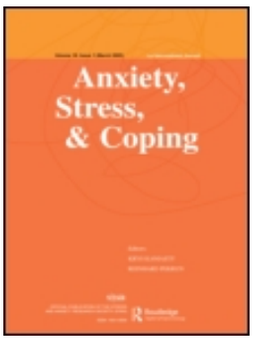

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Social integration buffers stress in New York police after the 9/11 terrorist attack

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Being socially integrated is regarded as a protective factor enabling people to cope with adversity. The stress-buffering effect reflects an interaction between stress and a social coping resource factor on subsequent outcomes. This study, based on 2943 police officers, examines mental health outcomes among officers who responded to the 9/11 terrorist attack on the World Trade Center. The Wave 1 data collection took place between September 2003 and November 2004 with a follow-up study (Wave 2) conducted from November 2006 through December 2007. A moderated mediation model was specified that uses event exposure as a distal predictor, earlier stress response as a mediator, and later stress response as an outcome, and social integration as a moderator of this relationship. The mediation hypothesis was confirmed, and moderation occurred at two stages. First, there was a multiplicative relationship between exposure levels and social integration: The higher the exposure level, the more stress responses occur, but this effect was buffered by a high level of social integration. Second, Wave 1 stress interacted with social integration on Wave 2 stress: The more the police officers were socially integrated, the lower the Wave 2 stress, which happened in a synergistic manner. The findings contribute to the understanding of mediating and moderating mechanisms that result in health outcomes such as posttraumatic stress disorder or resilience.

Keywords: resilience; social integration; trauma; posttraumatic stress disorder; stress buffer

Introduction

The terrorist attacks on the New York World Trade Center (WTC) on 11 September 2001, when two airplanes were piloted directly into the two towers, caused nearly 2800 immediate deaths and a substantial number of injuries (City of New York Bureau of Vital Statistics, 2003; Galea et al., 2002; Perlman et al., 2011). Police officers were among the first to arrive at the scene and witnessed people jumping from the burning and collapsing towers. Police officers were instrumental in assisting survivors, guarding the perimeter of the WTC site and makeshift morgues, and participating in the unremitting search for bodies and body parts. This experience represents a challenge for officers' mental health and resulted in diagnoses of

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posttraumatic stress disorder (PTSD) or less severe forms of anxiety and depression for many officers. However, a substantial number of officers were categorized as being resilient which means that they have bounced back from adversity in terms of mental health (Bonanno, Galea, Bucciarelli, & Vlahov, 2006; Bowler et al., 2012). The World Trade Center Health Registry (WTCHR) has accumulated a large longitudinal database on the health of people affected by the attack and its aftermath, and the present study is a reanalysis of some of these data. An earlier study has investigated the prevalence of PTSD using criteria of the Diagnostic and Statistical Manual (DSM) (American Psychiatric Association, 1994) and classified officers by their mental health outcomes three years after the WTC attacks (Bowler et al., 2012). Using four categories, 81% of the police officers were classified as being resilient, 5.3% as having chronic PTSD (in 2003–2004 as well as in 2006–2007), 11.2% as suffering from a delayed onset of PTSD (in 2006–2007), whereas 2.5% were found to have recovered from PTSD (no symptoms any longer in 2006–2007).

Following up these results, the present reanalysis examines resource factors that may account for the high level of resilience. Among such resource factors, social integration appears to be a promising candidate. Social integration refers to the structure and quantity of social relationships, such as the size and density of networks and the frequency of interaction. Social support, in contrast, refers to the function and quality of social relationships, such as perceived availability of help or support actually received. Support occurs through an interactive process and can be related to altruism, a sense of obligation, and the perception of reciprocity (Schwarzer & Knoll, 2010; Tay, Tan, Diener, & Gonzalez, 2013). As data on perceived or received support were not available, we limit our discussion to social integration.

A social integration index can include the number of roles one assumes in the family and in organizations, as well as the frequency of contact with other members of such groups. Duration of contacts and degree of reciprocity are also important. A social network represents a web of relationships that encircles an individual together with network characteristics, such as range or size (number of members), density (degree of interconnection), bondedness (extent of closeness such as kin, workplace, neighborhood), and homogeneity (similarity of members; Berkman, Glass, Brissette, & Seeman, 2000). There are various ways to assess these properties (for an overview, see Cohen, Underwood, & Gottlieb, 2000). Advanced network analyses have been used to document the dynamic spread of mental health and the clustering of well-being at the community level over a period of time (Fowler & Christakis, 2008). Community-based prospective epidemiological studies have documented a link between lack of social integration on the one hand and morbidity on the other. Socially isolated people are at risk for a variety of adverse mental and physical health outcomes.

