

# The 9/11 Terrorist Attack and Posttraumatic Stress Disorder Revisited

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**Abstract:** Research published in the aftermath of the 9/11 terrorist attack reported elevated rates of posttraumatic stress disorder (PTSD) in the US population (4.3%–17.0%), attributable to indirect exposure through the media. We use data from a national survey conducted in 2004 to 2005 (National Epidemiologic Survey on Alcohol and Related Conditions Wave 2) ( $n = 34,653$ ). The list of traumatic events covered in the survey included indirect exposure to 9/11 through media coverage. Respondents who endorsed more than 1 traumatic event were asked to single out “the worst event” they had ever experienced. The worst event (or the only event) was the index event for diagnosing PTSD. Indirect experience of 9/11 had the lowest PTSD risk of all the traumatic events in the list, 1.3%. In the subset that endorsed only 9/11 indirect exposure ( $n = 3981$ ), the PTSD risk was 0.3%. Of the total sample, 0.7% experienced PTSD in relation to indirect 9/11. Explanations for the lower estimates are discussed.

**Key Words:** 9/11 indirect exposure, PTSD, media transmitted 9/11 trauma.

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Epidemiological surveys conducted in the aftermath of the 9/11 terrorist attacks reported elevated rates of posttraumatic stress disorder (PTSD) in the general population, including regions that are geographically remote from lower Manhattan and the Pentagon (Galea et al., 2002; Schlenger et al., 2002; Silver et al., 2002). The prevalence of PTSD in the United States associated with the 9/11 attack, as summarized in a review by Neria et al. (Neria et al., 2008), ranged from 4.3% to 17%; the 12-month prevalence of PTSD in the National Comorbidity Survey-Replication attributable to any PTSD-level event experienced in lifetime was 3.6% (Kessler et al., 2005). Researchers emphasized the unprecedented nature of 9/11 as a distant trauma transmitted through the media to the entire population (Galea et al., 2002; Galea and Resnick, 2005). The 9/11 studies were not confined to specific groups of direct victims, as had been the case in previous postdisaster studies; the entire population was at risk for PTSD. Apart from PTSD, the 9/11 aftermath studies measured the population’s burden of stress reactions (Schuster et al., 2001; Silver et al., 2002; Stein et al., 2004). It was generally concluded that a large proportion of the US population suffered from considerable stress-related symptoms (Holman et al., 2008; Silver et al., 2002; Stein et al., 2004; Susser and Susser, 2002). A “dose-response” relationship between hours (or content) of television watching and the risk of PTSD or posttraumatic stress symptoms was reported in support of the potency of the TV images to cause PTSD-related

response (Ahern et al., 2002; Schlenger et al., 2002; Schuster et al., 2001; Silver et al., 2002).

Exposure to television images is not explicitly included in the Diagnostic and Statistical Manual of Mental Disorders (DSM) definition of PTSD-level stressors and until 9/11 viewing TV coverage of terrorist attack had not been included in epidemiological research on PTSD. Following the 9/11 aftermath reports, doubts have been expressed about these indirect experiences as cause of PTSD (Michels, 2002; Southwick and Charney, 2004). Further, the interpretation of the reported “dose-response” relationship as supporting a causal role of TV watching in PTSD has been questioned. Self selection by susceptible persons is a suspected alternative explanation (Ahern et al., 2002; Michels, 2002).

