Alcohol use trajectories among adults in an urban area after a disaster: evidence from a population-based cohort study

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ABSTRACT

Alcohol use increased in the New York City (NYC) metropolitan area in the first months after the 11 September 2001 terrorist attacks. Aims To investigate alcohol use trajectories in the NYC metropolitan area in the 3 years after 11 September and examine the relative contributions of acute exposure to the attacks and ongoing stressors to these trajectories. Design We used a population-based cohort of adults recruited through a random-digit-dial telephone survey in 2002; participants completed three follow-up interviews over 30 months. Setting The NYC metropolitan area. Participants A total of 2752 non-institutionalized adult residents of NYC. Measurements We used growth mixture models to assess trajectories in levels of total alcohol consumption and bingeing in the past 30 days, and predictors of these trajectories. Findings We identified five trajectories of alcohol consumption levels and three bingeing trajectories. Predictors of higher levels of use over time included ongoing stressors, traumatic events and lower income. Ongoing exposure to stressors and low income also play a central role in bingeing trajectories. Conclusions While point-in-time mass traumatic events may matter in the short term, their contribution subsides over time. Accumulated stressors and traumatic events, in contrast, lead to higher levels of consumption among respondents already vulnerable to high alcohol use. Interventions to mitigate post-disaster stressors may have substantial benefit in reducing alcohol abuse in the medium- to long term.

Keywords Alcohol use, bingeing, disasters, growth mixture, stressors, trajectories, trauma.

BACKGROUND

Patterns of alcohol use vary over the life course [1–6]. These include people who are stable non-users or who have stable low-use alcohol histories, stable high-use alcohol drinkers, people who ‘mature out’ of heavy drinking over time and those who drink more and more alcohol over time or report late onset of heavy alcohol use [7]. It is likely that different trajectories of alcohol use over the life course suggest distinct etiological profiles of problem drinking. Understanding what distinguishes, for example, stable high-level consumers from those who start out with high levels of alcohol use but decrease over time is important for developing more informed etiological models and developing effective interventions aimed at preventing heavy alcohol consumption.

Preliminary research indicates that stressful and traumatic life events over the life course can play a critical role in generating different pathways of risk behaviors, including alcohol use [8–12]. Sartor et al. [9] found that, among offspring of male twins from the Vietnam Era Twin Registry, parental divorce during childhood was associated with early alcohol initiation. Windle et al. [11] investigated trajectories of heavy alcohol use from adolescence to adulthood and found that stressful and traumatic life events, such as death of a parent or failing one or more subjects, were associated with a higher likelihood of belonging to a heavy use group among males. This study examined the influence of stressful events at only one point in time instead of comparing the relative impact of acute versus accumulated stressors. Although these studies indicate that life events may play
an important role in shaping alcohol use trajectories, we know little about how the accumulation of stressful and traumatic events over the life course influence alcohol use trajectories.

Disaster events offer an important opportunity to consider the influence of acute life events on alcohol use trajectories at a population level. Such events affect the whole population in the area of influence. Moreover, as they affect people in a random manner, disaster events are free from selection bias: alcohol use patterns are not likely to make people more vulnerable to have direct exposure to a disaster.

We are not aware of any studies that have looked at alcohol use trajectories in the post-disaster context. The extant literature measuring patterns of alcohol consumption at single time-points after natural disasters offers conflicting results, while studies investigating the impact of terrorist events do not compare alcohol levels in those exposed to attacks to comparable respondents who had not experienced an attack. Some studies have found a short-term impact of natural disaster exposures on alcohol use or related substance use. Reijneveld et al. [16], for example, found that adolescents exposed to a fire in a café in Volendam, the Netherlands, that resulted in 250 wounded adolescents and killed 14, reported more excessive use of alcohol than controls. In contrast, Kohn et al. [13] did not find a higher risk of alcohol misuse among elderly people exposed to Hurricane Mitch in Honduras. A need exists to move beyond studies that examine the impact of disasters at a static point of time to research that examines the impact of acute stressful life events on different pathways of substance use over the long term, and within the broader context of ongoing life stressors that may play a role in the determination of substance use.

