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Frequent binge drinking five to six years after exposure to 9/11: Findings from the World Trade Center Health Registry

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ABSTRACT

Background: Exposure to 9/11 may have considerable long-term impact on health behaviors, including increased alcohol consumption. We examined the association between frequent binge drinking, post-traumatic stress disorder (PTSD), and number of 9/11-specific experiences among World Trade Center Health Registry (Registry) enrollees five-to-six years after 9/11.
Methods: Participants included 41,284 lower Manhattan residents, workers, passers-by, and rescue/recovery workers aged 18 or older without a pre-9/11 PTSD diagnosis who completed Wave 1 (2003–2004) and Wave 2 (2006–2007) interviews. Frequent binge drinking was defined as consuming five or more drinks on five or more occasions in the prior 30 days at Wave 2. Probable PTSD was defined as scoring 44 or greater on the PTSD Checklist. 9/11 exposure was measured as the sum of 12 experiences and grouped as none/low (0–1), medium (2–3), high (4–5) and very high (6+).
Results: Frequent binge drinking was significantly associated with increasing 9/11 exposure and PTSD. Those with very high and high exposures had a higher prevalence of frequent binge drinking (13.7% and 9.8%, respectively) than those with medium and low exposures (7.5% and 4.4%, respectively). Upon stratification, very high and high exposures were associated with frequent binge drinking in both the PTSD and no PTSD subgroups.
Conclusions: Our findings suggest that 9/11 exposure had an impact on frequent binge drinking five-to-six years later among Registry enrollees. Understanding the effects of traumatic exposure on alcohol use is important to identify risk factors for post-disaster alcohol misuse, inform policy, and improve post-disaster psychological and alcohol screening and counseling.

1. Introduction

The September 11, 2001 (9/11) terrorist attacks have had considerable long-term consequences for physical and mental health and health behaviors for many of those directly exposed, including Manhattan residents, passers-by, office workers, and rescue and recovery workers (Brackbill et al., 2009). Additionally, 9/11 exposures were associated with high levels of psychological stress on dimensions linked with increased risk for heavy drinking and alcohol problems (Keyes et al., 2011), including severity, unexpectedness, and threat to physical as well as emotional integrity. Indeed, an elevated prevalence of post-disaster alcohol use has been consistently described in multiple populations exposed to traumatic events. Higher levels of alcohol use have been found in firefighters who served as rescue workers during the Oklahoma City bombing (North et al., 2002), survivors of Hurricane Katrina (Flory et al., 2009), and individuals who were impacted by the 9/11 terrorist attacks, including New York City (NYC) residents (Vlahov et al., 2002), Pentagon staff (Grieger et al., 2003), members of the Fire Department of New York (FDNY; Berninger et al., 2010) and individuals living in an area adjacent to NYC (Hasin et al., 2007); these findings are summarized in a meta-analysis by DiMaggio et al. (2009).

Among Manhattan residents living south of 110th Street, Vlahov et al. (2004) identified increases in alcohol use associated with level of 9/11-related exposure up to nine months after 9/11. Similarly, among NYC adults, level of exposure on 9/11 was associated with binge drinking one, and again two years after 9/11 (Boscarino et al.,

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2006). Personal proximity to the WTC on the day of the attack was associated with subsequent elevated drinking three months post-9/11 among residents of an area directly adjacent to NYC in New Jersey, even after controlling for a lifetime history of alcohol dependence (Hasin et al., 2007). Moreover, the prevalence of post-disaster problem drinking was two to six times greater among individuals with symptoms of posttraumatic stress disorder (PTSD) compared to those without symptoms (Adams et al., 2006; Berninger et al., 2010; Boscarino et al., 2011; Vlahov et al., 2006). These findings demonstrate that there likely exists a complex relationship among exposure to the events of 9/11, symptoms of PTSD, and problem drinking behaviors.