To date, no epidemiological data, other than the initial aftermath studies and their extensions, have been examined in relation to the PTSD effect of 9/11 in the general population. Such an examination could bring a new perspective, if questions about PTSD in relation to 9/11 were embedded in a broader context of inquiry and within a comprehensive list of lifetime traumatic events. The National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) incorporated the assessment of PTSD in Wave 2 (Grant et al., 2005). The comprehensive list of traumatic events read to the respondents included indirect exposure to 9/11 through media coverage. Administered 3 years after 9/11, the Wave 2 of NESARC measured lifetime PTSD, including cases that were no longer active at the time of the interview. We use data from this assessment to evaluate the conditional probability of PTSD associated with indirect exposure to 9/11 and other traumatic events on the list, using the index event method applied in the NESARC. Respondents who endorsed more than one traumatic event were asked to single out “the worst stressful event” they had ever experienced. The worst event (for respondents with multiple events) or the event reported by respondents who endorsed only 1 event was the index event for diagnosing PTSD. The large sample size of the NESARC offers a second way to evaluate the impact of 9/11. It allows us to estimate the PTSD risk in a subset that had never experienced any of the events in the list except for indirectly witnessing 9/11 through the media. Analysis of this subset avoids the problems associated with the potentially confounding effects of having experienced other traumatic events on the PTSD response to 9/11, as well as concerns about victims’ ability to link PTSD criterion symptoms with a specific event when they endorse multiple events. To capture the PTSD effect of indirect exposure to 9/11 in the general population, we went beyond the index event database and considered all the respondents who endorsed 9/11, including those who selected an event other than 9/11 as their worst event.

## METHODS

### Sample

The NESARC is a 2-wave face-to-face survey conducted by the National Institute on Alcohol Abuse and Alcoholism. Wave 1 was conducted between August 2001 and September 2003 and included 43,093 respondents aged 18 years or older. The sample represented the civilian, non-institutionalized adult population of the United States, with oversampling Blacks, Hispanics, and others aged between 18 and 24 years. Of these, 39,959 were eligible for

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**TABLE 1.** Cumulative Occurrence of Traumatic Events, Distribution of Index Events, and Conditional Probability of PTSD in NESARC Wave 2 Survey (2004–2005)

	Cumulative Occurrence of Traumatic Events ( <i>n</i> = 34,653) <sup>a</sup> %	Distribution of Index Events ( <i>n</i> = 31,650) <sup>b</sup> %	Unweighted Ns of Index Events <sup>c</sup>	Conditional Probability of PTSD %
Active military combat	4.5	2.4	675	11.5
Peacekeeper/relief worker	1.1	0.1	28	5.0
Civilian in war zone/place of terror	2.0	0.3	81	13.6
Refugee	1.2	0.2	69	7.0
Serious or life-threatening accident	16.5	2.5	782	9.6
Serious or life threatening illness	17.0	3.1	1024	9.1
Natural disaster (fire, flood, tornado, etc.)	15.7	1.7	582	5.1
Sexually assaulted as adult or child	8.7	3.0	1054	40.2
Beaten up before age 18	3.5	0.5	169	35.2
Neglected before age 18	3.1	0.2	94	31.9
Witnessed violence in home before age 18	10.0	1.3	444	17.8
Beaten up by spouse/romantic partner	6.1	1.2	471	34.9
Beaten up by someone else	7.7	0.5	152	14.6
Kidnapped/held hostage/POW	0.8	0.1	39	35.6
Stalked	5.4	0.5	178	19.5
Mugged, held up, or threatened with weapon	11.7	1.5	520	7.9
Saw someone die, injured, dead body	24.0	4.3	1322	9.5
You were injured in 9/11	0.02	—	—	—
You were injured in another attack	0.03	0.001	1	—
You directly experienced 9/11	0.5	0.1	46	10.6
You directly experienced another attack	0.5	0.01	5	—
You indirectly experienced 9/11	78.0	21.8	7015	1.3
You indirectly experienced another attack	0.8	0.2	54	2.8
Someone close to you...	—	—	—	—
died in 9/11	0.5	0.1	44	8.5
died in another attack	0.3	0.03	11	4.7
was injured in 9/11	0.5	0.1	17	—
was injured in another attack	0.5	0.02	8	9.7
directly experienced 9/11	3.6	0.6	177	3.2
directly experienced another attack	1.2	0.1	34	0.5
Unexpected death of someone close to you	41.6	23.1	7151	9.0
Serious illness/accident/injury to someone close	46.5	21.9	6699	4.9
Other traumatic event to someone close to you	13.9	4.1	1285	5.7
Any other event you experienced	5.1	4.5	1419	13.1
Any event	91.9	100.0	31,650	8.1

<sup>a</sup>The percentages in this column are not mutually exclusive, since those who reported >1 event appear in multiple categories.