This study examines the trajectories of alcohol use and bingeing in the aftermath of the World Trade Center (WTC) disaster that took place in New York City on 11 September 2001. The attacks were the largest human-made disaster in the United States since the Civil War: in New York City alone, 2726 people died and a large part of lower Manhattan suffered extensive damage from the attacks [20]. Previous research has documented an increase in alcohol use in the short term after the 11 September terrorist attacks [20–22], and a few population-based studies have found an association between exposure to the attacks and alcohol use [23,24]. However, research has been limited to the first few months after the disaster and has been cross-sectional: no prospective studies have assessed the long-term impact that exposure to the attacks had on alcohol use. More importantly, no studies have compared the impact of disasters to the influence that daily sources of stress and trauma have on alcohol use. This is a particularly important issue in the post-disaster context, when stressors and traumatic events may be particularly prevalent. Understanding the impact that the attack itself, in contrast to post-event cumulative stressors and traumatic events, has on alcohol use can help policy makers determine how to allocate resources to facilitate the post-disaster recovery process. In this study we set out to (i) document the trajectories of alcohol use after a large-scale human made disaster; and (ii) assess the relative role of exposure to a disaster and ongoing stressors in influencing the trajectories of alcohol use over several years. We examined alcohol use in two ways: (i) the trajectories of the full range of alcohol consumption from no use to regular high levels of consumption; and (ii) the particular patterns of heavy alcohol consumption, or bingeing, in the aftermath of the 11 September 2001 terrorist attacks.

**METHODS**

**Sample**

We conducted a prospective, population-based cohort study of the adult population of the New York City (NYC) metropolitan area. The cohort was assembled to assess the mental health of the NYC metropolitan area population approximately 6 months after the WTC disaster. Methods are described in detail elsewhere [25]. Respondents were sampled through simple area probability random-digit-dialing between 25 March 2002 and 25 June 2002. Adults in each household were selected randomly by choosing the adult whose birthday was closest to the interview date. The study had a survey cooperation rate of 56% and a response rate of 36%. Interviews were conducted in English, Spanish, Mandarin and Cantonese by trained interviewers using back-translated questionnaires and a computer-assisted telephone interview system.

Participants were followed approximately 6 months after baseline (25 September 2002–31 January 2003) and subsequently at yearly intervals (25 September 2003–29 February 2004, 15 December 2004–30 November 2005). Hence, the study follows participants approximately 6, 12, 24 and 39 months after the occurrence of the WTC disaster.

The original sample consisted of 2752 respondents: of these, 2282 completed at least one interview and were included in this study: 46% completed all four interviews. Among those who missed interviews, 21% missed one interview, 16% missed two and 17% missed three. There were no differences between included and excluded respondents on prevalence of bingeing and level of alcohol consumption or exposure to the WTC disaster, traumatic experiences or stressors at baseline; however, the excluded respondents were less likely to be females.
and more likely to be Hispanic, between 25 and 34 years of age, single and to have a high school-level education than the included respondents. The included respondents were 45.3% male, 60.6% white, 5.7% Asian, 14.1% African American and 16.2% Hispanic and 3.3% other race/ethnicity. The mean age was 44.7 years. The analytical sample has been shown to be representative of the NYC population based on 2000 Census data [26].

Measures

Alcohol consumption was assessed in two ways at each interview: (1) total number of drinks consumed per day in the past 30 days and (2) bingeing, defined as a binary variable, denoting having consumed an average of five or more drinks per day in the past 30 days for male respondents and as consuming an average of four or more drinks for females. Total consumption in the past 30 days was calculated by multiplying the number of days on which respondents reported to have drunk alcohol in the past 30 days (i.e. ‘thinking about just the past 30 days, on how many days did you drink any alcoholic beverages?’) and the average number of drinks reported per day (i.e. ‘on the days when you drank alcohol over the past 30 days, on average, how many drinks did you have each day?’). Alcohol consumption was first assessed in the baseline survey for the 30 days prior to the 11 September 2001 terrorist attacks, and also for the 30 days prior to the interview. In subsequent interviews, respondents were asked only about the number of drinks consumed per day for the past 30 days. All five times of measurement of alcohol use (i.e. the retrospective report of alcohol consumption on the 30 days prior to 11 September, and the reports of consumption on the 30 days prior to the baseline and three follow-up interviews) were used in the analysis.