Despite multiple studies documenting elevated rates of binge drinking following exposure to 9/11, several important areas remain unexplored. Studies have usually measured drinking after relatively short periods of time (one month to two years post-exposure); less is known about longer-term effects of 9/11 exposures and drinking, or about possible co-factors that may increase risk or extend it across time. Additionally, with the exception of Adams and Boscarino (2005), previous studies had limited data on type and intensity of 9/11 exposures and their relationship to drinking patterns. Very little information is available on how exposure to severe, unexpected trauma among adults impacts long-term drinking patterns. We examined the relationship between intensity of 9/11-related exposures, PTSD, and frequent binge drinking five to six years after 9/11 in a large cohort of adults directly exposed to the events of 9/11.

2. Methods

2.1. Data source

The World Trade Center Health Registry (the Registry) is a cohort study of 71,434 individuals directly exposed to the events of 9/11 and its aftermath. Details on recruitment methods and Registry findings have been published elsewhere (Brackbill et al., 2009; Farfel et al., 2008; Murphy et al., 2007). In summary, Registry enrollees belong to one or more of five eligibility groups: rescue/recovery workers and volunteers; lower Manhattan residents; area workers; passers-by; and school children and staff. There were two modes of enrollment into the Registry; list-identified enrollees (30%) were actively recruited from lists provided by governmental agencies, organizations, and employers, while self-identified enrollees (70%) contacted the Registry via phone or pre-registered on a website in response to intensive outreach efforts (Farfel et al., 2008). The Wave 1 baseline survey (2003–2004) included 68,802 adults, and elicited information on 9/11-related exposures and indicators of physical and mental health (Farfel et al., 2008). The Wave 2 survey (2006–2007) obtained additional information on 9/11-related exposures and provided an update on the health status of 46,602 (68%) of the original adult enrollees (Brackbill et al., 2009). The Registry protocol was approved by the institutional review boards of the Centers for Disease Control and Prevention and NYC Department of Health and Mental Hygiene.

2.2. Study sample

Data on alcohol consumption were collected only at Wave 2; thus, this analysis is limited to adult enrollees (i.e., 18 or older at Wave 1) who completed both survey waves ($n = 46{,}374$). Since a prior history of PTSD is associated with alcohol use (Breslau, 2009; Brewin et al., 2000; Chilcoat and Breslau, 1998; McFarlane, 1998), enrollees with medically diagnosed PTSD prior to 9/11 ($n = 602$), PTSD with a missing date of diagnosis ($n = 324$) or missing information on history of PTSD diagnosis ($n = 1449$) were excluded. Enrollees identifying only as school students or staff ($n = 86$) were excluded due to small numbers. Enrollees missing information on binge drinking ($n = 2629$) were also excluded. This resulted in a final sample of 41,284.

Enrollees completing Wave 2 were more likely to be self-identified, English speakers, male, aged 45–64, non-Hispanic whites, higher income, former smokers, and rescue and recovery workers; however, response rates did not vary by 9/11 exposures (Brackbill et al., 2009).

2.3. Measures

2.3.1. Primary outcome—frequent binge drinking. The study outcome, self-reported frequent binge drinking in the last 30 days, was derived from responses to the following question, "Considering all types of alcoholic beverages, how many times during the last 30 days did you have five or more drinks on one occasion?" Enrollees consuming five or more drinks on a single occasion on five or more days in the past 30 days were categorized as frequent binge drinkers (Substance Abuse and Mental Health Services Administration, 2011). This measure of frequent binge drinking has been used in several studies of college students, as it indicates a pattern of high-risk drinking that consists of binge drinking more than once per week and may lead to a greater risk of negative consequences when compared to infrequent binge drinking (Wechsler et al., 2002; White et al., 2006). Enrollees who reported having five or more drinks on a single occasion on fewer than five occasions in the last 30 days or who reported no binge drinking at all were categorized as non-frequent binge drinkers (Substance Abuse and Mental Health Services Administration, 2011).

2.3.2. Sociodemographic variables. We included sociodemographic variables that were associated with excess alcohol use in previous studies: age, gender, race/ethnicity, education, 2002 household income, marital status, and tobacco use; information on these variables was collected at either Wave 1 or 2. Consistent with previous Registry studies (Brackbill et al., 2009; Farfel et al., 2008), enrollees were categorized hierarchically into eligibility groups based on exposure using the following ordering: rescue/recovery worker, lower Manhattan resident, or lower Manhattan area worker/passer-by.

