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Prevalence and predictors of postdisaster major depression: convergence of evidence from 11 disaster studies using consistent methods

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Abstract

The objective of this study was to examine predictors of postdisaster major depression in two separate datasets of survivors of various disasters. Postdisaster major depression was examined in two disaster databases using consistent research methodology, permitting combination of databases into a combined dataset including 1,181 survivors of 11 disasters representing all major disaster typologies with full diagnostic assessment using structured diagnostic interviews from two databases. The first database includes 808 directly-exposed survivors of 10 disasters. The second includes 373 survivors of the September 11, 2001 attacks on New York City's World Trade Center, recruited from employees of eight organizations affected by the disaster. This rich dataset permitted comparison of predictors of postdisaster major depression between databases and across survivors of different disasters. Identical models applied to both databases found postdisaster major depression to be independently associated with pre-existing major depression, indirect exposure to disaster trauma through family/friends, and disaster-related PTSD. In a final model limited to directly-exposed disaster across both databases, postdisaster major depression was independently associated with terrorism in addition to the 3 variables that predicted postdisaster major depression in the two separate databases. Replication of findings from one model to the next across different types of disasters and populations in this study suggests that these three variables could potentially provide a powerful tool for estimating likelihood of postdisaster major depression.

Keywords

disaster; trauma; predictor; depression

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Introduction

Compared to posttraumatic stress disorder (PTSD), major depressive disorder (MDD) has been the subject of far less disaster mental health research (Bonde, Utzon-Frank, Bertelsen, et al, 2016; North, Pollio, Hong, et al, 2015; Salguero, Fernandez-Berrocal, Iruarrizaga, et al, 2011). Regardless, MDD is also recognized as an important consequence disaster trauma with need for further study (Bonde, Utzon-Frank, Bertelsen, et al, 2016).

Research has generally found lower postdisaster prevalence for major depression than for PTSD (Goldmann and Galea, 2014; Norris, Friedman, Watson, et al, 2002; North, 2017; North, Oliver, and Pandya, 2012). Studies fully assessing disaster-related PTSD criteria using structured diagnostic interviews have estimated its prevalence among trauma-exposed disaster survivors around 20%, with a ceiling of about 35% after incidents of the highest scope and magnitude (Norris, Friedman, Watson, et al, 2002; North, 2017; North, Nixon, Shariat, et al, 1999; North, Oliver, and Pandya, 2012). Major depression is usually the second most common postdisaster psychiatric disorder (North, 2017; North, Oliver, and Pandya, 2012; North, Pollio, Hong, et al, 2015). A systematic review of 5 studies of directly-exposed survivors of 4 separate terrorist attacks fully assessing major depression criteria found postdisaster prevalence ranging 13%–31% (Salguero, Fernandez-Berrocal, Iruarrizaga, et al, 2011). This review clarified the need to carefully define types of exposure to disaster trauma to be able to differentiate different types of disaster-related contributors to PTSD and major depression.

Risk factors for disaster-related PTSD have been extensively studied. The most consistently identified predictors are pre-existing psychopathology and female gender (Norris, Friedman, Watson, et al, 2002; North, 2017; North, Oliver, and Pandya, 2012). Other less consistent, less robust, or potentially confounded predictors of disaster-related PTSD are severity of disaster trauma exposure, injury in the disaster, younger age, marital status, minority membership, lower socioeconomic status, lack of social support, and maladaptive coping strategies such as avoidance (Goldmann and Galea, 2014; Norris, Friedman, Watson, et al, 2002; North, 2017; North, Oliver, and Pandya, 2012). Predictors of postdisaster major depression identified in a major review of terrorist attacks were female gender, injury in the attacks, loss of psychosocial resources after the disaster, and stressful life events in the year before or after the disaster (Salguero, Fernandez-Berrocal, Iruarrizaga, et al, 2011). Identified PTSD risk factors not found to be consistent predictors of major depression risk in this review were race/ethnicity, education, socioeconomic level, proximity of residence to the disaster site, and lack of social support. The authors concluded that research on predictors of major depression has been insufficient, and that further research is needed to elucidate predictors of major depression after disasters, especially involving specific disaster trauma exposures (Salguero, Fernandez-Berrocal, Iruarrizaga, et al, 2011). They particularly identified a need for replication of these major depression predictors using consistent research methods, to confirm generalizability across studies.