We also measured characteristics that, in previous work, have been shown to be associated with alcohol consumption [27–34]. Demographic variables included age, gender, race/ethnicity, education, low income (defined as earning less than $30,000 per year) and marital status. Direct exposure to the attacks of 11 September 2001 was operationalized as having: been in the WTC complex during the attacks, been injured during the attacks, lost possessions or property due to the attacks, had a friend or relative killed, lost a job as a result of the attacks, or been injured during the attacks, lost a friend or property due to the attacks, had a friend or relative seriously injured or violently killed; death of a spouse or mate; death of a close family member other than a spouse; any other extraordinarily stressful situation or event) in their lifetime at baseline; at each subsequent interview, respondents were questioned about traumatic events that had occurred since the previous interview. We also asked about stressors that may be experienced in daily life and that are not considered traumatic events. These included divorce or separation, marriage, family problems, problems at work and unemployment. During the baseline interview, respondents reported stressors that had occurred in their lifetime; at each subsequent interview, stressors occurring since the previous interview were assessed. The life stressor scale was developed for the nationally representative National Women’s Study and National Survey of Adolescents [36–38] to represent the universe of life course major stressors, and has been shown to have high content validity and to be highly predictive of adverse mental health and wellbeing throughout the life course [26,39]. Each trauma or stressor was reported dichotomously by respondents, and sums of these events (sum of traumas, sum of stressors) at baseline or during the previous follow-up period were included in the analysis. Given that alcohol use reports for the first two time-periods were measured at the same baseline interview, we had to assume that the time-varying covariates did not vary between these two time-points.

Analysis

We used sampling weights to adjust for potential selection bias related to the number of telephones in respondent households, people in the household and over-sampling of zones closest to the WTC. We conducted analyses using semi-parametric group-based modeling, which we used to identify the number of alcohol bingeing and consumption level trajectories and to determine the impact that socio-demographic characteristics and exposure to the WTC attacks had on trajectory group membership.

Group-based models serve to identify clusters of individuals that follow similar paths of behavior over time [40]. Rather than capturing variability in developmental trajectories through a random coefficient as do traditional growth curve models, group-based models assume that the sample is composed of a mixture of underlying trajectory groups, each defined by an average growth curve [7]. We used a binary logit distribution to model
bingeing and a censored normal distribution to model level of total alcohol consumption. We fitted separate models with two to six trajectory groups for bingeing and level of consumption, and used the Bayesian information criterion (BIC) to select the best-fitting model. Once we had selected the optimal number of groups for each outcome, we determined the optimal number of parameters used to define the shape of each trajectory group (i.e. linear, quadratic, cubic) by their significance at the $P < 0.05$ significance level. Covariates were finally added to the best-fitting group trajectory models: time-stable baseline covariates were incorporated assuming that they affected the probability of belonging to a particular group in contrast to a reference group, while time-varying covariates have an estimated association with the outcome for each separate trajectory. The coefficients presented in the tables for time-varying covariates are the trajectory-specific weighted average of the association of the covariate with the outcome for individuals experiencing the exposure at different points in time.

Dual-trajectory models were finally used to describe the relationship between class membership in the consumption classes and class membership in the bingeing classes. These models estimate jointly the trajectories for two different outcomes, and estimate probabilities linking membership in trajectory groups across outcomes.