2.3.3. WTC exposures. Exposure to the events of 9/11 was defined with a summary measure shown to be associated with mental health status and unmet mental health care need among Registry enrollees (Brackbill et al., 2013). This measure was defined as the number of positive responses to the following 12 events assessed at either Wave 1 or Wave 2: (1) being in the North or South WTC towers or another collapsed building at the time of the attack; (2) witnessing three or more events (seeing planes hit the buildings, buildings collapsing, people falling or jumping from buildings, people injured, or people running); (3) fear of being injured or killed; (4) having a relative killed on 9/11; (5) having a friend killed on 9/11; (6) having a co-worker killed on 9/11; (7) experiencing intense dust cloud; (8) having lost or damaged possessions; (9) sustaining an injury other than eye irritation/injury; (10) being a rescue/recovery or clean-up worker; (11) having evacuated one's home for at least 24 h after 9/11; and (12) having lost one's job because of 9/11. Based on the score distribution, exposure was categorized as none/low (0–1 experiences), medium (2–3), high (4–5), and very high (6 or more). This scale covers several dimensions of 9/11-related exposure, and each item has been shown to be associated with physical and/or mental health outcomes in previous Registry studies (Brackbill et al., 2009; DiGrande et al., 2011). A similar measure was used by Adams et al. (2006).

2.3.4. Posttraumatic stress disorder. Probable PTSD was assessed at Wave 2 using the PTSD Checklist-Civilian Version (PCL-17). The PCL-17 is a self-reported, 17-item scale corresponding to the criteria in the DSM-IV that is commonly used in epidemiological research (Blanchard et al., 1996; Ruggiero et al., 2003). Selected symptoms were queried as specific to 9/11 and all were current (within the last 30 days). Psychometric properties of the PCL used in this manner in other settings and with other traumatized populations have reported sensitivity ranging from 0.94 to 0.97, specificity from 0.86 to 0.99, positive predictive value from 0.70 to 0.97, and diagnostic efficiency from 0.83 to 0.96 (Blanchard et al., 1996; Ruggiero et al., 2003; Ventureyra et al., 2002; Weathers et al., 1993). Because studies have shown that the diagnostic efficiency of the PCL is improved when using a cut-off of 44 as opposed to 50 (Blanchard et al., 1996), in this study, as well as previous Registry studies (Brackbill et al., 2009; Debchoudhury et al., 2011; Farfel et al., 2008; Li et al., 2011), enrollees with a PCL score of 44 or greater at Wave 2 were considered to have probable PTSD (hereafter referred to as PTSD).

2.4. Analysis

Chi-square tests were used to test for significant associations between frequent binge drinking and selected sample descriptors and covariates. Cochran-Armitage tests were used to detect trends between age group and frequent binge drinking and exposure category and frequent binge drinking in the full sample and when stratified by PTSD. Using logistic regression, unadjusted and adjusted odds ratios were calculated to estimate the strength of the association between selected covariates and frequent binge drinking. Based on the results of preliminary analyses adjustment variables were: age group, race/ethnicity, gender, education, 9/11 exposures, tobacco use, and probable PTSD. The final model was stratified by PTSD status. We tested for interaction between PTSD and 9/11 exposures on an additive scale by assessing the relative excess risk due to interaction (RERI) using PROC NLMIXED in SAS (Richardson and Kaufman, 2009). Because there were four exposure categories, we assessed the RERI in three separate models comparing each level of exposure to the no/low exposure group. Analyses were conducted using SAS Version 9.2.

3. Results

The majority of the study population was aged 45–64 years at Wave 2 (50.9%), non-Hispanic white (71.5%), male (62.1%), married or living with a partner at Wave 2 (69.2%), and reported having a college or post-graduate education at Wave 1 (54.5%; Table 1). More than one-fourth (28.2%) reported a 2002 household income

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