Drinking Trajectories From Adolescence to the Fifties Among Alcohol-Dependent Men*

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ABSTRACT. Objective: Although it has been recognized that the course of alcoholism may differ across individuals, little work has characterized drinking trajectories from drinking onset to midlife. **Method:** The current study examined trajectories of alcohol dependence from adolescence to the mid-50s in a sample of 420 men with a lifetime diagnosis of alcohol dependence. Men from the Vietnam Era Twin Registry were given the Lifetime Drinking History, which assesses the patterns of alcohol consumption and diagnostic symptoms for self-defined drinking phases. Phase data were converted into person-year data, with alcohol-dependence diagnosis coded as present or absent for each of 13 age groupings, starting with up to age 20 and ending with ages 54-56. **Results:** Latent

growth mixture modeling was used to define four drinking trajectories: young-adult, late-onset, severe-nonchronic, and severe-chronic alcoholics. Further analyses with other diagnostic variables, other drinking variables, alcohol expectancies, personality scales, and religiousness scores were completed to differentiate men best categorized by each trajectory. **Conclusions:** Extension of Latent Growth Mixture Modeling (LGMM) into the mid-50s revealed that, although some individuals remain chronic alcohol users, others decline in alcohol problem use. Differences seen among these groups may help in the treatment of alcohol dependence, such that more energy can be spent treating those likely to be in the more severe trajectories. (*J. Stud. Alcohol Drugs* 70: 859-869, 2009)

INDIVIDUALS WHO COME TO BE described as alcoholics show great variability in the chronicity and extent of their problematic alcohol involvement, an observation that can be traced to Jellinek's seminal articles published 50 years ago (Jellinek, 1960). Since that time, many alcoholism typologies have been proposed (Babor et al., 1992; Cloninger et al., 1981; Zucker, 1979) that have incorporated factors such as chronicity, severity, and onset as defining characteristics. Although many of these typologies have suggested that different types of alcoholism are characterized by developmental course, only during the past 25 years has an influential conceptual model (Zucker et al., 1995; Zucker and Gomberg, 1986) given form to this area of inquiry. This line of research attempts to identify developmentally differentiated types of alcoholism, with the assumption that course differences are related to changing environmental, social, and individual characteristics, which become salient at different developmental stages. In addition, given that some types of problematic alcohol use may be more or less likely to conflict with interpersonal, social, and professional roles at different stages of the life span, whether problem alcohol use meets criteria for alcoholism also may change over time.

To date, empirical studies attempting to describe the developmental nature of alcoholism types have focused primarily on the period between drinking onset and young adulthood. Overall, this line of research has identified two major trajectories: one characterized by chronic problem use associated with deviant behavior (antisocial alcoholism) and the other by problem-drinking onset in late adolescence/early 20s, which declines by the mid-20s (developmentally limited alcoholism). Other patterns, although reported less consistently, have included stable-moderate drinking, escalating use, and heavy episodic drinking (Bennett et al., 1999; Chassin et al., 2002; Hill et al., 2000; Wiesner et al., 2007). In contrast with the rapidly growing and increasingly rigorous literature focused on alcoholism course through the young-adult years, almost no studies have considered the years from young adulthood through midlife, leaving unspecified the portrait of alcoholism relevant to this time period. Specifically, it is not yet known (1) whether individuals who demonstrate chronic levels of alcoholism in young adulthood maintain or even increase their problematic alcohol consumption in the fourth and fifth decades of life, (2) whether those individuals who show a decrease in consumption and problem drinking during the young-adult years continue to show lower levels of alcohol-related problems or whether problem drinking reemerges later in life, (3) whether novel subtypes of alcohol problems emerge in later life that are largely unrelated to earlier patterns of alcoholism, or (4) what is the nature of both distal and proximal influences that may identify different developmental types.

A few studies can be identified that have followed individuals into their 20s or 30s (Casswell et al., 2002; Jackson

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and Sher, 2005; Windle et al., 2005), but these studies have not yet examined trajectories past the beginning adulthood years. One study (Jackson et al., 2006) examined alcohol-dependence (AD) symptom profiles of individuals in the fourth decade of life, but analyses were restricted to two times: when individuals were ages 24-32 and 5 years later when they were ages 29-37. Analyses yielded useful information about the number of individuals who either regressed or progressed in severity of AD symptoms during this time. These studies also found that shifting to less severe patterns of drinking was more common than shifting to more severe patterns of drinking. At the other end of the life span, a study of the course of alcohol consumption of individuals older than age 60 (Gee et al., 2007) found a similar overall decrease in alcohol consumption for some individuals but stable and curvilinear (increasing, then decreasing) patterns of use as well. To our knowledge, no specific studies of the period between 40 and 60 years of age have been conducted.

The present study was aimed at identifying the number and nature of trajectories of AD from adolescence to the mid-50s and sought to identify distal and proximal markers of such trajectories. This work attempted to replicate and extend our earlier work in this area based on a sample of 330 middle-age men who had lifetime diagnoses of AD (Jacob et al., 2005). In that study, longitudinal, retrospective data were collected by means of the Lifetime Drinking History (LDH) interview and were analyzed by means of latent growth mixture modeling (LGMM). Four trajectories, covering the period from drinking onset to age 41, were identified, three of which (severe-chronic, young-adult, and late-onset alcoholism) had reasonably clear counterparts in the larger typology literature (antisocial alcoholism, developmentally limited alcoholism, and late-onset alcoholism; Zucker, 1994), whereas a fourth pattern (severe-nonchronic alcoholism) had not been described in the literature, notwithstanding its seeming importance and considerable prevalence in the study.

The present study builds on this earlier work in three ways: (1) the sample, although drawn from the same population (the Vietnam Era Twin Registry; Eisen et al., 1987; Henderson et al., 1990), was increased from 330 to 420 alcohol-dependent men; (2) additional possible trajectory markers were included (personality and religiousness variables); and (3) the age span was extended from age 41 to age 56. Most notably, extending the age range to 56 years allowed us to characterize the course of problem drinking into the mid-50s, and to describe changes in drinking trajectories that occur from the early 40s to the mid-50s. We were particularly interested in determining (1) the proportion of severe chronic alcoholics who persisted in problem drinking as they entered their 50s, (2) the proportion of young-adult alcoholics who returned to problem drinking at midlife, and (3) the fate of late-onset alcoholics as they entered their sixth decade of life. We hypothesized that the same variables distinguishing

among trajectories in the original study also would predict trajectory membership in the current study. Furthermore, for measures new to this report, we hypothesized that the more severe trajectories also would be differentiated in terms of the personality and religiousness variables. Namely, we predicted that individuals classified within the two more severe trajectories (severe-chronic and severe-nonchronic classes) would have higher aggression and neuroticism but lower control scores (given the positive association between AD and neuroticism/negative emotionality and aggression and the negative relationship between AD and behavioral control; see McGue et al., 1997; Sher et al., 2000) and lower religiousness scores (given the negative association between religiousness and AD; see Kendler et al., 2003).

