI not available as $n > 1000$ surveys indexed as reference group), with the rates increasing with progressively smaller samples. For example, the 37 surveys with 100 respondents or less produced a weighted PTSD prevalence estimate of 39.4% (95% CI, 24.3%-56.7%). The PAR comparing large ($n > 1000$) and small surveys ($n < 100$) suggested that 43.0% of the observed change in prevalence in the latter group could be attributed to sample size.

Sampling method also emerged as relevant, accounting for 4.4% of intersurvey variance; probability sampling (26.6%) yielded smaller prevalence estimates than surveys applying mixed, nonprobabilistic sampling approaches (37.2%; 95% CI, 26.7%-49.1%). Moreover, PTSD assessments based on self-report questionnaires (34.6%; 95% CI, 25.6%-44.8%) produced estimates 10

percentage points higher than those applying diagnostic interviews (24.6%) with a PAR of 24.9%. Higher prevalence estimates were obtained by surveys reporting point prevalence (32.9%) of PTSD vs period prevalence (17.0%; 95% CI, 10.0%-27.6%). Prevalence rates were not influenced by the response rate or calendar year of survey. A final multivariable meta-regression model applying forward selection criteria included sample size and type of measure and accounted for 12.9% of the intersurvey variance in PTSD prevalence.

Substantive Factors Adjusting for Methodological Factors. Sex (% female), site of survey (high-income country or low- and middle-income country), and residency status were not associated with PTSD prevalence rates, after adjusting for methodological factors. Seventy-seven surveys included data for reported exposure to torture. Torture accounted for the greatest intersurvey variance in reported PTSD (23.6%), after adjusting for methodological factors. Surveys undertaken in which 40% or more of the sample had reported a history of torture returned a weighted average prevalence for PTSD of 46.2% (95% CI, 33.0%-60.0%), 4 times (OR, 4.03; 95% CI, 2.31-7.04) the rate of that obtained from surveys with the lowest rates of torture ($\leq 19\%$ of the sample). The PTE adversity ratio could be calculated for 107 surveys and accounted for 10.8% of the method-corrected variance of PTSD. Reported PTSD rates increased from 11.1% for surveys with adversity ratios of 0 to 0.19 ($< 20\%$ of PTEs endorsed) to 35.5% (95% CI, 20.8%-53.5%) for studies with an adversity ratio of at least 0.40.

The PTS index for the source country was available for 107 surveys and accounted for 3.5% of the variance in PTSD rates. The weighted average prevalence of reported PTSD was 38.5% (95% CI, 28.6%-49.4%) for samples from countries with a PTS score of more than 4.1 compared with 28.1% for countries with a score of 4.0 or lower. Surveys conducted when the primary conflict was ongoing or had ceased for less than 1 year (n=49) had a PTSD prevalence of 39.9%

compared with those conducted subsequently (2-3 years, 22.1%; 3-5 years, 27.0%; ≥ 6 years, 22.3%). Of the source

countries and regions, Vietnam returned the lowest PTSD prevalence estimate (10%), which differed significantly

from rates obtained in surveys with populations from or residents in Cambodia (30.3%; 95% CI, 10.6%-

Table 1. Postconflict PTSD Random-Effects ORs and Prevalence Estimates by Significant Methodological and Substantive Factors^a

	Sample Size	No. of Surveys	Intersurvey Variance, %	Adjusted OR (95% CI)	t Value	Adjusted Prevalence Estimates, % (95% CI)	PAR, %
Random-effects null model	64 332	145				30.6 (26.3-35.2)	
Methodological Factors							
Sample size ^b	64 332	145	9.1	1.43 (1.15-1.77)	3.37		43.0
≥ 1001	30 175	17		1 [Reference]		15.7	
501-1000	17 998	27		2.21 (1.06-4.63)	2.11	29.1 (16.4-46.2)	
101-500	13 409	64		2.49 (1.30-4.77)	2.75	31.7 (19.5-47.0)	
≤ 100	2750	37		3.49 (1.73-7.05)	3.48	39.4 (24.3-56.7)	
Sampling method ^b	64 332	145	4.4	1.08 (0.76-1.55)	2.23		9.4
Probability survey	47 552	57		1 [Reference]		26.6	
Census survey	3531	15		0.72 (0.35-1.50)	-0.87	20.7 (11.2-35.2)	
Target population	4962	26		1.48 (0.82-2.65)	1.31	34.8 (23.0-48.9)	
Mixed sampling	8287	47		1.64 (1.01-2.67)	1.99	37.2 (26.7-49.1)	
Type of measure	64 185	144	3.7				
Diagnostic interview	29 831	55		1 [Reference]		24.6	
Questionnaire	34 354	89		1.62 (1.06-2.48)	2.21	34.6 (25.6-44.8)	24.9
Diagnostic time frame	64 185	144	5.9				
Point prevalence	44 165	126		1 [Reference]		32.9	
Period prevalence	20 020	18		0.42 (0.23-0.78)	-2.77	17.0 (10.0-27.6)	-22.2
Total method variance			12.9				
Substantive Factors							
PTE adversity ratio ^b	51 492	107	10.8	1.52 (1.21-1.91)	3.61		62.5
0-0.19	17 749	17		1 [Reference]		11.1	
0.20-0.29	8285	20		2.77 (1.24-6.14)	2.50	25.7 (13.5-43.5)	
0.30-0.39	12 595	29		3.20 (1.53-6.69)	3.09	28.6 (16.1-45.6)	
≥ 0.40	12 863	41		4.38 (2.09-9.19)	3.92	35.5 (20.8-53.5)	
Torture, % ^b	37 945	77	23.6	2.01 (1.52-2.65)	4.92		48.9
≤ 19	17 752	28		1 [Reference]		17.6	
20-39	12 254	25		2.00 (1.18-3.37)	2.59	29.8 (20.1-41.8)	
≥ 40	7939	24		4.03 (2.31-7.04)	4.90	46.2 (33.0-60.0)	
Political Terror Scale	49 915	107	3.5				26.6
≤ 4.0	20 506	47		1 [Reference]		28.1	
4.1-5.0	29 409	60		1.60 (1.03-2.50)	2.07	38.5 (28.6-49.4)	
Time since conflict, y ^b	62 923	141	10.0	0.77 (0.66-0.91)	-3.21		-45.3
0-1	26 323	49		1 [Reference]		39.9	
2-3	5382	18		0.43 (0.22-0.81)	-2.59	22.1 (13.0-35.1)	
4-5	9181	29		0.56 (0.33-0.95)	-2.13	27.0 (17.8-38.7)	
≥ 6	22 037	45		0.43 (0.27-0.70)	-3.43	22.3 (15.1-31.6)	
Country of origin ^c	64 185	144	5.7				
Vietnam	2422	6		1 [Reference]		10.0	
Cambodia	3210	8		3.89 (1.07-14.2)	2.06	30.3 (10.6-61.3)	
Other Asia	5254	18		2.86 (0.88-9.28)	1.75	24.2 (9.0-50.9)	
Bosnia/Yugoslavia	5177	26		3.54 (1.15-11.0)	2.20	28.3 (11.3-55.0)	
Kosovo/Yugoslavia	5989	11		4.15 (1.21-14.2)	2.26	31.6 (11.9-61.3)	
Middle East	14 069	23		2.25 (0.74-6.85)	1.42	20.0 (7.6-43.3)	
Africa	21 156	36		4.52 (1.48-13.8)	2.64	33.5 (14.2-60.7)	
Other	6908	16		2.76 (0.86-8.82)	1.71	23.5 (8.8-49.6)	

Abbreviations: CI, confidence interval; OR, odds ratio; PAR, population attributable risk; PTE, potentially traumatic event; PTSD, posttraumatic stress disorder.

