

Neighborhood social cohesion and posttraumatic stress disorder in a community-based sample: findings from the Detroit Neighborhood Health Study

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Abstract

Purpose Posttraumatic stress disorder (PTSD) is common and debilitating. Although research has identified individual-level risk factors for PTSD, the role of macro-social factors in PTSD etiology remains unknown. This study tests whether perceived neighborhood social cohesion (NSC), measured at the both the individual and neighborhood levels, plays a role in determining past-year risk of PTSD among those exposed to trauma.

Methods Data ($n = 1,221$) were obtained from an ongoing prospective epidemiologic study in the city of Detroit. Assessment of traumatic event exposure and PTSD was consistent with DSM-IV criteria. Generalized estimating equations (GEE) and logistic regression models were used to estimate the association of neighborhood-level perceived NSC with the risk of PTSD, adjusting for individual-level perceptions of NSC and other covariates.

Results The odds of past-year PTSD were significantly higher among those residing in a neighborhood with low social cohesion compared to high (OR = 2.44, 95 % CI: 1.58, 3.78), independent of individual sociodemographic characteristics, number of traumas, and individual-level

perceptions of NSC. The odds of past-year PTSD were not significantly associated with individual-level perceptions of NSC.

Conclusions These results demonstrate that social context shapes risk of PTSD and suggest that changing the social context may shift vulnerability to this disorder.

Keywords PTSD · Neighborhood · Social cohesion · Trauma · Social context

Introduction

Posttraumatic stress disorder (PTSD) is an atypical psychological response that can occur following exposure to a trauma involving sexual or physical violence, serious injury, or death [1]. Although a majority of Americans have been exposed to trauma in their lifetime (>80 %) [2, 3], only a minority of those exposed (<10 %) go on to develop PTSD [2–5]. Individual-level factors known to increase risk for PTSD include female sex, psychiatric history, lack of social support and childhood abuse [6–9]; however, the role of macro-social factors in PTSD etiology remains currently unknown.

Exposure to trauma, required for diagnosis, differs across populations, communities, and geographies [3, 7, 10]. Thus, one plausible pathway by which social context may influence the risk of PTSD is via shaping exposure to trauma [11, 12]. For example, exposure to assaultive violence is associated with heightened risk of PTSD compared to other traumatic events [3–5, 13] and has been found to vary by community, with markedly higher levels reported in inner city versus suburban areas of the Detroit Metropolitan Area and in impoverished versus more affluent areas of a large Mid-Atlantic city [3, 10].

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A second plausible way that context may shape an individual's the risk for PTSD is via vulnerability to the effects of trauma—even when one's exposure to trauma remains constant [12]. For example, neighborhood poverty, levels of crime, and availability of social networks may influence individuals' perceived level of control prior to trauma [12]; these perceptions, in turn, affect not only an individuals' pre-trauma psychological state but also one's ability to cope following trauma [12]. Similarly, community social context has posttrauma influences on an individual's risk for developing PTSD through the varying availability of community support networks or mental health services for trauma victims [12]. These dual pathways through which social context, on the one hand, shapes trauma exposure and, on the other hand, shapes vulnerability to trauma, suggest that investigation of PTSD determinants should, by definition, include an assessment of risk factors that exist at multiple levels; yet, to our knowledge, such approaches have yet to be adopted and/or reported in the literature.

A substantial body of literature has shown that social cohesion influences health (e.g., [14–18]). In particular, neighborhood social cohesion (NSC), defined as the willingness of residents who realize common values to intervene for the common good [19, 20], has been shown to influence population-level mental health, with low levels of NSC associated with increased depression and anxiety, independent of individual-level characteristics [21–24]. NSC plausibly can influence risk of PTSD through the two pathways mentioned previously: by shaping individual exposure to trauma as well as by influencing individual vulnerability to the effects of trauma. If less cohesive neighborhoods possess characteristics that heighten risk for exposure to traumatic events—for example, by being deficient in the “informal social control” necessary to discourage crime and delinquent behavior—then such neighborhoods may amplify the individual risk of experiencing trauma [9, 11, 20, 25–27] and, thus, increase risk for PTSD [7]. In addition, NSC may have pre and posttraumatic influences on an individual's psychological response to trauma [12]. Less cohesive neighborhoods are characterized by fragmented social networks and heightened crime; these features influence individual perceptions of controllability or negative valence, thereby influencing whether an experience is traumatic [12]. Furthermore, following exposure to trauma, lack of social networks within a less cohesive community may thwart an individual's ability to both restore feelings of controllability and dampen the negative valence of the experience [12].