**RESULTS**

**Identification of alcohol trajectories**

**Level of alcohol consumption trajectories**

The five-group trajectory model provided the best fit for the alcohol consumption level data. Average posterior group membership probabilities for the five-group model ranged between 0.82 and 0.95 (Table 1). The empirical growth curves for the five identified trajectory groups for level of alcohol consumption are shown in Fig. 1. The largest group (45.3% of sample) consisted of respondents who reported less than one drink in the past 30 days throughout the study period (hereby referred to as the ’stable non-drinker’ group), while the second-largest group (39.4% of sample) exhibited consistently low levels of drinking (hence labeled the ’low-user’ group). One of the groups (5.01% of sample) started with a low level of...
drinking and then increased markedly over the years (hereby known as the ‘increasing user’ group), while another group (6.2% of sample) showed a slight decrease from a moderate level of drinking (approximately one drink per day in the past 30 days) to a low–moderate level of consumption (labeled the ‘decreasing user’ group). Finally, the smallest group (4.0% of the sample) showed a consistently high level of alcohol consumption across time (labeled herein the ‘high stable users’ group).

Prevalence of bingeing trajectories

The three-group trajectory model was selected as the best model to fit the alcohol bingeing data. Although the four-group trajectory model had a lower BIC, three of the groups included between 2.7–6.9% of the sample and the posterior group membership probability for one of the groups was only 0.5. Hence, we selected the three-group model instead. Average posterior group membership probabilities for the three-group model ranged between 0.91 and 0.98 (Table 2). The observed growth curves for the three-trajectory group model are shown in Fig. 2. Among the largest group (89.9% of sample), approximately 1.0% of the respondents reported consuming five+/four+ drinks at each study wave (labeled the ‘stable non-bingers’). Two small groups reported changes in the prevalence of bingeing over time: in one group (5.4% of sample; labeled the ‘later bingeing onset’ group) 8.3% of the respondents reported, at baseline, having consumed an average of five+/four+ drinks per day 2 weeks before 11 September 2001, but 58.3% of the sample reported such bingeing by the last study wave; in the other group (4.7% of sample; labeled the ‘bingeing desisters’), 100% of the respondents reported heavy drinking at the beginning of the study, but by the end of the study only 9.5% of the members binged on a daily basis.

Table 2 Parameters for three-group trajectory model for alcohol bingeing prevalence.

<table>
<thead>
<tr>
<th>Group</th>
<th>Average group posterior probability</th>
<th>Parameter</th>
<th>Estimate</th>
<th>Standard error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable non-bingers</td>
<td>0.97</td>
<td>Intercept</td>
<td>-4.39***</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intercept</td>
<td>-2.66***</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Linear</td>
<td>0.19*</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quadratic</td>
<td>-0.002</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Linear</td>
<td>0.19*</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quadratic</td>
<td>-0.002</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bingeing desisters</td>
<td>Intercept</td>
<td>12.29***</td>
<td>2.88</td>
</tr>
<tr>
<td></td>
<td>Linear</td>
<td>-1.65***</td>
<td>0.41</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quadratic</td>
<td>0.06***</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cubic</td>
<td>-0.001***</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Group membership</td>
<td>Stable non-bingers (%)</td>
<td>89.96***</td>
<td>2.19</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Later bingeing onset (%)</td>
<td>5.38**</td>
<td>2.07</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bingeing desisters (%)</td>
<td>4.65***</td>
<td>0.69</td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05; **p < 0.01; ***p < 0.001.
Socio-demographic characteristics of alcohol use trajectory groups

Level of alcohol consumption

The time-varying covariates associated with the course of the trajectory groups for level of alcohol consumption are presented in Table 3. Having a low income was associated with a lower level of alcohol consumption for the stable non-drinkers, the low users and the decreasing users. Reporting a higher number of stressors in daily life throughout the study resulted in a higher level of consumption for the increasing users, while reporting a higher number of traumatic events was associated with a higher level of consumption for the high stable users.

Table 4 presents the association of baseline covariates with the likelihood of membership in each trajectory group, relative to the stable non-drinker group. In a model controlling only for stressors and traumatic events (model not shown), exposure to the WTC was associated with a higher likelihood of membership in the increasing user group than in the stable non-drinker group, while having experienced an emotional reaction to the event was associated with a lower likelihood of belonging to the high stable drinker group than the stable non-drinker group. Once we controlled for baseline socio-demographic characteristics, however (Table 4), these associations disappeared.