^aAdjusted OR is based on Wald test. The adjusted prevalence estimates are expressed as absolute prevalence and not relative to the reference group. See "Methods" section for definition of PAR. All substantive factors adjusted for the baseline multivariable methodological model. ^bIncludes the trend line for adjusted OR, t value, and PAR. ^cOther Asia includes Bhutan, Burma, East Timor, India, Indonesia, Kashmir, Laos, North Korea, and Tibet. Middle East includes Afghanistan, Iran, Iraq, Kuwait, Lebanon, and Palestinian National Authority. Africa includes Algeria, Burundi, Eritrea, Ethiopia, Liberia, Malawi, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Africa, Sudan, and Uganda, and mixed west Africa. Other includes Chechnya, Chile, other South and Central America, and mixed country of origin refugee groups.

61.3%), Bosnia (28.3%; 95% CI, 11.3%-55.0%), Kosovo (31.6%; 95% CI, 11.9%-61.3%), and 16 countries in Africa (33.5%; 95% CI, 14.2%-60.7%).

Serial Combinations of Methodological and Substantive Factors. We examined PTSD prevalence estimates associated with the serial combinations of methodological factors (TABLE 2). Sampling method was categorized into models using more scientifically rigorous approaches (prob-

ability and census-based) in contrast with convenience or mixed-sampling methods. Similarly, sample size was categorized into large (≥ 500) and small (< 500). The surveys ($n=68$) applying nonrandom sampling in combination with a sample size of less than 500 returned an average prevalence rate of 37.0% (95% CI, 26.3%-49.3%) compared with other combinations that returned more conservative rates of PTSD. The 2 models examining sampling

method and sample size as a product of measurement type identified a subset of large, well-designed surveys applying diagnostic interviews with lower rates of PTSD (15.4% and 13.2%, respectively), approximately half the prevalence rates yielded by other corresponding method combinations. The PAR percentage was more than 50% in both of these models, suggesting that 50% of the increase in prevalence is attributable to method factors.

Table 2. Postconflict PTSD Random-Effects ORs and Prevalence Estimates Stratified by Combinations of Methodological and Substantive Factors^a

	Sample Size	No. of Surveys	Intersurvey Variance, %	Adjusted OR (95% CI)	t Value	Adjusted Prevalence Estimate, % (95% CI)	PAR, %
Methodological Models							
Sampling method \times sample size ^b	64 332	145	4.7	1.23 (1.05-1.44)	2.50		11.7
Probability/census \times ≥ 500	35 866	37		1 [Reference]		25.0	
Probability/census \times < 500	15 217	35		1.04 (0.58-1.85)	0.12	25.7 (16.2-38.2)	
Target/mixed \times ≥ 500	3624	5		1.17 (0.37-3.73)	0.26	28.0 (10.9-55.4)	
Target/mixed \times < 500	9625	68		1.76 (1.07-2.92)	2.22	37.0 (26.3-49.3)	
Sampling method \times measure ^b	64 185	144	14.1	1.33 (1.11-1.59)	3.15		54.3
Probability/census \times diagnostic interview	25 852	30		1 [Reference]		15.4	
Probability/census \times questionnaire	25 231	42		2.92 (1.66-5.12)	3.72	34.6 (23.2-48.2)	
Target/mixed \times diagnostic interview	3979	25		3.65 (1.92-6.92)	3.96	39.8 (25.9-55.7)	
Target/mixed \times questionnaire	9123	47		2.91 (1.68-5.06)	3.80	34.6 (23.3-47.9)	
Sample size \times measure ^b	64 185	144	9.5	1.32 (1.08-1.61)	2.77		62.9
Diagnostic interview \times ≥ 500	15 053	14		1 [Reference]		13.2	
Diagnostic interview \times < 500	14 778	41		2.81 (1.34-5.90)	2.72	30.0 (16.9-47.4)	
Questionnaire \times ≥ 500	24 437	28		3.34 (1.53-7.31)	3.02	33.8 (18.9-52.7)	
Questionnaire \times < 500	9917	61		3.53 (1.74-7.16)	3.48	35.0 (20.9-52.2)	
Methodological and Substantive Models							
Torture \times sampling method ^b	37 945	77	20.3	1.54 (1.26-1.89)	4.21		34.3
$< 40\% \times$ probability/census	26 122	33		1 [Reference]		20.5	
$< 40\% \times$ target/mixed	3884	20		1.47 (0.82-2.65)	1.28	27.5 (17.4-40.6)	
$\geq 40\% \times$ probability/census	4397	7		3.10 (1.32-7.31)	2.59	44.5 (25.4-65.4)	
$\geq 40\% \times$ target/mixed	3542	17		3.46 (1.86-6.45)	3.92	47.2 (32.5-62.5)	
Torture \times sample size ^b	37 945	77	22.4	1.56 (1.26-1.93)	4.13		21.9
$< 40\% \times$ ≥ 500	20 055	21		1 [Reference]		22.2	
$< 40\% \times$ < 500	9951	32		1.08 (0.61-1.92)	0.27	23.6 (14.8-35.4)	
$\geq 40\% \times$ ≥ 500 ^c	4735	4					
$\geq 40\% \times$ < 500	3204	20		3.63 (1.91-6.88)	3.94	50.8 (35.3-66.2)	
PTE adversity ratio \times sampling method ^b	51 492	107	11.5	1.50 (1.21-1.87)	3.69		50.2
$< 0.3 \times$ probability/census	23 432	23		1 [Reference]		16.2	
$< 0.3 \times$ target/mixed	2602	14		1.69 (0.74-3.86)	1.24	24.6 (12.5-42.8)	
$\geq 0.3 \times$ probability/census	19 397	39		2.87 (1.51-5.46)	3.21	35.7 (22.6-51.4)	
$\geq 0.3 \times$ target/mixed	6061	31		3.27 (1.67-6.43)	3.45	38.8 (24.4-55.4)	
PTE adversity ratio \times sample size ^b	51 492	107	11.3	1.46 (1.18-1.82)	3.42		50.6
$< 0.3 \times$ ≥ 500	17 480	15		1 [Reference]		16.5	
$< 0.3 \times$ < 500	8554	22		1.35 (0.59-3.07)	0.72	21.1 (10.5-37.8)	
$\geq 0.3 \times$ ≥ 500	18 523	22		2.94 (1.30-6.64)	2.59	36.7 (20.4-56.7)	
$\geq 0.3 \times$ < 500	6935	48		3.00 (1.45-6.20)	2.96	37.2 (22.3-55.0)	