Method

Participants

Participants were drawn from a subsample of the Vietnam Era Twin Registry (Eisen et al., 1987; Goldberg et al., 1987; Henderson et al., 1990), assessed in the Family Twin Study (Jacob et al., 2003). The current sample consisted of 420 men ages 41 or older who were diagnosed with AD at some point in their life (based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition [DSM-IV]; American Psychiatric Association, 1994; except that the clustering criterion was not required). The twins were analyzed as individuals in the current study. In the sample of 420 alcohol-dependent men, there were 86 full twin pairs and 248 single twins (where the co-twin was not alcohol dependent and, therefore, was not included in the sample). See Scherrer et al. (2004) and Jacob et al. (2003) for further information about the Family Twin Study. As seen in Table 1, participants averaged 13.4 years of education, 88% were employed at the time of the study, and the median income bracket was \$50,001-\$60,000.

Procedure

In 1987, twins were enrolled in the Vietnam Era Twin Registry and completed a mailed questionnaire (Eisen et al., 1987; Henderson et al., 1990). Some of the registry men then participated in the Harvard Drug Study, a phone interview conducted in 1992, which focused on assessment of psychiatric disorders (Tsuang et al., 1996). In 2003, the Family Twin Study focused on a subsample of the Harvard Drug Study. It again involved a mailed self-report questionnaire and a telephone interview, which was conducted by trained interviewers at the Institute for Survey Research, Temple University, via Computer Assisted Telephone Interview (Jacob et al., 2003; Scherrer et al., 2004). Data in the current report are from the Family Twin Study except when noted otherwise.

TABLE 1. Demographic and drinking characteristics of the entire sample, and the subsamples returning and not returning the self-report mailed questionnaire

Variable	Entire sample Mean (SD) or %	Subsample returning self-report Mean (SD) or %	Subsample not returning self-report Mean (SD) or %
Age	50.4 (2.8)	50.3 (2.8)	50.8 (2.9)
Years of education	13.4 (1.8)	13.3 (1.8)	13.5 (1.9)
Employed full-time	88.3%	88.6%	87.2%
Median household income	\$50,001-\$60,000	\$50,001-\$60,000	\$50,001-\$60,000
ASPD diagnosis	7.1%	6.6%	9.3%
MDD diagnosis	17.6%	17.7%	17.4%
Nicotine dependence diagnosis	67.9%	66.2%	74.4%
Drug dependence	18.8%	18.0%	22.1%
Family alcohol history positive	45.5%	46.1%	44.7%
Age at first drink	15.7 (2.8)	15.6 (2.8)	16.2 (2.8)
Ever sought treatment	31%	30.2%	33.7%
Ever binge drinker	15.7%	16.5%	12.8%
Ever morning drinker	4.3%	3.6%	7.0%
Ever often drank alone	47.6%	46.1%	53.5%

Note: None of these differences was significant based on *t* tests (for mean differences) or chi-square tests (for dichotomous variables). Sample sizes for those returning the questionnaire ranged from 319-334, and for those not returning the questionnaire from 81-85. ASPD = antisocial personality disorder; MDD = major depressive disorder.

Measures

Lifetime Drinking History. Alcohol-use variables, including AD, were assessed using the LDH (Skinner and Sheu, 1982), as modified by Jacob (1998). The LDH interview uses a phase approach to lifetime drinking. The beginning (and ending) of phases is defined by changes in drinking patterns of the individual. Phase 1 begins when an individual first drinks regularly (at least one drink per month). Phase 1 ends and Phase 2 begins when there is a significant change in the frequency or quantity of drinking (and so on for all subsequent phases). An individual can report between 1 and 11 phases. In the current study, the mean (SD) number of reported phases was 4.1 (1.4) (range: 1-11).

To assist recall, individuals were encouraged during the interview to think about changes in their lives that may have precipitated a new phase of alcohol use. AD diagnosis for each phase was made based on the presence of three or more DSM-IV dependence symptoms (American Psychiatric Association, 1994). The LDH has been shown to be a reliable and valid instrument for assessing drinking over time (Gladsjo et al., 1992; Jacob et al., 2006; Koenig et al., 2009; Lemmens et al., 1997; Skinner and Schuller, 1982; Skinner and Sheu, 1982).

Other diagnoses. Major depressive disorder, antisocial personality disorder, nicotine dependence, and dependence diagnoses for cannabis, cocaine, opiates, or sedatives combined (drug dependence) were determined via DSM-III-R criteria (American Psychiatric Association, 1987) during the 1992 Harvard Drug Study interview (Tsuang et al., 1996). The percentage of the sample with each disorder is reported in Table 1.

Familial alcohol history. The men were asked to report on their familial alcohol history (whether their mothers and

fathers were ever "excessive drinkers"). Approximately 46% of the participants had a mother and/or a father who drank excessively (Table 1).

Other Lifetime Drinking History variables. Other LDH questions about alcohol use were included in the current study as third variables hypothesized to distinguish between trajectories. Descriptive statistics for these variables also are reported in Table 1. *Binge drinking* was defined as having a pattern of drinking for 2 or more days without sobering up. Time of day of typical drinking (evening, morning, afternoon, or no particular time) was asked for each phase. Drinking alone was coded present for anyone responding that he drank alone half the time or more. These variables, as well as a variable representing whether the participant had ever been in treatment for his alcohol problems, were coded across the entire life span: If an individual reported that the problem or event had ever occurred during one of his drinking phases, the variable was coded as present.

The men also were asked to report on events and experiences in their lives that led them to begin alcohol-dependent drinking (i.e., events that precipitated their first AD phase). Individuals could endorse more than one of the eight events: school (e.g., starting a new school, academic problems), work (e.g., quitting a job, getting a promotion), family (e.g., divorce, death, or birth in the family in which they grew up), relationships (e.g., a romantic relationship), peers (e.g., drinking habits of friends), emotional problems (e.g., depression, anxiety), military service (e.g., combat experience), and other (including medical, legal, or financial) events. Percentages of men endorsing each event were 5.2%, 22.1%, 11.9%, 31.0%, 57.1%, 31.9%, 49.8%, and 15.2% for school, work, family, relationships, peers, emotional, military, and other events, respectively.

Household income. Household income was reported via 19 categories, but the small sample sizes across these fine-grained categories by alcohol trajectory did not allow for statistical analyses. Instead, the categories were collapsed into five roughly equally probable income brackets: below \$30,000 (14%), \$30,001-\$50,000 (25%), \$50,001-\$60,000 (18%), \$60,001-\$80,000 (22%), and above \$80,001 (22%).

