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Comparison of health outcomes among affiliated and lay disaster volunteers enrolled in the World Trade Center Health Registry

Indira Debchoudhury [a,*], Alice E. Welch [a], Monique A. Fairclough [a], James E. Cone [a], Robert M. Brackbill [a], Steven D. Stellman [a,b], Mark R. Farfel [a]

[a] New York City Department of Health and Mental Hygiene, World Trade Center Health Registry, 2 Gotham Center, 42–09 28th Street, 7th Floor, Queens, NY 11101, USA
[b] Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, USA

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ABSTRACT

Background. Volunteers (non-professional rescue/recovery workers) are universally present at man-made and natural disasters and share experiences and exposures with victims. Little is known of their disaster-related health outcomes.

Methods. We studied 4974 adult volunteers who completed the World Trade Center Health Registry 2006–07 survey to examine associations between volunteer type (affiliated vs. lay) and probable posttraumatic stress disorder (PTSD); new or worsening respiratory symptoms; post-9/11 first diagnosis of anxiety disorder, depression, and/or PTSD; and asthma or reactive airway dysfunction syndrome (RADS). Affiliated volunteers reported membership in a recognized organization. Lay volunteers reported no organizational affiliation and occupations unrelated to rescue/recovery work. Adjusted odds ratios (OR_{adj}) were calculated using multinomial regression.

Results. Lay volunteers were more likely than affiliated volunteers to have been present in lower Manhattan, experience the dust cloud, horrific events and injury on 9/11 and subsequently to report unmet healthcare needs. They had greater odds of early post-9/11 mental health diagnosis (OR_{adj} 1.6; 95% CI: 1.4–2.0) and asthma/RADS (1.8; 1.2–2.7), chronic PTSD (2.2; 1.7–2.8), late-onset PTSD (1.9; 1.5–2.5), and new or worsening lower respiratory symptoms (2.0; 1.8–2.4).

Conclusions. Lay volunteers' poorer health outcomes reflect earlier, more intense exposure to and lack of protection from physical and psychological hazards. There is a need to limit volunteers' exposures during and after disasters, as well as to provide timely screening and health care post-disaster.

Introduction

Volunteers are a universal feature of man-made and natural disasters serving as one of the main sources of outside support in post-disaster recovery work (Thormar, et al., 2010). In the last decade, volunteers have played a key role in recovery and relief efforts after the oil spill in the Gulf of Mexico (2010), the Haitian earthquake (2010), Hurricane Katrina (2005), the London transit bombings (2005), and the Indian Ocean earthquake and tsunami (2004). Volunteer participation is often necessary and unavoidable due to the magnitude and impact of such events (Thormar, et al., 2010).

On September 11, 2001, two airplanes crashed into the Twin Towers of the World Trade Center (WTC), causing their collapse and extensive damage to numerous other buildings. Approximately 2800 people lost their lives (Farfel, et al., 2008). Subsequent recovery and relief efforts included paid and volunteer professional rescue/recovery workers (RRW) (fire, police or other emergency personnel), volunteers affiliated with relief organizations and lay volunteers (i.e., not affiliated with a recognized response organization) (American Red Cross, 2002, Steffen and Fothergill, 2009, Tierney, et al., 2001). The WTC disaster exposed an estimated 409,000 individuals to potentially hazardous chemicals, environmental toxins and psychological stressors that are risk factors for asthma and posttraumatic stress disorder (PTSD) (Landrigan, et al., 2004, Murphy, et al., 2007). A recent review found that all WTC disaster workers including volunteers faced an increased risk of mental health sequelae as a consequence of their intense disaster exposures (Bills, et al., 2008). Findings from the 2003–04 WTC Health Registry (Registry) survey demonstrate that RRW in occupations less prepared for the type of work performed at WTC sites were more likely to develop PTSD (Perrin, et al., 2007).

* Corresponding author at: New York City Department of Health and Mental Hygiene, World Trade Center Health Registry, 2 Gotham Center, 42–09 28th Street, 7th Floor, Queens, NY 11101, USA. Fax: +1 212 788 4127.
E-mail addresses: idebchou@health.nyc.gov (I. Debchoudhury), awelch1@health.nyc.gov (A.E. Welch), mfairclo@health.nyc.gov (M.A. Fairclough), jcone@health.nyc.gov (J.E. Cone), rbrackbi@health.nyc.gov (R.M. Brackbill), sstellma@health.nyc.gov (S.D. Stellman), mfarfel@health.nyc.gov (M.R. Farfel).

