Symptoms of Posttraumatic Stress Disorder and Depression Among Children in Tsunami-Affected Areas in Southern Thailand

Warunee Thienkrua, MSc

Barbara Lopes Cardozo, MD, MPH

M. L. Somchai Chakkraband, MD

Thomas E. Guadamuz, MHS

Wachira Pengjuntr, MD

Prawate Tantipiwatanaskul, MD

Suchada Sakornsatian, MOT

Suparat Ekassawin, MD

Benjaporn Panyayong, MD

Anchalee Varangrat, MSc

Jordan W. Tappero, MD, MPH

Merritt Schreiber, MD

Frits van Griensven, PhD

for the Thailand Post-Tsunami Mental Health Study Group

O N DECEMBER 26, 2004, A massive undersea earthquake northwest of Sumatra, Indonesia, with a Richter-scale magnitude of 9.3, caused a giant ocean shockwave, or tsunami, that devastated the shorelines of Indonesia, Sri Lanka, India, Thailand, and several other countries.[1] More than 200 000 people are estimated to have died from the tsunami, making it one of the deadliest natural disasters in history.[1] In Thailand, Phang Nga province was most severely affected, followed by Krabi and Phuket.[2] In Phang Nga alone, more than 4200 people died, and another estimated 4250 people were displaced after their houses were

Context On December 26, 2004, an undersea earthquake occurred off the northwestern coast of Sumatra, Indonesia. The tsunami that followed severely impacted all 6 southwestern provinces of Thailand, where approximately 20 000 children were directly affected.

Objective To assess trauma experiences and the prevalence of symptoms of posttraumatic stress disorder (PTSD) and depression among children in tsunami-affected provinces in southern Thailand.

Design, Setting, and Participants Population-based mental health surveys were conducted among children aged 7 to 14 years in Phang Nga, Phuket, and Krabi provinces from February 15-22, 2005 (2 months posttsunami), and September 7-12, 2005 (9 months posttsunami).

Main Outcome Measures Trauma experiences and symptoms of PTSD and depression as measured by a tsunami-modified version of the PsySTART Rapid Triage System, the UCLA PTSD Reaction Index, and the Birleson Depression Self-Rating Scale.

Results A total of 371 children (167 displaced and living in camps, 99 not displaced from villages affected by the tsunami, and 105 not displaced from unaffected villages) participated in the first survey. The prevalence rates of PTSD symptoms were 13% among children living in camps, 11% among children from affected villages, and 6% among children from unaffected villages (camps vs unaffected villages, $P=.25$); for depression symptoms, the prevalence rates were 11%, 5%, and 8%, respectively ($P=.39$). In multivariate analysis of the first assessment, having had a delayed evacuation, having felt one's own or a family member's life to have been in danger, and having felt extreme panic or fear were significantly associated with PTSD symptoms. Older age and having felt that their own or a family member's life had been in danger were significantly associated with depression symptoms. In the follow-up survey, 72% (151/210) of children from Phang Nga participated. Prevalence rates of symptoms of PTSD and depression among these children did not decrease significantly over time.

Conclusions This assessment documents the prevalence of mental health problems among children in tsunami-affected provinces in southern Thailand at 2 and 9 months posttsunami. Traumatic events experienced during the tsunami were significantly associated with symptoms of PTSD and depression. These data may be useful to target mental health services for children and may inform the design of these interventions.

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Author Affiliations: Thailand Ministry of Public Health–US Centers for Disease Control and Prevention Collaboration, Nonthaburi, Thailand (Mss Thienkrua and Varangrat, Mr Guadamuz, and Drs Tappero and van Griensven); US Centers for Disease Control and Prevention, Atlanta, Ga (Drs Lopes Cardozo, Tappero, and van Griensven); Department of Mental Health, Ministry of Public Health, Nonthaburi, Thailand (Drs Chakkraband, Pengjuntr, Tantipiwatanaskul, Ekassawin, and Panyayong and Ms Sakornsatian); and Neuropsychiatric Institute and Hospital, David Geffen School of Medicine at the University of California at Los Angeles (Dr Schreiber). Dr Schreiber is now at the Center for Public Health and Disasters, School of Public Health, University of California, Los Angeles.
Members of the Thailand Post-Tsunami Mental Health Study Group are listed at the end of this article.
Corresponding Author: Barbara Lopes Cardozo, MD, MPH, Centers for Disease Control and Prevention, National Center for Environmental Health, 1600 Clifton Road NE, Mailstop E-97, Atlanta, GA 30333 (bhc8@cdc.gov).

Figure 1. Sampling Stages for Displaced Children in Phang Nga Province
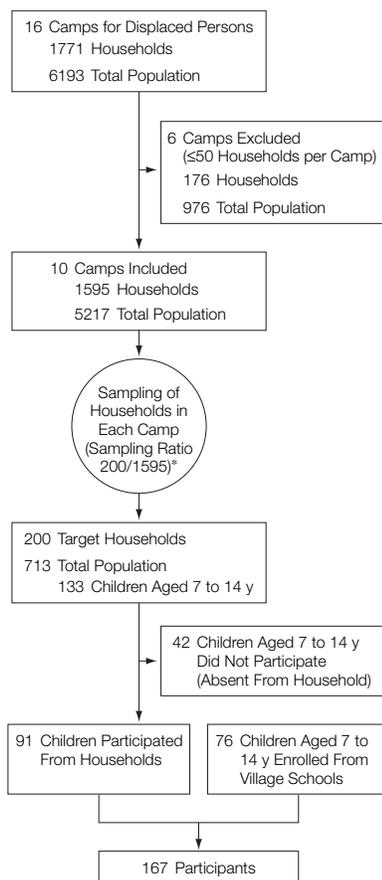
*Households were used as the primary sampling unit and were defined as any group of persons (sometimes multiple families) sharing the same structure and resources, such as food or bedding.