Self-report questionnaire. A self-report questionnaire was used to assess drinking expectancies, personality, and religiousness/spirituality. A total of 334 individuals (79.5%) returned the questionnaire, although missing data on any given scale score vary somewhat. Because of the lower response rate of returning mailed questionnaires, fewer individuals had scores for these scales. (A description of how these men differed from others in the sample is given in the following Results section).

The Comprehensive Effects of Alcohol (CEOA) scale measures both positive and negative expected effects from the use of alcohol, and it has been shown to be psychometrically strong (Fromme et al., 1993). The CEOA measures seven drinking expectancies, with each item rated on a 4-point scale from "strongly disagree" to "strongly agree": sociability (e.g., "I would act sociable"), tension reduction (e.g., "I would feel calm"), sexuality (e.g., "I would be a better lover"), liquid courage (e.g., "I would be brave and daring"), cognitive and behavioral impairment (e.g., "I would feel dizzy"), risk and aggression (e.g., "I would be loud, boisterous, or noisy"), and self-perception (e.g., "I would feel guilty").

In the current questionnaire, the risk and aggression scale had three items, with a total score ranging from 3 to 12, and all other CEOA scales had two items, with total scores ranging from 2 to 8. The sample size for each scale was 332, except for tension reduction ($n = 331$) and liquid courage ($n = 330$). In the full Family Twin Study sample ($N = 770$), α coefficients for the CEOA scales ranged from .60 (sociability) to .85 (sexuality).

Extraversion, openness, neuroticism, agreeableness, and conscientiousness ($n = 332$ -333) were assessed via the Revised NEO Personality Inventory (McCrae, 1999; McCrae and John, 1992). Aggression and control ($n = 330$) were assessed via the Multidimensional Personality Questionnaire (MPQ; Tellegen, 1982). Each NEO scale was represented by 12 items, whereas the MPQ aggression and control scales include 10 and 9 items, respectively, rated on a 5-point scale ("strongly disagree" to "strongly agree"). The MPQ and the NEO personality inventories have been shown to have high reliability and validity (Costa and McCrae, 1992; McCrae, 1989; Tellegen, 1982). In the full Family Twin Study sample, the coefficient α for the NEO and the MPQ scales ranged from .64 (openness) to .84 (neuroticism).

Two religious involvement items were asked: (1) a self-rated (1-100) religious or spiritual orientation ($n = 334$) and (2) an assessment of the amount of time spent on religious/

spiritual practices (a 4-point scale from "once a year or less" to "several times per week or more"; $n = 332$). Eight items also were asked from the Spiritual Well-Being Scale (Ellison, 1983) (rated on a 4-point scale ranging from "strongly disagree" to "strongly agree"). These items were used to form two spiritual well-being scales composed of four items each: religious well-being (e.g., "I feel most fulfilled when I'm in close communication with God"; $n = 329$) and existential well-being (e.g., "I feel very fulfilled and satisfied with life"; $n = 327$). In the full Family Twin Study sample, the coefficient α was .93 for both the religious and the existential scales.

Analyses

Data preparation. The LDH phase data were converted to a "person-year" structure. Based on phase reports of AD described above, a dichotomous variable was calculated for each year corresponding to whether an AD diagnosis was reported. We then collapsed the person-year diagnoses into 13 different age categories so that the LGMM trajectories could be more easily estimated: up to age 20, ages 21-23, and continuing with 3-year intervals until ages 54-56. The first eight categories were those used in the previous LGMM article (Jacob et al., 2005). Data were missing starting at ages 45-47, because some men in the sample were younger than others. Twelve men (2.9%) at ages 45-47 and 70 men (16.7%) at ages 48-50 had missing data. After age 50, the percentage of men with missing data drastically increased (191 men, 45.5%, for ages 51-53; and 379 men, 90.2%, for ages 54-56). When considering missing data by trajectory categorization, each trajectory had 49%-62% of the original sample by ages 51-53, and 5%-12% of the original sample left by ages 54-56. Therefore, caution in interpreting trajectories into the later age ranges is appropriate.

Latent growth mixture modeling. As in our previous article, we used LGMM (Muthén and Shedden, 1999), which is an extension of finite mixture modeling (McLachlan and Peel, 2000), designed for the analysis of longitudinal data. LGMM attempts to identify common patterns of growth associated with a given trajectory via two latent variables, corresponding to intercept and slope over time. Individual trajectories are identified under this model via estimated means associated with the intercept and slope latent variables. Variability within trajectory group is thought to exist; that is, the intercept and the slope latent variables are modeled as random effects, as opposed to fixed effects, a major characteristic distinguishing LGMM models from latent class growth analysis (Nagin and Tremblay, 1999).

LGMM models were fit for one, two, three, four, and five latent groups using Mplus Version 4.2 (Muthén and Muthén, 1998-2007), with the number of starts increased to 2,000 and the second stage optimizations increased to 30. The 10-fold increase in the number of random starts and the exploration of a larger number of solutions for subsequent minimization was completed to minimize the effect of missing data pat-

terns and/or cohort confounds in the identification of mixture models (which also may make resulting LGMM models susceptible to local minima; Hipp and Bauer, 2006). The default parameters for LGMMs within Mplus were overridden. One group was constrained to have a mean (age 21) intercept of 0 (as we assumed one trajectory would be typified by a mean of 0), whereas a second group was constrained to have a mean slope factor of 0 (as we assumed that at least one trajectory would maintain a relatively high pattern of alcohol use over time). This latter constraint does not imply that mean levels of diagnosis are uniform over time for this group, because individual differences in variability about the latent slope would result in differences in mean across measurement occasions even for this group.

The fit of the models with different numbers of latent groups were compared, using Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) statistics. Mplus calculates AIC as $-2LL + 2r$ and BIC as $-2LL + r \ln(n)$, where LL is the likelihood function, r is the number of free parameters, and n is the sample size. Additionally, entropy values of 1 indicate a clear delineation of classes (Celeux and Soromenho, 1996). We interpreted the value of .90 as indicating an acceptable degree of mixture delineation.

Class characteristics. Once individuals were assigned to an AD trajectory class based on their highest probability class membership, general linear models (for continuous variables) and likelihood ratio chi-square analyses (for dichotomous variables) were conducted to determine whether significant differences existed between classes on these variables. Although it is possible to specify LGMMs that incorporate such hypotheses, the number of dependent variables and the sample size under consideration precluded construction of a single multivariate model. General linear model analyses were run in SAS (Ninth Edition; SAS Institute Inc., Cary, NC), using least squares (LS) mean contrasts with p values for the pairwise LS means comparisons adjusted via the Tukey method. Additionally, models were run in SAS to correct for the correlated nature of the data (i.e., that the data include some twin pairs) using PROC MIXED (Littell et al., 1996). The pattern of significant results did not change, and the original, uncorrected results are presented. Chi-square analyses were run in SPSS, and no specific post hoc tests were completed when the chi-square was significant. We interpret effects with $p < .05$ as significant but realize that the Type I error rate is likely increased with the large number of comparisons.