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To build upon previous Registry findings by expanding the range of post-disaster outcomes, Registry data were used to compare mental and physical health outcomes and health care utilization among affiliated and lay volunteers. We hypothesized that lay volunteers would be more likely than affiliated volunteers to experience long-term adverse mental and physical health outcomes due to earlier arrival at WTC sites and more intense exposure to a multitude of hazards, as well as a lack of training, prior disaster experience, or insufficient post-disaster support. We also predicted they would be more likely to report unmet health care needs and less utilization of post-9/11 monitoring and treatment programs.

Methods

The Registry, created in 2002 by the NYC Department of Health and Mental Hygiene (NYCDOHMH) in collaboration with the Agency for Toxic Substances and Disease Registry, prospectively follows 71,437 individuals highly exposed to the WTC disaster and belonging to one or more eligibility groups: RRW and volunteers, lower Manhattan residents, area workers, passers-by, and school children and staff. The protocol was approved by the institutional review boards of the Centers for Disease Control and Prevention and NYCDOHMH.

List-identified enrollees were recruited from lists of potentially eligible individuals from governmental agencies, organizations, and employers. Self-identified enrollees contacted the Registry via phone or pre-registered on a website. The 2003–04 Wave 1 survey (W1) included 68,802 adults (Farfel, et al., 2008). The 2006–07 Wave 2 (W2) survey updated the health status of 46,322 of the original adult enrollees (68% response rate) (Brackbill, et al., 2009). Registry methods are described in detail elsewhere (Brackbill, et al., 2009, Farfel, et al., 2008, Perrin, et al., 2007).

The present analysis focuses on 4974 enrollees who completed W1 and W2 surveys, were aged 18 years or older on 9/11, and reported volunteering in rescue/recovery activities between 09/11/01 and 06/30/02. Enrollees identifying as professional RRW, whether paid or unpaid for their services, were not considered volunteers for this analysis. Volunteer status was categorized as affiliated or lay based on the W1 question, "What organization did you work for at the WTC site?" Affiliated volunteers reported membership in recognized organizations (e.g., American Red Cross). Lay volunteers reported no organizational affiliation and occupations unrelated to rescue and recovery work. Lay volunteers included members of church groups or community organizations and individuals present in the area immediately following the attack. The W2 response rates for affiliated and lay volunteers were 67.7% and 67.8% respectively. From 9/11/01 to 9/14/01 lower Manhattan south of 14th street was considered a restricted zone, open only to credentialed emergency management and rescue personnel (Lorber, et al., 2007). Lay volunteers may have subsequently joined a professional organization to continue volunteering. After October 2001, only Ground Zero was restricted (Lorber, et al., 2007). Students and school staff who worked as volunteers were excluded due to small numbers.

We included as categorical variables: recruitment source (list- vs. self-identified), gender, eligibility category (worker-only vs. multiple eligibility groups), age group, race/ethnicity, education, 2002 household income, employment status, New York City residency, and state of residence on 9/11.

We assessed exposures and experiences previously shown to be associated with increased risk of adverse mental and physical health outcomes. Presence on 9/11 was defined as meeting at least one of the following criteria: being south of Chambers Street between the first plane's impact and noon, being caught in the dust cloud, witnessing horrific events, sustaining an injury, or beginning work on the pile (the construction/restricted zone composed of rubble and remains from the collapse) on 9/11. Dust cloud exposure was classified as intense, some, or none (Brackbill, et al., 2009). Witnessing horrific events was assessed as having seen at least one of the following: an airplane hitting the WTC, people falling or jumping from the Towers, buildings collapsing, people running from a cloud or smoke, and people injured or killed. Injuries sustained on 9/11 included burns, cuts/abrasions/puncture wounds, sprain/strain, fractured/dislocated bones and head injury. Bereavement was defined as knowing anyone who lost his/her life on 9/11. Timing of volunteer work was classified by the first date enrollees worked at any WTC site and time spent at all sites combined. Because 9/11-related experiences were highly correlated with volunteer status, they were not controlled for in the data analyses.

