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 New York City (NYC) in the first months after the September 11, 2001 terrorist attacks. We used a population-based cohort to investigate alcohol use trajectories in NYC for three years after September 11, and to examine the relative contribution of acute exposure to the attacks and ongoing stressors to these trajectories. We recruited 2,752 participants through a random digit dial telephone survey in 2002; participants completed three follow-up interviews over 30 months. We used growth mixture models to assess trajectories in alcohol use. We identified four trajectories of alcohol use and five trajectories of levels of alcohol use. Predictors of higher levels of use over time included ongoing stressors, peri-event emotional reactions to the attacks, and higher socioeconomic status. Ongoing exposure to stressors plays a central role in alcohol use trajectories consistent with greater use, while the impact of point-in-time mass traumatic events subsides over time.

Word count for abstract: 150

Word count for text: 4,322

Background

Alcohol abuse poses a substantial burden to population morbidity and mortality. In 2001-2, the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) found that 8.9% of White adults and 6.86% of Black adults had an alcohol use disorder in the past 12 months [1, 2]. Alcohol abuse accounts for approximately 105,000 deaths each year in the United States, associated with intentional and unintentional injury, cirrhosis, stroke, pneumonia, and cancers of the digestive system [3]. Almost two-fifths of traffic fatalities are the result of alcohol abuse [3]. For each death, alcohol is associated with many more cases of nonfatal illness due to cirrhosis, cancer, fetal alcohol syndrome and violence.

Extant research suggests that there are substantial differences in the patterns of alcohol use during the lifecourse [4-9]. Latent class analyses have shown several different alcohol-use trajectories. These include persons who are chronic nonusers or who have stable low-use alcohol histories, persons who are chronically high-use alcohol drinkers, persons who "mature out" of drinking over time, and persons who drink more and more alcohol over time or report late onset of heavy alcohol use [10]. It is likely that different trajectories of alcohol use over the lifecourse suggest distinct etiologic profiles. Therefore, understanding the nature of the heterogeneity in trajectories of alcohol use is important for developing more informed etiologic models and developing effective interventions aimed at preventing heavy alcohol consumption.

Most research on alcohol trajectories has focused on the role that socio-demographic characteristics, peer networks and parenting play in leading persons into different trajectories. A few studies increasingly show that stressful life events over the

lifecourse can also play a critical role in generating different pathways of problem behaviors [11-15]. Stiffman et al. [16] for example, studied problem behavior trajectories among Native American adolescents, and found that the group of adolescents who started out with a high level of problem behaviors but improved over time reported markedly lower levels of neighborhood problems and individual stressors than the group that showed consistently high levels of behavior problems. Wills et al. used cluster analysis to identify smoking trajectories, and found that adolescent and family stressful life events were associated with membership in the early onset or intermediate onset smoking groups among adolescents, rather than the late onset or no onset group [17]. We were only able to identify one study that focused on trajectories of alcohol use: Windle et al. [14] investigated trajectories of heavy alcohol use from adolescence to adulthood, and found that stressful life events were associated with a higher likelihood of belonging to a heavy use group among males. This study only examined the influence of stressful events at one point in time, instead of comparing the relative impact of acute vs. accumulated stressors. Although such preliminary evidence indicates that life events may play an important role in shaping alcohol use trajectories, we know very little about how the accumulation of stressful events over the lifecourse 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. They affect the whole population in the area of influence, but different persons still have distinct levels of exposure to the event. Moreover, as they affect persons 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.

No studies, that we are aware of, have looked at the impact of disasters on alcohol use trajectories. The extant literature measured patterns of alcohol consumption at single time points after disasters [18-21] and individual traumatic event experiences [22-25], and offers conflicting results. Some studies have found a short-term impact of disaster exposures on alcohol use or related substance use: Reijneveld et al. [21] 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, while Parslow and Jorm [20] found that experience of traumatic events related to a bushfire in Canberra, Australia, was associated with an increase in tobacco consumption. In contrast, Kohn et al. [17] did not find a higher risk of alcohol misuse among elderly persons exposed to Hurricane Mitch in Honduras, while North et al. [18] failed to find new cases of alcohol abuse among survivors of the Great Midwestern Floods of 1993. 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 such acute stressful life events on different pathways of substance use over the long-term, and that examines the influence of acute events such as disasters within the context of the broader range of ongoing life stressors that may also play a role in substance use.