destroyed. In Krabi, the death toll measured 721, and in Phuket, 279.[3] It is estimated that approximately 20 000 children in southern Thailand were displaced, lost 1 or more family members, were orphaned or injured, or lost important belongings (material possessions with sentimental value to the child).[1]

Several studies have reported increased psychological trauma among children after natural disasters.[4-8] Posttraumatic stress disorder (PTSD) and depression may arise weeks or months after the traumatic event. The severity of children's symptoms depends on factors such as level of exposure to the event, personal injury, loss of loved ones, level of parental support, and dislocation.[9] Life-threatening events during a disaster have been associated with psychological problems in children.[10]

As part of a public health emergency response, we conducted a rapid assessment of symptoms of mental illness among adults and children 2 months after the tsunami. A surveillance follow-up survey was conducted among a subset of those most affected, 9 months after the disaster. Here we present the prevalence of symptoms of PTSD, depression, and associated risk factors among children aged 7 to 14 years in tsunami-affected provinces in southern Thailand at 2 and 9 months posttsunami. Symptoms of PTSD, anxiety, and depression among adults after the tsunami in Thailand are reported elsewhere in this issue.[11] To our knowledge, no data have been published regarding posttsunami mental health problems in children. An assessment of such problems is essential to estimate the need for mental health services, to identify those at highest risk for mental health problems, and to design and implement appropriate mental health interventions for them.

METHODS
Study Design

Two mental health assessments were conducted among children aged 7 to 14 years, 2 and 9 months posttsunami. The first survey was conducted between February 15 and 22, 2005, in Phang Nga, Krabi, and Phuket provinces. These provinces were selected because they were the most severely affected by the tsunami. A follow-up survey was conducted in Phang Nga only, between September 7 and 12, 2005, 9 months after the disaster. We aimed to enroll 200 displaced and 150 nondisplaced households from Phang Nga and 200 nondisplaced households from Krabi and Phuket. As explained elsewhere,[11] this sample size was calculated on the basis of an assumed PTSD prevalence of 15% in displaced and 12.5% in nondisplaced adults, a design effect of 2, and a 95% confidence interval (CI) (±5%). For the purpose of this analysis we aimed to enroll a sample of 350 children: 150 living in camps for displaced persons, 100 not displaced from from villages affected by the tsunami, and 100 not displaced from unaffected villages. These numbers would allow us to estimate a prevalence of mental health problems of 5%, with an accuracy of 95% (±4%) and a design effect of 1.5.

The first survey included children aged 7 to 14 years, either those living in camps for displaced persons in Phang Nga or those not displaced from affected and unaffected villages in Phang Nga, Krabi, and Phuket. Of 16 camps registered by February 14, 2005, 10 were selected. Six camps were excluded because they had fewer than 50 households. Households were used as the primary sampling unit and were defined as any group of persons (sometimes multiple families) sharing the same structure and resources, such as food or bedding. Household members were not necessarily relatives by blood or marriage.

We drew a systematic sample of households living in displacement camps in Phang Nga, as explained elsewhere (**FIGURE 1**).[11] In every household, all children aged 7 to 14 years were asked to participate. Of the 133 children in this age group identified in these households, 91 were located and interviewed, either in the camp or in the village school. If children were not present during initial field-staff visits, staff returned at a later time, for a maximum of 2 visits. Forty-two children were absent or could not be located. With the help of village school staff, we identified all eligible 7- to 14-year-old children living in the camps who were present at the school at the time of the field staff visit but who had not been able to participate through the household survey. All of the children (n=76) were identified and included to reach the target sample size, bringing the total number of children from camps to 167. All these children were asked for assent, and their parents or guardians provided oral informed consent to participate. If children were present, refusal to participate was rare.

To identify nondisplaced children, we drew a multistage cluster sample of 350 households from affected and unaffected villages in Phang Nga (defined as the high-impact cluster, 4224 deaths), and Krabi and Phuket (defined as the lower-impact cluster, 721 and 279 deaths, respectively) as explained elsewhere in this issue[11] (**FIGURE 2**). In every household all children aged 7 to 14 years were asked to participate. Of the 202 eligible children (87 from affected and 115 from unaffected villages), 108 (47 from affected and 61 from unaffected villages) were located and interviewed, either at home or at the village school. If children were not present during initial field-staff visits, staff returned at a later time, for a maximum of 2 visits. Ninety-four children were absent or could not be located. With the help of village school staff in 2 villages (1 affected, 1 unaffected), we identified all eligible children who were present at the school at the time of the field staff visit but who had not been able to participate through the household survey. All of these children (n=96; 52 from affected villages, 44 from unaffected villages) were identified and included to reach the target sample size, bringing the total number of children from the villages to 204 (99 from affected and 105 from unaffected villages). All children were asked for assent, and their parents or guardians provided oral informed consent to participate. If children were present, refusal to participate was rare.

Instruments and Data Collection

For both the initial rapid assessment and the surveillance follow-up assessment, we used standard instruments to assess the prevalence of symptoms of PTSD and depression. Other measures of mental health problems (eg, anxiety) were excluded to limit the number of questions and the duration of the interview for children. To inform fieldwork procedures and tsunami-specific questions, we collected information from adult key informants (persons affected by the tsunami, health care workers, and community leaders) about traumatic experiences, culture-specific coping mechanisms, and tsunami-related mental health and subsistence issues. Thai nationality was determined by the interviewers (a child with a Thai national identification number was considered Thai; children who lacked a number but who could speak Thai were offered enrollment); nationality was determined to control for the numbers of legal and illegal immigrants from Burma working in the tsunami area. Religion was assessed by having the interviewers ask for that information.