Prevalence of binging trajectories

The time-varying covariates associated with the course of the trajectory groups for prevalence of binging are presented in Table 5. Within the group which had a consistently low number of bingers, having a low income throughout the study resulted in a higher level of consumption for the increasing users, while reporting a higher number of traumatic events was associated with a higher level of consumption for the high stable users.

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the WTC attacks nor emotional reactions to the event were associated with membership in any of the bingeing trajectory groups.

**Dual trajectories**

The dual-trajectory model included three consumption classes and three bingeing classes. Although the consumption single-trajectory model had included five classes, it became necessary to reduce it to three classes in order for the dual-trajectory model to converge.

Figures 3–5 present three alternative representations of the linkages between consumption levels and bingeing. One is the probability of membership in the bingeing classes, conditional upon membership in the consumption classes (Fig. 3). Figure 4 presents the reverse set of probabilities: probability of membership in the consumption classes, conditional upon membership in the bingeing classes. The third form of presentation, Fig. 5, is the joint probability of membership in the consumption and bingeing classes. The three figures show a strong linkage between the trajectories for the two manifestations of

Table 4 Baseline covariates associated with alcohol level of use trajectory membership†.

<table>
<thead>
<tr>
<th>Alcohol level of use trajectories (relative to stable non-drinker trajectory)</th>
<th>Low users</th>
<th>Increasing users</th>
<th>Decreasing users</th>
<th>Stable high users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta</td>
<td>Beta</td>
<td>Beta</td>
<td>Beta</td>
<td>Beta</td>
</tr>
</tbody>
</table>

| Age (18–34 reference) | 0.10 | 0.04 | -0.21 | -0.35 |
| 35–54 | -0.78** | -0.40 | -0.97**** | -0.83**** |
| 55+ | -0.76*** | -1.48*** | -0.94* | -2.49*** |
| Female | -1.25** | -15.42*** | -2.49** | -2.23* |
| Race/ethnicity (white reference) | -1.03*** | -1.63* | -2.29** | -2.80** |
| Asian | -0.92** | -2.02*** | -1.06**** | -1.81** |
| Black | -0.65 | -1.76* | -1.68**** | -3.81*** |
| Hispanic | 0.05 | -0.12 | 0.03 | 0.51 |
| Other | 0.50* | 0.83**** | 1.85*** | 1.68*** |
| Marital status (married reference) | -2.28* | 0.13 | -0.21 | 0.35 |
| Divorced/ separated/ widowed | -0.49* | -0.29 | -0.85 | 0.35 |
| Single/ unmarried cohabiting | -0.62 | -3.95** | 0.21 | -1.11 |
| Education (college reference) | 0.11 | 0.56 | -0.33 | -0.47 |
| High school/general educational development | -0.03 | 0.26 | -0.88 | -1.50 |

Table 5 Time-varying covariates associated with course of alcohol bingeing trajectories†.

<table>
<thead>
<tr>
<th>Alcohol bingeing trajectories</th>
<th>Stable non-bingers</th>
<th>Later bingeing onset</th>
<th>Bingeing desisters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta</td>
<td>Beta</td>
<td>Beta</td>
<td>Beta</td>
</tr>
<tr>
<td>Low income (&lt;$30 000)</td>
<td>-2.28*</td>
<td>0.13</td>
<td>-0.21</td>
</tr>
<tr>
<td>Number of stressors</td>
<td>1.73***</td>
<td>-0.25</td>
<td>0.24</td>
</tr>
</tbody>
</table>

*P < 0.05; **P < 0.01; ***P < 0.001; ****P < 0.10. †Controlling for low income, number of traumatic experiences and daily stressors at each time-point.

alcohol use. Figure 3 indicates that the stable non-drinkers were only members of the stable non-binger class, while the low users were most likely to belong to the later bingeing onset class and the stable high users were most likely to belong to the bingeing disasters group. The high degree of overlap in classes was also reflected in Fig. 5, where the two most prevalent joint probabilities were for the overlap of stable non-bingers and stable non-drinkers, as well as low users and those experiencing later bingeing onset.