In light of the plausible influence of NSC on PTSD, this study examines whether NSC shapes the risk of PTSD. Using data from the Detroit Neighborhood Health Study (DNHS), we investigate here the relation between

perceived NSC, measured at both the individual and neighborhood levels, and the risk of PTSD.

Materials and methods

Study population

The DNHS is a longitudinal study of adults aged 18 years or older who reside in the city of Detroit. A probability sample of 1,547 households within the city limits of Detroit was initially chosen and one individual per household was selected for a telephone survey [28]. Details about the sampling design are described elsewhere [29]. Participants were administered a 40-min telephone survey, which included questions pertaining to neighborhood perceptions, exposure to traumatic events, demographic characteristics, and a standardized assessment of posttraumatic stress symptoms [28, 29]. The Institutional Review Board of the University of Michigan reviewed and approved this study.

Measures

All individual- and neighborhood-level variables were drawn from telephone interviews in Wave 1 of DNHS data collection.

Outcome variable

Symptoms of PTSD were assessed using the PTSD checklist (PCL-C) [30], a 17-item self-report measure of DSM-IV symptoms of PTSD [1]. Additional questions were asked about duration, timing, and impairment due to symptoms [28]. Participants were asked about their past trauma exposure from a list of 19 events [3]. PTSD symptoms were assessed in reference to both the traumatic event the participant regarded as the worst and one randomly selected traumatic event from the remaining traumas the participant may have experienced [28]. Past-year PTSD cases met all six DSM-IV criteria in reference to either the worst or random traumatic event. A question pertaining to timing determined whether symptoms had occurred within the past year [28]. The validation of the identification of PTSD is described elsewhere [28].

Analysis of data from the in-person interviews showed that the PTSD instrument used during the telephone interviews had excellent internal consistency and good psychometrics [28].

Neighborhood social cohesion

Individual perceptions of NSC were assessed by asking participants to respond if their neighborhood is “close-knit

or unified,” neighbors are willing to help each other, neighbors get along, neighbors share common values, and neighbors can be trusted [20, 31]. Responses were measured using a 5-point Likert scale with higher numbers indicating greater social cohesion; two questions were reverse coded. Responses were summed for each individual and were divided into roughly equal tertiles considering all the participants in the sample, with a higher score representing greater cohesion.

Neighborhood-level perceptions of NSC (i.e., neighborhood-level NSC) were calculated by aggregating the mean social cohesion scores for all individuals residing in each neighborhood [24]. Participant addresses were geocoded to block groups, which in turn were aggregated to the 54 neighborhoods of Detroit [32, 33]. These neighborhood boundaries are recognized by city planners as established community boundaries [32, 33]. Neighborhood-level NSC scores were divided into roughly equal tertiles considering aggregate NSC scores for all 54 neighborhoods, with a higher score representing greater cohesion.

Additional covariates

Individual-level covariates associated with neighborhood characteristics and/or PTSD in the analysis included age, gender, race/ethnicity, educational attainment, marital status, years residing in neighborhood, and number of lifetime traumatic events experienced. Race/ethnicity was self-reported. Educational attainment was classified by three categories: less than high school, high school graduate, and some college/college graduate/graduate school. Marital status was included in the analysis because of its influence on the risk of PTSD [4], and was categorized as married, divorced/separated/widowed, and never married. Number of lifetime traumas, found to have a cumulative effect on PTSD symptoms [34], was classified into three categories: 1–3, 4–6, and 7 or more events. The number of years residing in a neighborhood was treated as a continuous variable in the analysis.

Statistical analysis

Analyses

Analyses were restricted to those who lived in their current neighborhood for at least 1 year and had experienced at least one traumatic event in their lifetime ($n = 1,221$).

Analyses that included the individual- and/or the neighborhood-level NSC variable were analyzed using general estimating equations (GEE) logistic regression to obtain parameter estimates that accounted for possible correlation in predicted outcomes among participants residing in the same neighborhood [35, 36]. Logistic regression models

were fitted for all other models that did not include at least one of the aforementioned NSC variables.

Additional analyses included a sensitivity analysis to assess whether the effects of NSC on the risk of PTSD were enhanced when an individual experienced a trauma in their current neighborhood at the time of their traumatic event (again using logistic regression or GEE logistic regression as appropriate); and a secondary analysis to assess whether the frequency of plausible network-based traumatic events in our dataset (e.g., witnessing someone being killed or seriously injured or learning that a closed friend was seriously injured, raped, or physically abused) differed across the three levels of NSC (determined via a Chi-square test). All analyses were performed using SAS 9.2. Two-tail p values were used and all confidence intervals were 95 %.