Symptoms of PTSD were evaluated using the child version of the University of California, Los Angeles PTSD Reaction Index. This index has been used to assess traumatized children after major disasters and catastrophic violence.[12] The questionnaire contains 20 yes/no items, with a 4-point scale to measure range of affirmative responses, ranging from 1 ("a little of the time") to 4 ("most of the time"). A "no" answer was given a score of 0. A total PTSD symptom score was obtained by summing across all items. A child with a score higher than 40 was classified as having PTSD symptoms.

The Birleson Depression Self-Rating Scale was used to assess symptoms of depression. This scale is considered a valid tool for the screening of depressive symptoms in children.[13,14] The questionnaire contains 18 items rating the frequency of depressive symptoms over the previous week on a 3-point scale ("most of the time," "sometimes," "never"). A score of 15 or higher was used to classify a child as having as symptoms of depression.

A tsunami-modified version of the PsySTART Rapid Triage System[15,16] was used to ask children 13 yes/no questions about tsunami-specific trauma experiences. These traumatic experiences included having seen tsunami waves, having seen anyone dead or injured, having heard screams, having had a delayed evacuation, having felt one's own or a family member's life to have been in danger, having felt unable to escape, having felt extreme panic or fear, having lost a close family member or friend, having had a close family member or friend injured, having lost home or important belongings, and having sustained an injury.

All questions were translated from English to Thai and verified for accuracy by bilingual local mental health experts (but were not back-translated). Questionnaires were programmed for use on handheld computers and administered by trained interviewers who were psychologists, social workers, and psychiatric nurses. Completed questionnaires were downloaded to a laptop computer and electronically transported to the Bangkok-based data management center using General Packet Radio Service at the end of each day.

The protocol of our assessment was reviewed by the US Centers for Disease Control and Prevention and by the Department of Mental Health of the Thailand Ministry of Public Health and was determined an emergency public health response, which, consequently, did not require an institutional review board review. Data collection consisted of face-to-face interviews carried out in a temporary housing structure, a home, or a school. The parent or guardian was not in close proximity during interviews; thus, each child responded to all questions without consultation or interference. Parents received 100 Baht (US $2.50) as compensation for their children's participation. Children in need of mental health support were referred to mental health services available both in camps and in community areas.

Data Analysis

Prevalence rates of symptoms of PTSD and depression and other characteristics were calculated and analyzed using SPSS version 12.0 (SPSS Inc, Chicago, Ill). Frequencies and standard deviations were calculated for descriptive data, t tests were used to compare mean values, and χ^2 tests were used for categorical data. Pearson correlation was used to assess the relationships among the independent and dependent variables.

Figure 2. Sampling Stages for Nondisplaced Children in Phang Nga, Phuket, and Krabi Provinces
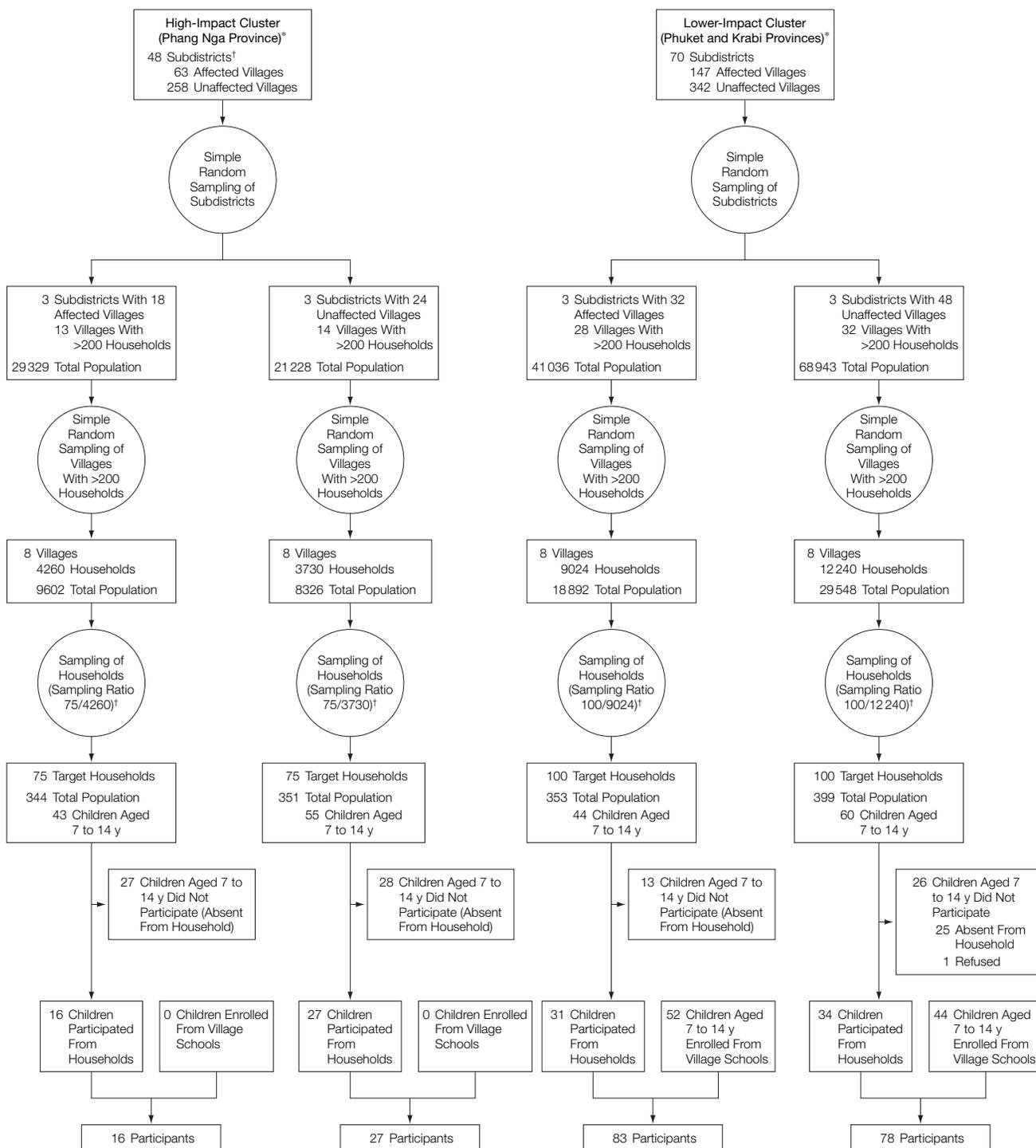
*High-impact cluster was used to describe the large number of tsunami-related deaths in the Phang Nga Province (4224 deaths). Krabi and Phuket were characterized as lower-impact clusters (721 and 279 deaths, respectively).
†Households were used as the primary sampling unit and were defined as any group of persons (sometimes multiple families) sharing the same structure and resources, such as food or bedding.