A self-reported professional post-9/11 mental health diagnosis of depression, PTSD, and/or anxiety disorder for the first time after 9/11/01 was classified as early if diagnosed prior to 12/31/03 and late if diagnosed between 01/01/04 and 12/31/07. Date of diagnosis reflects time of presentation for care, not disease onset. Probable PTSD was defined as a score of 44 or greater on the stressor-specific PTSD Checklist-Civilian Version and categorized into four groups: chronic (W1+ (present at W1), W2+ (present at W2)), late onset (W1− (absent at W1), W2+), resolved (W1+, W2− (absent at W2)) or no PTSD (W1−, W2−) (American Psychiatric Association, 1994, Blanchard, et al., 1996, Dobie, et al., 2002, Koenen, et al., 2003, Perrin, et al., 2007, Ruggiero, et al., 2003).

New or worsening lower respiratory symptoms (LRS) since 9/11 were defined as having at least one of these symptoms at W1 that began or got worse after 9/11: wheezing, shortness of breath and/or persistent cough. Early post-9/11 asthma was defined as asthma or reactive airway dysfunction syndrome (RADS) diagnosed between 9/11/01 and 12/31/03 and late if diagnosed between 01/01/04 and 12/31/07.

Enrollees were asked at W2 if they had any unmet health care needs. Those answering affirmatively were asked if they were unable to get care for a problem related to 9/11. All were asked whether they had received any services from a list of established post-disaster medical monitoring and treatment programs.

Analyses were conducted using SAS Version 9.1 (SAS, 2005). Bivariate analyses tested differences between affiliated and lay volunteers using chi-square. Multinomial logistic analyses were performed for four outcomes: post-9/11 mental health diagnosis (early, late vs. no post-9/11), probable PTSD (chronic, late onset, resolved vs. no PTSD), new or worsening respiratory symptoms since 9/11, and post-9/11 asthma/RADS (early, late vs. none). Volunteer status (with affiliated volunteers as the reference group) was the primary predictor variable for all models. Crude and adjusted odds ratios and 95% confidence intervals (CI) are reported. Adjustment variables were recruitment source, gender, age on 9/11, race/ethnicity, and education.

Results

Volunteer groups differed significantly on all sociodemographic characteristics except education (Table 1). Affiliated volunteers were predominately list-identified, female, members of only one eligibility group, ages 45–64 years and non-Hispanic white. The largest proportion reported a 2002 household income of $25,000–49,999. Lay volunteers were predominantly self-identified, male, members of more than one eligibility group, ages 25–44, and non-Hispanic white. The largest proportion reported a 2002 household income of $75,000–149,999. Lay volunteers were more likely to have known someone who lost their life on 9/11 and to have lived in NYC or New York State (NYS) on 9/11.

Lay volunteers had a wider range of exposures and experiences than affiliated volunteers (Table 2). A substantially greater proportion of lay volunteers were present on 9/11 (77.3% vs. 25.7%), thereby at greater risk for acute exposures, such as: intense dust cloud exposure, witnessing horrific events and sustaining an injury on 9/11 than affiliated volunteers. More lay volunteers began work on 9/11 (29.7%) and worked seven days or less (74.1%) than affiliated volunteers. Almost half (48.7%) of affiliated volunteers arrived between 9/18/2001 and 12/31/2001, and the majority worked more than seven days (54.0%).

Compared to affiliated volunteers, lay volunteers were significantly more likely to have received a post-9/11 mental health diagnosis (30.9% vs. 18.6%), have probable PTSD at W1 or W2 (34.0% vs. 13.3%), and report new or worsening LRS since 9/11 (63.5% vs. 34.9%) as well as post 9/11 asthma/RADS (8.5% vs. 4.3%) (Table 3). Table 4.1 shows the crude and adjusted odds ratios for mental health outcomes. The odds of having an early post-9/11 mental health diagnosis was 1.6 times (95% CI: 1.4–2.0) greater among lay than affiliated volunteers. Lay volunteers were 2.2 times (95% CI: 1.7–2.8) more likely to have chronic probable PTSD, 1.9 times (95% CI: 1.5–2.5) more likely to have late-onset probable PTSD and 1.7 times (95% CI: 1.2–2.6) more likely to have resolved probable PTSD than affiliated