Course of Alcohol Dependence Among Vietnam Combat Veterans and Nonveteran Controls*

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ABSTRACT. Objective: Identifying developmental trajectories of alcohol use is fundamental in building theories of alcoholism etiology and course. The purpose of this study was to replicate and generalize our previous finding that had been based on a twin sample drawn from the Vietnam Era Twin Registry. In this study, we made use of a nontwin sample of Vietnam veterans drawn from the Vietnam Era Study—a 25-year follow-up of the Vietnam Drug User Returns project that assessed the long-term medical and psychiatric consequences of substance abuse or dependence in Vietnam. **Method:** Alcohol-related behaviors and psychiatric status were assessed in a sample of 839 individuals that comprised 323 veterans who tested positive for drugs (i.e., opiates, barbiturates, or amphetamines) on discharge from Vietnam, 319 veterans who tested negative for drugs at that time, and a nonveteran control sample (n = 197). Individuals with a lifetime diagnosis of alcohol dependence (n = 293) were selected for further analysis. Using detailed life history charts, in-person structured interviews were conducted, which entailed retrospective reports covering the 25 years since the 1972 survey. Measures of alcohol and drug use as well as psychiatric symptoms were obtained by assessing each year of the follow-up interval, beginning with 1972. **Results:** Using latent growth mixture modeling, a four-class model was identified with trajectories that were parallel to those identified in our previous studies based on the Vietnam Era Twin Registry: severe chronic alcoholics, severe nonchronic alcoholics, late-onset alcoholics, and young-adult alcoholics. **Conclusions:** Present findings provide additional support for the replicability and generalizability of meaningful differences in the course of alcoholism from early adulthood to midlife. (*J. Stud. Alcohol Drugs, 71,* 629-639, 2010)

VARIOUS TYPES OF ALCOHOLISM have been discussed in both the clinical and empirical literatures over the past 5 decades (Cloninger, 1987; Jellinek, 1960; Zucker, 1994) and have been organized in terms of severity, chronicity, comorbidity, and etiology. Although it is often suggested that different courses may characterize different alcoholism types, this issue has rarely been examined beyond young adulthood. To address this gap in the literature, our research group has been assessing the course of alcohol dependence in a sample of 50- to 60-year-old veterans from the Vietnam Era Twin Registry (VETR). Using the Lifetime Drinking History questionnaire—a retrospective report of alcohol use with impressive reliability and validity (Jacob et al., 2006; Koenig et al., 2009)—each year between drinking onset and current age was coded for alcohol-dependence status. Using this approach, we identified several drinking trajectories that were interpretable and consistent with typologies discussed in the clinical literature (Jacob et al., 2005, 2009). Nonetheless, replication of our findings with other samples, particularly nontwins, would provide greater confidence in the generalizability of our findings.

In this article, we report on one such sample derived from the Vietnam Era Study (VES; Price et al., 2001a, 2001b). In contrast with the VETR, the VES was comprised of nontwins and oversampled for veterans who tested positive for drug use at discharge from Vietnam. Thus, the sample members were likely to exhibit greater substance abuse or dependence severity and comorbidity than participants from the VETR (Hedden et al., 2010). Replicating our findings based on a sample with different characteristics than the VETR is of considerable importance to determining the generalizability of the patterns we identified.

Since the foundational work of Jellinek (1960), many alcoholism typologies have been proposed and differentiated on various dimensions, including age at onset, gender, chronicity, severity, comorbity, and genetic underpinning (Babor et al., 1992; Cloninger et al., 1981; Jacob et al., 2001; Zucker, 1979). In terms of distinguishing these typologies on course, the major influence in this literature was Zucker's consolidation of extant studies and his clearly articulated, evidenced-based description of four alcoholism types (i.e., antisocial alcoholism, developmentally limited alcoholism, late-onset alcoholism, primary alcoholism) and their distinct developmental patterns (Zucker et al., 1995; Zucker and Gomberg, 1986). Since that time, a number of empirical studies have focused on differences in patterns of onset and course that characterize varying alcoholism

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trajectories (Chassin et al., 2002; Hill et al., 2000; Jackson and Sher, 2005; Windle et al., 2005).