Backward stepwise selection multivariate logistic regression analysis adjusted for confounding variables was used to identify independent risk factors for symptoms of PTSD and depression. All variables that were theoretically relevant (eg, displacement status) or that had *P* values of .05 or lower in bivariate analysis were entered into multivariate models. Risk factors examined for PTSD included displacement status, having seen tsunami waves, having seen anyone dead or injured, having heard screams, having had a delayed evacuation, having felt one's own or a family member's life to have been in danger, having felt unable to escape, having felt extreme panic or fear, having lost a close family member or friend, having lost home or important belongings, and having sustained an injury. Risk factors examined for depression included displacement status, age, having seen tsunami waves, having seen anyone dead or injured, having felt one's own or a family member's life to have been in danger, having felt unable to escape, having felt extreme panic or fear, and having had a close family member or friend injured.

RESULTS
Demographic Characteristics
Of 371 children participating in the first survey, 167 (45%) were living in displacement camps, 99 (27%) were nondisplaced from affected villages, and 105 (28%) were nondisplaced from unaffected villages. Religion differed significantly between camps, affected villages, and unaffected villages (*P*<.001). Among children from camps, 49% were boys, 93% were Buddhist (3% Muslim, 4% Christian), and 99% were Thai, with a mean age of 10.1 years; among children from affected villages, 53% were boys, 47% were Buddhist (52% Muslim, 2% Christian), and 99% were Thai, with a mean age of 10.1 years; among children from unaffected villages, 39% were boys, 62% were Buddhist (37% Muslim, 1% Christian), and 99% were Thai, with a mean age of 10.6 years. Seventy-two percent (151/210) of children from the first survey in

Phang Nga participated in the follow-up survey. In all cases (n=59), relocation was determined to be the reason for loss to follow-up.

Prevalence of PTSD and Depression at 8 Weeks and 9 Months
In the first survey, prevalences of PTSD symptoms among children from displacement camps, affected villages, and unaffected villages were 13%, 11%, and 6%, respectively (camps vs unaffected villages, *P*=.25). Prevalences of depression symptoms among children from camps, affected villages, and unaffected villages were 11%, 5%, and 8%, respectively (*P*=.39). The prevalence of PTSD was higher among children from camps than among those from unaffected villages (*P*=.049); other differences were not statistically significant (**TABLE 1**).

Nine months posttsunami in Phang Nga, prevalence of PTSD symptoms among children in camps had decreased from 13% (22/167) to 10% (12/119), but this decline was not significant (*P*=.43). Prevalence of depression among children in camps stayed approximately similar, with 11% (18/167) in the first survey and 12% (14/119) in the second (*P*=.79). The numbers of children participants from affected and unaffected villages in Phang Nga was too small for meaningful statistical analysis.

Tsunami Experiences, First Survey
Children living in displacement camps were significantly more likely (75% [125/167]) to have had direct tsunami experiences (ie, to have seen the tsunami waves) than children not displaced from affected villages (55% [54/99]) and unaffected villages (28% [29/105]) (*P*<.001 for all comparisons) (Table 1).

Children living in camps more frequently reported experiences of fear, loss, and personal injuries during the tsunami than nondisplaced children from other areas. Most children living in camps reported having felt their own or a family member's life to have been

in danger (75%; 95% CI, 67.6%-81.2%), having felt unable to escape (64%; 95% CI, 55.7%-70.8%), having felt extreme panic or fear (81%; 95% CI, 74.7%-87.0%), and having lost close family member or friend (83%; 95% CI, 76.0%-88.1%) (*P*<.001 for all comparisons). Nearly all children from camps (90%; 95% CI, 84.9%-94.4%) reported having lost important belongings (*P*<.001) (Table 1).

Analysis of PTSD and Depression Symptoms, First Survey
The correlation coefficients presented in **TABLE 2** indicate there were no significant correlations between independent variables; however, the dependent variables PTSD and depression were significantly correlated at *P*=.01.