Some investigators have suggested that intentionally human-induced disasters such as terrorism have more negative mental health impact than other typologies (Goldmann and Galea, 2014; Norris, Friedman, Watson, et al, 2002; Salguero, Fernandez-Berrocal,

Iruarizaga, et al, 2011). However, a systematic study of 811 directly-exposed survivors of 10 different disasters concluded that after controlling for pre-existing characteristics of the samples and the disaster scope and magnitude, terrorism did not differ from other disaster types in association with PTSD (North, Oliver, and Pandya, 2012). Goldmann et al. concluded that characteristics of the disaster, rather than the type of disaster, may represent the more salient aspects to consider in terms of mental health outcomes (2014). Little is known, however, about disaster typology in relation to MDD.

Identifying and confirming robust predictors of postdisaster MDD across disaster studies using consistent research methods and full diagnostic assessment is needed to advance understanding of individual risk for disaster-related MDD and inform the development of targeted strategies to intervene with at-risk individuals. To address this need, this study examined predictors of postdisaster major depression in two separate data sets of survivors of various disasters using consistent research methodology, including full diagnostic assessment with structured diagnostic interviews and careful assessment of trauma exposures.

Method

Two disaster databases were collected with consistent research methodology, including full diagnostic assessment with structured diagnostic interviews, across all the disasters studied. The first, a 10-disaster database, includes 808 directly-exposed survivors of 10 disasters of all types, including natural disasters (floods, tornado, earthquake), technological accidents (plane crash into hotel, firestorm), and intentionally-caused disasters (4 mass murder episodes and a terrorist bombing) between 1 and 6 months (median=3 months) post disaster. Six of the 10 disaster studies used systematic sampling, with a 77% participation rate and 4 included volunteer samples with unknown participation rates. The second includes a volunteer sample of 373 survivors of the September 11, 2001 (9/11) terrorist attacks on New York City's World Trade Center (WTC) recruited from employees of eight NYC organizations including evacuees from the WTC towers and others in the adjacent vicinity, with a 27% direct exposure to disaster trauma approximately 3 years after the disaster. Details of the disasters and research methods are provided in previously published articles (North, Oliver, and Pandya, 2012; North, Ringwalt, Downs, et al, 2011). Institutional Review Board (IRB) approval for human subject research was obtained in advance, and all participants provided written informed consent.

Interviews of all participants were conducted with the Diagnostic Interview Schedule (DIS) (Robins, Cottler, Compton, et al, 1998) and Disaster Supplement (North, Pfefferbaum, Robins, et al, 2001). The DIS has been demonstrated to possess acceptable diagnostic reliability and validity (Erdman, Klein, Greist, et al, 1987; Goethe and Ahmadi, 1991; Helzer, Spitznagel, and McEvoy, 1987; Ross, Swinson, Coumanik, et al, 1995; Wittchen, Semler, and von Zerssen, 1985) and has been extensively used in disaster research (North, Oliver, and Pandya, 2012; North, Ringwalt, Downs, et al, 2011). DIS modules used were demographics, major depression, PTSD, panic disorder, generalized anxiety disorder, and alcohol/drug use disorders. The Disaster Supplement assessed disaster trauma exposures according to *DSM-IV* PTSD criterion A.

Data analysis

SAS 9.4 (SAS Institute, Cary, NC) was used for data analysis. Consistent research methods used to collect the data allowed merging of the databases, yielding a total sample of N=1,181 survivors of 11 disasters. Chi-square tests compared dichotomous variables (Fisher exact tests for expected cell sizes <5). Nonparametric Wilcoxon-Mann-Whitney U tests (PROC NPAR1WAY) compared dichotomous and numerical variables.

In the 10-disaster model, hierarchical multivariate logistic regression models were tested (PROC GLIMMIX specifying a logit linkage function with binary distribution) with survivors nested within separate disasters to develop predictive models for postdisaster major depression (dependent variable) from several independent covariates entered simultaneously. Independent variables were those found in bivariate comparisons to be associated ($p < .10$) with postdisaster major depression in bivariate analyses: sex, age > 65, Hispanic ethnicity, married status, college education, predisaster major depression, predisaster PTSD, predisaster alcohol use disorder, indirect exposure through close family/friend disaster trauma, physical injury in the disaster, seeing people being hurt or killed in the disaster, disaster-related PTSD, and occurrence of adverse life events after the disaster. Serial iterations of the multivariate model were conducted, removing the least significant variable until only significantly associated ($p < .05$) variables remained. Interaction terms among pairs of independent variables in the final model were created (i.e., predisaster major depression X PTSD, predisaster major depression X indirect exposure, and PTSD X indirect exposure) and inserted into the model as additional independent covariates. The same approach was applied to modeling 9/11 WTC data (without nesting for one disaster).