<sup>b</sup>Index traumas are traumatic events, 1 per respondent, that were the focus of PTSD assessment.

<sup>c</sup>N's of index trauma are the base numbers on which PTSD was estimated. All estimates are on weighted data.

POW indicates prisoner of war; PTSD, posttraumatic stress disorder; NESARC, National Epidemiologic Survey on Alcohol and Related Conditions.

follow-up in wave 2, and 34,653 completed wave 2 interviews from August 2004 to September 2005. PTSD was assessed only in Wave 2. The wave 2 response rate was 86.7 (Grant et al., 2005, 2003b). The sample was weighted to adjust for the probabilities of selection of a sample housing units, nonresponse at the household and person levels, the selection of 1 person per household, and oversampling of minorities and young adults. Once weighted, the data were adjusted to be representative of the US population for region, age, sex, race, and ethnicity, based on the 2000 Census (Grant et al., 2003a).

### Assessment of Posttraumatic Stress Disorder in National Epidemiologic Survey on Alcohol and Related Conditions

The National Institute on Alcohol Abuse and Alcoholism Alcohol Use Disorder and Associated Disabilities Interview Schedule DSM-IV version (Grant et al., 2001) was used to assess multiple

psychiatric disorders, including lifetime exposure to traumatic events and PTSD. A list of 32 specific events included 12 events that refer to various types of exposure to terrorist attacks (e.g., having been injured in a terrorist attack, having been in the building that was attacked) experienced either by the respondent or someone close to the respondent (see Table 1 for the list of events in abbreviated phrases). The last question in the series concerns indirect exposure to 9/11: "Did you see or witness a terrorist attack even though you did not experience it directly, like seeing it on TV or listening to it on the radio?" and, if the answer was "yes," "Did it happen on 9/11?"

Respondents who endorsed more than 1 traumatic event on the list were asked to single out "the worst stressful event" from all the events they endorsed. The worst event (for respondents with multiple events) or the event reported by respondents who endorsed only 1 event was the index event for diagnosing PTSD.

The NESARC PTSD module covers the DSM-IV criteria and includes additional questions that are not required for diagnosis; some criterion symptoms are covered by more than one item. We used the NESARC interview data to diagnose PTSD, applying the DSM-IV criteria. When 2 items are used in the interview to ascertain a single symptom, replies were combined as one item rather than counted as 2 symptoms (The diagnostic algorithm is available upon request). The PTSD module is closely modeled on the National Institute of Mental Health -Diagnostic Interview Schedule and the The World Health Organization Composite International Diagnostic Interview. Although there are no published data on clinical reassessment of PTSD in NESARC, high concordance was reported between the ascertainment of the The World Health Organization Composite International Diagnostic Interview/PTSD by lay interviewers and independent clinical interviews, using the Clinician Administered PTSD Scale (CAPS-DX). Positive predictive value was 0.75, negative predictive value was 0.97, and odds ratio was 94.8 (Breslau et al., 1998).

**Statistical Analysis**

N's in tables and in the text are unweighted. Weighted percentages and adjusted odds ratios from multivariable logistic regressions were estimated using STATA 10.1. Taylor series linearization was used to take into account the complex survey design. The frequencies of specific traumatic events, including indirect exposure to the 9/11 attack, were estimated on the total NESARC Wave II sample (n = 34,653). The lifetime conditional risk of PTSD associated with specific events was estimated on the subset reporting exposure to one or more events in the list (n = 31,650), based on index event classification. Multivariable logistic analysis of lifetime PTSD associated with indirect exposure to 9/11 was performed on the subset with indirect exposure to 9/11 as the index event (n = 7015).