Examination of this literature indicates that (a) the majority of studies have focused on the period between drinking onset and young adulthood and have most often identified two major patterns (chronic problem drinking associated with deviant behavior ["antisocial alcoholism," Zucker, 1994] and problem drinking with an onset in late adolescence/early 20s, which declines by the mid-20s ["developmentally limited alcoholism," Zucker, 1994]; (b) the literature on drinking in later life has included a limited number of studies that focused on the changing nature of alcohol use and abuse/dependence from midlife to late life (Gee et al., 2007; Moos et al., 2009; Schutte et al., 2009); and (c) very few studies have examined the years from young adulthood through middle age (Jackson et al., 2006), despite high rates of treatment-seeking in middle age. Given this limited literature, several questions remain unanswered: Do individuals who exhibit chronic alcoholism during young adulthood continue to do so into middle age? Do individuals who decrease consumption and problem drinking during young adulthood continue to show low levels of alcohol-related problems, or does problem drinking re-emerge later in life? Are there alcoholism trajectories that emerge only in later life? Can we identify individual, interpersonal, and contextual variables that differentiate distinct courses of alcohol dependence?

The present study addressed these issues in an attempt to replicate and extend our earlier work (Jacob et al., 2005; 2009). In these efforts, retrospective longitudinal data obtained from the Lifetime Drinking History interview were analyzed with latent growth mixture modeling (LGMM) on veterans from the VETR who had a lifetime diagnosis of alcohol dependence (Eisen et al., 1987; Henderson et al., 1990). In our first analysis of 330 veterans (Jacob et al., 2005), four alcoholism trajectories, covering the period from drinking onset to age 41, were identified, three of which—severe chronic, young adult, and late onset—had clear counterparts in the larger typology literature. The fourth pattern, severe nonchronic, had not been described in the literature despite its seeming importance and considerable prevalence in the study. We subsequently assessed an expanded and older sample of veterans (n = 420) from drinking onset to age 56, drawn from the same population used in our first study. As before, four alcohol-dependence trajectories were identified (severe chronic, severe nonchronic, young adult, and late onset) providing evidence that these developmental types may be present into midlife. These analyses also clarified the nature of change and stability for these alcoholism trajectories over time. For example (a) only half of those classified as severe chronic alcoholics at age 41 (25% of the total sample) were classified as severe chronic at age 56 (13% of the total sample), with many of these individuals reclassified as severe nonchronic based on ages 41 to 56; (b) the majority of those classified as young-adult alcoholics at age 41 were also classified as young-adult alcoholics at age 56; (c) the late-onset trajectory peaked at age 41 and declined in diagnostic probability from ages 41 to 56; and (d) a substantial number 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 of time.

To date, we have examined the issue of alcohol-dependence trajectories only in twins. Although a convincing literature has documented strong similarities in the prevalence of psychiatric disorders and socioemotional status in twin and nontwin samples (De Geus and Boomsma, 2001; Johnson et al., 2002; Kendler, 1993, 2001; McCaffery et al., 2001), similarities in the trajectories of alcohol problems have not been examined between twins and nontwins. Thus, uncertainty remains regarding the generalizability of our previous findings. It is important to clarify, however, that in our prior work there were 64 twin pairs in the sample of 330 (Jacob et al., 2005) and 86 twin pairs in the sample of 420 (Jacob et al., 2009). Furthermore, when using the full sample and modeling subjects as independent, the results were virtually identical to the results based on removal of one member of each twin pair.

The primary aim of the present study was to conduct trajectory analyses to determine the degree to which our previous analyses can be replicated. In this effort, we made use of data from the VES study (Price et al., 2001a, 2001b), a 25-year follow-up of the Vietnam Drug User Returns (Robins, 1974) project, which assessed the long-term medical and psychiatric consequences of substance misuse in Vietnam. In contrast with the VETR, the VES is a nontwin, high-risk sample by virtue of an oversampling of veterans who tested positive for drug use on discharge from Vietnam. Further, the VES dataset contains a diverse set of covariates (e.g., sociodemographics, family history, health and psychiatric functioning, drug-use status at discharge, posttraumatic stress disorder before and after induction, combat exposure) that allow us to assess for cross-trajectory differences on variables that are potentially related to differences in the course of alcohol dependence.