This study examines the trajectories of alcohol use, and their predictors, in the aftermath of the World Trade Center disaster that took place in New York City on September 11, 2001. The attacks were the largest human-made disaster in the United States since the Civil War: just in New York City 2726 people died and a large part of lower Manhattan suffered extensive damage from the attacks [26]. Prior research has documented an increase in alcohol use in the short-term after the September 11 terrorist

attacks [2, 25, 26], and a couple of studies have found an association between exposure to the attacks and alcohol use [27, 28]. However, research has been limited to the first few months after the disaster: no studies seem to have assessed the long-term impact that exposure to the attacks had on trajectories of alcohol use, relative to the impact that daily post-disaster sources of stress and trauma had on such trajectories.

In this study we set out to (a) document the trajectories of alcohol use after a large-scale human made disaster, (b) assess the relative role of exposure to a disaster and ongoing stressors in influencing the trajectories of alcohol use over the lifecourse.

Methods

Sample

We conducted a prospective, population-based cohort study of the adult population of New York City (NYC). The cohort was assembled to assess the mental health of the NYC population approximately six months after the World Trade Center disaster (WTC). Methods are described in detail elsewhere [29]. Respondents were sampled through simple area probability random-digit-dialing between March 25, 2002 and June 25, 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 six months after baseline (September 25, 2002-January 31, 2003) and subsequently at yearly intervals (September 25, 2003-February 29, 2004, December 15, 2004-November 30, 2005).

Measures

Alcohol consumption was assessed in two ways: 1) presence of any alcohol use in the past 30 days; and 2) total number of drinks consumed per day in the past 30 days. Total consumption in the past 30 days was calculated by multiplying the number of days 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. " A drink is 1 can or bottle of beer, 1 glass of wine, 1 can or bottle of wine cooler, 1 cocktail, or 1 shot of liquor. On the days when you drank alcohol over the past 30 days, on average, how many drinks did you have each day?"). Total amount of alcohol consumption was first assessed in the baseline survey for the 30 days prior to the September 11, 2001 terrorist attacks, and also for the 30 days prior to the interview. In the subsequent interviews, respondents were only asked about the number of drinks consumed per day for the past 30 days.

We also measured characteristics that, in previous work, have been shown to be associated with alcohol consumption [30-37]. Demographic variables included age, gender, race/ethnicity, education, yearly income and marital status. Direct exposure to the attacks of September 11, 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 attack, had a friend or relative killed, lost a job as a results of the attacks, or been involved in the rescue effort. We also measured peri-event emotional reactions after the WTC attacks with a modified version of the Diagnostic Interview Schedule subscale for panic [38]. The presence of four or more symptoms listed in the Diagnostic and Statistical Manual (DSM-IV) within the first few hours after the WTC attacks served to

classify respondents as having had a peri-event emotional reaction. Respondents were also asked about the occurrence of any of 12 traumatic events (natural disaster; serious accident at work, in a car, or somewhere else; assault with a weapon; assault without a weapon; unwanted sexual contact; serious injury or illness; other situation involving serious injury or physical damage; situation causing fear of death or serious injury; seeing someone 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, and subsequently at each interview since the previous interview. We also asked about the experience of stressors in the past year 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. 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.

Analysis

We used sampling weights to adjust for potential selection bias related to the number of telephones in respondent households, persons in the household, and over-sampling. We conducted analyses using semi-parametric group-based modeling, which we used to identify the number of alcohol presence 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 [39]. Rather than capturing variability in developmental

trajectories through a random coefficient like traditional growth curve models do, group-based models assume that the sample is composed of a mixture of underlying trajectory groups, each defined by an average growth curve [10]. We used a binary logit distribution to model any presence of alcohol use, and a censored normal distribution to model level of consumption. We fit separate models with two to six trajectory groups for alcohol presence and level of consumption, and used the Bayesian information criterion 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 they affected the probability of belonging to a particular group, while time-varying covariates were assumed to affect the shape of each trajectory [40]. Although we started with the same set of covariates for alcohol use and level of consumption, the final models presented here only include those covariates that were associated with at least one trajectory group. The only exception is direct exposure to the WTC attacks, which we kept regardless, given that it was one of the main predictors of interest.