Results

Table 1 shows the distribution of sociodemographic characteristics, traumatic event experience, and neighborhood characteristics of the study population. The study sample included 1,221 individuals who were exposed to at least one traumatic event and had lived in their current neighborhood for at least 1 year; among these 133 (11 %) were affected by past-year PTSD. The mean length of residence in one’s current neighborhood was 18.5 years (± 15.1 years), with mean individual- and neighborhood-level social cohesion scores of 17.0 and 17.1, respectively. Cases of past-year PTSD were significantly different from non-cases by age, sex, education, marital status, lifetime traumatic event experience, and mean individual- and neighborhood-level social cohesion scores (Table 1).

Table 2 presents the results of the bivariable regression analyses. The odds of past-year PTSD were significantly higher among women than men [odds ratio (OR) = 2.20, 95 % confidence interval (CI): 2.16, 2.24], non-whites than whites (OR = 3.87, 95 % CI: 3.65, 4.10) and those who had never been married (OR = 2.35, 95 % CI: 2.29, 2.41). Less than a high school education and exposure to more than three traumatic events in a lifetime also predicted significantly increased risk of past-year PTSD. With respect to neighborhood variables, the odds of past-year PTSD were not significantly associated with individual-level NSC; however, low levels of neighborhood-level NSC were associated with increased risk of past-year PTSD (OR = 2.36, 95 % CI: 1.42, 3.93).

Table 3 shows results from our final, fully adjusted multivariable regression analyses. Similar to bivariable analyses, a significantly increased risk of past-year PTSD was observed for females, non-whites, and those who had never been married. Exposure to more than seven traumatic events in a lifetime also significantly predicted an elevated

Table 1 Sample characteristics, Wave 1 Detroit Neighborhood Health Study

Sample characteristics	All participants ^a (<i>n</i> = 1,221)		Cases of past-year PTSD (<i>n</i> = 133)		Non-cases of past-year PTSD (<i>n</i> = 1,088)		Chi-square test <i>p</i> value
	(<i>N</i>)	(%)	(<i>N</i>)	(%)	(<i>N</i>)	(%)	
Age (years)							
18–24	101	8.3	11	8.3	90	8.3	0.04
25–34	106	8.7	13	9.8	93	8.6	
35–44	217	17.8	30	22.6	187	17.2	
45–54	285	23.3	35	26.3	250	23.0	
55–64	273	22.4	32	24.1	241	22.2	
65+	239	19.6	12	9.0	227	20.9	
Sex							
Female	686	56.2	92	69.2	594	54.6	0.001
Male	535	43.8	41	30.8	494	45.4	
Race/ethnicity							
White	118	9.7	10	7.5	108	9.9	0.38
Non-white	1,103	90.3	123	92.5	980	90.1	
Education							
<HS	158	12.9	25	18.8	133	12.2	0.04
HS Grad/GED	375	30.7	45	33.8	330	30.3	
Some College/College Grad/Grad Degree	688	56.4	63	47.4	625	57.4	
Marital status							
Married	316	25.9	20	15.0	296	27.2	0.005
Divorced	445	36.5	50	37.6	395	36.3	
Never married	460	37.7	63	47.3	397	36.5	
Lifetime traumatic event experience							
1–3 events	440	36.0	21	15.8	419	38.5	<0.0001
4–6 events	344	28.2	24	18.1	320	29.4	
7 + events	437	35.8	88	66.2	349	32.1	
Neighborhood							
Mean years living in neighborhood (SD)	18.5 (15.1)		17.6 (14.9)		18.6 (15.2)		0.50 ^b
Mean individual-level NSC (SD)	17.0 (4.8)		15.7 (5.2)		17.2 (4.8)		0.0007^b
Mean neighborhood-NSC (SD)	17.1 (1.5)		16.7 (1.5)		17.1 (1.5)		0.002^b

Grad graduate, *GED* graduate equivalency degree, *HS* high school, *NSC* neighborhood social cohesion, *PTSD* posttraumatic stress disorder, *SD* standard deviation

^a Participants who experienced at least one lifetime traumatic event and have lived in their current neighborhood for at least 1 year