Method

Sample and procedures

Participants for the current study were drawn from the VES study (Price et al., 2001a, 2001b), a 25-year follow-up of the Vietnam Drug User Returns project. The original Vietnam Drug User Returns cohort, assessed in 1972, comprised 1,227 men derived from three sample sources: (a) the "DEROS-positive" sample, individuals chosen randomly from the Date Eligible for Return from Overseas (DEROS) program (Stanton, 1976) who tested positive for opiates,

barbiturates, or amphetamines at the time of their departure from Vietnam in September 1971; (b) the "general" sample, individuals chosen randomly from the total population of nonofficer Army returnees in the same month, including those who tested positive for drugs; and (c) a nonveteran control sample (n = 284), added to the Vietnam Drug User Returns follow-up survey in 1974, chosen from Selective Service registrations and individually matched to veterans from the general sample in terms of draft eligibility, draft board location, age, and education at the time of the veteran's entry into service (Robins et al., 1980). For the VES survey (conducted in 1996-1997), the overlap between the "DEROS-positive" and "general" samples (n = 39) was reclassified into the "drug-positive" veterans for the sake of simplicity, thus yielding a drug-positive group (n = 512) and the remaining "drug-negative" (n = 431) veteran subsamples that are nonoverlapping (Price et al., 2001a).

Of the original Vietnam Drug User Returns cohort (n = 1,227), 10.5% were deceased by the time of the VES survey. Of the surviving members (n = 1,024), 93% had relocated, and 841 were interviewed (82.1% participation rate). Two respondents who were missing data on most variables were removed from the sample, yielding a final N of 839 (drug positive = 323, drug negative = 319, nonveteran = 197). Because of oversampling of individuals who tested positive for drug use at discharge, participants in this sample were at high risk for several forms of psychopathology. Lifetime diagnostic rates for drug-positive participants, for example, were 12% for major depressive disorder, 29% for posttraumatic stress disorder, 39% for antisocial personality disorder, and 44% for drug-use disorder.

Of the total sample, 293 individuals (34.9%) met criteria for an alcohol-dependence diagnosis at some point during the 25-year follow-up period and were used for the present analyses. At the time of the VES survey, the alcohol-dependence sample was, on average, 45.9 years old (SD = 2.08); 66% were married, 70% were employed, 73% had completed high school, and 18% were African-American (per Price et al., 2001b; 76.2% of VES participants were White).

The percentage of individuals within each sample source who reported an alcohol-dependence diagnosis were as follows: drug positive = 54%, drug negative = 29%, nonveteran = 11%. Among the alcohol-dependent participants, the sample sources did not differ significantly on initial alcohol-dependence severity (i.e., number of alcohol-dependence symptoms in 1972). There were, however, significant differences in the percentage of individuals across the sample sources who (a) were African-American, $\chi^2(2, 293) = 15.95$, $p < .01$, drug positive = 25%, drug negative = 6%, nonveteran = 9%; (b) were college educated at time of the VES survey, $\chi^2(2, 293) = 22.79$, $p < .01$, drug positive = 2%, drug negative = 14%, nonveteran = 26%; and (c) had received a diagnosis of drug dependence at some point during the 25-year follow-up interval, $\chi^2(2, 293) = 16.33$, $p < .01$, drug positive = 61%, drug negative = 36%, nonveteran = 39%.

Measures

Sampling status, sociodemographics, and a measure of combat experiences were extracted from the Vietnam Drug User Returns survey in 1972. All other variables were extracted from the VES interview in 1996-1997. The interview modules used to create time-variant measures were modified from the Diagnostic Interview Schedule (Price et al., 1996). With the aid of a detailed life history chart (Lyketsos et al., 1994), VES in-person structured interviews entailed retrospective reports covering the 25 years since the 1972 survey. The life chart was used at the beginning of the interview to elicit major life events since 1972 (e.g., residences, employment, relationships). Responses to the chart were paired with year-to-year assessments to increase recall accuracy in subsequent sections (Eaton et al., 1997). Using this approach, symptoms and diagnoses for alcohol and drug dependence, as well as other psychiatric disorders, were timed so that presence or absence of each of the symptoms from the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association, 1994), could be computed for each of the past 25 years (Price et al., 2004). It is important to note that in our prior work with the VETR, participants reported on lifetime drinking patterns using both retrospective and prospective assessments (Koenig et al., 2009). Results indicated a high degree of correspondence across these assessments in terms of the quantity and frequency of alcohol use during overlapping ages (rs = .47-.69).