Results

The original sample consisted of 2,752 respondents; of these, 2,282 completed at least one interview and were thus used in this study. The sample has been shown in another study [41] to be representative of the NYC population based on 2000 Census data. There were no differences between included and excluded respondents on level of alcohol use at baseline. 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.

Identification of alcohol use trajectories

     Presence of alcohol use trajectories

     Using the BIC statistic to compare models with different numbers of trajectory

groups, we determined that a four-trajectory model best fit the data in the case of alcohol

presence. As shown in Table 1, average posterior probabilities of group assignment

ranged between 0.76-0.9 for the four-group solution. Figure 1 displays the empirical

growth curves for the four trajectory classes for alcohol presence. One class (34.47% of

the sample) consisted of respondents who consistently reported no consumption (herein

labeled the "non-user" class). The second class (20.41% of sample) had an initially low

alcohol use prevalence rate, which peaked after approximately 2 years (herein labeled the

"increaser" class), while another class (17.25% of sample) showed an initially very high

prevalence rate, which declined to moderate levels after approximately 12 months

(labeled the "decreaser" class). Finally, another class (27.87% of sample) maintained a

consistently high prevalence rate throughout the length of the study (labeled the "regular

user" class).

     Level of alcohol consumption trajectories

     The five-group trajectory model provided the best fit for the alcohol consumption

level data. Average posterior class membership probabilities for the five-class model

ranged between 0.82 and 0.95 (Table 2). The empirical growth curves for the five

identified trajectory classes for level of alcohol consumption are shown in Figure 2. The

largest class (45.29% 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 "non-user" class), while the second-largest class (39.41% of sample) exhibited consistently low levels of drinking (hence labeled the "low-user" class). One of the classes (5.01% of sample) started with a low level of drinking and then increased markedly over the years (hereby known as the "increaser" class), while another class (6.24% 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 "decreaser" class. Finally, the smallest class (4.04% of the sample) showed a consistently high level of consumption across time (herein labeled the "regular users" class).

Socio-demographic characteristics of alcohol use trajectory groups

Presence of alcohol use trajectories

The baseline covariates associated with membership in the alcohol use trajectory groups reflecting increasing use, decreasing use, and regular use, compared to no use throughout the study period, are presented in Table 3a. In the alcohol use trajectory models adjusting for race/ethnicity, gender, marital status, education, and experiences of trauma, respondents who were 55 years old or older were less likely to have been assigned to any of the alcohol use groups than to the no-use group. Women were less likely to have been assigned to the increasers or to the regular use groups than to the non-user group. Being Asian or Hispanic was associated with a lower likelihood of belonging to the regular user group, while Blacks were less likely to belong to the decreaser or the regular user classes, relative to the non-users. Reporting a single civil status and having experienced a traumatic event sometime in their life was predictive of membership in the group that decreased in use over time, rather than in the non-users group, while having

experienced a peri-event emotional reaction to the WTC attacks was predictive of membership in the group that increased use over time, relative to the non-user group. Finally, respondents who had a high school degree or a GED were less likely to belong to the regular users group than to the non-user group, in comparison to respondents who had graduated from college.

The time-varying covariates associated with the slope of the trajectory groups for alcohol presence are presented in Table 3b. Having a higher level of income was associated with an increase in the rate of alcohol consumption for members of the class that increased in their rate of use over time, and the class that reported a consistently high rate of use throughout the study. Among those classified as regular users for their consistently high rate of use, having been exposed to stressors throughout the course of the study was associated with a lower rate of alcohol consumption. Having at least one traumatic experience throughout the study was predictive of a higher rate of use for the respondents who had originally been classified as non-users.