In bivariate analysis, demographic characteristics, including living in a displacement camp, were not significantly associated with PTSD symptoms (**TABLE 3**). A significantly higher prevalence of PTSD symptoms were found among children who reported having seen tsunami waves, having seen anyone dead or injured, having heard screams, having had a delayed evacuation, having felt their own or a family member's life to have been in danger, having felt unable to escape, having felt extreme panic or fear, having lost a close family member or friend, having lost home or important belongings, or having sustained an injury (Table 3). In multivariate analysis, having had a delayed evacuation, having felt one's own or a family member's life to have been danger, and having felt extreme panic or fear were significantly and independently associated with PTSD symptoms (Table 3).

In bivariate analysis, older age, having seen the tsunami waves, having seen anyone dead or injured, having felt one's own or a family member's life to have been in danger, having felt unable to escape, having felt extreme panic or fear, and having had a close family member or friend injured as a result of the tsunami were significantly associated with symptoms of depression (**TABLE 4**). In multivariate analysis,

older age and having felt one's own or a family member's life to have been in danger were significantly and independently associated with symptoms of depression (Table 4).

COMMENT

Our assessment showed that a significantly higher percentage of children displaced in southern Thailand as a result of the December 2004 tsunami reported symptoms of PTSD compared with those who had not been displaced from unaffected villages in the same area (13% vs 6%, respectively; $\chi^2 = 3.88$; $P = .049$). However, no such

Table 1. Demographic Characteristics, Traumatic Experiences, and Mental Health Outcomes Among Children Enrolled From Displacement Camps, Tsunami-Affected Villages, and Unaffected Villages—Southern Thailand, 2005

Characteristic	No. (% [95% CI])			P Value*
	Displacement Camps (n = 167)	Affected Villages (n = 99)	Unaffected Villages (n = 105)	
Demographics				
Age group, y				
7-10	96 (57.5 [49.6-65.1])	57 (57.6 [47.2-67.5])	47 (44.8 [35.0-54.8])	.09
11-14	71 (42.5 [34.9-50.4])	42 (42.4 [32.5-52.8])	58 (55.2 [45.2-65.0])	
Sex				
Boys	81 (48.5 [40.7-56.4])	52 (52.5 [42.2-62.7])	41 (39.0 [29.7-49.1])	.14
Girls	86 (51.5 [43.7-59.3])	47 (47.5 [37.3-57.8])	64 (61.0 [50.9-70.3])	
Religion				
Buddhist	156 (93.4 [88.5-96.7])	46 (46.5 [36.4-56.8])	65 (61.9 [51.9-71.2])	<.001
Other	11 (6.6 [3.3-11.5])	53 (53.5 [43.2-63.6])	40 (38.1 [28.8-48.1])	
Tsunami-related traumatic experiences†				
Saw tsunami waves				
Yes	125 (74.9 [67.6-81.2])	54 (54.5 [44.2-64.6])	29 (27.6 [19.3-37.2])	<.001
No	42 (25.1 [18.8-32.4])	45 (45.5 [35.4-55.8])	76 (72.4 [62.8-80.7])	
Saw anyone dead or injured				
Yes	93 (55.7 [47.8-63.4])	45 (45.5 [35.4-55.8])	39 (37.1 [27.9-47.1])	.01
No	74 (44.3 [36.6-52.2])	54 (54.5 [44.2-64.6])	66 (62.9 [52.9-72.1])	
Heard screams				
Yes	72 (43.1 [35.5-50.9])	35 (35.4 [26.0-45.6])	28 (26.7 [18.5-36.2])	.02
No	95 (56.9 [49.0-64.5])	64 (64.6 [54.4-74.0])	77 (73.3 [63.8-81.5])	
Had delayed evacuation				
Yes	50 (29.9 [23.1-37.5])	25 (25.3 [17.1-35.0])	10 (9.5 [4.7-16.8])	.004
No	117 (70.1 [62.5-76.9])	74 (74.7 [65.0-82.9])	95 (90.5 [83.2-95.3])	
Felt one's own or a family member's life to have been in danger				
Yes	125 (74.9 [67.6-81.2])	59 (59.6 [49.3-69.3])	44 (41.9 [32.3-51.9])	<.001
No	42 (25.1 [18.8-32.4])	40 (40.4 [30.7-50.7])	61 (58.1 [48.1-67.7])	
Felt unable to escape				
Yes	106 (63.5 [55.7-70.8])	38 (38.4 [28.8-47.7])	26 (24.8 [16.9-34.1])	<.001
No	61 (36.5 [29.2-44.3])	61 (61.6 [51.3-71.2])	79 (75.2 [65.9-83.1])	
Felt extreme panic or fear				
Yes	136 (81.4 [74.7-87.0])	65 (65.7 [55.4-74.9])	48 (45.7 [36.0-55.7])	<.001
No	31 (18.6 [12.9-25.3])	34 (34.3 [25.1-44.6])	57 (54.3 [44.3-64.0])	
Lost close family member or friend				
Yes	138 (82.6 [76.0-88.1])	45 (45.5 [35.4-55.7])	43 (41.0 [31.5-51.0])	<.001
No	29 (17.4 [11.9-23.9])	54 (54.5 [44.2-64.6])	62 (59.0 [49.0-68.5])	
Close family member or friend injured				
Yes	107 (64.1 [56.3-71.3])	37 (37.4 [27.9-47.7])	33 (31.4 [22.7-41.2])	<.001
No	60 (35.9 [28.7-43.7])	62 (62.6 [52.3-72.1])	72 (68.6 [58.8-77.3])	
Lost home or important belongings‡				
Yes	151 (90.4 [84.9-94.4])	46 (46.5 [36.4-56.8])	21 (20.0 [12.8-28.9])	<.001
No	16 (9.6 [5.6-15.1])	53 (53.5 [43.2-63.6])	84 (80.0 [71.1-87.2])	
Sustained injury				
Yes	38 (22.8 [16.6-29.9])	14 (14.1 [8.0-22.6])	5 (4.8 [1.6-10.8])	<.001
No	129 (77.2 [70.1-83.4])	85 (85.9 [77.4-92.0])	100 (95.2 [89.2-98.4])	
Mental health outcomes				
PTSD	22 (13.2 [8.4-19.3])	11 (11.1 [5.8-19.0])	6 (5.7 [2.1-12.0])	.15
Depression	18 (10.8 [6.5-16.5])	5 (5.1 [1.7-11.4])	8 (7.6 [3.3-14.5])	.25