(continued)

Table 2. Postconflict PTSD Random-Effects ORs and Prevalence Estimates Stratified by Combinations of Methodological and Substantive Factors (continued)^a

	Sample Size	No. of Surveys	Intersurvey Variance, %	Adjusted OR (95% CI)	t Value	Adjusted Prevalence Estimate, % (95% CI)	PAR, %
Substantive Models							
Torture × time, y ^b	37 263	75	21.1	1.61 (1.30-2.01)	4.31		38.9
<40% × ≥3	15 074	28		1 [Reference]		22.3	
<40% × <3	14 347	24		1.26 (0.71-2.22)	0.79	26.6 (17.0-38.9)	
≥40% × ≥3	2906	10		2.78 (1.33-5.79)	2.72	44.4 (27.7-62.5)	
≥40% × <3	4936	13		4.01 (2.02-7.93)	3.98	53.5 (36.8-69.5)	
Torture × level of PTS ^b	27 825	56	29.3	1.69 (1.37-2.10)	4.81		52.6
<40% × ≤4.0	12 113	20		1 [Reference]		19.2	
<40% × 4.1-5.0	9911	19		2.10 (1.23-3.57)	2.73	33.3 (22.6-45.9)	
≥40% × ≤4.0	1218	8		2.98 (1.44-6.15)	2.94	41.4 (25.5-59.4)	
≥40% × 4.1-5.0	4583	9		4.85 (2.46-9.57)	4.55	53.5 (36.8-69.5)	
PTE adversity ratio × time, y ^b	50 907	106	11.1	1.46 (1.19-1.80)	3.57		48.8
<0.3 × ≥3	16 889	23		1 [Reference]		16.8	
<0.3 × <3	8560	13		1.56 (0.68-3.56)	0.42	23.9 (12.1-41.8)	
≥0.3 × ≥3	9042	35		1.81 (0.94-3.47)	1.70	26.7 (16.0-41.1)	
≥0.3 × <3	16 416	35		3.22 (1.70-6.10)	3.50	39.3 (25.5-55.1)	
PTE adversity ratio × level of PTS ^b	41 120	82	12.1	1.41 (1.16-1.71)	3.76		46.6
<0.3 × ≤4.0	14 469	19		1 [Reference]		19.8	
<0.3 × 4.1-5.0	4183	19		1.36 (0.67-2.75)	0.85	25.1 (14.2-40.5)	
≥0.3 × ≤4.0	5261	11		1.52 (0.70-3.28)	1.07	27.3 (14.8-44.8)	
≥0.3 × 4.1-5.0	17 207	33		2.84 (1.55-5.21)	3.38	41.3 (27.7-56.3)	

Abbreviations: CI, confidence interval; OR, odds ratio; PAR, population attributable risk; PTE, potentially traumatic event; PTS, Political Terror Scale; PTSD, posttraumatic stress disorder.

^aAdjusted OR, adjusted prevalence estimates, definition of PAR, and all substantive factors are explained in first footnote to Table 1. ^bIncludes the trend line for adjusted OR, t value, and PAR. ^cAdjusted prevalence rates have only been reported for variable strata with 5 or more surveys.

The next set of models examined torture prevalence and then PTE ratio by sample size and sampling method (Table 2). A consistent pattern emerged across all 4 models examined, indicating that surveys with populations recording high levels of exposure to torture (≥40%) or cumulative exposure to PTEs (ratio ≥0.3) returned substantially higher PTSD prevalence estimates than those surveys recording lower exposure to either of these 2 factors, irrespective of the sample size or sampling method used.

Further analyses examined for an association of torture and PTE according to the time lapsed since cessation of major hostilities or resettlement and the country level of political terror at the time of the survey (Table 2). The cross-product of torture and time since conflict accounted for 21.1% of interstudy variance in PTSD. The trend line (OR, 1.61; 95% CI, 1.30-2.01) supported a significant linear increase in

risk in the expected direction. Samples with the highest exposure to torture (≥40%) that were proximate in time to the conflict (<3 years) returned the highest weighted prevalence of PTSD (53.5%; 95% CI, 36.8%-69.5%). There was an incremental reduction in prevalence for the other derived categories: high torture but extended time (44.4%; 95% CI, 27.7%-62.5%); low torture, recent exposure (26.6%; 95% CI, 17.0%-38.9%); and low torture, extended time (22.3%). A similar pattern emerged for the cross-product of time × PTE adversity ratio, which accounted for a smaller (11.1%) yet significant proportion of interstudy variance in PTSD.

The likelihood of a survey recording higher PTSD prevalence also showed a linear increase when examining the cross-product of torture and the PTS index of country level violence, ranging from 19.2% for surveys conducted in populations recording lower torture rates in countries with lower levels of politi-

cal terror to a high of 53.5% (95% CI, 36.8%-69.5%) in the greatest torture-exposed populations from countries with the highest ongoing political terror. There was an average 69% (OR, 1.69; 95% CI, 1.37-2.10) increase in PTSD odds across the 4 strata assessed. A similar pattern emerged for cumulative PTE exposure and political terror.

We examined the level of within-strata heterogeneity using the Cochran Q test and *I*² index for the cross-products shown in Table 2. Across all strata reported, the Cochran Q test remained statistically significant with the *I*² index ranging between 93.1% and 99.6%, indicating substantial interstudy heterogeneity in reported PTSD prevalence.

Weighted Prevalence and Factors Associated With Depression

A total of 117 surveys (n=57 796) reported the prevalence of depression. Rates of depression ranged from 3.0%

to 85.5%, reflecting a substantial degree of heterogeneity ($Q = 10\,793$, $df = 116$, $P = .001$; $I^2 = 98.9\%$). The most common assessment tool was the Hopkins Symptom Checklist,³⁶ followed by the Composite International Diagnostic Interview³³ and the Structured Clinical Interview for DSM³⁷ (eTable 4). The eFigure provides a funnel plot for depression prevalence by sample size. As with PTSD, there was evidence of asymmetry with the largest survey samples returning conservative prevalence estimates.³⁵ There was no suggestion that the distribution of prevalence estimates across smaller surveys represented underreporting in the low-prevalence spectrum. TABLE 3 presents the results from the random-effects regression models, yielding an adjusted weighted prevalence for depression of 30.8% (95% CI, 26.3%-35.6%) across the 117 surveys.

Depression Meta-regression

Methodological Factors. Sample size accounted for 14.6% of the total interstudy variance in the depression prevalence. Surveys based on at least 1001 respondents reported substantially lower depression estimates (13.3%) than those with smaller numbers, resulting in a PAR of 55.1% (Table 3). Surveys using nonprobabilistic sampling strategies produced the highest prevalence estimates (46.9%; 95% CI, 35.0%-59.2%) compared with probability samples (27.3%) and small census surveys (21.2%; 95% CI, 12.3%-34.1%). Surveys that used a self-report questionnaire yielded higher prevalences (36.7%; 95% CI, 27.3%-47.2%) than those applying diagnostic interview (23.2%; OR, 1.91; 95% CI, 1.24-2.95). With regard to diagnostic time frame, point prevalence (34.8%) was associated with a higher prevalence of depression than period prevalence (OR, 0.40; 95% CI, 0.24-0.68; prevalence, 17.6%; 95% CI, 11.2%-26.5%). The multivariable method model, including sample size, sampling method, and measure type, accounted for 27.7% of interstudy variance in depression estimates.