Level of alcohol consumption

Table 4a presents the baseline covariates associated with membership in the trajectory groups for level of alcohol consumption. In contrast to the case of alcohol prevalence, being 55 years or older was only less predictive of membership in the low use group, rather than the non-users. Being a woman and Asian or Hispanic however, was associated with a lower likelihood of belonging to any of the user groups, in contrast to the non-users. Blacks were less likely to be assigned to the low use, decreasing use or regular use groups, relative to the non-users. Marital status and education were predictive of membership in more groups in the case of level of use, in contrast to the case of

alcohol prevalence: single respondents were more likely to belong to the low user, decreasing user and regular user groups, than the non-user group. Respondents with a high school degree or GED were less likely to belong to the low user group, while those who had not finished high school were less likely to be in the increasing group, in contrast to the non-user group. Finally, peri-event emotional reactions to the WTC attacks were associated with a lower likelihood of membership in the regular user group.

The time-varying covariates associated with the slope of the trajectory groups for level of alcohol consumption are presented in Table 4b. Having a higher income was associated with a higher level of alcohol consumption for the non-users and the low users. Reporting exposure to stressors in daily life throughout the study resulted in a higher level of consumption for the increasing users.

Discussion

This is one of the first studies to investigate the heterogeneity in trajectories of alcohol use among adults, and to examine the joint influence of baseline and ongoing exposure to stressors on alcohol use trajectories. Using data from a population-based cohort of NYC and applying semi-parametric group-based modeling, we identified four distinct trajectories of alcohol prevalence and five trajectories of level of consumption among adults over a period of approximately two-and-a-half years. Our findings confirm that a great level of heterogeneity exists in drinking pathways among adults [5]. The trajectory groups we detected are consistent with those found by prior 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 varying levels of consumption throughout the study period [5, 7, 42-44].

One of the main motivations for this study was to investigate the long-term impact that exposure to an acute disaster had on alcohol use trajectories, relative to ongoing exposure to accumulated stressors. Consistent with our own prior research on the role that direct exposure to the September 11, 2001 terrorist attacks had on alcohol use in the short term [2, 26], we did not find it to be a significant determinant of alcohol use trajectories in the long term. The findings are also consistent with long-term studies of post-traumatic stress disorder (PTSD), which has been found to be co-morbid with alcohol problems [24, 45-47]: prior studies have found substantial resolution of population-based PTSD among NYC residents two and a half years after September 11 [41]. However, we substantially expanded on previous work by considering the impact of the attacks on the trajectories followed by distinct types of alcohol users over almost three years of study.

In contrast to the fading role of the disaster event experiences themselves over time as determinants of alcohol trajectories, peri-event emotional reactions to the attacks were significant predictors of alcohol presence trajectories. Emotional reactions were associated with a higher likelihood of belonging to the increasing alcohol use prevalence group rather than the no-use group. As reported in prior studies [26, 41, 48], individuals who are physiologically vulnerable to experience emotional reactions to traumatic events may be particularly likely to increase alcohol consumption in order to decrease levels of anxiety, and may thus especially benefit from targeted psychosocial interventions following the onset of a disaster [49, 50].

While the acute experience of the attacks did not predict alcohol consumption patterns, ongoing exposure to traumatic events and stressors was a consistent predictor of alcohol use trajectories. In the case of the prevalence of alcohol use, lifetime traumatic events predicted membership in the decreasing use group rather than the non-use group, while ongoing experiences of traumatic events were associated with an increased rate of alcohol use among the non-users. These findings are consistent with those from prior studies of substance use trajectories, which found that traumatic events such as having a serious illness or 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 [14] and discriminated smoker groups from the abstainers [17]. Alcohol has been proposed to act as a mechanism to cope with stress or to medicate symptoms of post-traumatic stress disorder [14, 26, 27, 45, 47, 51, 52].

We also found that ongoing exposure to stressors, such as financial problems or divorce, played a role in predicting trajectories of alcohol use, independent of traumatic events [26, 34, 53, 54]. Accumulation of stressors was associated with an increase in the level of consumption among the increasing use group. The contribution of ongoing stressful life events to the risk of increasing alcohol consumption among persons who already showed a tendency to increase their level of alcohol use over time seems particularly important to consider in the post-disaster setting, given that disasters themselves have been shown to incite fear and economic instability [29]. 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 [41]. 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.