Results

Latent growth mixture modeling

Based on an examination of LGMM model fit statistics and the conceptual interpretability of the solution, a four-group solution was selected (AIC = 4,788.78, BIC = 4,909.97, and entropy = .90). The number of latent groups to retain was not a clear-cut decision, given conflicting recom-

mendations of the fit statistics for the models. Results of the Vuong-Lo-Mendell-Rubin test would have favored five latent trajectories for these data ($p = .003$), whereas AIC and BIC values favored the four-class solution. Exploration of more than five classes was not possible, because the obtained minimization failed to replicate even after specifying generous random starts. Given that the five-class solution appeared to subdivide one of the classes in the four-group solution—so that the additional analyses in the article would be better served by considering larger classes—and the interpretability of the four-class solution, we decided to retain the four-class solution as most representative of the latent mixtures in the data. We believe that our decision to retain four groups also produces a solution that is conceptually similar to the four-group solution reported in our earlier work.

LGMM models also yield estimates of class-membership probabilities for each individual (i.e., the probability that a given individual is a member of Trajectory Class 1, 2, 3, or 4), and individuals can be assigned to the best-fitting trajectory group. The pattern of the four trajectories can be seen in Figure 1. Severe-chronic alcoholics ($n = 55$, 13.1% of the sample) were diagnosed at high rates up until age 56; severe-nonchronic alcoholics ($n = 76$, 18.0%) had a high probability of AD diagnosis until age 41, at which point AD diagnosing probabilities began to decline; young-adult alcoholics ($n = 186$, 44.3%) started with fairly high probabilities of diagnosis that began to decline immediately, becoming zero by age 42; and late-onset alcoholics ($n = 103$, 24.5%) started with low probabilities of diagnosing, which increased and peaked at ages 42–44, after which the probability of AD diagnosis decreased again.

Comparison between age 41 and age 56 LGMM analyses

In our previous study, LGMM analyses were conducted on a subsample of 330 Vietnam Era Twin Registry men using data up to age 41 (Jacob et al., 2005). To assess change in trajectories when class designations were based on the 56-year timeline versus the 41-year timeline, two LGMM analyses were conducted with our 420 men: an LGMM analysis up to age 41 (with no missing data) and an LGMM analysis up to age 56. Table 2 shows the cross-tabulation between the two different class designations. As seen, the majority of individuals in the young-adult and late-onset alcoholic groups at age 41 were classified in these same trajectories when behavior up to age 56 was considered. In contrast, of those in the severe-chronic group at age 41, a number of these individuals (54%) had periods of nondiagnosis between 41 and 56 years of age and were classified as severe nonchronic when analyses were extended to age 56. As a result, the severe-chronic group contained fewer cases than seen with the analyses ending at age 41 (13% vs 25%). Finally, of men in the severe-nonchronic group at age 41, approximately 67% were classified as young-adult alcoholics when analyses were extended to 56 years of age.

FIGURE 1. Trajectories of alcoholism from age at first drink up to age 56. AD = alcohol-dependence, SC = severe chronic, SNC = severe nonchronic, YA = young adult, LO = late onset.

TABLE 2. Cross-tab analysis of trajectory designations using data up to age 41 versus data up to age 56

Class at age 41	Class at age 56				Total
	Severe chronic	Severe nonchronic	Young adult	Late onset	
Severe chronic	52	55	0	0	107
Severe nonchronic	0	14	29	0	43
Young adult	0	3	144	1	148
Late onset	3	4	13	102	122
Total	55	76	186	103	420

Attrition analyses

Because of the smaller sample size for some of the third variables (drinking expectancies, personality, and religious/spiritual orientation), the difference between those who did and did not return the questionnaire based on trajectory membership was assessed. More than 76% of the respondents in each trajectory had the self-report data. No significant differences were found in the percentage of men returning questionnaires as a function of class trajectory ($\chi^2 = 1.8$, 3 df, $p = .62$; $n = 420$) or in demographic and drinking characteristics by trajectory, as shown in Table 1.

TABLE 3. Mean (or %, when noted) of demographic characteristics, other mental disorder diagnoses, antecedent events for first alcohol-dependence (AD) diagnosis, and personality and religiousness variables across the four classes

Variable	Class designation				<i>F</i> or χ^2	
	Severe chronic	Severe nonchronic	Young adult	Late onset	Statistic	<i>p</i>
Demographic characteristics*						
Age at interview	49.8	50.6	50.3	50.6	1.0	.40
Education, mean years [§]	12.9	13.0	13.5	13.5	3.0	.03
Household income					21.3	.05
% <\$30,000	26.0%	16.0%	9.0%	14%		
% >\$80,001	8.0%	25.0%	23.0%	23%		
Employed at assessment	81.8%	82.9%	91.4%	90.3%	6.2	.10
Other mental disorder diagnoses, %[†]						
Antisocial personality	20.0	11.8	3.2	3.9	19.0	<.001
Nicotine dependence	70.9	67.1	67.7	67.0	0.3	.96
Any drug dependence	25.5	17.1	18.3	17.5	1.8	.62
Major depression	14.5	23.7	17.2	15.5	2.5	.48
Antecedent events for first AD diagnosis, %[†]						
Military	54.5	60.5	62.4	16.5	65.8	<.001
Relationship	30.9	15.8	22.6	57.3	46.1	<.001
Work	20.0	14.5	18.4	35.9	14.7	.002
Other	10.9	7.9	14.0	25.2	11.8	.008
Peer	63.6	61.8	60.2	58.9	8.8	.03
Emotional	29.1	28.9	27.4	43.7	8.5	.04
School	5.5	6.6	7.0	1.0	6.9	.07
Family	14.5	18.4	10.8	7.8	5.2	.16
Personality and religiousness[‡]						
NEO agreeableness	40.3 ^a	40.7 ^a	43.5 ^b	42.2 ^{a,b}	5.8	.001
NEO neuroticism	35.6 ^a	34.0 ^{a,b}	31.6 ^b	31.5 ^b	4.3	.005
MPQ aggression	22.7 ^{a,b}	23.4 ^a	20.8 ^b	21.5 ^{a,b}	3.5	.016
NEO extraversion	36.3	37.5	38.7	38.0	2.2	.09
NEO conscientiousness	43.0	44.6	45.2	44.7	1.4	.23
MPQ control	30.5	30.7	31.4	31.3	0.8	.47
NEO openness	36.2	36.1	36.0	36.4	0.1	.97
Self-rating of R/S	45.9	55.8	55.9	47.8	2.4	.07
Time spent on religion	2.0	2.3	2.4	2.1	1.4	.23
Existential well-being	10.8	10.5	10.2	10.9	1.1	.37
Religious well-being	11.1	10.1	12.2	10.5	1.0	.38