Alcohol and substance use. Diagnostic assessments of alcohol dependence were gathered for those who met minimum drinking criteria since 1972 (i.e., ever had seven or more drinks in 1 day, one or more drinks every day for 2 weeks, or six or more drinks per day at least once a week for several weeks). For each year of the follow-up interval, the number of DSM-IV alcohol-dependence symptoms were obtained and used to compute year-by-year categorical diagnoses of alcohol dependence (i.e., three of seven symptoms endorsed in a given year). For drug dependence, diagnostic assessments were gathered separately for eight classes of drugs (sedatives, stimulants, cannabis, cocaine, opiates, phencyclidine, hallucinogens, inhalants) for respondents who reported illicit use five or more times since 1972. As with the assessment of alcohol use, the number of DSM-IV criterion symptoms that were met for each class was used to compute year-by-year categorical diagnoses over time.

Family history. Participants were asked to report on their family history of substance abuse or dependence and mental illness while growing up (i.e., parents, siblings) and during their adult life (i.e., spouses, children), adapted from the Washington University Home Environment Interview (Rob-

ins, 1982). Respondents reported whether each of these family members had problems with drinking, problem drug use, or a hospitalization or functional impairment with emotional or substance-use problems or made a suicide attempt. We created four dichotomous variables corresponding to whether respondents had one or more family members with a history of alcohol problems, drug problems, depression, or suicide attempts.

Health problems. Participants were asked about each of 15 serious health problems they had experienced since 1972 with items adapted from the 36-item Short Form Health Survey (SF-36; Ware and Sherbourne, 1992). Scores for this scale ranged from 0 to 10. Satisfactory psychometric properties for this measure have been reported by McHorney and colleagues (1993, 1994).

Combat experiences. Veteran participants were asked in 1972 whether they had exposure to various combat situations during their tour(s) in and around Vietnam (e.g., "Were you ever under enemy fire?"). For questions endorsed in the affirmative, the frequency of these combat situations was reported on five- or six-point scales tapping duration (months) or frequencies of the experiences. Based on seven items, the scores in the total sample ranged from 7 to 31.

Other psychiatric diagnoses. For major depressive disorder, posttraumatic stress disorder, and antisocial personality disorder, symptoms for each disorder were assessed for year of onset and recency. From these responses, year-by-year diagnoses were obtained. This procedure was used for these disorders because of time limitations and because pilot work suggested that respondents could not pinpoint year-by-year symptoms for emotional states, unlike drinking and drug symptoms, which were remembered very well.

Data preparation and analyses

A longitudinal data file was constructed with dichotomous variables, indicating whether an alcohol-dependence diagnosis was reported, for each year of the follow-up interval. Person-year diagnoses were collapsed into 10 age categories to more easily estimate latent alcohol-dependence trajectories: ages 19-21, 22-24, 25-27, 28-30, 31-33, 34-36, 37-39, 40-42, 43-45, and 46-48. These intervals are consistent with the age categories used in our past studies (Jacob et al., 2005, 2009). Each participant reported on their alcohol-dependence diagnoses for the past 25 years, and, given the relatively wide age range in the sample, data on alcohol-dependence diagnoses were available for ages 19-65 (with each individual having data for 25 consecutive years and missing data for the remaining ages). A large majority (91.1%) of the alcohol-dependence sample had missing data for ages 49 years or older, thus limiting our ability to estimate the trajectory of alcohol dependence into the 50s and beyond. By contrast, only 47.8% of the alcohol-dependence sample had missing data for the age interval of 46-48 years, and only 52.2% were missing data at ages 19-21. Therefore, we chose the age range of 19-48 years to minimize the impact of missing data.

LGMM (Muthén and Muthén, 2000a) was used to identify underlying trajectory groups (i.e., latent classes) that can account for heterogeneity in the developmental course of alcohol dependence. LGMM represents an extension of finite mixture modeling that combines features of growth curve models and latent class analysis (McLachlan and Peel, 2000). Briefly, this method identifies clusters of individuals based on similar patterns of growth on a given variable that is measured over multiple time points. Within each class that is identified, individual trajectories are estimated via latent variables that correspond to the intercept and slope over time with the means of these variables allowed to differ across the latent classes. With LGMM, variability within each latent class is estimated in the form of intercepts and slopes that are modeled as random (as opposed to fixed) effects, a feature that distinguishes this method from latent class analysis.