^b Equal variance *t* test used; significant values are indicated in bold type

risk for past-year PTSD (OR = 8.99, 95 % CI: 3.86, 20.93). Consistent with the bivariable results, the effect of individual-level NSC on the risk of past-year PTSD was not significant, but the odds of PTSD were significantly higher among those residing in neighborhoods with low neighborhood-level NSC compared to high (OR = 2.44, 95 % CI: 1.58, 3.78). Furthermore, sensitivity analyses showed that this association was strengthened when analysis was restricted to those who were living in their current neighborhood at the time when they experienced the traumatic event on which their PTSD diagnosis was based (*n* = 835): the elevated odds of PTSD for participants

residing in neighborhoods with low levels of neighborhood-level NSC increased more than threefold compared to those residing in neighborhood with high levels of neighborhood-level NSC (OR = 3.09, 95 % CI: 1.83, 5.22) while the odds of PTSD remained non-significant for moderate levels of neighborhood-level NSC (OR = 1.44, 95 % CI: 0.84, 2.47). Similar to the results from the fully adjusted analysis (Table 3), there was no significant effect of individual-level NSC observed when analysis was restricted to those who were living in their current neighborhood at the time when they experienced the traumatic event on which their PTSD status was based.

Table 2 Unadjusted odds of past-year PTSD among those who have experienced at least one traumatic event and have lived in current neighborhood for at least 1 year ($n = 1,221$)

	Unadjusted analysis		
	OR	95 % CI	
		Lower	Upper
Age (years)			
18–24	Ref		
25–34	0.99	0.96	1.03
35–44	1.20	1.17	1.24
45–54	1.28	1.25	1.32
55–64	0.98	0.95	1.01
65+	0.66	0.64	0.69
Sex			
Male	Ref		
Female	2.20	2.16	2.24
Race/ethnicity			
White	Ref		
Non-white	3.87	3.65	4.10
Education			
Some college/college degree/Grad degree	Ref		
HS Grad/GED	0.99	0.97	1.01
<HS	1.39	1.36	1.43
Marital status			
Married	Ref		
Divorced/separated/widowed	1.85	1.80	1.90
Never married	2.35	2.29	2.41
Lifetime traumatic event experience			
1–3 events	Ref		
4–6 events	1.81	1.75	1.88
7 + events	7.39	7.18	7.60
Years lived in neighborhood	0.99	0.99	0.99
Individual-level NSC^a			
3 (High)	Ref		
2	1.04	0.61	1.77
1 (Low)	1.13	0.65	1.95
Neighborhood-level NSC^a			
3 (High)	Ref		
2	1.14	0.72	1.81
1 (Low)	2.36	1.42	3.93

Grad graduate, *GED* graduate equivalency degree, *HS* high school, *NSC* neighborhood social cohesion, *OR* odds ratio, *PTSD* posttraumatic stress disorder, *SD* standard deviation

^a A generalized estimating equation (GEE) model assuming an exchangeable working correlation matrix for intra-neighborhood responses was used. Significant values are indicated in bold type

Table 3 Odds of past-year PTSD among those who have experienced at least one traumatic event and have lived in current neighborhood for at least 1 year ($n = 1,221$)

	Adjusted analysis ^a		
	OR	95 % CI	
		Lower	Upper
Age (years)			
18–24	Ref		
25–34	0.59	0.19	1.80
35–44	0.94	0.38	2.30
45–54	1.11	0.44	2.83
55–64	1.02	0.35	3.03
65+	1.03	0.27	3.89
Sex			
Male	Ref		
Female	2.42	1.35	4.34
Race/ethnicity			
White	Ref		
Non-white	2.95	1.17	7.43
Education			
Some college/college degree/Grad degree	Ref		
HS Grad/GED	0.98	0.54	1.78
<HS	1.18	0.57	2.46
Marital status			
Married	Ref		
Divorced/separated/widowed	1.97	0.90	4.30
Never married	2.52	1.31	4.86
Lifetime traumatic event experience			
1–3 events	Ref		
4–6 events	1.89	0.72	4.96
7 + events	8.99	3.86	20.93
Years living in neighborhood	1.00	0.97	1.02
Individual-level NSC			
3 (High)	Ref		
2	0.93	0.54	1.60
1 (Low)	0.82	0.44	1.53
Neighborhood-level NSC			
3 (High)	Ref		
2	0.97	0.65	1.44
1 (Low)	2.44	1.58	3.78

Grad graduate, *GED* graduate equivalency degree, *HS* high school, *NSC* neighborhood social cohesion, *OR* odds ratio, *PTSD* posttraumatic stress disorder, *SD* standard deviation

^a GEE model assuming exchangeable correlation matrix adjusted for sociodemographic characteristics, number of lifetime traumatic events, number of years lived in neighborhood, individual-level social cohesion, and neighborhood-level social cohesion. Significant values are indicated in bold type

Results from the secondary analyses are presented in online resources 1 and 2. Online resource 1 shows the frequencies of network-based traumatic events by the level

of NSC. Online resource 2 shows the frequencies of the total number of network-based events experienced in a lifetime, by the level of NSC. Overall, the frequencies of

each network-based traumatic event as well as the total number of network-based events experienced in a lifetime did not significantly differ across the three levels of NSC.