### DISCUSSION

This is one of the first studies to examine the joint influence of ongoing stressors and traumatic event experiences during the life course on different alcohol use trajectories. Using data from a population-based cohort of NYC and applying semi-parametric group-based modeling, we confirmed that a great level of heterogeneity exists in drinking pathways among adults [2]. The five trajectory groups we detected for consumption levels are

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**Table 6** Baseline covariates associated with alcohol bingeing trajectory membership†.

**Alcohol bingeing trajectories (relative to stable non-binger group)**

<table>
<thead>
<tr>
<th></th>
<th>Later bingeing onset</th>
<th>Bingeing desisters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td>Beta</td>
</tr>
<tr>
<td>Age (18–34 reference)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35–54</td>
<td>8.03*</td>
<td>6.16</td>
</tr>
<tr>
<td>55+</td>
<td>-28.19***</td>
<td>-7.49</td>
</tr>
<tr>
<td>Female</td>
<td>-2.49**</td>
<td>-2.49**</td>
</tr>
<tr>
<td>Race/ethnicity (white reference)</td>
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<td></td>
</tr>
<tr>
<td>Asian</td>
<td>3.02**</td>
<td>0.25</td>
</tr>
<tr>
<td>Black</td>
<td>3.44*</td>
<td>0.84</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.93****</td>
<td>0.77</td>
</tr>
<tr>
<td>Other</td>
<td>-3.80</td>
<td>-2.86</td>
</tr>
<tr>
<td>Marital status (married reference)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Divorced/separated/widowed</td>
<td>1.22</td>
<td>1.88****</td>
</tr>
<tr>
<td>Single/unmarried cohabiting</td>
<td>-0.16</td>
<td>1.66*</td>
</tr>
<tr>
<td>Education (college reference)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school/general educational development</td>
<td>-6.34</td>
<td>-4.31</td>
</tr>
<tr>
<td>Less than high school</td>
<td>-9.53*</td>
<td>-5.80</td>
</tr>
<tr>
<td>Experience of 11 September</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directly affected by 11 September</td>
<td>-0.18</td>
<td>-0.14</td>
</tr>
<tr>
<td>Emotional reactions to 11 September</td>
<td></td>
<td>-5.79</td>
</tr>
</tbody>
</table>

*P < 0.05; **P < 0.01; ***P < 0.001; ****P < 0.10. †Controlling for low income and daily stressors at each time-point.
consistent with those found by previous research conducted with adolescents and young adults: longitudinal studies using mixture models have identified a range from four to six trajectory groups, including a group of regular users, non-users, and a range of groups that show increasing or decreasing levels of consumption throughout the study period [2,4,42–44]. We also identified three bingeing groups, which are consistent with previous studies of adults: studies with participants in middle and older adulthood [43,45] indicate that heavy drinking subsided in later adulthood, and heavy drinking trajectories were restricted to four groups, including stable, declining, curvilinear and abstainers. Our findings indicate that while the level of heterogeneity in severe levels of drinking may decrease after young adulthood, the general patterns of variation in alcohol consumption levels persist in adulthood, after developmental changes have been established. The dual-trajectory analysis also provides a more comprehensive understanding of the different forms of alcohol use as it indicates, for example, that respondents who showed a low degree of use over time may have experienced later onset of bingeing, while those who had a consistently high degree of alcohol consumption may have desisted from bingeing over time.

One of the main motivations for this study was to investigate the long-term impact of exposure to an acute disaster had on different types of alcohol use trajectories, relative to ongoing exposure to accumulated stressors and traumatic events in the post-disaster setting. In a previous comparison of two cross-sectional samples in two time-periods, we had found that exposure to the attacks was not associated with an increase in alcohol use 6 months after 11 September, but that a peri-event emotional event did predict an increased rate of use [21]. In this new prospective long-term study, we found that neither exposure to the 11 September 2001 terrorist attacks nor experience of a peri-event emotional reaction differentiated between different trajectories of alcohol consumption levels or bingeing over the 4 years following this event. This study expands on previous work in several ways. First, it presents a stronger design, as we followed the same respondents over time rather than comparing levels of alcohol use in two different cross-sectional samples. Secondly, we considered the specific impact of the attacks on the trajectories followed by distinct types of alcohol users and bingers over several years after the attacks. Thirdly, we followed the respondents over the long term, and found that the impact of an acute disaster on alcohol use subsides over time.