In the present analyses, growth mixture models specifying one through five latent classes were fit to the categorical data and run in Mplus 5.2 (Muthén and Muthén, 1998-2008). For LGMM with categorical data, a latent response variable is used to map the categorical data onto a continuous scale, and scaling factors are used to model the underlying continuous distribution that is theorized to produce the proportion of individuals with an alcohol-dependence diagnosis. Model estimation was based on the maximum likelihood ratio estimator. Linear slope values for estimating growth were set to the midpoint of each age interval. The mean slope factor for all classes was freely estimated. To adjudicate among the models in terms of the "best" fit to the data, we examined the following fit indices: Akaike Information Criterion (AIC) = $-2LL + 2p$; Bayesian Information Criterion (BIC) = $-2LL + p \times ln(n)$; sample-size adjusted BIC = $-2LL + p \times ln((n + 2)/24)$. (Note: LL = log-likelihood function; p = number of free parameters; n = sample size). A lower value for each fit index denotes a better fitting model. However, because models with more classes will tend to explain variability in alcohol dependence over time better than models with fewer classes, we used the Vuong-Lo-Mendell-Rubin test to evaluate the relative improvement in fit with successive increases in the number of classes (Lo et al., 2001; Vuong, 1989). In addition, entropy was used to evaluate the quality of classification or the extent to which the latent classes are distinguishable from one another. Entropy values approaching 1.0 indicate clear delineation of classes with values of .80 interpreted as an acceptable level of delineation (Celeux and Soromenho, 1996).

LGMM estimation yields three estimates that describe the characteristics of the latent classes. These are (a) estimated class sizes (or class proportions): estimated number of individuals that belong to each latent group; (b) conditional diagnostic probabilities across time: odds of an alcohol-

dependence diagnosis across the age intervals within each class; and (c) class membership probabilities: probability that individuals belongs to each latent group. Class membership probabilities were used to assign individuals to a latent alcohol-dependence class based on their highest probability of class membership. Using these class assignments, general linear models (GLM) for continuous variables and likelihood ratio chi-square tests for dichotomous variables were conducted in SPSS to examine if there were significant differences between the groups on a range of external correlates. Although it is possible a priori to specify growth mixture models that incorporate covariates on which the classes are assumed to differ, the large number of covariates, in conjunction with our relatively modest sample size, precludes such an approach. Post hoc tests for significant GLM analyses were performed using the Tukey method to adjust for multiple comparisons. No post hoc tests were conducted for significant chi-square tests.

Results

Latent growth mixture modeling and class characteristics

Results of the LGMM model fitting suggested a four-class solution based on the fit indices (AIC = 2,860.642, BIC = 2,901.124, Adjusted BIC = 2,866.240, Entropy = .81) and the Vuong-Lo-Mendell-Rubin tests, which indicated that four classes provided a significant improvement in fit over three classes (likelihood ratio test [LRT] = 80.4, $p = .02$). A five-class solution did not provide a better fit to the data than the four-class solution (LRT = 46.0, $p = .06$). The pattern of alcohol dependence over time for the four latent classes is depicted in Figure 1. Conditional diagnostic probabilities of alcohol dependence across the 10 age-intervals are presented in Table 1 and represent the proportions for the latent classes based on the estimated posterior probabilities. These groups were highly consistent with our two previous studies (Jacob et al., 2005, 2009). Class 1 comprised the severe chronic alcoholics ($n = 31$, 10.6% of the total alcohol-dependence sample) who were marked by relatively high diagnostic probabilities of alcohol dependence in early adulthood, which remained high until the late 40s. Class 2 was defined as severe nonchronic alcoholics ($n = 42$, 14.3%). As in our previous work, this group was characterized by high diagnostic probabilities of alcohol dependence until their mid-30s, followed by a rapid decline in diagnostic likelihood thereafter and into the late 40s. Class 3 represented late-onset alcoholics ($n = 82$, 28.0%), characterized by low probabilities of alcohol dependence in young adulthood followed by a monotonic increase in diagnostic probability that peaked in the late