Discussion

To our knowledge, this is the first study to directly assess the association of perceived NSC, measured at the neighborhood level, and the risk of PTSD. In our cross-sectional analysis we found that the lowest level of NSC was significantly associated with elevated odds of past-year PTSD, independent of individual sociodemographic characteristics, individual perceived NSC, and number of traumatic events experienced. This association was strengthened after restricting analysis to those living in their current neighborhood at the time of the traumatic event on which their PTSD diagnosis was based. At the individual level, there was no significant relationship observed between NSC and the risk for PTSD in either unadjusted or adjusted analyses. These results demonstrate that social context shapes the risk of PTSD. They also suggest that social context shapes the response to traumas experienced at the individual level and, further, that changing the social context may shift vulnerability to PTSD.

As noted in the “[Introduction](#)”, there are at least two pathways that may account for the heightened risk of PTSD observed within less cohesive neighborhoods in this study. First, NSC may shape individual exposure to trauma. However, a secondary analysis of plausible network events in our dataset did not provide evidence in support of this hypothesis (Online resources 1, 2). Alternatively, NSC may influence the psychological consequences of exposure to trauma [9, 12, 37, 38]. This hypothesis is supported by the increased risk observed in this study when analysis was restricted to those who were living in their current neighborhood at the time of their traumatic event on which their PTSD diagnosis was based. Overall, these results favor the hypothesis that NSC shapes the risk of PTSD predominantly through individual responses to trauma. Notably, these macro-social influences on traumatic stress could not have been detected if analyses had been restricted to the individual level, and emphasize the need of incorporating multi-level analyses into studies investigating the social features of neighborhoods and mental illness [39].

To date, only one study has assessed the direct association between NSC and PTSD [38]. Similar to Gapen et al.’s findings, we found that low levels of NSC were associated with elevated risk of PTSD within an urban, predominately African American population [38]. However, our study differs from Gapen’s in several ways. First, past-year risk of PTSD was assessed rather than PTSD symptomatology over the prior 2 weeks [38]. Assessing

symptom expression over a 2-week period could plausibly introduce greater same-source bias, as those recently experiencing PTSD symptoms may be more likely to report lower levels of neighborhood cohesion [24, 31]. Second, the sampling design of our study allows for capture of Detroit as a whole. Gapen et al. [38] sampled from one medical facility, which has implications for generalizability and may have introduced selection bias resulting in overestimation of the effects of neighborhood cohesion on PTSD symptomatology. Finally, and most germane to this study, our work sought to assess the effect of NSC, measured at the neighborhood level, on the risk of PTSD while accounting for possible correlation between outcomes of individuals residing in the same neighborhood. This multi-level approach thus captured the (macro) social effects of NSC on individual health, assessed here as PTSD.

This study has limitations. The cross-sectional design does not allow for inferences about causation and the direction of causality. Specifically, reverse causation may have resulted in overestimates of the effects of interest, since those with prior mental illness may end up living in less cohesive neighborhoods. However, the mean length of residence in the one’s neighborhood was 18 years. Thus, if the neighborhood environment remains relatively constant over time, then this study’s cross-sectional associations may accurately capture the effects of these long-term cumulative exposures on the development of PTSD [21]. In addition, the measurement of NSC poses some limitations. Same-source bias is inevitable to some extent, since the same population was used to assess both PTSD and NSC [24, 31]. Therefore, those who have been diagnosed with PTSD may be more likely to report lower levels of social cohesion [24, 31], resulting in overestimates of the effects of interest. In addition, the definition of neighborhood is a limitation. That is, neighborhoods as assessed in this study may not be geographically meaningful, as the conception of community may transcend smaller levels of geography [40], and thus may not be the most pertinent to the development of PTSD [21]. However, this limitation would most likely have resulted in underestimates of the effects of interest [21]. Finally, the inability to discern whether or not potentially traumatic events occurred in participants’ neighborhoods, or due to exposures that involved people that participants may have known through their neighborhood network, are important limitations to our analyses as they do not allow complete capture of the influence of one’s neighborhood on the risk of PTSD.

PTSD has long-term life course consequences and substantial societal costs [5]. Together with prior research, this study suggests that interventions at the individual-level may fall short, as the social environments in which people live matter for PTSD and may demonstrate associations that differ than those observed at the individual level.

Public health interventions that address the neighborhood environment will play a role in reducing the burden of PTSD. Furthermore, additional studies should assess whether these contextual factors are also pertinent for other mental health outcomes.

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