Another key contribution of this study involves finding that while the acute experience of the attacks did not predict long-term alcohol consumption patterns, ongoing post-disaster exposure to traumatic events and stressors was a consistent predictor of alcohol use and bingeing trajectories. We are not aware of other studies that have examined the impact that post-disaster cumulative stressors and traumatic events have on different types of alcohol consumers over time. Concurrent exposure to trauma seems to be associated with increased consumption among adult constant consumers of high levels of alcohol: more ongoing experiences of traumatic events were associated with an increased mean number of drinks consumed in the past 30 days among the high stable alcohol users. These findings build upon previous studies of adolescent and young adult substance use trajectories, which found that baseline traumatic events such as the death of a loved one contributed to a higher likelihood of belonging to a heavy or very heavy drinking trajectory group rather than a non-heavy drinking stable group [11] and discriminated smoker groups from the abstainers [46]. Alcohol has been proposed to act as a mechanism to cope with stress or to medicate symptoms of post-traumatic stress disorder (PTSD) [11,20,23,47–50].

We also found that ongoing exposure to stressors, such as financial problems or divorce, played a role in predicting trajectories of adult alcohol use and bingeing [20,31,51,52]. Ongoing stressors were associated with a higher level of consumption among the increasing users group as well as with an increased number of bingers in the stable non-binger group. The contribution of ongoing stressful life events to the risk of higher alcohol consumption among people who already showed a tendency to increase their level of alcohol use over time, as well as to the risk of shifting to heavy levels of use, seem particularly important to consider in the post-disaster setting, given that disasters themselves have been shown to incite fear and economic instability [25]. Hence, the stressful circumstances that result from the attacks may have an influence on long-term population risk of alcohol use,
distinct from the immediate impact of the traumatic event itself. Ongoing stressors have been found to play a similar role on the risk of PTSD after the WTC disaster [26]. This finding suggests that, in the aftermath of disasters, interventions that aim to mitigate the stressors that may be endemic to a post-disaster situation may have substantial population-level benefit in the medium- to long term.

Several caveats should be noted related to these findings. First, respondents’ recall of alcohol use may have been less accurate for the month preceding the 11 September attacks than it was when asked about the month immediately preceding the survey. Baseline estimates of alcohol use are comparable to national estimates, however, providing some basis for confidence in self-report measures [26]. As we used telephones to conduct our interviews, we restricted the survey to households which had telephones. We did find, however, that socio-demographic characteristics of respondents were comparable to those of the 2000 Census for the New York metropolitan area. Thirdly, as with all longitudinal studies, we had a degree of loss to follow-up, which may have resulted in a biased sample. Applications of censoring weights in another study using the same data [26] did not alter the nature of results, giving us confidence in our findings. Finally, although we did conduct a longer follow-up post-disaster than any other study of which we are aware, we may have failed to detect patterns of use that we could have detected had the follow-up continued.

In conclusion, we showed that in a longitudinal population-based sample, ongoing exposure to traumatic events and stressors plays an important role in alcohol use and bingeing trajectories, while the impact of a single mass traumatic event subsides over time. By applying multiple-trajectory approaches, we also contributed to a more specific understanding of the contributors to the heterogeneous pathways of alcohol use among adults [53]. This study indicates that in order to reduce the risk of increased alcohol abuse in a post-disaster context, public policy investment should focus not only upon managing the immediate mental health consequences of exposure to the event, but also on alleviating sources of stressors that may ensue following a mass disaster, such as loss of employment, property or the breakdown of family structures. Further, it suggests that in order to make a lasting population-level impact to prevent individuals from engaging in higher levels of consumption, sustained attention should be invested in increasing availability of social and mental health treatment services for those sectors of the population that, because of their existing social and economic vulnerability, are disproportionately more likely to experience stressors and traumatic events.

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References