According to stress theories (e.g., Hobfoll, 2010; Lazarus & Folkman, 1984), social integration represents one resource factor, among others, that influences the cognitive appraisal of stressful encounters. Coping is then a result of this cognitive appraisal. Consequently, theory suggests that better integration is associated with better coping, i.e., social integration represents a resource that not only influences coping, but also coping outcomes indirectly.

Social integration can have a main effect on various outcomes, or it can interact with the experience of stress. It has been postulated that social resources might reveal

their beneficial effect on health and emotions mainly in times of distress, as they may buffer the negative impact of stressful events. This moderating impact is known as the "stress-buffering effect" (Cohen & Wills, 1985). The stress–health connection can be better understood when accounting for mediating and moderating factors, including social resources and personal strengths that might help to buffer the adverse impact of stressful life events (Luszczynska, Benight, & Cieslak, 2009). Many studies have detected resources as the determinants of successful coping with a life event, which in turn buffer the detrimental effects for the mental and physical health of the victims (Schwarzer & Luszczynska, 2012). For example, social resources have buffered posttraumatic stress symptomatology in the military (Smith et al., 2013).

Aims

This analysis of WTCHR longitudinal data is focused on stress-buffering effects of social integration. We examine whether coping resources may moderate the detrimental effect of stress on mental health outcomes. In particular, the research question aims at identifying social integration as a beneficial resource factor that accounts for a less severe stress response in those who are socially more integrated. For this purpose, we specify a moderated mediation model that uses event exposure as a distal predictor, earlier stress response as a mediator, and later stress response as an outcome, and social integration as a putative moderator of this mediating relationship. It is expected that the 2007 stress response is predicted by the 2004 stress response which, in turn, depends on initial exposure levels. Technically, this makes the earlier stress response a mediator. If such mediation does not operate for all respondents but mainly for those who lack social integration, then the latter operates as a moderator on top of the mediation.

Method

Participants and procedure

The WTCHR, the largest post-disaster exposure health registry in US history, is following a diverse cohort of 71,437 directly affected people who performed 9/11-related rescue/recovery work or lived, worked or attended school in lower Manhattan on 9/11/01. The goals are to identify the long-term physical and mental health effects of the 9/11 WTC disaster; disseminate findings and recommendations to enrollees and others exposed, the public, and the scientific community; share information about 9/11-related resources and services; and inform healthcare policy and disaster response planning. Between September 2003 and November 2004, enrollees provided informed consent and completed a computer-assisted telephone (94.5%) or in-person (5.5%) enrollment interview regarding demographics, exposures incurred during and after the disaster, physical symptoms and mental health, and medically diagnosed conditions (Wave 1). A Wave 2 follow-up study, conducted from November 2006 through December 2007, requested an update of registrants' symptoms, medically diagnosed conditions and social integration. The Wave 2 study used two initial data collection modes: Internet-based and via mail. In the last three months of data collection, nonresponders were re-contacted to complete a computer-aided telephone interview.

The present study includes a subsample of 2943 police officers who had worked at least one shift from 11 September 2001 to 30 June 2002, at the WTC or related sites, or were involved in the transportation of the debris between the WTC site and barges, and completed both Wave 1 and Wave 2 questionnaires (Bowler et al., 2010). The sample included 2529 men and 414 women. Average age was 43.10 years ($SD =$ 7.26). Wave 2 survey nonresponders were more likely to be African-Americans, have lower income, fewer years of education, and were more likely to be unmarried and younger compared to Wave 2 responders. Details on demographics, including response rates and attrition analysis, are reported by Bowler et al. (2012).

The Centers for Disease Control and Prevention (CDC) and New York City (NYC) Department of Health and Mental Hygiene (DOHMH) institutional review boards approved the Registry protocol.

Measures

Stress response was assessed by symptoms indicative of probable posttraumatic stress disorder (PTSD) using the stressor-specific PTSD Checklist (PCL), a 17-item self-report instrument (U.S. Department of Veterans Affairs, National Center for PTSD, 2010) based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria (American Psychiatric Association, 1994) and linked to a specific traumatic exposure (i.e., "the events of September 11"). An example item is: How much have you been bothered by the following problems in the last 30 days: repeated, disturbing memories, thoughts, or images of the events of 9/11? Answers were made on a 5-point scale ranging from to "not at all" to "extremely." Cronbach's alphas were .92 at Wave 1, and .95 at Wave 2. Possible scores ranged from 17 to 85.

Exposure levels were assessed by the sum score of five events that the participants reported to have witnessed. Interviewer asked participant: "On September 11th, 2001, did you personally witness any of the following?" followed by the events: airplane hitting the WTC, buildings collapsing, people running away from cloud of smoke, witnessing anyone injured or killed, and witnessing people falling or jumping from WTC. Answers were yes/no, and possible scores ranged from 0 to 5. Cronbach's alpha was .78.