Receiver Operating Curve (ROC) analysis was used logistic regression (PROC LOGISTIC) including significant predictors of postdisaster major depression in separate hierarchical multivariate regression models (nesting 10-disaster survivors within disasters). To evaluate calibration of agreement between predicted and observed probabilities, model-predicted probabilities were compared with goodness-of-fit chi-square tests, with higher p values indicating better fit.

Findings from the 10-disaster model were next applied to the 9/11 WTC database. The prediction of postdisaster major depression from the three independent variables plus parameter estimates in the 10-disaster data were examined for predictability of postdisaster major depression from equivalent independent variables in 9/11 WTC data. The generalized linear mixed models (GLMM) procedure (PROC GLIMMIX) with the options “noblu” (not using predictors of random effects in computing the statistic) and “ilink” (which computes the statistic on the scale of the data) generated predicted probabilities for postdisaster major depression in 9/11 WTC data based on model parameter estimates for postdisaster major depression in the 10-disaster data. Probabilities $\geq .5$ were considered predictive of postdisaster major depression, and probabilities $< .5$ considered predictive of absence of postdisaster major depression.

ROC analysis was conducted with application of predicted probabilities of postdisaster major depression in the 10-disaster data to the 9/11 WTC data across all predicted probability cut points. Linear regression (PROC REG) was used to further assess the final

10-disaster model's performance in application to the 9/11 WTC, indicated by mean squared (prediction) error (MSE). Kendall's tau b concordance measure (PROC CORR KENDALL) was also used to further assess the application of the 10-disaster model's prediction of postdisaster major depression to the 9/11 WTC data. Conversely, these ROC analysis procedures were applied to the 10-disaster data to assess performance of the predicted probabilities of postdisaster major depression from the 9/11 WTC model to the 10-disaster data.

Variables were created to reflect the count of positive items among the variables in the 3-variable models in both 10-disaster and 9/11 WTC databases. These constructed variables and the three individual variables from which they were created were compared with postdisaster major depression in first in the 10-disaster data and then in the 9/11 WTC data. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated for prediction of postdisaster major depression from these variables in both databases.

Results

In the 10-disaster database, a hierarchical multivariate logistic regression model nesting survivors within separate disasters provided a predictive model for postdisaster major depression (dependent variable) from several independent covariates entered simultaneously, followed by sequential removal of the least predictive variable in each model to trim the final model to variables significantly associated with the dependent variable. The final 10-disaster model (Table 1, Model 1) included 3 variables significantly associated with postdisaster major depression independent of one another: predisaster major depression, indirect exposure through close family/friend disaster trauma, and disaster-related PTSD. Interaction terms among pairs of independent variables separately added into the model provided no further prediction of postdisaster major depression. In ROC analysis of the final 3-variable model (Fig. 1a), the area under the curve (AUC)=.88 (95% CI=.84, .92), indicating that this model discriminated well between survivors with and without postdisaster major depression. Comparison of goodness of fit chi-square tests for observed versus model-predicted probabilities yielded $p=1.00$, indicating good fit.

In the 9/11 WTC database, similar hierarchical multivariate logistic regression modeling was used to predict postdisaster major depression (dependent variable) from independent covariates entered simultaneously followed by sequential trimming of variables. The final 9/11 WTC disaster model (Table 1, model 2) included 5 variables independently associated with postdisaster major depression: unmarried status, indirect exposure through close family/friend disaster trauma, predisaster major depression, disaster-related PTSD, and injury in the disaster (an additional model adding an independent covariate for direct exposure to disaster danger found this variable to be unassociated with postdisaster major depression). Comparison of goodness-of-fit chi-square tests for observed versus model-predicted probabilities for this model yielded $p=.219$, indicating good fit.

The results of the final 10-disaster data analysis were applied to the 9/11 WTC data to create a model predicting postdisaster major depression (dependent variable) from three

independent variables (predisaster major depression, indirect exposure through close family/friend disaster trauma, and disaster-related PTSD) in the 9/11 WTC data corresponding to the three variables that were significantly associated with postdisaster major depression in the 10-disaster model. The resulting 9/11 WTC model was consistent with the 10-disaster final model results (Table 1, model 3), with the three significant 10-disaster variables also significantly associated with 9/11 data postdisaster major depression. ROC analysis with the final 3-variable 9/11 WTC model (Fig. 1b) yielded $AUC=.83$ (95% $CI=.79, .88$), a value somewhat lower than in the 10-disaster database yet still indicating good discrimination between 9/11 WTC survivors with and without postdisaster major depression. Comparison of goodness-of-fit chi-square tests for observed versus model-predicted probabilities for this model yielded $p=.460$, indicating good fit.