**RESULTS**

We present in Table 1 the lifetime experience of traumatic events and PTSD in NESARC sample, to provide the context in which the effect of indirect exposure to 9/11 was evaluated. Nearly all the respondents experienced at least one of the traumatic events on the list, 91.9% (n = 31,650) (Table 1, column 1). By far, the single most frequently endorsed event, reported by 78% (n = 26,496) of the sample, was indirectly experiencing the 9/11 terrorist attack through TV or radio coverage. In contrast with indirect exposure to the 9/11 attack, various types of direct exposure to the attack (e.g., "being in a building that was attacked or in the immediate area") were rarely reported. Two events, apart from indirect exposure to 9/11, stand out as frequent traumas: unexpected death of someone close to you, reported by 41.6%, and life-threatening illness, accident, or injury suffered by someone close to you, reported by 46.5% (Table 1, column 1).

We display in Table 1, column 2 the distribution of the index events, 1 per respondent, on which information on lifetime PTSD criteria was obtained in the interview. An index event is either the worst event (for those with multiple events) or the only event (for those who endorsed no other event on the list). For 7015 of the respondents, indirect exposure to 9/11 was the index event: 3981 endorsed only 9/11 and 3034 selected it as the worst from multiple events. Estimates of the PTSD risk are based on the number of persons in each type of index event (Table 1 Column 3). Indirect exposure to 9/11 has the lowest PTSD risk of all events, 1.26% (95% confidence interval [CI]: 0.95, 1.57) (rounded in the Table to 1.3%) (Table 1, column 4). The highest PTSD risk (>30%) is associated with a subset of traumatic events that involve assaultive violence,

**TABLE 2. Conditional Probability of PTSD Associated With Indirect Exposure to 9/11 Across Subgroups of the Population: Percentages and Adjusted Odds Ratios (n = 7015)**

	%	AOR	95% CI		p
<b>Race/ethnicity</b>					
White, non-Hispanic	0.97	Reference	—	—	—
Black, non-Hispanic	1.69	1.52	0.79	2.92	0.202
Hispanic	2.22	2.33	1.31	4.13	0.005
Other	1.03	1.14	0.38	3.40	0.807
<b>Sex</b>					
Male	0.80	Reference	—	—	—
Female	1.72	1.98	1.23	3.19	0.006
<b>Age</b>					
20–29	0.32	Reference	—	—	—
30–39	1.29	4.21	1.54	11.52	0.006
40–49	1.60	5.44	2.01	14.72	0.001
50–59	2.43	8.44	2.98	23.86	<0.0001
≥60	1.18	3.63	1.16	11.36	0.027
<b>Marital status</b>					
Married	1.15	Reference	—	—	—
Living with someone	2.23	2.11	0.73	6.05	0.164
Widowed	2.23	1.86	0.92	3.74	0.082
Divorced	2.22	1.59	0.78	3.24	0.197
Separated	1.75	1.15	0.47	2.82	0.759
Never married	0.75	1.17	0.60	2.30	0.635
<b>Education</b>					
Less than high school	1.64	Reference	—	—	—
High school or GED	1.45	1.15	0.63	2.11	0.641
Some college	1.32	1.22	0.63	2.36	0.544
College graduate or higher	0.75	0.70	0.31	1.55	0.368

The base for the estimates is the subset of the sample (n = 7015) whose index event was indirect exposure to 9/11 (either as the only event endorsed or selected as the worst from multiple events).

PTSD indicates posttraumatic stress disorder; CI, confidence interval; AOR, adjusted odds ratio.

such as sexual assault and having been severely beaten-up before age 18 or by a spouse or romantic partner.

**Posttraumatic Stress Disorder Risk Associated With Indirect Exposure to 9/11 Across Subgroups of the Population**

The conditional risk of PTSD associated with indirect exposure to 9/11 was higher in females than males (Table 2). It was higher in members of minority groups relative to Whites, except for Asian/native Hawaiian and Pacific islanders, and was lower among persons aged between 20 and 39 years than in persons aged 40 to 59 years. Adjusted odds ratios of PTSD, displayed in Table 2, are significantly elevated for Hispanics, compared with Whites. The adjusted risk of PTSD among Blacks compared with whites is not significant. The increased risk among Hispanic, relative to Whites, does not reflect a general vulnerability to the PTSD—effect of trauma. Hispanics' overall conditional risk of PTSD associated with any trauma was lower than Whites' (adjusted OR = 0.88; 95% CI: 0.73, 1.07). The interpretation of the difference between Hispanics and Whites in the risk of PTSD associated with 9/11 should take into account that the estimates were low in both groups, with a difference of only 1% (1% in Whites and 2% in Hispanics).