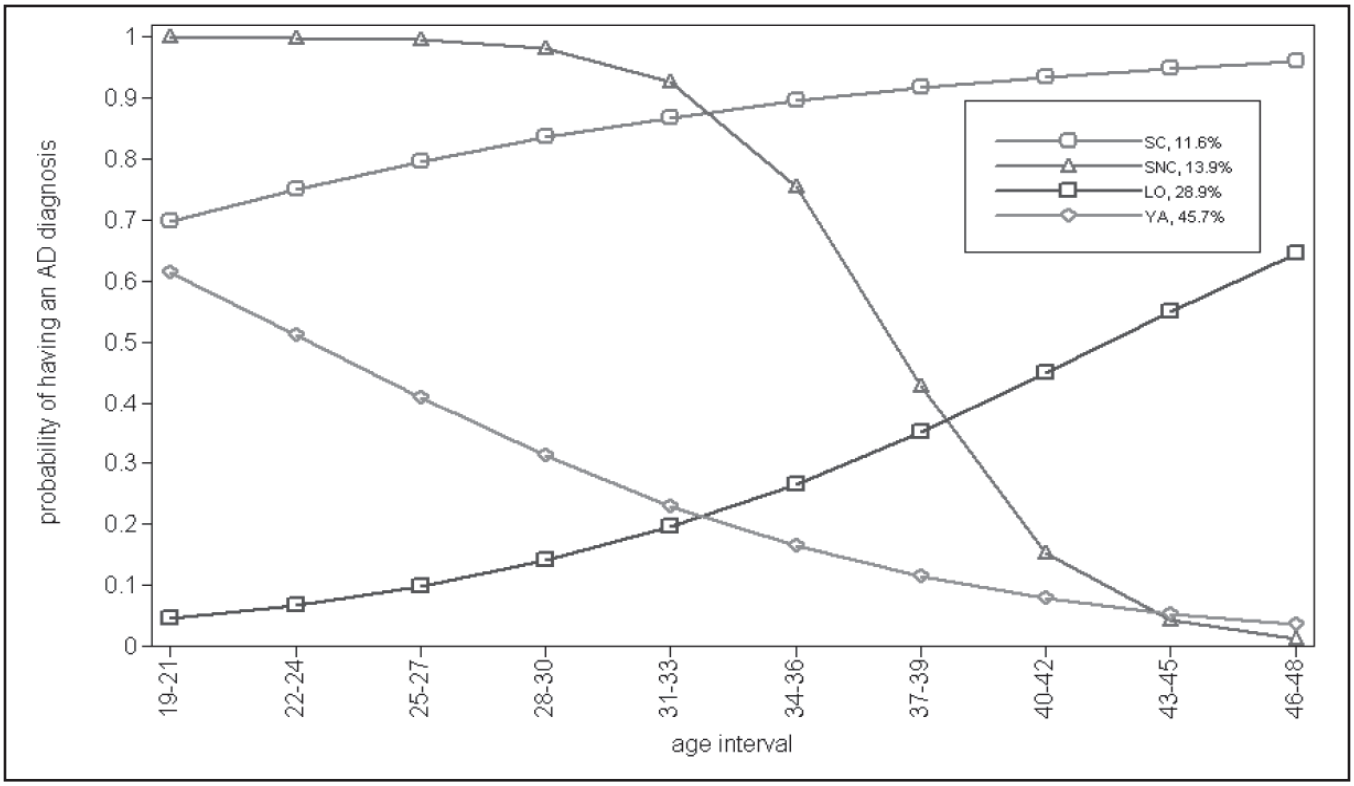

FIGURE 1. Probabilities of diagnosis across time for four latent classes of alcohol dependence. Percentages refer to the proportion of the sample that fell into each of the latent classes based on estimated posterior probabilities. AD = alcohol dependence; SC = severe chronic; SNC = severe nonchronic; LO = late onset; YA = young adult.

TABLE 1. Conditional diagnostic probabilities of alcohol dependence across time for the four-class solution

Age categories, in years	Class 1 (SC) (*n* = 31)	Class 2 (SNC) (*n* = 42)	Class 3 (LO) (*n* = 82)	Class 4 (YA) (*n* = 138)
19-21	.70	1.00	.05	.62
22-24	.75	.99	.07	.51
25-27	.80	.99	.10	.41
28-30	.84	.98	.14	.31
31-33	.87	.93	.20	.23
34-36	.90	.76	.27	.16
37-39	.92	.43	.35	.12
40-42	.94	.15	.45	.08
43-45	.95	.04	.55	.05
46-48	.96	.01	.65	.04

Notes: *N* = 293; Class 1 = severe chronic (SC) alcoholics (10.6%); Class 2 = severe nonchronic (SNC) alcoholics (14.3%); Class 3 = late-onset (LO) alcoholics (28.0%); Class 4 = young-adult (YA) alcoholics (47.1%). The *n*s listed under each class heading represent the class sizes based on the most likely class membership of each individual.