The ability of the final 10-disaster 3-variable model to predict postdisaster major depression from equivalent variables in 9/11 WTC data is indicated in terms of sensitivity=.14, specificity=.99, PPV=.89, and NPV=.99. Fig. 1c presents results of ROC analysis applying predicted probabilities of postdisaster major depression from the final 10-disaster 3-variable model to the final 9/11 WTC 3-variable model across all probability cut points. The $AUC=.83$ (95% $CI=.79, .87$) indicates good performance of the final 9/11 WTC model relative to the final 10-disaster model in differentiating between survivors with and without postdisaster major depression. A regression model examining the final 10-disaster model's performance applied to the final 9/11 WTC model is also indicated by $MSE=.04$ and correlation coefficient=.29 ($p<.001$).

Conversely, the ability of the 3-variable 9/11 WTC 3-variable model to predict postdisaster major depression in 10-disaster data was examined using the above procedures. The ability of the 9/11 WTC 3-variable model to predict postdisaster major depression in the 10-disaster 3-variable model is indicated by findings of sensitivity=.35, specificity=.98, PPV=.80, NPV=.98. Fig. 1d presents ROC analysis results applying predicted probabilities of postdisaster major depression from the final 9/11 WTC model to the final 10-disaster model across predicted probability cut points. $AUC=.88$ (95% $CI=.84, .92$) indicates good performance of the final 10-disaster model relative to the final 9/11 WTC model in differentiating between survivors with and without postdisaster major depression. A regression model examining the final 9/11 WTC model's performance applied to the final 10-disaster model is also indicated by $MSE=.09$ and correlation coefficient=.49 ($p<.001$).

Based on results from 3-variable models in the 10-disaster and 9/11 WTC databases, the 9/11 WTC and 10-disaster databases were combined into a single database representing all 11 disasters ($N=1,181$) for final modeling of relevant variables. A variable was created to represent disasters classified as terrorist incidents (the Oklahoma City bombing and the 9/11 WTC attacks in these databases). In this combined dataset, a multiple regression model including only subsets of survivors directly exposed to disaster trauma was used to predict postdisaster major depression (dependent variable) simultaneously from four independent covariates: terrorist incidents, predisaster lifetime major depression, indirect exposure through close family/friend disaster trauma, and disaster-related PTSD. All four independent variables in this model were independently associated with postdisaster major depression (Table 1, model 4). Comparison of goodness-of-fit chi-square tests for observed versus

model-predicted probabilities for this model yielded $p=.998$, indicating good fit. Two similar models substituting human-caused and intentionally-caused disasters respectively for terrorist incidents found that these disaster typologies were not significantly associated with postdisaster major depression independent of effects of other variables in the models.

Individual independent variables in the 10-disaster and 9/11 WTC 3-variable models were examined for ability to predict postdisaster major depression. In the 10-disaster data, postdisaster major depression was present in 57% of those with and 7% of those without lifetime predisaster major depression ($\chi^2=215.51$, $df=1$, $p<.001$), 19% of those with indirect exposure through close family/friend disaster trauma vs. 12% without ($\chi^2=6.43$, $df=1$, $p=.011$), and 44% of those with and 6% of those without disaster-related PTSD ($\chi^2=154.68$, $df=1$, $p<.001$). In the 9/11 WTC data, postdisaster major depression was present in 63% of those with and 15% of those without predisaster major depression ($\chi^2=88.63$, $df=1$, $p<.001$), 45% of those with indirect exposure through close family/friend disaster trauma vs. 27% without ($\chi^2=7.43$, $df=1$, $p=.006$), and 63% of those with and 24% of those without disaster-related PTSD ($\chi^2=33.30$, $df=1$, $p<.001$).

