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Post-9/11 drug- and alcohol- related hospitalizations among World Trade Center Health Registry enrollees, 2003–2010

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ABSTRACT

Objective: To describe patterns of drug- and alcohol-related hospitalizations among persons exposed to the 2001 World Trade Center (WTC) terrorist attacks and to assess whether 9/11-related exposures or post-9/11 post-traumatic stress disorder (PTSD) were associated with increased odds of hospitalization.

Methods: Data for adult enrollees in the WTC Health Registry, a prospective cohort study, were linked to New York State (NYS) administrative hospitalization data to identify alcohol- and drug-related hospitalizations from enrollment to December 31, 2010. Logistic regression was used to analyze the associations between substance use-related hospitalization, 9/11-related exposure and PTSD.

Results: Of 41,176 NYS resident enrollees, we identified 626 (1.5%) who had at least one alcohol- or drug-related hospitalization; 53.4% (n = 591) of these hospitalizations were for alcohol only diagnoses and 46.6% (n = 515) were drug-related. Witnessing ≥ 3 traumatic events on 9/11 was significantly associated with having a drug-related hospitalization (AOR 1.4, 95% CI = [1.1, 1.9]). PTSD was significantly associated with both having a drug-related hospitalization as well as an alcohol only-related hospitalization. (AOR 2.6, 95% CI = [2.0, 3.3], AOR 1.8, 95% CI = [1.4, 2.3], respectively).

Conclusions: Witnessing traumatic events and having PTSD were independently associated with substance use-related hospitalizations. Targeting people who witnessed traumatic events on 9/11 and/or who have PTSD for substance use- treatment could reduce alcohol and drug-related hospitalizations connected to 9/11.

1. Introduction

In the United States, alcohol and drug use are important public health concerns. Data from the Nationwide Inpatient Sample showed that, for those aged 45 and older, alcohol-related hospital admissions have increased 86% from 610,634 in 1993 to 1,134,876 in 2010 (Sacco et al., 2015). Among New York City residents, the rates of both drug and alcohol-related hospitalizations increased from 2009 to 2012 (drugs: from 553 to 585 per 100,000, and alcohol: from 561 to 616 per 100,000; New York City Department of Health and Mental Hygiene, 2017). Studies have shown that the September 11, 2001 terrorist attacks in New York City are associated with increased odds of substance use behaviors. Findings from a study that used the CAGE questionnaire, a screening test for potential alcohol problems, as well as additional questions about drinking, suggest that 2.2% of the six million people in New York City (NYC) had new onset drinking problems after 9/11 (Vlahov et al., 2006). Other studies have shown significant differences in drinking habits after 9/11 associated with a higher level of 9/11 exposure (Welch et al., 2014; Beseler et al., 2011; Boscarino et al.,

2006), low education, male sex, and Latino ethnicity (Boscarino et al., 2006).

Post-traumatic stress disorder (PTSD) is one of the most common mental health conditions observed post-9/11. Studies have shown a significantly higher prevalence of PTSD among persons who were directly exposed to the 9/11 attack or its aftermath compared to those less directly exposed (Brackbill et al., 2009; Galea et al., 2002; Welch et al., 2016; Maslow et al., 2015; Farfel et al., 2008). PTSD was significantly associated with more frequent (Welch et al., 2014) and more intense (Welch et al., 2016) binge drinking among World Trade Center Health Registry enrollees. A study by Boscarino et al. (2011) found that increased alcohol consumption and binge drinking were associated with PTSD onset after 9/11, and that among those with delayed-onset PTSD post-9/11, alcohol consumption significantly increased over time from one year before 9/11 to at least 24 months after the 9/11 attacks.

While numerous studies have examined the associations between exposure to 9/11, PTSD, and self-reported alcohol use, there is a limited body of research examining their associations with objective measures of alcohol use as well as other substance use, such as illicit drugs. This

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study assesses hospitalizations due to drug- or alcohol-related diagnoses among a 9/11-exposed population that includes World Trade Center responders and community members who lived and/or worked in the affected area in NYC. Based on previous findings, we hypothesize that higher levels of 9/11-related exposure and PTSD will be associated with increased odds of having a drug- or alcohol-related hospitalization.

2. Material and methods

2.1. Data sources

2.1.1. World Trade Center Health Registry

This study used data from the World Trade Center Health Registry (Registry). The Registry is a longitudinal cohort study of 71,431 people who were enrolled 2 years after 9/11 with a baseline survey of all participants (“enrollment”) (Farfel et al., 2008). In order to be eligible for enrollment, one needed to be: (1) a rescue or recovery worker or volunteer at Ground Zero or at the Staten Island recovery site, (2) a building occupant or passer-by south of Chambers Street on 9/11, (3) a resident south of Canal Street on 9/11, or (4) a student or staff at a school south of Canal Street on 9/11. The baseline survey included questions pertaining to a person’s exposure to the disaster on 9/11, demographic information, as well as physical and mental health status. All enrollees provided verbal informed consent.