Notes: Statistics sharing a common superscript in a given row are not significantly different from one another, whereas statistics with different superscripts are significantly different. Sample sizes for the four groups were as follows: Demographics/diagnoses/antecedent events: severe chronic = 50-55, severe nonchronic = 69-76, young adult = 179-186, late onset = 98-103; Personality/religiousness: severe chronic = 45-47, severe nonchronic = 57-58, young adult = 144-147, late onset = 80-82. *Demographics: *F* on 3 (numerator) and 396 or 416 (denominator) df. Chi-square for income on 12 df, $n = 408$, for employment 3 df, $n = 420$; §pairwise mean comparisons were not significant, after correcting for multiple comparisons; †diagnoses and antecedent events: chi-square on 3 df, with $n = 419-420$; percentages for the events do not sum to 1, because individuals could indicate more than one event as an antecedent for their first AD diagnosis. ‡Personality/religiousness: *F* on 3 (numerator) and 323-330 (denominator) df. MPQ = Multidimensional Personality Questionnaire; R/S = religiousness/spirituality.

Class characteristics

Demographic variables. The top section in Table 3 presents demographic characteristics by class designation. Education was the only demographic variable that significantly differed across classes ($F = 3.0$, 3/396 df, $p = .03$), although no pairwise comparisons were significant after adjustment for multiple comparisons.

Drinking variables. Table 4 presents differences among classes for other drinking variables, including drinking symptoms, family history, and drinking expectancies. Age at first drink ($F = 5.9$, 3/416 df, $p < .001$), age at first AD diagnosis ($F = 214.6$, 3/416 df, $p < .001$), age at first alcohol-use disorder (alcohol abuse or AD) diagnosis ($F = 75.7$, 3/415 df, $p < .001$), and age at first AD symptom ($F = 33.7$, 3/416 df, $p < .001$) were all statistically significant predictors of class. Severe-chronic and severe-nonchronic class members started drinking, on average, around age 15, with late-onset class members starting to drink at age 16.5. The late-onset group also was the latest to exhibit an AD diagnosis or symptom, which occurred, on average, in the late 20s or early 30s. The other three groups had their first alcohol-use disorder diagnosis and/or AD symptom around age 20.

Differences in two other drinking symptoms also occurred: drinking alone ($\chi^2 = 13.4$, 3 df, $p = .004$; $n = 420$) and having ever sought treatment ($\chi^2 = 11.0$, 3 df, $p = .01$; $n = 420$). Young-adult alcoholics had the lowest rates of treatment and drinking alone, with severe-nonchronic alcoholics having the highest rates of treatment and severe-chronic al-

coholics having the highest rates of drinking alone. Parental history of excessive drinking was not a significant predictor of class membership. Of the drinking expectancies, severe-chronic alcoholics had a significantly higher expectancy that alcohol would prompt them to engage in more risky behavior than late-onset alcoholics (risk and aggression scores; $F = 3.1$, 3/327 df, $p = .03$; $n = 328$). Also, differences in tension-reduction expectancies tended toward significance ($F = 2.6$, 3/327 df, $p = .05$), with the highest level found in the late-onset alcoholics, who, based on previous research, should have higher levels of drinking as a result of personal problems, such as depression.

Psychiatric variables. The percentages of men in each trajectory with a comorbid diagnosis are presented in Table 3. Antisocial personality disorder was the only significant predictor of class membership ($\chi^2 = 19.0$, 3 df, $p < .001$; $n = 420$), with the severe-chronic alcoholics having a much higher rate of antisocial personality disorder than the young-adult or late-onset alcoholics.

Transition variables. Table 4 presents the percentage of men in each trajectory who indicated that a specific type of event was antecedent to their first AD diagnosis. Late-onset alcoholics were much more likely to be influenced by work events ($\chi^2 = 14.7$, 3 df, $p < .002$; $n = 419$), relationship events ($\chi^2 = 46.1$, 3 df, $p < .001$; $n = 420$), emotional events ($\chi^2 = 8.5$, 3 df, $p = .04$; $n = 420$), and other events ($\chi^2 = 11.8$, 3 df, $p = .008$; $n = 420$). They were much less likely to be influenced by military events ($\chi^2 = 65.8$, 3 df, $p < .001$; $n = 420$), although military events did have a high prevalence

TABLE 4. Mean (or %, when noted) of drinking characteristics across the four classes

Variable	Class designation				F or χ^2 *	
	Severe chronic	Severe nonchronic	Young adult	Late onset	Statistic	p
Age at first drink	14.6 ^a	15.4 ^a	15.7 ^{a,b}	16.5 ^b	5.9	<.001
Age at first AD diagnosis	20.7 ^{a,b}	20.0 ^a	21.6 ^b	33.2 ^c	214.6	<.001
Age at first AD or AB diagnosis	20.1 ^a	19.2 ^a	20.5 ^a	28.4 ^b	75.7	<.001
Age at first AD symptom	18.9 ^a	19.1 ^a	19.5 ^a	24.1 ^b	33.7	<.001
Either father or mother excessive drinker, %	46.3	42.7	47.8	44.1	0.7	.87
Ever sought treatment, %	36.4	42.1	23.1	31.9	11.0	.01
Ever drinking alone, %	60.5	52.7	38.2	52.4	13.4	.004
Ever drink in morning, %	7.3	3.9	2.2	6.8	3.9	.18
Ever binge drinking, %	18.4	12.7	18.3	10.7	3.9	.28
Drinking expectancies						
Risk and aggression	8.0 ^a	7.4 ^{a,b}	7.3 ^{a,b}	7.0 ^b	3.1	.03
Tension reduction	5.1	5.1	5.2	5.5	2.6	.05
Liquid courage	5.2	4.9	4.8	4.6	2.2	.08
Self-perception	4.8	4.8	4.5	4.5	1.7	.16
Sociability	5.9	5.5	5.7	5.6	1.2	.30
Cognitive and behavioral impairment	5.2	4.8	5.0	5.0	0.8	.48
Sexuality	4.6	4.5	4.5	4.5	0.1	.95

Notes: Statistics sharing a common superscript in a given row are not significantly different from one another, whereas statistics with different superscripts are significantly different. Sample sizes for the four groups were as follows: For all variables except drinking expectancies, severe chronic = 52-55, severe nonchronic = 73-76, young adult = 184-186, late onset = 100-103; for drinking expectancies, severe chronic = 47, severe nonchronic = 57, young adult = 145-146, late onset = 81-82. * F statistic on 3 (numerator) and 326-416 (denominator) df. Chi-square on 3 df, with $n = 417$ -420. AD = alcohol dependence; AB = alcohol abuse.

across the entire sample. Peer influences also were common across all four trajectories.