Variables representing the count of positive values on the above three variables was created in both the 10-disaster and 9/11 WTC databases. In the 10-disaster data, the likelihood of postdisaster major depression was 2% with 0 positive items, 12% with 1 (compared to 0 positive, $\chi^2=88.57$, $df=1$, $p<.001$), 47% with 2 (compared to 0 positive, $\chi^2=208.61$, $df=1$, $p<.001$), and 94% with 3 (compared to 0 positive, Fisher exact $p<.001$). In the 9/11 WTC data, the likelihood of postdisaster major depression was 7% with 0 positive items, 55% with 1 positive item (compared to 0 positive, $\chi^2=102.82$, $df=1$, $p<.001$), 73% with 2 positive items (compared to 0 positive, $\chi^2=41.53$, $df=1$, $p<.001$), and 80% with 3 positive items (compared to 0 positive, Fisher exact $p=.020$). The proportions with positive values on the above three variables did not differ between the 10-disaster and 9/11 WTC databases. The 3-variable count of positive values was positively associated with postdisaster major depression in both the 10-disaster (mean=1.70, $SD=.81$ vs. mean=.54, $SD=.66$; Wilcoxon $S=72727$, $z=12.82$, $p<.001$) and 9/11 WTC (mean=1.19, $SD=.68$; Wilcoxon $S=29783$, $z=10.55$, $p<.001$) databases. Table 2 presents sensitivity, specificity, PPV, and NPV values for the count of the three items in association with postdisaster major depression in the 10-disaster and 9/11 WTC databases.

Discussion

This study examined postdisaster major depression in two disaster databases using consistent methods, permitting combination of databases into a combined dataset including 1,181 survivors of 11 disasters representing all major disaster typologies (natural disasters, technological accidents, and intentionally-caused disasters including terrorism) with full diagnostic assessment using structured diagnostic interviews. This rich dataset permitted comparison of predictors of postdisaster major depression between databases and across survivors of different disasters. Identical models applied to both databases found postdisaster major depression to be independently associated with pre-existing major depression, indirect exposure to disaster trauma through family/friends, and disaster-related PTSD.

The 10-disaster model performed well in prediction of postdisaster major depression in the 9/11 WTC database, and both 10-disaster and 9/11 WTC databases performed well in association with one another in predicting postdisaster major depression based on probabilities established from one model applied to one another. Replication of findings of models across different types of disasters and populations suggests that these three variables could potentially provide a consistent tool for estimating likelihood of postdisaster major depression. In a final model limited to directly-exposed disaster across both databases, postdisaster major depression was independently associated with terrorism in addition to the 3 variables that predicted postdisaster major depression in the two separate databases.

These variables differ from variables included in a comprehensive model found to predict PTSD in previous analyses of directly-exposed survivors in the 10-disaster database. In that analysis, disaster-related PTSD was not associated with the type of disaster (North, Oliver, and Pandya, 2012), in contrast to the significant association of major depression with terrorism in the current study's model of directly-exposed survivors. Additionally, sex, race/ethnicity, education, injury in the disaster, and adverse life events all independently predicted PTSD (North, Oliver, and Pandya, 2012), in contrast to the current analysis that found none of these variables to be independently associated with postdisaster major depression. The one common predictor of both disaster-related PTSD and postdisaster major depression in these analyses was pre-existing psychopathology.

Only 2%–7% of survivors who were negative on all 3 of these variables developed postdisaster major depression, but 80%–94% of survivors with positives on all 3 of these variables developed postdisaster major depression. Sensitivities of 88%–92% and specificities of almost 100% depending on the positive number of items (1, 2, or 3) representing the cutoff (see Table 2) suggest the utility of these items as a potentially powerful tool for predicting postdisaster major depression.

Strengths of this study include a large (N=1,181) sample of survivors of all major disaster types, consistent methods allowing merging of samples from different disasters, structured diagnostic interviews, and careful assessment of disaster exposure types. These strengths provided a unique opportunity to test the application of models from one database to the other and vice versa. Limitations of the study include volunteer sampling in some of the disaster sites and recall bias based on length of time to data collection in the 9/11 WTC study.

The apparent inconsistency of variables predicting major depression (female sex, injury in the attacks, loss of postdisaster psychosocial resources, and stressful life events) identified in a systematic review of terrorist attacks (Salguero, Fernandez-Berrocal, Iruarrizaga, et al, 2011) differing from those associated with major depression in this study (pre-existing major depression, indirect exposure through close family/friend disaster trauma, and disaster-related PTSD) may reflect methodological differences among studies in these two reports. Another important potential source of differences between the Salguero et al. review and the findings of this study is that the review compared variables with postdisaster major depression separately, whereas the current study examined independent variables together in a single model controlling for the effects of one another. In the current study, variables

associated with major depression in bivariate analyses but not in the final model matched those of the review, including female sex, injury in the disaster, and adverse life events, as well as greater age, Hispanic ethnicity, married status, college education, and seeing people being hurt or killed in the disaster.