Some measures, such as the General Health Questionnaire³⁸ and Self Reporting Questionnaire-20,³⁹ although including the construct of depression, also measure other elements of mental disorder, a potential source of interstudy heterogeneity. We recalculated the depression model limiting the analysis to the 97 surveys that used measures designed specifically to assess depression. That analysis failed to alter the level of heterogeneity ($Q = 9239$, $I^2 = 99\%$) or interstudy variance accounted for by methodological factors (31.3%); therefore, further analyses included the larger sample.

Substantive Factors Adjusting for the Methodological Factors. Variables that did not affect the prevalence of depression after adjusting for the methodological factors included sex, place of survey, year of survey, and the PTS rating of county-level violence. The PTE adversity ratio (Δ total R^2 between base methodological model and base model + substantive factor [ΔR^2] = 22.0% across 75 surveys) and the rate of torture reported in a survey (ΔR^2 = 11.4% across 55 surveys) were significantly associated with prevalence of depression after adjusting for the methodological factors. Surveys with a PTE ratio ranging between 0 and 0.19 returned a weighted depression prevalence of 13.7%, an estimate that increased to 34.8% (95% CI, 23.7%-48.0%) and 40.0% (95% CI, 28.4%-52.9%) in surveys with a PTE adversity ratio of more than 0.30 and 0.40, respectively. Surveys in which 40% or more of the respondents reported torture returned a weighted depression prevalence of 49.6% (95% CI, 34.2%-64.9%), higher than in surveys in which less than 20% of respondents reported exposure to that abuse (28.1%).

Reported rates of depression also showed a pattern of gradual decline with increasing time since the conflict or resettlement to a safe third (mainly western) country (OR, 0.80; 95% CI, 0.69-0.93). Populations located in environments free from conflict for at least 6 years had significantly lower rates of depression (19.2%; 95% CI, 13.0%-27.5%) compared with populations in

which the primary conflict was ongoing or in which hostilities had ceased for less than 1 year (34.7%). Residency status was also associated with depression, with displaced populations (38.2%; 95% CI, 27.2%-50.5%) and those residing in refugee camps (39.6%; 95% CI, 25.5%-55.5%) having higher rates of depression than refugees resettled to high-income countries (24.1%). In keeping with the PTSD data, the 15 surveys undertaken among populations originating from Vietnam returned the lowest depression rates (15.7%).

Serial Combinations of Methodological and Substantive Factors. Nonrandom sampling, small sample sizes, and use of self-report questionnaires were all individually associated with higher prevalence rates of depression (TABLE 4). Surveys applying nonrandom sampling and small sample size, or either of these methodological factors in combination with self-report questionnaires, consistently returned the highest prevalence estimates, ranging between 38.9% (95% CI, 21.7%-59.3%) and 43.4% (95% CI, 29.5%-58.4%). The most conservative depression prevalence rates were recorded in the 8 surveys applying diagnostic interviews to samples of more than 500 persons (8.1%; 95% CI, 4.0%-16.0%), followed by the 26 surveys combining diagnostic interviews with representative sampling frames (17.3%; 95% CI, 11.9%-24.5%).

There were insufficient surveys recording high levels of exposure to torture ($\geq 40\%$) and large sample sizes or probability surveys to generate stable prevalence estimates ($n = 4$). With respect to cumulative exposure to PTEs, surveys recording a high exposure level (ratio ≥ 0.3) returned higher depression prevalence estimates than surveys recording lower exposures did, irrespective of the sample size or sampling method used.

We next examined the combined effects of torture and time since conflict, a product that accounted for 20.5% of interstudy variance in the prevalence rates of depression, adjusting for the methodological model across the 53 surveys reporting both sets of data. The

Table 3. Postconflict Depression Random-Effects ORs and Prevalence Estimates by Significant Methodological and Substantive Factors^a

	Sample Size	No. of Surveys	Intersurvey Variance, %	Adjusted OR (95% CI)	t Value	Adjusted Prevalence Estimate, % (95% CI)	PAR, %
Random-effects base model	57 796	117				30.8 (26.3-35.6)	
Methodological Factors							
Sample size ^b	57 796	117	14.6	1.41 (1.13-1.78)	2.98		55.1
≥1001	30 600	17		1 [Reference]		13.3	
501-1000	12 847	19		3.80 (1.84-7.86)	3.60	36.8 (22.0-54.7)	
101-500	12 744	59		3.44 (1.89-6.27)	4.03	34.6 (22.5-49.1)	
<100	1605	22		3.37 (1.65-6.89)	3.33	34.1 (20.2-51.4)	
Sampling method ^b	57 796	117	13.2	1.28 (1.09-1.51)	2.93		9.3
Probability survey	42 616	52		1 [Reference]		27.3	
Census survey	5432	15		0.72 (0.37-1.38)		21.2 (12.3-34.1)	
Target population	3704	17		0.82 (0.44-1.53)		23.6 (14.2-36.5)	
Mixed sampling	6044	33		2.35 (1.43-3.85)		46.9 (35.0-59.2)	
Type of measure	57 796	117	7.0				33.9
Diagnostic interview	25 419	48		1 [Reference]		23.2	
Questionnaire	32 377	69		1.91 (1.24-2.95)	2.94	36.7 (27.3-47.2)	
Diagnostic time frame	57 714	116	9.7				-30.8
Point prevalence	35 098	93		1 [Reference]		34.8	
Period prevalence	22 616	23		0.40 (0.24-0.68)	-3.41	17.6 (11.2-26.5)	
Total method variance			27.7				
Substantive Factors							
PTE adversity ratio ^b	36 462	75	22.0	1.64 (1.39-1.93)	5.83		62.5
0-0.19	13 920	16		1 [Reference]		13.7	
0.20-0.29	6008	14		1.68 (0.92-3.07)	2.02	21.0 (12.8-32.7)	
0.30-0.39	8098	20		3.38 (1.96-5.83)	4.89	34.8 (23.7-48.0)	
≥0.40	8436	25		4.22 (2.51-7.10)	5.35	40.0 (28.4-52.9)	
Torture, % ^b	28 926	55	11.4	1.48 (1.07-2.04)	2.38		48.9
≤19	16 322	24		1 [Reference]		28.1	
20-39	9006	17		0.90 (0.50-1.60)	-0.97	25.9 (16.4-38.5)	
≥40	3598	14		2.51 (1.33-4.74)	2.40	49.6 (34.2-64.9)	
Residency status ^b	57 796	117	5.0	1.30 (1.07-1.57)	2.55		36.7
Resettled	13 389	33		1 [Reference]		24.1	
Not displaced	26 686	39		1.60 (0.98-2.60)	0.63	33.6 (23.7-45.2)	
Displaced	11 146	31		1.97 (1.12-3.45)	2.08	38.2 (27.2-50.5)	
Refugee camp	6575	14		2.07 (1.08-3.94)	2.36	39.6 (25.5-55.5)	
Time since conflict, y ^b	56 821	112	21.9	0.80 (0.69-0.93)	-4.74		-45.3
0-1	26 140	44		1 [Reference]		34.7	
2-3	4394	14		0.81 (0.44-1.50)	0.48	30.2 (19.0-44.5)	
4-5	6757	22		1.02 (0.61-1.73)	1.21	35.3 (24.4-47.9)	
≥6	19 530	32		0.45 (0.28-0.71)	-3.21	19.2 (13.0-27.5)	
Country of origin	57 796	117	6.8				
Vietnam	9393	15		1 [Reference]		15.7	
Cambodia	2490	6		2.46 (0.92-6.54)	2.06	31.4 (14.7-55.0)	
Other Asia	5187	19		1.85 (0.91-3.77)	1.75	25.7 (14.5-41.3)	
Bosnia/Yugoslavia	3769	11		1.51 (0.67-3.39)	2.20	22.0 (11.1-38.8)	
Kosovo/Yugoslavia	1336	4		1.57 (0.50-4.95)	2.26	22.7 (8.6-48.0)	
Middle East	14 484	27		1.66 (0.87-3.17)	1.42	23.7 (14.0-37.2)	
Africa	14 902	21		2.66 (1.37-5.17)	2.64	33.2 (20.4-49.1)	
Other	6235	14		2.65 (1.27-5.56)	1.71	33.1 (19.1-50.9)	