Personality/religion variables. Agreeableness ($F = 5.8$, 3/328 df, $p = .001$) and neuroticism ($F = 4.3$, 3/238 df, $p = .005$) varied significantly by trajectory class (see Table 3). Young-adult alcoholics were significantly more agreeable than the severe-chronic and severe-nonchronic alcoholics, whereas severe-chronic alcoholics were significantly more neurotic than the young-adult and late-onset alcoholics. Aggression also was a significant predictor of class membership, with severe-nonchronic alcoholics being significantly more aggressive than young-adult alcoholics ($F = 3.5$, 3/326 df, $p = .016$). There were no significant differences among class trajectories for the religious/spiritual orientation items or scales.

Discussion

Four trajectories of AD were identified in this middle-age sample of men with a lifetime diagnosis of AD: severe-chronic, severe-nonchronic, young-adult, and late-onset alcoholics. These trajectories were found when using data up to age 41 (as was seen in our previous study, Jacob et al., 2005) and when using data up to age 56, providing evidence that these four developmental types are present into midlife. Our analyses indicated that (1) only half of those classified as severe chronic at 41 (25% of the total sample) also were so classified at age 56 (13% of the total sample); (2) the young-adult alcoholism trajectory continued to decline in diagnostic probabilities into midlife, and only four individuals were reclassified from the young-adult trajectory at age 41 to a different trajectory at age 56; and (3) the late-onset alcoholism trajectory peaked at age 41 and declined in diagnosing probabilities from age 41 to age 56. These insights were possible only with data that characterized individuals beyond young adulthood, allowing us to more accurately describe the developmental nature of these alcoholism types. Several important implications of the present findings can be noted.

First, the paths of the late-onset and severe-nonchronic trajectories were different when based on the 56- versus 41-year data. The late-onset trajectory did not continue in its upward trend of diagnosing probabilities after age 41 but decreased into the 50s, whereas the downward trend for the severe-nonchronic alcoholics began at a slightly later age. Given the overall decrease seen in alcohol use with age (see Gee et al., 2007; Grant et al., 2006), these findings are both expected and of potential importance when considering treatment of AD in midlife.

Second, the prevalence of the trajectories changed between the age 41 and the age 56 analyses, with fewer men falling into the severe-chronic trajectory based on the age 56 timeline. By contrast, prevalence of the severe-nonchronic and the young-adult trajectories increased under the 56-year

timeline. Overall, many severe-chronic alcoholics moderated their problem drinking between 41 and 56 years of age and were better classified as severe-nonchronic alcoholics under the extended timeline. Similarly, a large proportion of those classified as severe nonchronic at age 41 were better classified within the young-adult trajectory when drinking patterns were examined over a longer period. Both patterns reveal a “downgrading” of the AD trajectory from a more severe class to a less severe class—findings consistent with those recently reported by Jackson et al. (2006). Given the additional data available with the 56-year analyses, it might become more “clear” as to which trajectory an individual is best classified—thus explaining the trajectory switching we see between the two analyses.

Third, although the downward trend in alcohol consumption in later life has been reported in the epidemiological literature for many years (e.g., Grant et al., 2006), our study indicates a heterogeneity in the course by which different individuals reach this state. Our analyses show that, although most men end up at the same place (social drinking or abstinence), the paths by which this result is obtained are not the same. In systems theory, this process is referred to as “equifinality,” or the presence of many paths that lead to the same outcome (Cicchetti and Rogosch, 1996).

Fourth, collateral variables that can be used to identify trajectory membership were, in general, similar to those identified in our previous study. Given that the current sample included individuals also used in the previous study, this finding is not surprising. These four subgroups (severe chronic, severe nonchronic, young adult, and late onset) have been identified and described by various investigators, and, although the labels have varied, the distinguishing characteristics have been relatively consistent (Zucker et al., 1995). We turn now to a discussion of these distinguishing characteristics, as found in the current study as well as in past research.

When contrasting severe-chronic alcoholics with those with more moderate drinking practices (i.e., those who are less likely to achieve diagnoses as they move from 40 to 56 years of age), the most obvious difference appears to be one of severity (e.g., early age of drinking onset, symptoms, more likely to engage in solitary drinking) and greater psychiatric comorbidity (high prevalence of antisocial personality disorder along with AD). These differences in turn are associated with personality features and drinking expectancies reflective of higher levels of aggression and risk taking and with lower levels of socioeconomic functioning. The greater likelihood of severe-nonchronic alcoholics to seek treatment than severe-chronic alcoholics may be one factor in their desistance from problem drinking or may indicate a pre-existing difference between the groups (e.g., personality or social-support differences that make some individuals more likely to seek treatment). Unfortunately, our data do not contain information about possible time-varying influ-

ences that alter the course of severe-chronic alcoholics (e.g., divorce, academic underachievement, or job loss). Similarly, we do not know what environmental variables may have protected the late-onset alcoholics from developing alcohol symptoms at an earlier age or what influences predate and predict problem onset during the individuals' 30s and 40s.

As suggested earlier, the late-onset group in the current study shares similarities with negative-affect alcoholism, which is thought to be associated with internalizing disorders (in particular, depression; Zucker, 1994). Negative-affect alcoholism also is thought to be accompanied by interpersonal stressors that increase the likelihood that alcohol will be turned to as a means of reducing stress. Late-onset alcoholics in our study did not have a higher prevalence of depression, and they were more likely to attribute the onset of problem drinking to emotional, interpersonal, and work-related problems. They were additionally less likely to attribute their drinking to military events, probably because their AD was removed in time from their military experience. Finally, young-adult alcoholics are clearly related to what Zucker and others have referred to as developmentally limited alcoholics, where "the excesses of youth" diminished with age and maturation into adult roles and responsibilities.

In summary, the current study provides evidence for multiple alcoholisms and extends previous work into midlife. This study is not without limitations. First, there are limitations to LGMM methodology. For example, given that the manifest variables in the current study are dichotomous, the use of thresholds in the latent-response variables of the LGMM requires the assumption that the underlying continuous variables have the same variance over time (Cho et al., 2009; Millsap and Tein, 2004). The extent to which this assumption is violated may contribute to model misfit. Although we could have avoided the use of a dichotomy by examining ordered categories with more than two levels in the present study (using, for example, categories of nondiagnosis, abuse, and dependence), given the number of manifest variables and the relatively small sample size, we would have had insufficient observations for estimating the additional thresholds for such models.

Other potentially serious limitations inherent in the model include that (1) such models assume both independence between manifest variables and normality between manifest variables conditional on group membership, (2) missing data that occur are missing at random, and (3) the individual participants represent independent observations. The instability of LGMM analyses suggests that further work, both with LGMM and with other statistical methodologies, be completed to examine the development of AD. For example, using survival analysis to understand other aspects of drinking trajectories, such as time to first AD or time to relapse, would provide additional useful information about possible environmental triggers of alcohol use.