We documented counterintuitive associations between peri-event emotional reactions and stressors with membership in the high-level, regular user group. Peri-event reactions were associated with a lower likelihood of membership in the regular high level of use group than in the non-user group, while high-level regular users who were exposed to more stressors reported a lower rate of alcohol use than high-level users who reported fewer stressors. These associations may reflect reporting bias: chronic consumers of high levels of alcohol may perceive that they experience fewer stressors and may have suppressed memories of emotional reactions to the attacks, particularly because of the "medicating" impact that alcohol may have.

This study confirmed the distribution of alcohol use by age, gender, race/ethnicity marital and socioeconomic status, found in prior research. Several longitudinal studies estimating trajectories of alcohol use have found that younger males [6, 12, 43], Whites and individuals of higher socioeconomic status [6, 10, 14] are more likely to belong to groups of higher alcohol consumption over time rather than to the stable non-user class, while married people are less likely to belong to the higher-use classes [12]. We confirmed these trends in a longitudinal adult sample, taking into account exposure to traumatic experiences and stressors, and delving in detail into the specificity of impact on different patterns of alcohol consumption.

Several caveats should be considered with these findings. First, respondents' recall of alcohol use may have been less accurate for the month preceding the September

11 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 [55]. As we used telephones to conduct our interviews, we restricted the survey to households which had telephones, which excluded persons without household telephones. We did find however, that sociodemographic characteristics of respondents were comparable to those of the 2000 Census for New York City. Fourth, 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 however [41] 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 that we are aware of, we may have failed to detect patterns of use that we could have detected if the follow-up had 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 consumption 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 [56]. We propose that public health practitioners in post-disaster setting should consider investing in interventions that target those particularly vulnerable to the consequences of disasters, such as those who experienced peri-event emotional attacks, and assist the population in coping with ongoing sources of adversity such as financial problems.

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Table 1. Parameters for 4-group trajectory model for drinking prevalence

Group	Average class posterior probability	Parameter	Estimate	Standard error
Chronic non-users	0.82	Intercept	-3.58***	0.39
Increasers	0.82	Intercept	-3.16***	0.36
		Linear	0.23***	0.04
		Quadratic	-0.003***	0
Decreasers	0.9	Intercept	3.05***	0.37
		Linear	-0.19***	0.04
		Quadratic	0.004***	0
Regular users	0.76	Intercept	2.46***	0.37
		Linear	25.28	13.54
		Quadratic	-8.41*	3.95
		Cubic	0.69*	0.29
Group membership				
Chronic non-users		(%)	34.47***	2.77
Increasers		(%)	20.41***	2.58
Decreasers		(%)	17.25***	2.15
Regular users		(%)	27.87***	2.28

* $p<0.05$; **$p<0.01$; ***$p<0.001$

Figure 1.