Abbreviations: CI, confidence interval; OR, odds ratio; PAR, population attributable risk; PTE, potentially traumatic event.

^aAdjusted OR, adjusted prevalence estimates, definition of PAR, and all substantive factors are explained in first footnote to Table 1. Countries of origin are explained in third footnote to Table 1. ^bIncludes the trend line for adjusted OR, t value, and PAR.

trend line supported a significant linear increase in risk across the derived time by torture categories. Samples with

the highest exposure to torture ($\geq 40\%$) had higher rates of depression than those with lower rates of torture expo-

sure, regardless of time since conflict. The importance of time was particularly notable with respect to surveys in

Table 4. Postconflict Depression Random-Effects ORs and Prevalence Estimates Stratified by Combinations of Methodological and Substantive Factors^a

	Sample Size	No. of Surveys	Intersurvey Variance, %	Adjusted OR (95% CI)	t Value	Adjusted Prevalence Estimate, % (95% CI)	PAR, %
Methodological Models							
Sample design \times sample size ^b	57 796	117	6.5	1.26 (1.06-1.49)	2.66		8.6
Probability/census \times ≥ 500	32 404	31		1 [Reference]		25.2	
Probability/census \times < 500	15 644	36		0.90 (0.23-3.58)	-0.15	23.3 (7.1-54.7)	
Target/mixed \times ≥ 500	2360	3					
Target/mixed \times < 500	7388	47		1.92 (1.13-3.27)	2.42	39.3 (27.6-52.4)	
Sampling method \times measure ^b	57 796	117	13.7	1.45 (1.20-1.76)	3.81		48.6
Probability/census \times diagnostic interview	21 011	26		1 [Reference]		17.3	
Probability/census \times questionnaire	27 037	41		2.29 (1.32-4.00)	2.93	32.5 (21.6-45.6)	
Target/mixed \times diagnostic interview	4408	22		2.24 (1.18-4.27)	2.46	32.0 (19.8-47.2)	
Target/mixed \times questionnaire	5340	28		3.66 (2.00-6.70)	4.20	43.4 (29.5-58.4)	
Sample size \times measure ^b	57 796	117	16.9	1.51 (1.22-1.86)	3.83		77.8
Diagnostic interview \times ≥ 500	9978	8		1 [Reference]		8.1	
Diagnostic interview \times < 500	24 786	26		4.41 (1.91-10.17)	3.47	28.1 (14.5-47.4)	
Questionnaire \times ≥ 500	15 441	40		5.64 (2.36-13.47)	3.90	33.4 (17.3-54.4)	
Questionnaire \times < 500	7591	43		7.17 (3.12-16.46)	4.64	38.9 (21.7-59.3)	
Methodological and Substantive Models							
Torture \times sampling method ^b	28 926	55	16.0	1.40 (1.08-1.82)	2.56		23.8
$< 40\% \times$ probability/census	22 901	28		1 [Reference]		24.9	
$< 40\% \times$ target/mixed	2427	13		1.09 (0.53-2.22)	0.22	26.5 (15.0-42.5)	
$\geq 40\% \times$ probability/census ^c	1864	4					
$\geq 40\% \times$ target/mixed	1734	10		2.36 (1.07-5.18)	2.13	43.9 (26.3-63.2)	
Torture \times sample size ^b	28 926	55	20.1	1.55 (1.20-1.99)	3.37		73.5
$< 40\% \times$ ≥ 500	16 819	18		1 [Reference]		19.7	
$< 40\% \times$ < 500	8509	23		1.81 (0.94-3.48)	1.79	30.7 (18.8-46.0)	
$\geq 40\% \times$ ≥ 500 ^c	1210	1					
$\geq 40\% \times$ < 500	2388	13		3.62 (1.70-7.71)	3.33	47.0 (29.3-65.4)	
PTE adversity ratio \times sampling method ^b	36 462	75	32.3	1.83 (1.48-2.25)	5.64		54.4
$< 0.3 \times$ probability/census	17 796	19		1 [Reference]		17.4	
$< 0.3 \times$ target/mixed	2132	11		1.15 (0.55-2.38)	0.37	19.5 (10.5-33.5)	
$\geq 0.3 \times$ probability/census	13 719	30		3.24 (1.85-5.68)	4.10	40.6 (28.1-54.5)	
$\geq 0.3 \times$ target/mixed	2815	15		5.45 (2.80-10.6)	5.01	53.5 (37.2-69.1)	
PTE adversity ratio \times sample size ^b	36 462	75	31.4	1.75 (1.42-2.16)	5.19		70.2
$< 0.3 \times$ ≥ 500	11 793	10		1 [Reference]		14.1	
$< 0.3 \times$ < 500	8135	20		1.57 (0.75-3.31)	1.19	20.6 (11.0-35.3)	
$\geq 0.3 \times$ ≥ 500	11 941	15		4.90 (2.43-9.86)	4.45	44.7 (28.6-61.9)	
$\geq 0.3 \times$ < 500	4593	30		4.98 (2.29-10.8)	4.05	45.1 (27.4-64.1)	
Substantive Models							
Torture \times time, y ^b	28 244	53	20.5	1.82 (1.41-2.34)	4.62		39.9
$< 40\% \times$ ≥ 3	16 887	25		1 [Reference]		20.2	
$< 40\% \times$ < 3	7856	15		2.08 (1.18-3.65)	2.54	34.4 (23.0-48.0)	
$\geq 40\% \times$ ≥ 3	1501	6		2.57 (1.20-5.49)	2.42	39.3 (23.2-58.1)	
$\geq 40\% \times$ < 3	2000	7		4.97 (2.42-10.2)	4.38	55.7 (38.0-72.0)	
PTE adversity ratio \times time, y ^b	35 877	74	21.2	1.51 (1.30-1.77)	5.25		53.5
$< 0.3 \times$ ≥ 3	16 864	22		1 [Reference]		15.6	
$< 0.3 \times$ < 3	2479	7		1.74 (0.84-3.58)	1.50	24.3 (13.5-39.7)	
$\geq 0.3 \times$ ≥ 3	3585	17		3.50 (2.04-5.99)	5.09	39.2 (27.4-52.5)	
$\geq 0.3 \times$ < 3	12 949	28		3.36 (2.11-5.35)	4.57	38.2 (28.0-49.6)	

Abbreviations: CI, confidence interval; OR, odds ratio; PAR, population attributable risk; PTE, potentially traumatic event.