The increase in missing data is a second limitation of the study. Using all data up to age 56 was justified, however, because when the four-group analysis was rerun using only data up to age 53, only one individual changed class designation (from severe nonchronic to young adult). Although our data are retrospective, past research has shown that the LDH is a reliable and valid measure, especially with respect to the pattern of alcohol consumption (e.g., Jacob et al., 2006; Koenig et al., 2009). Nevertheless, there are limitations in the use of retrospective data collection; therefore, it will be important that future studies make use of longitudinal data collections.

Finally, although the current study focused on individuals with a lifetime diagnosis of AD, trajectories of alcoholism also should be studied in general population samples (to investigate false-positive and false-negative rates of trajectory classifications), as well as samples with greater severity of alcohol problems. Examinations of the trajectories of other drinking behaviors—such as alcohol abuse, binge drinking, or consumption levels—are important as well. These studies can help to validate the trajectories found here, as well as to provide additional knowledge regarding other outcomes, given the variety of assessments and variables gathered in different studies.

References

- AMERICAN PSYCHIATRIC ASSOCIATION. Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R), Washington, DC, 1987.
- AMERICAN PSYCHIATRIC ASSOCIATION. Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), Washington, DC, 1994.
- BABOR, T.F., HOFMANN, M., DEL BOCA, F.K., HESSELBROCK, V., MEYER, R.E., DOLINSKY, Z.S., AND ROUNSAVILLE, B. Types of alcoholics: I. Evidence for an empirically derived typology based on indicators of vulnerability and severity. *Arch. Gen. Psychiat.* **49**: 599-608, 1992.
- BENNETT, M.E., MCCRADY, B.S., JOHNSON, V., AND PANDINA, R.J. Problem drinking from young adulthood to adulthood: Patterns, predictors and outcomes. *J. Stud. Alcohol* **60**: 605-614, 1999.
- CASSWELL, S., PLEDGER, M., AND PRATAP, S. Trajectories of drinking from 18 to 26 years: Identification and prediction. *Addiction* **97**: 1427-1437, 2002.
- CELEUX, G. AND SOROMENHO, G. An entropy criterion for assessing the number of clusters in a mixture model. *J. Classificat.* **13**: 195-212, 1996.
- CHASSIN, L., PITTS, S.C., AND PROST, J. Binge drinking trajectories from adolescence to emerging adulthood in a high-risk sample: Predictors and substance abuse outcomes. *J. Cons. Clin. Psychol.* **70**: 67-78, 2002.
- CHO, S.B., WOOD, P.K., AND HEATH, A.C. Decomposing group differences of latent means of ordered categorical variables with the genetic factor model. *Behav. Genet.* **39**: 101-122, 2009.
- CICCHETTI, D. AND ROGOSCH, F.A. Equifinality and multifinality in developmental psychopathology. *Devel. Psychopathol.* **8**: 597-600, 1996.
- CLONINGER, C., BOHMAN, M., AND SIGVARDSSON, S. Inheritance of alcohol abuse: Cross-fostering analysis of adopted men. *Arch. Gen. Psychiat.* **38**: 861-868, 1981.
- COSTA, P.T., JR. AND MCCRAE, R.R. Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) Professional Manual, Odessa, FL: Psychological Assessment Resources, 1992.
- EISEN, S., TRUE, W., GOLDBERG, J., HENDERSON, W., AND ROBINETTE, C.D. The Vietnam Era Twin (VET) Registry: Method of construction. *Acta Genet. Med. Gemellol.* **36**: 61-66, 1987.