Abbreviations: CI, confidence interval; PTSD, posttraumatic stress disorder.
*P value expresses statistical evaluation of children residing in camps, affected villages, and unaffected villages.
†Assessed using categories from the PsySTART Rapid Triage System.[15,16]
‡"Important belongings" refers to physical possessions of sentimental value to the child.

differences were seen between children who were displaced and those who had not been displaced from affected villages (11%) (*P* = .62). Of children residing in displacement camps, 11% reported symptoms of depression, but this percentage was not higher than among nondisplaced children living elsewhere in provinces affected by the tsunami. Many of these children had lost their homes, 1 or more of their parents and siblings, and belongings with sentimental value and had undergone close-to-death experiences during the tsunami. With the exception of religion, demographic characteristics were similar between children in camps and villages. Children in camps were more likely to be Buddhist than those in the villages, since most of them originated from Baan Nam Khem, a predominantly Buddhist village from Phang Nga province that was completely destroyed by the tsunami.

The timing of our surveys to assess PTSD and depression was critical, since it is believed that by 8 weeks postdisaster, acute manifestations of mental health problems have either disappeared or have become more permanent.[5,17] In the second survey, 9 months posttsunami, prevalence of PTSD and depression among children in Phang Nga had not declined, and follow-up assessments must be conducted to assess the long-term mental health outcomes and the long-term need for mental health services. Several studies have shown that after disasters, mental health problems among children are common and of the same magnitude as those found in our assessment. After Typhoon Rusa in South Korea, for instance, 12% of elementary school children were classified as having PTSD.[7] After a wildfire disaster in Australia, 9.0% of students aged 8 to 18 years had PTSD.[8] Following an earthquake in Greece, rates of PTSD and depression among students aged 9 to 18 years were 5% and 14%, respectively.[18]

In our assessment, having had a delayed evacuation, having felt one's own or a family member's life to have been in danger, and having felt extreme panic or fear were independent risk factors for PTSD symptoms, while older age and having felt one's own or a family member's life to have been in danger were independent risk factors for depression symptoms. Children who had experienced extreme panic or fear had a 9 times higher risk for PTSD symptoms compared with children without this experience. Moreover, children who had felt their own or a family member's life to have been in danger had a 6 times higher risk for depression symptoms. These results may help to identify children with an elevated risk for either PTSD or depression so that they can be targeted for appropriate mental health interventions.

Table 2. Intercorrelation Coefficient Matrix of Tsunami-Related Traumatic Experiences and Mental Health Outcomes—Southern Thailand, 2005

| | *R* | | | | | | | | | | | | | | | |
| | | | | | | Traumatic Events* | | | | | | | | | | |
	PTSD	Dep	Age	Sex	Rel	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
PTSD	1															
Depression (Dep)	0.182†	1														
Age group (Age)	0.071	0.112‡	1													
Sex	0.005	0.050	−0.070	1												
Religion (Rel)	0.001	0.007	0.001	−0.075	1											
Saw tsunami waves (E1)	0.126‡	0.110‡	0.023	−0.103‡	−0.125‡	1										
Saw anyone dead or injured (E2)	0.148†	0.121‡	0.102‡	−0.021	−0.200†	0.313†	1									
Heard screams (E3)	0.197†	0.096	0.076	0.026	−0.185†	0.399†	0.433†	1								
Had delayed evacuation (E4)	0.210†	−0.026	0.075	−0.015	−0.040	0.315†	0.224†	0.254†	1							
Felt one's own or a family member's life to have been in danger (E5)	0.217†	0.179†	−0.034	−0.012	−0.085	0.459†	0.269†	0.357†		1						
Felt unable to escape (E6)	0.179†	0.133†	0.029	0.030	−0.152†	0.422†	0.270†	0.294†	0.413†	0.450†	1					
Felt extreme panic or fear (E7)	0.221†	0.108‡	0.037	−0.060	−0.125‡	0.421†	0.301†	0.315†	0.231†	0.436†	0.402†	1				
Lost close family member or friend (E8)	0.184†	0.102‡	0.087	0.022	−0.275†	0.226†	0.223†	0.238†	0.187†	0.308†	0.282†	0.345†	1			
Close family member or friend injured (E9)	0.095†	0.141†	0.080	−0.054	−0.140†	0.269†	0.265†	0.287†	0.263†	0.224†	0.248†	0.290†	0.345†	1		
Lost home or important belongings (E10)§	0.162†	0.095	−0.049	−0.008	−0.282†	0.450†	0.285†	0.349†	0.235†	0.383†	0.430†	0.381†	0.417†	0.351†	1	
Sustained injury (E11)	0.122†	0.033	0.086	−0.109‡	−0.099	0.347†	0.296†	0.299†	0.284†	0.199†	0.283†	0.171†	0.157†	0.237†	0.266†	1

*See column 1 for definitions of categories of tsunami-related traumatic experiences. Categories are from the PsySTART Rapid Triage System.[15,16]
†Statistically significant at *P* = .01.
‡Statistically significant at *P* = .05.
§"Important belongings" refers to physical possessions of sentimental value to the child.