Social Integration was measured by a set of five items that referred to contacts with friends or relatives (e.g., writing, hosting, phone calls, visiting) such as "Over the last 12 months, about how often did you get together with friends or relatives like going out together or visiting each other's homes?" Response formats differed between 1 to 6 and 1 to 7, and, therefore, no sum score was calculated. Instead, standard factor scores were derived ranging from -2.76 to $+1.93$. Cronbach's alpha was .76. Table 1 provides an overview of measures and desciptive statistics, and Table 2 provides the correlation matrix.

Statistical analyses

All analyses were performed with SPSS 20. First, a simple mediation model was specified to predict Wave 2 stress response from exposure levels, using the PROCESS macro by Hayes (2012). Wave 1 stress served as a mediator which means that it depends on exposure levels and it predicts Wave 2 stress. Second, a moderated mediation model was examined. Social integration was specified as a putative

Table 1. Descriptive statistics of study variables.

Variable	Mean	SD	Alpha	Items	Range	N
Exposure	1.63	1.64	.78	5	0–5	2927
Social integration	0	1	.76	5	−2.76/1.93	2904
PCL Wave 1	25.56	9.91	.92	17	17–85	2943
PCL Wave 2	30.20	13.58	.92	17	17–85	2943
Age at Wave 2	43.10	7.26			23–74	2943

PCL = PTSD checklist of stress responses (U.S. Department of Veteran Affairs).

Table 2. Correlations of study variables.

	Exposure	Social	PCL Wave 1	PCL Wave 2
Exposure	1.00			
Social integration	.04*	1.00		
PCL Wave 1	.22**	.23**	1.00	
PCL Wave 2	.19**	.32**	.66**	1.00
Age at Wave 2	.08**	.07**	.08**	.06**

* $p < .05$, ** $p < .01$.
PCL = PTSD checklist of stress responses (U.S. Department of Veteran Affairs).

moderator at the left and right sides of the model (first and second stage moderation). This means that we expect the mediation model to only operate for a subgroup of participants who lack social contacts. Indirect effects were tested using the product of coefficients technique with bias-corrected bootstrapping (based on 5000 draws) and 95% confidence intervals (MacKinnon & Fairchild, 2009; Preacher, Rucker, & Hayes, 2007).

Results

First, the simple mediation model to predict Wave 2 stress response from exposure levels, with Wave 1 stress as a mediator and sex and age as covariates, resulted in a significant mediation effect, Sobel $z = 9.84$, $p < .001$. Building upon this finding, the moderated mediation model was tested, with social integration as the moderator at two stages (Model 58, according to the Process macro, Hayes, 2012). In addition to the main effects of social integration on stress responses, there was an interaction between exposure and social integration ($p < .001$), as well as an interaction between earlier stress responses and social integration on later stress responses ($p < .001$). Of the Wave 1 stress response variance, 12% were jointly predicted by exposure levels, social integration, and their interaction. Of the Wave 2 stress response variance, 48% were jointly predicted by the baseline, social integration, and their interaction. The model controlled for sex and age at Wave 1 only, because there was no association among covariates and Wave 2. Figure 1 displays the model with the unstandardized parameter estimates.

Figure 2 illustrates the buffer effect of social integration for the first stage moderation, reflected by an interaction between exposure levels and social integration on Wave 1 stress responses. A similar pattern emerged for the second stage