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### Posttraumatic Stress Disorder Among Respondents Reporting Only Indirect Exposure to 9/11

The PTSD conditional risk of 1.3%, presented in Table 1, is based on respondents for whom 9/11 indirect exposure was the index event ( $n = 7015$ ), those who reported only 9/11 and those who also reported other events and selected 9/11 as the worst. Among those who reported only indirect exposure to 9/11 and no other event on the list ( $n = 3981$ ), the PTSD risk (weighted) was 0.3% (95% CI: 0.1, 0.5), 0.2% (95% CI: -0.1, 0.6%) among men, and 0.4% (95% CI: 0.2, 0.7) among women.

### Estimating the 9/11 Indirect Posttraumatic Stress Disorder in the Total Sample: Beyond the Index Event

The results reported earlier are based on data from respondents whose index event was indirect exposure to 9/11, those who endorsed only indirect 9/11, and those who endorsed multiple events and singled out indirect 9/11 as their worst event. However, indirect 9/11 may have contributed to PTSD symptoms in some respondents who endorsed indirect 9/11 but did not cite it as their worst event (i.e., they cited another event as the worst). When respondents with PTSD due to an event other than 9/11 ( $n = 2264$ ) were asked to identify the "stressful event that caused" them to have PTSD symptoms most recently, 6.6% (weighted) identified indirect 9/11. This probe is a way of estimating the influence of indirect 9/11 in this group.

When this last subset is added to the subset with PTSD from indirect 9/11 as the index event, we find that the weighted overall lifetime PTSD associated with indirect exposure to 9/11 in the total NESARC sample ( $n = 34,653$ ) is 0.7% (95% CI: 0.6, 0.8), 0.4% (95% CI: 0.3, 0.5) in males, and 0.9 (96% CI: 0.8, 1.1) in females.

Figure 1 illustrates the breakdown of subgroups used to estimate the PTSD impact of indirect 9/11 in the sample.

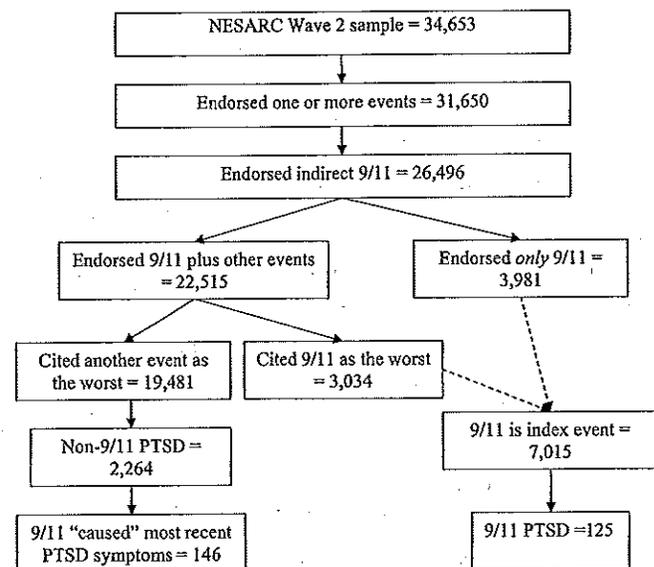
### DISCUSSION

In this representative sample of US adults, interviewed in 2004–2005, respondents were asked about a wide range of traumatic