^aAdjusted OR, adjusted prevalence estimates, definition of PAR, and all substantive factors are explained in first footnote to Table 1. ^bIncludes the trend line for adjusted OR, t value, and PAR. ^cAdjusted prevalence rates have only been reported for variable strata with 5 or more surveys.

the lower torture category (<40%) in which rates were 34.4% (95% CI, 23.0%-48.0%) when the survey was undertaken proximate in time to the conflict (<3 years) in contrast to an average rate of 20.2% for surveys undertaken at least 3 years after resettlement or the cessation of major hostilities. The comparable analysis for the PTE adversity ratio \times time also yielded a significant linear trend, accounting for 21.2% of interstudy variance in depression. Surveys with populations endorsing less than 30% of PTEs in which resettlement or cessation of major hostilities occurred 3 years or more previously reported substantially lower rates of depression (15.6%) compared with surveys recording a PTE ratio of 0.3 and above. Due to the absence of an association between PTS and interstudy variance in depression, we did not undertake further analyses using that variable.

We also calculated the within-strata heterogeneity using the Cochran Q test and I^2 index for the cross-products shown in Table 4. Across all strata, the Q test remained statistically significant with I^2 index ranging between 92.5% and 99.6%, indicating substantial interstudy heterogeneity in depression prevalence.

COMMENT

Our study addressed a range of issues in the field of refugee and postconflict mental health. First, there has been a need to explain the large differences in rates of PTSD and depression that have emerged from epidemiologic surveys. Second, controversy has persisted about the association of torture and other PTEs with mental disorder across culturally and ethnically diverse populations.^{11,40}

Two previous quantitative reviews^{8,41} and a series of qualitative reviews^{15,42-44} have been undertaken in the field. Fazel et al⁸ analyzed 20 surveys focusing specifically on refugees resettled in high-income countries and found that methodological factors, including sample size and type of diagnostic measure used, influenced preva-

lence rates, as did contextual influences including length of resettlement. Porter and Haslam⁴¹ and Porter⁴⁵ derived an effect size index of psychological distress from the heterogeneous outcome measures used in a subset of 59 surveys that compared a displaced population with a nondisplaced control group. Rates of distress were influenced both by methodological as well as ecological-social variables, including restricted economic opportunity, insecure housing, and location of residency. Our review incorporates a larger body of surveys comprising a population of 81 866 persons from 40 source countries and included an assessment of the association between torture and other PTEs and the prevalence of PTSD and depression.

The surveys reviewed suggest that torture is endemic in countries affected by pervasive conflict, with respondents in 29 of 40 source countries reporting exposure. In total, 21% of participants in 84 surveys reported personal experiences of torture. The analysis shows that torture and other PTEs are associated with mental disorder across these settings. After adjusting for methodological factors, reported torture accounted for the highest intersurvey variance of PTSD among the substantive factors (23.6%). Torture also emerged as an important source of variance in depression rates, accounting for 11.4% of the method-adjusted interstudy variance.

Cumulative exposure to PTEs emerged as a high source of intersurvey variance for PTSD and depression but was most strongly associated with the latter outcome. For depression, the PTE adversity ratio was the strongest substantive factor (22% of method-adjusted interstudy variance). The PTEs experienced by refugees and other conflict-affected groups often involve multiple losses and deprivations that, in lesser form in civilian settings, have been reported to be associated with depression.^{46,47} In addition, the findings consolidate those of individual surveys showing a dose-response effect for PTEs in relation to both depression and

PTSD.^{48,49} There was a tendency toward reduction in mental health risk associated with cumulative PTE exposure as the length of time since conflict or resettlement increased.⁵⁰

PTSD increasingly is conceptualized not simply as a condition triggered by life-threatening PTEs but one that is shaped by conditions of ongoing threat or insecurity.^{51,52} To our knowledge, our study is the first to include a society-wide index of terror, the PTS,²⁸ that is independent of the reports of individual respondents. The association yielded, albeit modest, between political terror and the prevalence of PTSD therefore provides confirmation of the association between the general state of political violence in a country at the time and mental health identified by individual self-reports.

The results also support the notion that broader ecological-social factors interact with personal exposure to PTEs in shaping mental health responses.^{18,53} Populations that were displaced within or external to the source country or living in a refugee camp had higher rates of PTSD than those that were permanently resettled in another country. These data may inform policies and strategies that focus on improving conditions in the recovery environment in mitigating the mental health effects of mass conflict and displacement.⁵⁴

Methodological characteristics of surveys accounted for 13% and 28% of the interstudy variance in PTSD and depression, respectively. These findings provide guidance for future researchers in designing surveys in the field. Nonrandom sampling, small sample sizes, and use of self-report questionnaires all tend to generate higher prevalence rates. Self-report questionnaires generate point prevalence estimates, explaining the seemingly anomalous finding that 12-month and lifetime prevalence estimates (based on diagnostic interviews) yielded lower prevalence rates.

The weighted prevalence estimates derived from the subset of method-

ologically robust surveys may provide the most accurate indicator of PTSD and depression rates among conflict-affected populations included in our review. These rates ranged between 13% and 25% for PTSD and are broadly comparable with the World Health Organization's estimate of 20% for the median prevalence of mental disorder that may be expected in societies exposed to humanitarian emergencies.⁵⁵ An important corollary, however, is that the rate of disorder will depend on the population exposure to the identified risk factors which, as indicated by our analysis, exert a substantial effect on prevalence. Such projections in turn need to be moderated by the recognition that there remains substantial intersurvey heterogeneity in reported prevalence estimates even for surveys using similar methodologies among populations exposed to comparable levels of identified risk factors.

A number of potential limitations exist in our analysis. We have not examined the extent to which the instruments used in the surveys were culturally validated for the specific populations in which they were applied. Shown previously,⁵⁶ criterion validity has rarely been tested in population-based refugee samples. There is an ongoing debate as to whether measures of common psychological reaction patterns such as depressive symptoms measure disorder or distress.^{14,57} Although many other mental health variables are salient,⁵⁴ our review focused only on depression and PTSD, because these are the outcome indices that have been studied sufficiently. The assessment of torture across the majority of surveys reviewed was reliant on self-reports, most commonly based on endorsement of the torture item on the Harvard Trauma Questionnaire,³² leaving open the possibility of variation in personal understandings of the term. The effect of cumulative exposure to PTEs was assessed by the ratio of the population PTE count by the total number of PTEs assessed. The index provides a relative measure of PTE exposure that may obscure the absolute number of PTE events re-

ported. Moreover, the index does not assess the subjective component of PTE exposure.⁵⁸ Our review was limited to surveys conducted with displaced, conflict-affected populations, or both. In defining this group of surveys, we excluded the subset of studies focusing on terrorist-affected populations in high-income countries. Thus, we cannot generalize our findings (eg, the prevalence rate of torture identified) to other countries affected by different patterns of violence.