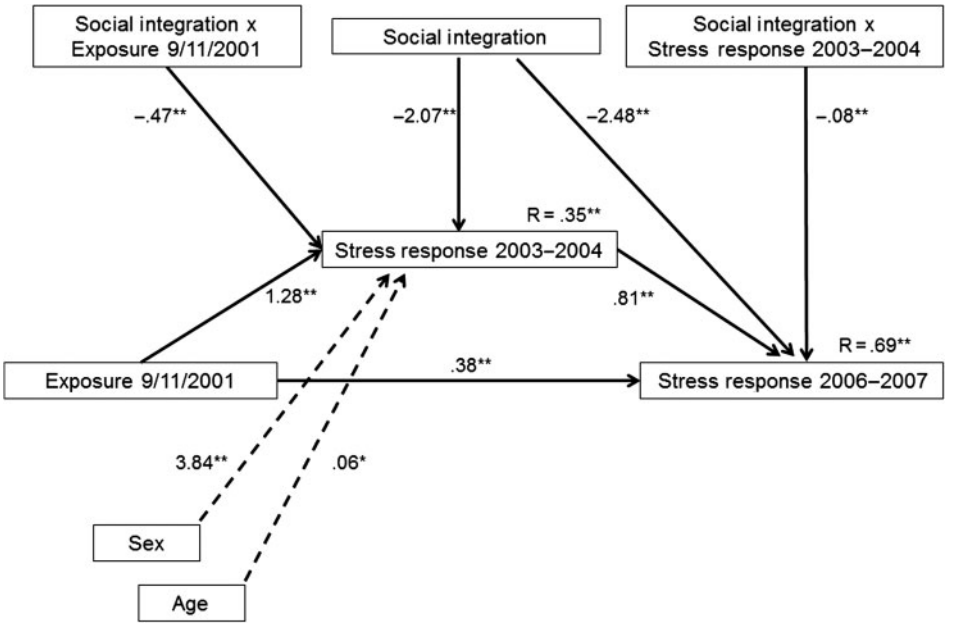

Figure 1. Mediation of Wave 1 stress responses between exposure levels and Wave 2 stress responses, moderated by social integration, controlling for sex and age at Wave 1.
Note: $N = 2887$ (2% missing data). Mean-centered solution with unstandardized coefficients; bootstrapped with 5000 resamples. Dotted lines refer to covariates.
$^{*}p < .05$, $^{**}p < .01$. Stress response measured by the PTSD checklist of stress responses (U.S. Department of Veteran Affairs).

moderation, the interaction between Wave 1 stress responses and social integration on Wave 2 stress responses.

Discussion

This reanalysis of the WTCHR longitudinal database has examined the stress-buffering effect and has identified social integration as a beneficial resource factor that accounts for a less severe stress response in police officers who are socially more integrated. Thus, the high rate of resilient officers that was found by Bowler et al. (2012) may be partly explained by such coping resources that moderate the detrimental effect of stress on mental health outcomes. By way of conditional process modeling, event exposure was specified as a distal predictor, earlier stress response as a mediator, and later stress response as an outcome. The mediation effect was confirmed, and social integration operated as a moderator of this mediation. As shown in Figure 2, there is a multiplicative relationship between exposure levels and social integration. The higher the exposure level, the more stress responses (main effect), but at a high level of social integration, this effect is buffered (interaction effect). The experience of witnessing horrible events in combination with a lack of social integration yields the highest level of stress. A similar pattern of results emerged at the right side of the model, where Wave 1 stress interacted with social

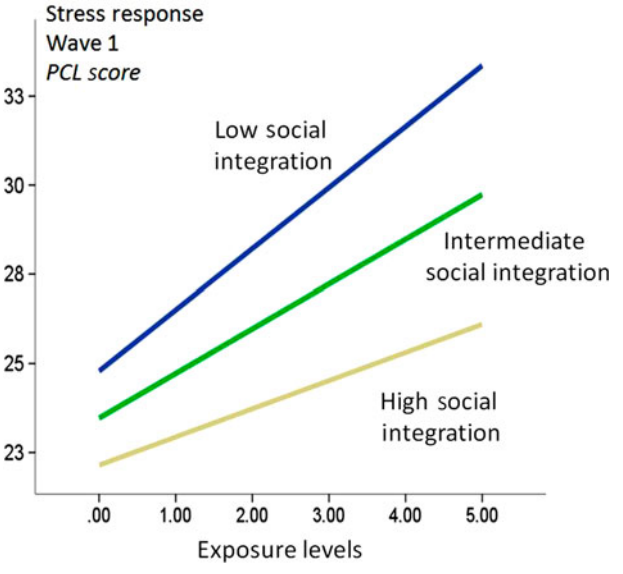

Figure 2. Slopes reflecting the interaction between exposure and social integration on Wave 1 stress response.
Note: Stress response measured by the PTSD checklist of stress responses (U.S. Department of Veteran Affairs).

integration on Wave 2 stress. The more social integration was present, the less Wave 2 stress was documented (main effect), in a synergistic manner (interaction effect).

Moreover, there were effects of gender on Wave 1 but not on Wave 2 stress responses. Women reported initially higher stress levels, but the sex differences ceased to exist later on (Bowler et al., 2010, 2012).

A limitation of the present data lies in their self-report nature and in the lack of additional measurement points in time. Specifying social integration at Wave 2, although with retrospective questions, makes the assumption that this constitutes a stable factor that has already been present before. All variables were assessed via interviews or questionnaires, and no objective data were available. It would be desirable to obtain objective data, in particular to have a valid event exposure measure that is not retrospectively assessed as in the present data. Moreover, self-reports of stress levels by police officers may be biased. The police likely represent a unique culture compared to area residents in their reluctance to reveal and self-disclose due to fears of job consequences which may result in losing the privilege of carrying a weapon (Dowling, Moynihan, Genet, & Lewis, 2006). Nevertheless, the longitudinal data on 2943 police officers who have experienced a traumatic life event embody a valuable resource for further study. The moderated mediation design explored in this analysis represents a step toward the closer examination of psychological mechanisms that will advance our understanding of social integration as a resource factor and help explain individual differences among those who may be more resilient against PTSD. Further research should explore the potential for workplace interventions that might strengthen the social resources of affected victims.

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