2.1.2. Statewide Planning and Research Cooperative System

The substance use-related hospitalization data were obtained from the Statewide Planning and Research Cooperative System (SPARCS), which is a database of patient-level details on over 95% of all hospitalizations in the state of New York, excluding federal and psychiatric hospitals (New York State Department of Health, 2002). This study excluded persons who did not live in New York State at enrollment ($n = 27,671$) and who did not live in New York State on 9/11 ($n = 453$), who withdrew from the Registry ($n = 423$), were younger than 18 years of age ($n = 1372$), or had at least one alcohol- or drug-related hospitalization prior to enrollment ($n = 336$). This resulted in a sample size of 41,176 enrollees to be included in the analysis.

2.2. Measures

2.2.1. Drug- and alcohol-related hospitalizations

This study evaluated hospitalizations that occurred between Registry enrollment and December 31, 2010. A hospitalization was determined to be alcohol- or drug-related if an ICD-9 code indicating alcohol or drug use was listed as either a primary or secondary diagnosis. The ICD-9 codes used in this analysis were selected based on the Healthcare Cost and Utilization Project’s Statistical Brief #191 (Heslin et al., 2012). Diagnoses included those indicating alcohol or drug dependence (ICD-9 codes 265.2, 303, 304, 357.5, 425.5, 535.3), non-dependent abuse (ICD-9 codes 305.0, 305.2–305.9), poisoning (ICD-9 codes 965, 967, 969, 970, 968.0, 968.5, 980.0), alcohol or drug-induced mental disorders (ICD-9 codes 291 and 292), and alcohol-related chronic health conditions such as alcoholic cirrhosis of the liver and alcoholic gastritis (ICD-9 codes 571.0–571.9, with the exception of 571.5). Hospitalizations were categorized as either having only an alcohol-related diagnosis with no drug-related diagnosis (referred to as “alcohol only”) or having a drug-related diagnosis, regardless of whether there was an additional alcohol-related diagnosis. One person could have had multiple hospitalizations, including both alcohol only- and drug-related hospitalizations.

2.2.2. World Trade Center exposure

Traumatic exposure to the World Trade Center disaster (WTC) was a main risk factor of interest and comprised four items: (1) having been a rescue/recovery worker, (2) having sustained an injury other than an eye irritation/injury on 9/11, (3) having been present in the North or

South Towers or other buildings that fully collapsed or having been south of Chambers Street at the time of the attack, and (4) having witnessed three or more traumatic events on 9/11 (planes hitting the buildings, the buildings collapsing, people falling or jumping from the buildings, people injured or people running.) Eligibility into the WTC Health Registry required exposure to the 9/11 disaster, though the types and degree of exposure vary among persons in the cohort. Therefore, we used internal comparisons to assess the association between specific exposures and substance use hospitalizations.

2.2.3. Mental health

Probable 9/11-related PTSD (referred to as “PTSD”) was the other main risk factor of interest for alcohol- and drug-related hospitalizations. PTSD is an anxiety disorder that is triggered by a traumatic, perceived life-threatening event. In this study, PTSD at enrollment was measured using the PTSD Checklist (PCL-17) that was specific to 9/11. The PCL-17 is a self-administered 17-item questionnaire that assesses the degree to which a person has been bothered by a particular symptom in the preceding month, measured from 1 (“not at all”) to 5 (“extremely”). The total score ranges from 17 to 85. This scale assesses three domains of PTSD: re-experiencing, avoidance and hyperarousal based on the criteria from the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). The internal reliability for the scale is 0.929, and the validity ranges from 0.820 to 0.935 (Blanchard, 1996). We used a cut-off score of 44 or greater to indicate probable PTSD, which has previously been determined to have the highest sensitivity and specificity: 0.944 and 0.864, respectively (Blanchard, 1996).

2.2.4. Sociodemographic variables

Covariates included the sociodemographic variables age at enrollment, race, Hispanic or Latino ethnicity, gender, education level, marital status, and history of smoking (Boscarino et al., 2006; Boscarino et al., 2011; Galea et al., 2002). History of physical health conditions, including self-reported cancer, diabetes, emphysema, stroke, angina, heart disease, hypertension, other heart conditions, or asthma, was also included as a covariate. Data on these variables were collected at enrollment.

2.3. Statistical analysis

Chi-squared tests were used to test for significant associations between the proportions of enrollees with and without a drug-related or alcohol only-related hospitalization and sociodemographic characteristics, WTC exposure, and physical and mental health conditions. Multivariable logistic regression was used to calculate adjusted odds ratios for the associations between PTSD, 9/11 exposures and being hospitalized with a drug- or alcohol-related diagnosis. Initial models for both analytic methods included the four World Trade Center exposures as well as all of the sociodemographic and physical health variables listed above. Further analysis was performed by adding PTSD to the initial models to assess its effect on the association between WTC exposure and substance-related hospitalizations. Analyses were conducted using R studio Version 0.99. Statistical significance was set at a two-sided p -value of less than .05.

3. Results

3.1. Study population characteristics

Of the 41,176 enrollees in this study, the largest proportions were male (61.9%), between the ages of 25 and 44 years (53.2%), non-Latino white (60.8%), married or living with a partner (61.7%), had earned a college or post-graduate degree (46.8%), and had never smoked (57.2%) (Table 1). With respect to the 9/11-related exposures and PTSD, 21.2% of the enrollees in the sample had been injured on 9/11, 47.8% had been rescue/recovery workers, 40.0% had witnessed three

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