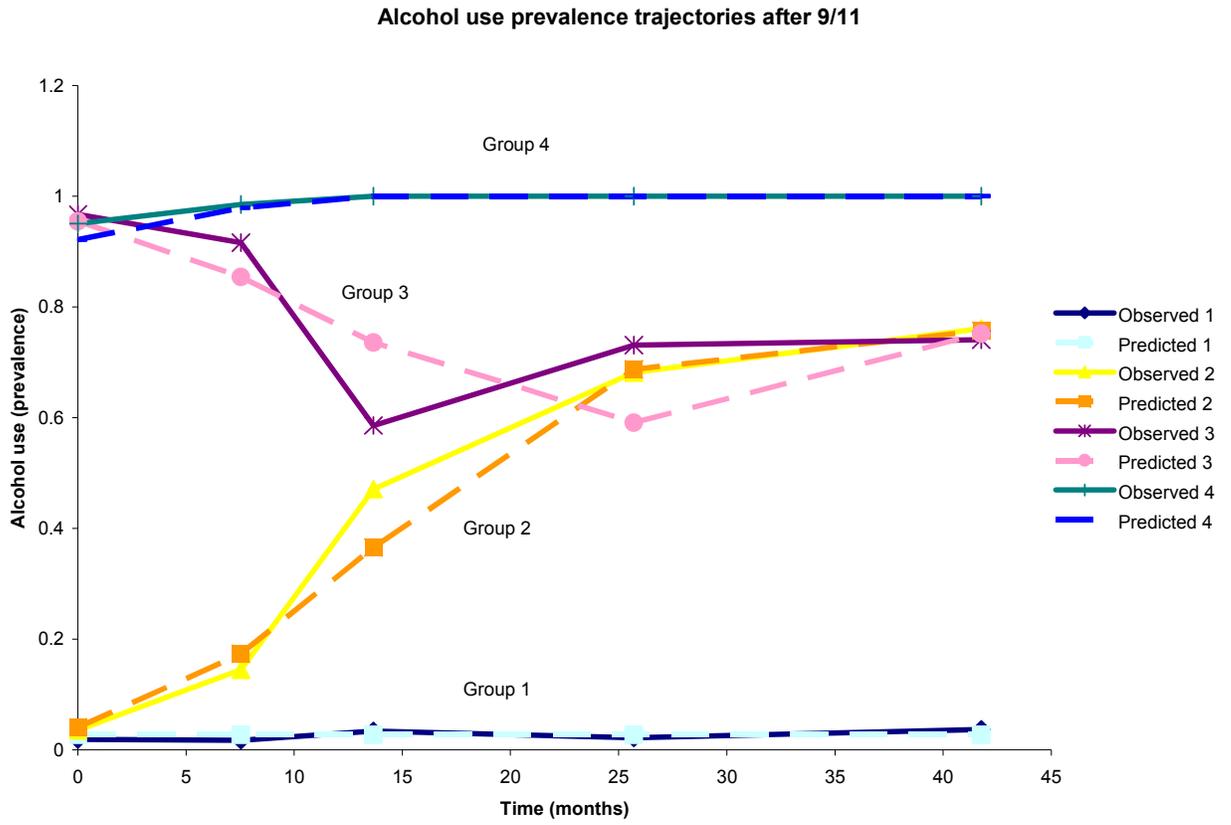**Alcohol use prevalence trajectories after 9/11**

Table 2. Parameters for 5-group trajectory model for level of alcohol consumption

Group	Average class posterior probability	Parameter	Estimate	Standard error
Chronic non-users	0.91	Intercept	-18.48***	1.32
Low users	0.89	Intercept	2.76*	1.09
		Linear	0.15***	0.03
Increasers	0.82	Intercept	10.53	6.63
		Linear	0.88*	0.41
Decreasers	0.83	Intercept	34.92***	8.67
		Linear	-0.36	0.28
Regular users	0.95	Intercept	56.28***	3.28
		Quadratic	0.33	0.63
		Cubic	-0.006	0.01
Group membership				
Chronic non-users		(%)	45.29***	2.24
Low users		(%)	39.41***	1.94
Increasers		(%)	5.01	2.96
Decreasers		(%)	6.24*	2.75
Regular users		(%)	4.04***	0.81

* $p<0.05$; **$p<0.01$; ***$p<0.001$

Figure 2.

Trajectories of level of alcohol consumption after 9/11
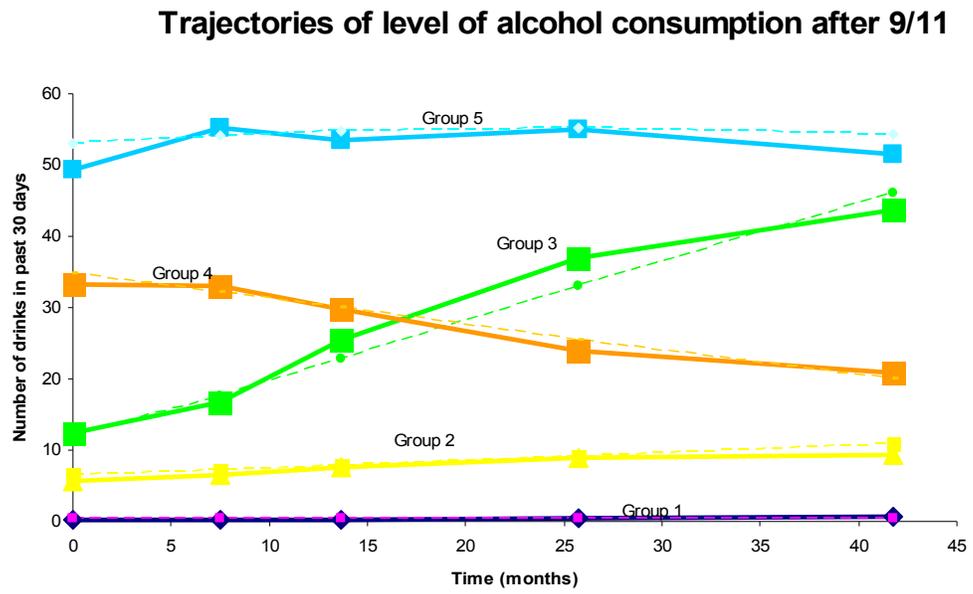
Table 3a. Baseline covariates associated with alcohol use trajectory membership