- ELLISON, C.W. Spiritual well-being: Conceptualization and measurement. *J. Psychol. Theol.* **11**: 330-340, 1983.
- FROMME, K., STROOT, E.A., AND KAPLAN, D. Comprehensive effects of alcohol: Development and psychometric assessment of a new expectancy questionnaire. *Psychol. Assess.* **5**: 19-26, 1993.
- GEE, G.C., LIANG, J., BENNETT, J., KRAUSE, N., KOBAYASHI, E., FUKAYA, T., AND SUGIHARA, Y. Trajectories of alcohol consumption among older Japanese followed from 1987-1999. *Res. Aging* **29**: 323-347, 2007.
- GLADISO, J.A., TUCKER, J.A., HAWKINS, J.L., AND VUCHINICH, R.E. Adequacy of recall of drinking patterns and event occurrences associated with natural recovery from alcohol problems. *Addict. Behav.* **17**: 347-358, 1992.
- GOLDBERG, J., TRUE, W., EISEN, S., HENDERSON, W., AND ROBINETTE, C.D. The Vietnam Era Twin (VET) Registry: Ascertainment bias. *Acta Genet. Med. Gemellol.* **36**: 67-78, 1987.
- GRANT, B.F., DAWSON, D.A., STINSON, F.S., CHOU, S.P., DUFOUR, M.C., AND PICKERING, R.P. The 12-month prevalence and trends in DSM-IV alcohol abuse and dependence: United States, 1991-1992 and 2001-2002. *Alcohol Res. Hlth* **29**: 79-91, 2006.
- HENDERSON, W.G., EISEN, S., GOLDBERG, J., TRUE, W.R., BARNES, J.E., AND VITEK, M.E. The Vietnam Era Twin Registry: A resource for medical research. *Publ. Hlth Rep.* **105**: 368-373, 1990.
- HILL, K.G., WHITE, H.R., CHUNG, I.-J., HAWKINS, J.D., AND CATALANO, R.F. Early adult outcomes of adolescent binge drinking: Person- and variable-centered analyses of binge drinking trajectories. *Alcsm Clin. Exp. Res.* **24**: 892-901, 2000.
- HIPP, J.R. AND BAUER, D.J. Local solutions in the estimation of growth mixture models. *Psychol. Meth.* **11**: 36-53, 2006.
- JACKSON, K.M., O'NEILL, S.E., AND SHER, K.J. Characterizing alcohol dependence: Transitions during young and middle adulthood. *Exp. Clin. Psychopharmacol.* **14**: 228-244, 2006.
- JACKSON, K.M. AND SHER, K.J. Similarities and differences of longitudinal phenotypes across alternate indices of alcohol involvement: A methodologic comparison of trajectory approaches. *Psychol. Addict. Behav.* **19**: 339-351, 2005.
- JACOB, T. Modified Lifetime Drinking History, 1998, unpublished measure, VA Palo Health Care System, Palo Alto, CA.
- JACOB, T., BUCHOLZ, K.K., SARTOR, C.E., HOWELL, D.N., AND WOOD, P.K. Drinking trajectories from adolescence to the mid-forties among alcohol-dependent males. *J. Stud. Alcohol* **66**: 745-755, 2005.
- JACOB, T., SEILHAMER, R.A., BARGIEL, K., AND HOWELL, D.N. Reliability of Lifetime Drinking History among alcohol dependent men. *Psychol. Addict. Behav.* **20**: 333-337, 2006.
- JACOB, T., WATERMAN, B., HEATH, A., TRUE, W., BUCHOLZ, K.K., HABER, R., SCHERRER, J., AND FU, Q. Genetic and environmental effects on offspring alcoholism: New insights using an offspring twins design. *Arch. Gen. Psychiat.* **60**: 1265-1272, 2003.
- JELLINEK, E.M. The Disease Concept of Alcoholism, New Brunswick, NJ: Hillhouse Press (distributed by Rutgers Center of Alcohol Studies, New Brunswick, NJ), 1960.
- KENDLER, K.S., LIU, X.-Q., GARDNER, C.O., MCCULLOUGH, M.E., LARSON, D., AND PRESCOTT, C.A. Dimensions of religiosity and their relationship to lifetime psychiatric and substance use disorders. *Amer. J. Psychiat.* **160**: 496-503, 2003.
- KOENIG, L.B., JACOB, T., AND HABER, J.R. Validity of the Lifetime Drinking History: A comparison of retrospective and prospective quantity-frequency measures. *J. Stud. Alcohol Drugs* **70**: 296-303, 2009.
- LEMMENS, P.H., VOLOVIC, L., AND DE HAAN, Y. Measurement of lifetime exposure to alcohol: Data quality of a self-administered questionnaire and impact on risk assessment. *Contemp. Drug Probl.* **24**: 581-600, 1997.
- LITTELL, R.C., MILLIKEN, G.A., STROUP, W.W., AND WOLFINGER, R.D. SAS System for Mixed Models., Cary, NC: SAS Institute, 1996.
- MCCRAE, R.R. Why I advocate the five-factor model: Joint factor analyses of the NEO-PI with other instruments. In: BUSS, D.M. AND CANTOR, N. (Eds.) *Personality Psychology: Recent Trends and Emerging Directions*, New York: Springer-Verlag, 1989, pp. 237-245.
- MCCRAE, R.R. Mainstream personality psychology and the study of religion. *J. Pers.* **67**: 1209-1218, 1999.
- MCCRAE, R.R. AND JOHN, O.P. An introduction to the Five-Factor Model and its applications. *J. Pers.* **60**: 175-215, 1992.
- MCGUE, M., SLUTSKE, W., TAYLOR, J., AND IACONO, W.G. Personality and substance use disorders: I. Effects of gender and alcoholism subtype. *Alcsm Clin. Exp. Res.* **21**: 513-520, 1997.
- MCLACHLAN, G.J. AND PEEL, D. *Finite Mixture Models*, Hoboken, NJ: John Wiley & Sons, 2000.
- MILLSAP, R.E. AND YUN-TEIN, J. Assessing factorial invariance in ordered-categorical measures. *Multivar. Behav. Res.* **39**: 479-515, 2004.
- MUTHÉN, B. AND SHEDDEN, K. Finite mixture modeling with mixture outcomes using the EM algorithm. *Biometrics* **55**: 463-469, 1999.
- MUTHÉN, L.K. AND MUTHÉN, B.O. *Mplus User's Guide*, Version 5, Los Angeles, CA: Muthén & Muthén, 1998-2007.
- NAGIN, D. AND TREMBLAY, R.E. Trajectories of boys' physical aggression, opposition, and hyperactivity on the path to physically violent and non-violent juvenile delinquency. *Child Devel.* **70**: 1181-1196, 1999.
- SCHERRER, J.F., WATERMAN, B.M., HEATH, A.C., BUCHOLZ, K.K., TRUE, W.R., AND JACOB, T. Are substance use, abuse and dependence associated with study participation? Predictors of offspring nonparticipation in a twin-family study. *J. Stud. Alcohol* **65**: 140-144, 2004.
- SHER, K.J., BARTHOLOW, B.D., AND WOOD, M.D. Personality and substance use disorders: A prospective study. *J. Cons. Clin. Psychol.* **68**: 818-829, 2000.
- SKINNER, H. AND SCHULLER, R. *Validation of the Lifetime Drinking History: Biochemical, medical history and psychosocial evidence*, Toronto, Canada: Addiction Research Foundation, 1982, unpublished manuscript.
- SKINNER, H.A. AND SHEU, W.-J. Reliability of alcohol use indices: The Lifetime Drinking History and MAST. *J. Stud. Alcohol* **43**: 1157-1170, 1982.
- TELLEGEN, A. *Brief manual of the Multidimensional Personality Questionnaire*, Minneapolis, MN: University of Minnesota, 1982, unpublished manuscript.
- TSUANG, M.T., LYONS, M.J., EISEN, S.A., GOLDBERG, J., TRUE, W., LIN, N., MEYER, J.M., TOOMEY, R., FARAONE, S.V., AND EAVES, L. Genetic influences on DSM-III-R drug abuse and dependence: A study of 3,372 twin pairs. *Amer. J. Med. Genet.* **67**: 473-477, 1996.
- WIESNER, M., WEICHOLD, K., AND SILBEREISEN, R.K. Trajectories of alcohol use among adolescent boys and girls: Identification, validation, and sociodemographic characteristics. *Psychol. Addict. Behav.* **21**: 62-75, 2007.
- WINDLE, M., MUN, E.Y., AND WINDLE, R.C. Adolescent-to-young adulthood heavy drinking trajectories and their prospective predictors. *J. Stud. Alcohol* **66**: 313-322, 2005.
- ZUCKER, R.A. Developmental aspects of drinking through the young adult years. In: BLANE, H.T. AND CHAFETZ, M.E. (Eds.) *Youth, Alcohol, and Social Policy*, New York: Plenum Press, 1979, pp. 91-146.
- ZUCKER, R.A. Pathways to alcohol problems and alcoholism: A developmental account of the evidence for multiple alcoholisms and for contextual contributions to risk. In: ZUCKER, R., BOYD, G., AND HOWARD, J. (Eds.) *The Development of Alcohol Problems: Exploring the Biopsychosocial Matrix of Risk*. NIAAA Research Monograph, No. 26, NIH Publication No. 94-3495, Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism, 1994, pp. 255-289.
- ZUCKER, R.A., FITZGERALD, H.E., AND MOSES, H.D. Emergence of alcohol problems and the several alcoholism: A developmental perspective on etiologic theory and life course trajectory. In: CICCETTI, D. AND COHEN, D.J. (Eds.) *Developmental Psychopathology*, Vol. 2: Risk, Disorder, and Adaptation, Hoboken, NJ: John Wiley & Sons, 1995, pp. 677-711.
- ZUCKER, R.A. AND GOMBERG, E.S.L. Etiology of alcoholism reconsidered: The case for a biopsychosocial process. *Amer. Psychol.* **47**: 783-793, 1986.