Disaster-related experiences can be traumatic and can have lasting effects in children.[19-21] The impact of a disaster on children depends on many factors, such as separation from parents and how quickly a child is evacuated as well as experience of traumatic events such as witnessing death, hearing screams for help, and feeling danger to one's own life or that of a loved one.[22] Events threatening to one's own life or to that of a loved one dur-

Table 3. Bivariate and Multivariate Analysis of PTSD Symptoms Among Children—Southern Thailand, 2005

	PTSD, No. (%)	Bivariate OR (95% CI)	P Value	Multivariate OR (95% CI)	P Value
Overall	39 (10.5)				
Venue					
Displacement camps	22 (13.2)	2.50 (0.98-6.41)		NA*	
Affected villages	11 (11.1)	2.06 (0.73-5.82)	.16		
Unaffected villages	6 (5.7)	1.00			
Demographics					
Age group, y					
7-10	17 (8.5)	1.00			
11-14	22 (12.9)	1.59 (0.81-3.10)	.18		
Sex					
Boys	18 (10.4)	1.00			
Girls	21 (10.7)	1.03 (0.53-2.01)	.92		
Religion					
Buddhist	28 (10.5)	1.00			
Other	11 (10.6)	1.01 (0.48-2.11)	.98		
Tsunami-related traumatic experiences†					
Saw tsunami waves					
Yes	29 (13.9)	2.48 (1.17-5.25)		NA*	
No	10 (6.1)	1.00	.02		
Saw anyone dead or injured					
Yes	27 (15.3)	2.73 (1.34-5.57)		NA*	
No	12 (6.2)	1.00	.006		
Heard screams					
Yes	25 (18.5)	3.60 (1.80-7.20)		NA*	
No	14 (5.9)	1.00	<.001		
Had delayed evacuation					
Yes	19 (22.4)	3.83 (1.93-7.58)		2.09 (1.02-4.29)	
No	20 (7.0)	1.00	<.001	1.00	.05
Felt one's own or a family member's life to have been in danger					
Yes	36 (15.8)	8.75 (2.64-28.99)		3.45 (0.99-12.04)	
No	3 (2.1)	1.00	<.001	1.00	.05
Felt unable to escape					
Yes	28 (16.5)	3.41 (1.64-7.07)		NA*	
No	11 (5.5)	1.00	.001		
Felt extreme panic or fear					
Yes	38 (15.3)	21.79 (2.96-160.72)		9.50 (1.24-72.87)	
No	1 (0.8)	1.00	.003	1.00	.03
Lost close family member or friend					
Yes	34 (15.0)	4.96 (1.89-13.00)		2.43 (0.89-6.64)	
No	5 (3.5)	1.00	.001	1.00	.08
Close family member or friend injured					
Yes	24 (13.6)	1.87 (0.95-3.70)			
No	15 (7.7)	1.00	.07		
Lost home or important belongings‡					
Yes	32 (14.7)	3.59 (1.54-8.36)		NA*	
No	7 (4.6)	1.00	.003		
Sustained injury					
Yes	11 (19.3)	2.44 (1.14-5.24)		NA*	
No	28 (8.9)	1.00	.02		

Abbreviations: CI, confidence interval; NA, not available (see below); OR, odds ratio; PTSD, posttraumatic stress disorder.
*Dropped out of the multivariate model.
†Categories of tsunami-related traumatic experiences are from the PsySTART Rapid Triage System.[15,16]
‡"Important belongings" refers to physical possessions of sentimental value to the child.

ing a disaster have consistently been found to be significantly associated with postdisaster mental health problems.[8,21-24]

Our study has several limitations, some of which are inherent to disaster emergency response and rapid assessments. For instance, our interviewers

were not blinded for participants' displacement status; hence, it is possible that information bias may have been introduced into the assessment. How-

Table 4. Bivariate and Multivariate Analysis of Depression Symptoms Among Children—Southern Thailand, 2005