Our review also was limited to surveys published in the peer-reviewed English-language literature. Funnel plots did not provide evidence of publication bias.³⁵ Publication bias may be less of a threat to the validity of meta-analytic surveys focusing on observational surveys than it is to reviews of randomized controlled trials.^{59,60} Nevertheless, there was asymmetry across studies, with larger samples returning more conservative prevalence estimates. The nationally representative population surveys⁶¹⁻⁶⁴ from conflict-affected populations all returned low PTSD prevalence estimates, suggesting that the effects of conflict and displacement are not evenly distributed across societies. Finally, the meta-analytic procedures used are limited to the examination of predictors of interstudy variability only and not within-survey variation.⁶⁵ Initial testing of the present data identified substantial interstudy heterogeneity in prevalence estimates, necessitating the use of random-effects models. The regression models therefore applied more conservative error parameters, which may underestimate the strength of association of some variables.

Conclusion

The results of our analysis indicate that variation in prevalence rates of reported PTSD and depression across surveys can be explained both by methodological factors (sampling and the choice of diagnostic instruments) and substantive risk factors. After adjustment for methodological factors, torture emerged as the strongest substan-

tive factor associated with PTSD and cumulative exposure to PTEs was the strongest substantive factor associated with depression.

Considered as a whole, our findings should encourage researchers to use more methodologically rigorous and valid survey designs when conducting mental health assessments in postconflict settings. These findings should also assist health professionals in their efforts to advocate against human rights abuses and the implementation of international treaties prohibiting the use of torture, to highlight the mental health needs of affected populations, and at an international level to encourage policy makers to ensure that refugees and conflict-affected societies worldwide are assured of secure and supportive recovery environments.⁵⁴

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REFERENCES

1. Obermeyer Z, Murray CJ, Gakidou E. Fifty years of violent war deaths from Vietnam to Bosnia: analysis of data from the world health survey programme. *BMJ*. 2008;336(7659):1482-1486.
2. United Nations High Commissioner for Refugees.