	Increasers	Decreasers	Regular users
	Beta	Beta	Beta
Age (18-34 reference)			
35-54	-0.30	-0.37	-0.13
55+	-0.94*	-0.99*	-0.93**
Female	-1.06***	-0.22	-1.72***
Race/ethnicity (White reference)			
Asian	-1.09~	-0.80	-3.85**
Black	-0.06	-1.35**	-1.66***
Hispanic	0.00	-0.55	-1.52***
Other	-1.24	-0.68	-2.10
Marital status (married reference)			
Divorced/ separated/ widowed	0.11	-0.04	-0.14
Single/ unmarried cohabiting	0.01	1.01**	0.52
Education (college reference)			
HS/ GED	-0.52	-0.62~	-0.75*
Less than HS	0.01	-15.43	-0.10
Trauma and stress			
Lifetime trauma	-0.11	0.15*	-0.07
Directly affected by 9/11	0.06	0.21	-0.02
Emotional reactions to 9/11	0.97*	-0.17	0.21

Table 3b. Time-varying covariates associated with shape of alcohol use trajectories

Alcohol use trajectories

	Chronic non-users	Increasers	Decreasers	Regular users
	Beta	Beta	Beta	Beta
Income (in units of $10,000)	0.51	0.23**	-0.02	1.16*
Stressors	0.63	0.36	0.23	-1.73*
Traumatic experiences	0.29**	0.18	-0.28~	0.24

* p<0.05; **p<0.01; ***p<0.001

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

	Non-users	Increasing users	Decreasing users	Regular users
Alcohol level of use trajectories (relative to chronic non-user trajectory)				
	Beta	Beta	Beta	Beta
Age (18-34 reference)				
35-54	0.14	-0.35	-0.20	-0.39
55+	-0.67*	-0.32	-1.07~	-0.52
Female	-0.75***	-1.37**	-0.80*	-2.37***
Race/ethnicity (White reference)				
Asian	-1.24**	-15.62***	-2.76***	-2.11*
Black	-1.03***	-1.04	-2.53**	-2.49*
Hispanic	-0.86**	-1.54*	-1.36*	-1.36**
Other	-0.72	-1.85~	-2.17	-2.41
Marital status (married reference)				
Divorced/ separated/ widowed	0.05	-0.11	0.31	0.49
Single/ unmarried cohabiting	0.57*	0.65	2.01***	1.87***
Education (college reference)				
HS/ GED	-0.46*	0.00	-0.74	0.23
Less than HS	-0.56	-3.93**	0.26	-1.35
Trauma and stress				
Directly affected by Sept 11	0.10	0.60	-0.28	-0.48
Emotional reactions to 9/11	0.00	0.39	-0.89	-1.57*

* p<0.05; **p<0.01; ***p<0.001

Table 4b. Time-varying covariates associated with shape of level of alcohol use trajectories

	Chronic non-users	Low users	Increasing users	Decreasing users	Regular users
Alcohol level of use trajectories					
	Beta	Beta	Beta	Beta	Beta
Income (in units of $10,000)	1.70***	1.64***	1.70	1.71~	-0.33
Stressors in daily life	1.82	1.04~	10.17**	1.07	-2.73
Traumatic experiences	0.55	0.40	-1.64~	-2.29	-2.48

* p<0.05; **p<0.01; ***p<0.001