	Depression, No. (%)	Bivariate OR (95% CI)	P Value	Multivariate OR (95% CI)	P Value
Overall	31 (8.4)				
Venue					
Displacement camps	18 (10.8)	1.47 (0.61-3.51)		NA*	
Affected villages	5 (5.1)	0.65 (0.20-2.05)	.26		
Unaffected villages	8 (7.6)	1.00			
Demographics					
Age group, y					
7-10	11 (5.5)	1.00	.04	1.00	.03
11-14	20 (11.7)	2.28 (1.06-4.90)		2.34 (1.07-5.13)	
Sex					
Boys	12 (9.0)	1.44 (0.68-3.06)	.34		
Girls	19 (8.0)	1.00			
Religion					
Buddhist	22 (8.2)	1.00	.90		
Other	9 (8.7)	1.06 (0.47-2.37)			
Tsunami-related traumatic experiences†					
Saw tsunami waves					
Yes	23 (11.1)	2.41 (1.05-5.54)	.04	NA*	
No	8 (4.9)	1.00			
Saw anyone dead or injured					
Yes	21 (11.9)	2.48 (1.13-5.42)	.02	NA*	
No	10 (5.2)	1.00			
Heard screams					
Yes	16 (11.9)	1.98 (0.95-4.15)	.07		
No	15 (6.4)	1.00			
Had delayed evacuation					
Yes	6 (7.1)	0.79 (0.31-2.00)	.62		
No	25 (8.7)	1.00			
Felt one's own or a family member's life to have been in danger					
Yes	28 (12.3)	6.53 (1.95-21.88)	.002	5.87 (1.72-20.03)	.005
No	3 (2.1)	1.00		1.00	
Felt unable to escape					
Yes	21 (12.4)	2.69 (1.23-5.89)	.01	NA*	
No	10 (5.0)	1.00			
Felt extreme panic or fear					
Yes	26 (10.4)	2.73 (1.02-7.29)	.05	NA*	
No	5 (4.1)	1.00			
Lost close family member or friend					
Yes	24 (10.6)	2.34 (0.98-5.59)	.06		
No	7 (4.8)	1.00			
Close family member or friend injured					
Yes	22 (12.4)	2.92 (1.31-6.52)	.009	2.14 (0.94-4.89)	.07
No	9 (4.6)	1.00		1.00	
Lost home or important belongings‡					
Yes	23 (10.6)	2.14 (0.93-4.92)	.07		
No	8 (5.2)	1.00			
Sustained injury					
Yes	6 (10.5)	1.36 (0.53-3.48)	.52		
No	25 (7.9)	1.00			

Abbreviations: CI, confidence interval; NA, not available (see below); OR, odds ratio; PTSD, posttraumatic stress disorder.
*Dropped out of the multivariate model.
†Categories of tsunami-related traumatic experiences are from the PsySTART Rapid Triage System.[15,16]
‡"Important belongings" refers to physical possessions of sentimental value to the child.

ever, interviewers had no knowledge of our analysis plan to compare children in camps, affected villages, and unaffected villages. Another limitation was that not all children may have been able to understand or verbalize their feelings regarding tsunami-related experiences; thus, some manifestations of PTSD and depression may be underreported. Also, our instruments were developed and validated in the Western world; therefore, cultural factors may play a role in the underreporting or overreporting of these conditions. In addition, the instruments have been used to screen for symptoms of PTSD and depression but do not provide clinician-verified diagnoses.

Moreover, some of the symptoms of PTSD and depression found among children in camps may have been associated with the camp experience itself and not with tsunami-specific trauma alone. However, our data suggest that such an effect would be small, since displacement status was not significantly associated with symptoms of PTSD and depression in multivariate analysis.

Another concern was the limited number of children aged 7 to 14 years in our sampling areas. As a result, we had to obtain a supplemental sample of children present in village schools at the time of our assessment. The limited number of children also negatively affected our ability to perform subgroup analysis (because of small cell sizes), which in turn resulted in wide CIs for many of our results. With regards to generalizability of our results, some children may have been taken into custody by family members or caretakers living outside the sampling areas because they were more severely affected. In addition, we did not record specific information on physical injuries or on whether some of these children were orphaned or had lost siblings as a result of the tsunami. On the other hand, participating children may also have had access to mental health services made available after the tsunami or to other conditions more favorable for a rapid and better recovery.

After the tsunami, the Department of Mental Health of the Royal Thai Government immediately responded to the needs of affected children by deploying 6 mobile mental health teams of Thai mental health professionals to tsunami-affected provinces. Each team consisted of up to 10 professionals—a psychiatrist, 2 to 3 psychologists, 2 psychiatric nurses, a social worker, a pharmacist, an assistant nurse, and a driver. To address long-term needs, a Mental Health Center was established in Phang Nga with a 5-member team including a psychiatrist, a psychologist, a psychiatric nurse, a social worker, and a counselor.[25] The Mental Health Center provides psychological services for PTSD, depression, and other conditions related to the tsunami. It also provides off-site mental health services and provides assistance to traumatized children in remote areas.[25,26]

Findings in our assessment may provide a better understanding of posttsunami mental health problems and associated risk factors among children. Therapeutic approaches may be needed to help children understand and manage their feelings of fear, so that possible negative impacts on their development are minimized. Family counseling may be necessary to make sure that parents are able to recognize and address mental health problems, and schools may be another important venue for affected children to be identified and provided with services to reduce PTSD and depression.[27-29] Teachers, in particular, may play a crucial role in the support and referral of affected children; hence, appropriate sensitivity training for mental health–related problems is recommended for school-based staff.

Parallel to our work in children, we assessed mental health problems among adults in the same geographic areas.[11] The prevalence rates of PTSD symptoms assessed in adults and children from Phang Nga were similar.[11] Symptoms of depression, however, were almost 3 times higher among adults than among children. It is important to note that while the assessment took place in similar settings and during the same time frame, the instruments to assess PTSD and depression in children and adults were not the same. Overall, the prevalence of depression symptoms in children was lower than in adults, but the risk increased significantly with age. This finding suggests that older children may have been better able to evaluate and understand the possible negative consequences of the tsunami, such as the loss of loved ones, friends, and possessions. Among adults, the main risk factors for symptoms of PTSD and depression were the loss of livelihood as a result of the tsunami. Thus, the focus of intervention approaches for adults and children may need to be different. Children may benefit from therapeutic interventions, while for adults, contextual interventions aimed at the restoration of livelihood may be more appropriate.

Finally, regular follow-up of tsunami-affected children is recommended, since negative mental health consequences of the tsunami may emerge later in life and may otherwise go unnoticed.[5,6,20,21,30] Depending on the outcomes of these assessments, it may be critical that mental health services for such children and others remain available for many years to come.

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