- Statistical Yearbook 2007: Trends in Displacement, Protection and Solutions*. Geneva, Switzerland: United Nations High Commissioner for Refugees; 2008.
3. van Ommeren M, Saxena S, Saraceno B. Mental and social health during and after acute emergencies: emerging consensus? *Bull World Health Organ*. 2005;83(1):71-75, discussion 75-76.
 4. Hashemian F, Khoshnood K, Desai MM, et al. Anxiety, depression, and posttraumatic stress in Iranian survivors of chemical warfare. *JAMA*. 2006;296(5):560-566.
 5. de Jong K, Mulhern M, Ford N, et al. The trauma of war in Sierra Leone. *Lancet*. 2000;355(9220):2067-2068.
 6. Steel Z, Silove D, Chey T, et al. Mental disorders, disability and health service use amongst Vietnamese refugees and the host Australian population. *Acta Psychiatr Scand*. 2005;111(4):300-309.
 7. Fox SH, Tang SS. The Sierra Leonean refugee experience: traumatic events and psychiatric sequelae. *J Nerv Ment Dis*. 2000;188(8):490-495.
 8. Fazel M, Wheeler J, Danesh J. Prevalence of serious mental disorder in 7000 refugees resettled in western countries. *Lancet*. 2005;365(9467):1309-1314.
 9. Wenzel T. Torture. *Curr Opin Psychiatry*. 2007;20(5):491-496.
 10. Amnesty International. Amnesty International Report 2008. <http://www.amnesty.org>. Accessibility verified July 7, 2009.
 11. Bracken PJ, Giller JE, Summerfield D. Psychological responses to war and atrocity. *Soc Sci Med*. 1995;40(8):1073-1082.
 12. Dershowitz AM. The torture warrant: a response to Professor Strauss. *New York Law School Law Review*. 2004;48:275-294.
 13. Weathers FW, Keane TM. The Criterion A problem revisited: controversies and challenges in defining and measuring psychological trauma. *J Trauma Stress*. 2007;20(2):107-121.
 14. Rodin D, van Ommeren M. Commentary: explaining enormous variations in rates of disorder in trauma-focused psychiatric epidemiology after major emergencies [published online May 4, 2009]. *Int J Epidemiol*. 2009.
 15. Johnson H, Thompson A. The development and maintenance of post-traumatic stress disorder (PTSD) in civilian adult survivors of war trauma and torture: a review. *Clin Psychol Rev*. 2008;28(1):36-47.
 16. Goldfeld AE, Mollica RF, Pesavento BH, Faraone SV. The physical and psychological sequelae of torture. *JAMA*. 1988;259(18):2725-2729.
 17. Başoğlu M, Paker M, Paker O, et al. Psychological effects of torture: a comparison of tortured with nontortured political activists in Turkey. *Am J Psychiatry*. 1994;151(1):76-81.
 18. Silove D. The psychosocial effects of torture, mass human rights violations, and refugee trauma. *J Nerv Ment Dis*. 1999;187(4):200-207.
 19. Silove D, Steel Z, Watters C. Policies of deterrence and the mental health of asylum seekers. *JAMA*. 2000;284(5):604-611.
 20. Marshall GN, Schell TL, Elliott MN, et al. Mental health of Cambodian refugees 2 decades after resettlement in the United States. *JAMA*. 2005;294(5):571-579.
 21. Wilczynski NL, Haynes RB; Team Hedges. Optimal search strategies for identifying mental health content in MEDLINE. *Ann Gen Psychiatry*. 2006;5:4.
 22. Stroup DF, Berlin JA, Morton SC, et al. Meta-analysis of observational studies in epidemiology. *JAMA*. 2000;283(15):2008-2012.
 23. The PILOTS Database. An electronic index to the traumatic stress literature. <http://www.ncptsd.va.gov/ncmain/>. Accessed June 21, 2009.
 24. Bleich A, Gelkopf M, Solomon Z. Exposure to terrorism, stress-related mental health symptoms, and coping behaviors among a nationally representative sample in Israel. *JAMA*. 2003;290(5):612-620.
 25. Hauff E, Vaglum P. Organised violence and the stress of exile: predictors of mental health in a community cohort of Vietnamese refugees three years after resettlement. *Br J Psychiatry*. 1995;166(3):360-367.
 26. Shrestha NM, Sharma B, van Ommeren M, et al. Impact of torture on refugees displaced within the developing world. *JAMA*. 1998;280(5):443-448.
 27. Van Ommeren M, de Jong JT, Sharma B, et al. Psychiatric disorders among tortured Bhutanese refugees in Nepal. *Arch Gen Psychiatry*. 2001;58(5):475-482.
 28. Gibney M, Dalton M. The political terror scale. *Policy Stud Developing Nations*. 1996;4:73-84.
 29. SAS software [computer program]. Version 9.13. Cary, NC: SAS Institute Inc; 2002.
 30. van Houwelingen HC, Arends LR, Stijnen T. Advanced methods in meta-analysis: multivariate approach and meta-regression. *Stat Med*. 2002;21(4):589-624.
 31. Huedo-Medina TB, Sánchez-Meca J, Marín-Martínez F, Botella J. Assessing heterogeneity in meta-analysis: Q statistic or I² index? *Psychol Methods*. 2006;11(2):193-206.
 32. Mollica RF, Caspi-Yavin Y, Bollini P, et al. The Harvard Trauma Questionnaire: validating a cross-cultural instrument for measuring torture, trauma, and posttraumatic stress disorder in Indochinese refugees. *J Nerv Ment Dis*. 1992;180(2):111-116.
 33. Wittchen HU, Robins LN, Cottler LB, et al. Cross-Cultural Feasibility, Reliability and Sources of Variance of the Composite International Diagnostic Interview (Cidi). *Br J Psychiatry*. 1991;159:645-653, 658.
 34. Weathers F, Litz B, Herman D, Huska J, Keane T. The PTSD Checklist (PCL): Reliability, Validity, and Diagnostic Utility. Paper presented at: 9th Annual Meeting of the International Society for Traumatic Stress Studies; October 1993; San Antonio, TX.
 35. Sterne JA, Egger M, Smith GD. Systematic reviews in health care: investigating and dealing with publication and other biases in meta-analysis. *BMJ*. 2001;323(7304):101-105.
 36. Mollica RF, Wyshak G, de Marneffe D, et al. Indochinese versions of the Hopkins Symptom Checklist-25: a screening instrument for the psychiatric care of refugees. *Am J Psychiatry*. 1987;144(4):497-500.
 37. First MB, Spitzer RL, Gibbon M, Williams JBW. *Structured Clinical Interview for DSM-IV Axis I Disorders*. New York, NY: American Psychiatric Press; 1997.
 38. Goldberg DP, Williams PA. *A User's Guide to the General Health Questionnaire*. Windsor, England: NFER-Nelson; 1988.
 39. Beusenbergh M, Orally J. *A User's Guide to Self-Reporting Questionnaire (SRQ)*. Geneva, Switzerland: World Health Organization; 1994.
 40. Summerfield D. A critique of seven assumptions behind psychological trauma programmes in war-affected areas. *Soc Sci Med*. 1999;48(10):1449-1462.
 41. Porter M, Haslam N. Predisplacement and post-displacement factors associated with mental health of refugees and internally displaced persons: a meta-analysis. *JAMA*. 2005;294(5):602-612.
 42. Quiroga J, Jaranson JM. Politically-motivated torture and its survivors: a desk study review of the literature. *Torture*. 2005;15(2-3):1-112.
 43. Murthy RS, Lakshminarayana R. Mental health consequences of war: a brief review of research findings. *World Psychiatry*. 2006;5(1):25-30.
 44. Karam E, Ghosn MB. Psychosocial consequences of war among civilian populations. *Curr Opin Psychiatry*. 2003;16(4):413-419.
 45. Porter M. Global evidence for a biopsychosocial understanding of refugee adaptation. *Transcult Psychiatry*. 2007;44(3):418-439.
 46. Tennant C. Life events, stress and depression: a review of recent findings. *Aust N Z J Psychiatry*. 2002;36(2):173-182.
 47. Kessler RC. The effects of stressful life events on depression. *Annu Rev Psychol*. 1997;48:191-214.
 48. Mollica RF, McInnes K, Poole C, Tor S. Dose-effect relationships of trauma to symptoms of depression and post-traumatic stress disorder among Cambodian survivors of mass violence. *Br J Psychiatry*. 1998;173:482-488.
 49. Mollica RF, McInnes K, Pham T, et al. The dose-effect relationships between torture and psychiatric symptoms in Vietnamese ex-political detainees and a comparison group. *J Nerv Ment Dis*. 1998;186(9):543-553.
 50. Steel Z, Silove D, Phan T, Bauman A. Long-term effect of psychological trauma on the mental health of Vietnamese refugees resettled in Australia. *Lancet*. 2002;360(9339):1056-1062.
 51. Steel Z, Silove D, Brooks R, et al. Impact of immigration detention and temporary protection on the mental health of refugees. *Br J Psychiatry*. 2006;188:58-64.
 52. Momartin S, Steel Z, Coello M, et al. A comparison of the mental health of refugees with temporary versus permanent protection visas. *Med J Aust*. 2006;185(7):357-361.
 53. Miller KE, Kulkarni M, Kushner H. Beyond trauma-focused psychiatric epidemiology: bridging research and practice with war-affected populations. *Am J Orthopsychiatry*. 2006;76(4):409-422.
 54. Inter-Agency Standing Committee. *IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings*. Geneva, Switzerland: Inter-Agency Standing Committee; 2007.
 55. van Ommeren M, Saxena S, Saraceno B. Aid after disasters. *BMJ*. 2005;330(7501):1160-1161.
 56. Hollifield M, Warner TD, Lian N, et al. Measuring trauma and health status in refugees: a critical review. *JAMA*. 2002;288(5):611-621.
 57. Horwitz AV, Wakefield JC. *The Loss of Sadness: How Psychiatry Transformed Normal Sorrow Into Depressive Disorder*. New York, NY: Oxford University Press; 2007.
 58. Hollifield M, Eckert V, Warner TD, et al. Development of an inventory for measuring war-related events in refugees. *Compr Psychiatry*. 2005;46(1):67-80.
 59. Egger M, Schneider M, Davey Smith G. Spurious precision? meta-analysis of observational studies. *BMJ*. 1998;316(7125):140-144.
 60. Turner EH, Matthews AM, Linardatos E, et al. Selective publication of antidepressant trials and its influence on apparent efficacy. *N Engl J Med*. 2008;358(3):252-260.
 61. Stein DJ, Seedat S, Herman A, et al. Lifetime prevalence of psychiatric disorders in South Africa. *Br J Psychiatry*. 2008;192(2):112-117.
 62. Karam EG, Mneimneh ZN, Dimassi H, et al. Lifetime prevalence of mental disorders in Lebanon: first onset, treatment, and exposure to war. *PLoS Med*. 2008;5(4):e61.
 63. Alhasnawi S, Sadik S, Rasheed M, et al. The prevalence and correlates of DSM-IV disorders in the Iraq Mental Health Survey (IMHS). *World Psychiatry*. 2009;8(2):97-109.
 64. Zlotnick C, Johnson J, Kohn R, et al. Epidemiology of trauma, post-traumatic stress disorder (PTSD) and co-morbid disorders in Chile. *Psychol Med*. 2006;36(11):1523-1533.
 65. Khoshdel A, Attia J, Carney L. Basic concepts in meta-analysis: a primer for clinicians. *Int J Clin Pract*. 2006;60(10):1287-1294.