The conditional nature of PTSD based on trauma exposure that is not a requirement of diagnostic criteria for major depression might have contributed to differences models predicting PTSD vs. major depression in these datasets. Indeed, injury in the disaster and witnessing disaster trauma to others (Criterion A trauma exposures for PTSD diagnosis) were independently associated with disaster-related PTSD in a previous analysis (North, Oliver, and Pandya, 2012), but these variables were not independently predictive of postdisaster major depression in the current study. In contrast, indirect exposure through disaster trauma to family/friends was not independently associated with disaster-related PTSD (North, Oliver, and Pandya, 2012), but this variable was consistently associated with postdisaster major depression in the models emerging from these analyses.

A recent review of disaster and military combat studies (2016) noted that in 9/11 research, PTSD appeared to be related to direct disaster trauma exposure, whereas postdisaster major depression was related to losses (close associates, property, or job), suggesting that PTSD is more related to disaster trauma exposure and major depression to personal losses. They stated a need for additional research to collaborate or refute their hypothesis. The systematic review of terrorist attacks (2011) proposed different pathways to PTSD and major depression after terrorism, through trauma exposure for PTSD and psychosocial loss and bereavement for major depression. These observations are consistent with this study's findings pointing to trauma exposure in the development of PTSD in contrast to interpersonal associations and losses for major depression.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

Panel (a). ROC curves for predictors of postdisaster major depression: 10-disaster data 3-variable model. Panel (b). ROC curves for predictors of postdisaster major depression: 9/11 WTC data 3-variable model. Panel (c). ROC curves applying predicted probabilities of postdisaster major depression in the 10-disaster 3-variable model to the 9/11 WTC 3-variable model across all predicted probability cut points. Panel (d). ROC curves applying predicted probabilities of postdisaster major depression in the 9/11 WTC 3-variable model to the 10-disaster 3-variable model across all predicted probability cut points.

Table 1

Independent predictors of postdisaster major depression.

Variables	Beta (SE)	OR (95% CI)	p value
Model 1: 10-disaster data			
Predisaster major depression	3.10 (.30)	22.16 (12.19, 40.27)	<.001
Indirect exposure through family/friend	0.61 (.31)	1.83 (1.01, 3.34)	.048
Disaster-related PTSD	2.19 (.29)	8.93 (5.07, 15.72)	<.001
Model 2: 9/11 WTC data			
Married	-.86 (.30)	.42 (.24, .76)	.005
Predisaster major depression	2.70 (.32)	14.85 (7.98, 27.62)	<.001
Indirect exposure through family/friend	.83 (.40)	2.29 (1.05, 4.99)	.036
Disaster-related PTSD	2.00 (.40)	7.35 (3.34, 16.18)	<.001
Injured in disaster	1.53 (.56)	4.64 (1.55, 13.85)	.006
Model 3: application of 10-disaster significant independent variables to 9/11 WTC data			
Predisaster major depression	2.63 (.30)	13.88 (7.72, 24.97)	<.001
Indirect exposure through family/friend	0.83 (.38)	2.30 (1.10, 4.83)	.028
Disaster-related PTSD	2.07 (.38)	7.92 (3.77, 16.62)	<.001
Model 4: combined 10-disaster and 9/11 WTC data (directly-exposed only)			
Terrorism	1.47 (.63)	4.36 (1.28, 14.89)	.019
Predisaster major depression	3.05 (.28)	21.04 (12.17, 36.39)	<.001
Indirect exposure through family/friend	0.86 (.27)	2.36 (1.39, 4.01)	.002
Disaster-related PTSD	2.03 (.25)	7.60 (4.66, 12.41)	<.001

Table 2

Prediction of postdisaster major depression from counts of 3 items (predisaster major depression, indirect exposure through close family/friend disaster trauma, and disaster-related PTSD) in 10-disaster and 9/11 WTC models.

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
10 - disaster data				
1 items	92.0	55.7	25.2	97.7
2 items	63.7	90.9	53.3	93.9
3 items	14.2	99.9	94.1	87.7
9/11 WTC data				
1 items	88.3	69.1	54.8	93.3
2 items	27.0	95.8	73.2	75.6
3 items	3.6	99.6	80.0	70.9