events they might have ever experienced, chiefly, personal experiences of violence, accidents, serious illness, and childhood abuse and neglect. The list included 1 public event, the 9/11 terrorist attack of 2001. Witnessing the 9/11 attack indirectly through TV coverage was associated with the lowest PTSD risk of all the events in the list, 1.3%, based on the index event method, which allows a comparison with other traumatic events. The much lower PTSD risk among respondents who endorsed indirect exposure to 9/11 as their only event on the list, 0.3%, provides a unique perspective on the impact of 9/11 per se, unencumbered by respondents' susceptibility associated with prior exposure and prior PTSD, or a predisposition for recalling negative personal experiences (Rubin et al., 2008). The lifetime estimate based on the total NESARC sample ( $n = 34,653$ ), going beyond the index event database, is 0.7% (95% CI: 0.6, 0.8). According to these data, the PTSD impact of 9/11 in the US population was far smaller than expected based on the aftermath studies.

Risk estimates of PTSD in this study refer to lifetime risk (that is, the risk of onset), regardless of the respondent's status (active or remitted) at the time of the interview. Because we have not estimated current PTSD at the time of the interview, but the lifetime risk associated with indirect exposure to 9/11, the low estimates should not be interpreted as consistent with a decline over time from an earlier (unmeasured) level. Declines in the current prevalence of 9/11 PTSD at 6 months after baseline have been documented in longitudinal studies (Galea et al., 2003; Silver et al., 2002). The lower lifetime impact observed in the NESARC data, compared with the previous estimates, might be explained by respondents who had attributed unrelated distress symptoms (e.g. sleep problems, irritability) to 9/11 in the immediate aftermath but have not done so 3 years later. The 9/11 aftermath studies concentrated on how the media transmitted information about the attack. They did not consider the fact that the media, which transmitted the traumatizing images, also informed viewers about the risk of experiencing the characteristic PTSD symptoms, often through interviews with experts (Young, 2007). Early fears of subsequent attacks have not materialized, and respondents' perspective on the event as pathogenic might have changed in this new context. To the extent that the new context has given us results that are less influenced by persons' susceptibility to attribute to 9/11 unrelated symptoms or to report their response in PTSD language in the immediate aftermath, the time gap had facilitated a clearer picture concerning the pathological nature, and therefore the diagnostic significance, of the self-reported symptoms. Alternatively, it might be the case that, despite our intent to reconstruct the lifetime PTSD effect of indirect exposure to 9/11, respondents' recall of their early distress might have faded at the time of the NESARC interview. In this regard, it is important to note that recall of a traumatic event as distressing does not necessarily diminish with time and that there is evidence that it might in fact be amplified (Heir et al., 2009).

NESARC shares limitations with other epidemiological studies of psychiatric disorders. These include the use of nonclinician interviewers and the potential bias associated with less than full participation of eligible persons. It should also be noted that the NESARC survey offers an important advantage, apart from its large size and the broader context in which the inquiry about 9/11 was embedded. In contrast with the 2 national studies on 9/11-PTSD (as distinct from posttraumatic stress symptoms) that used Web-based technology (Schlenger et al., 2002; Silver et al., 2002), the NESARC survey is a face-to-face personal interview. Despite their utility in disaster research (Schlenger and Silver, 2006), Web-based surveys have limitations compared with face-to-face interviews (Couper, 2000; Heerwegh and Loosveldt, 2008). Chief among them are sampling coverage, uncertainty about respondent's commitment to



**FIGURE 1.** PTSD associated with index event = 125/7015 (1.3%, weighted). PTSD in NESARC sample = 125+146/34,653 (0.7%, weighted). 8157 (34,653–26,496) who did not endorse indirect 9/11 contribute zero 9/11 PTSD.

perform the cognitive work needed to provide quality answers to survey questions, respondent's distractibility ('multitasking'), and uncertainty concerning responses by participants in a Web-panel who had been polled previously through similar formats. The NESARC data offer a new perspective on the PTSD impact of 9/11, gained by the data collection method, the broader context in which the inquiry about 9/11-PTSD was embedded (a general psychiatric survey unrelated to a specific event) and the time span from the intensive and pervasive media coverage of the attack accompanied by information on PTSD as the expected response.

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