40s. Class 4 (the largest group) is described as young-adult alcoholics (*n* = 138, 47.1%) and displayed relatively high diagnostic probabilities in early adulthood that peaked at ages 19-21 then decreased steadily thereafter.

Latent alcohol-dependence class by sample source

Table 2 lists the percentage of individuals from the total alcohol-dependence sample and the four latent classes by sample source. Among the total alcohol-dependence sample, the majority of these individuals (60.1%) were veterans from the drug-positive group who tested positive for opiates, barbiturates, or amphetamines on discharge from Vietnam. Approximately one third of alcohol-dependence cases were veterans from the drug-negative group, with the nonveteran (control) sample making up the remaining 7.8% of alcohol-dependence cases. Although the majority of alcohol-dependence cases were from the drug-positive group, the percentage of individuals from this subsample that fell into each of the four latent alcohol-dependence classes was highly comparable. A similar pattern was evident for the drug-negative group. For the nonveteran group, a larger percentage of alcohol-dependence cases was characterized by trajectories of late-onset and young-adult alcoholism rather than the severe chronic or severe nonchronic alcoholism. Chi-square tests, however, suggested no relationship between sample source and alcohol-dependence class, $\chi^2(6) = 5.61$, $p = .468$. Thus, in this high-risk sample, a positive urine analysis for heavy drug use on return from service was not a significant predictor of the developmental course of alcohol dependence over time.

TABLE 2. Percentage of individuals from each sample source (drug positive, drug negative, nonveteran) for the full alcohol-dependence (AD) sample and by latent AD class (severe chronic, severe nonchronic, late onset, young adult)

	Total AD sample	Latent AD class			
		SC	SNC	LO	YA
	(*N* = 293)	(*n* = 31)	(*n* = 42)	(*n* = 82)	(*n* = 138)
Sample source	%	%	%	%	%
D+	60.1	64.5	64.3	63.4	55.8
D−	32.1	32.2	33.3	28.0	34.1
NV	7.8	3.2	2.3	8.5	10.1

Notes: D+ = drug positive; D− = drug negative; NV = nonveteran; SC = severe chronic; SNC = severe nonchronic; LO = late onset; YA = young adult. Chi-square tests suggested no relationship between sample source and latent AD class, $\chi^2(6) = 5.61$, $p = .468$.

Correlates of class membership

We investigated whether there were significant differences across the alcohol-dependence classes on various external correlates. Descriptive statistics are presented in Tables 3 and 4 for the total alcohol-dependence sample and by latent class. As seen, the percentage of individuals completing high school differed significantly across the classes, with a substantially lower percentage of severe chronic alcoholics completing high school compared with the other classes; individuals from the severe chronic class were employed for significantly fewer years than individuals from either the late-onset or young-adult groups; the rate of marriage at the time of assessment differed significantly across the classes, with the late-onset group having the fewest number of individuals married in their late 40s; and late-onset and severe chronic alcoholics were married for fewer years compared with the young-adult group (Table 3). No other cross trajectory differences in socioeconomic status–related variables were identified.

In the total alcohol-dependence sample, 46.8% of the sample had a family history of drinking problems, 32.8% had a family history of drug problems, 39.9% had a family history of depression, and 15.7% had a family history of attempted suicide. No significant differences were observed across classes with respect to any of these family history variables.

Table 4 presents differences among the alcohol-dependence classes for health problems, initial alcohol-dependence severity, and other psychiatric variables. Although the omnibus *F* test indicated significant differences across the classes in terms of serious health problems, none of the pairwise comparisons was significant after adjusting for multiple comparisons; however, there was a trend toward more serious health problems for individuals in the severe chronic group than the young-adult group ($p = .06$). Alcohol-dependence classes differed in number of alcohol dependence symptoms in 1972, an index of initial alcohol-dependence severity. Post hoc testing indicated significant differences between all groups, with severe nonchronic alcoholics reporting the greatest number of alcohol-dependence symptoms, followed by severe chronic, young-adult, and late-onset alcoholics. In terms of depression, although a higher percentage of late-onset and severe nonchronic alcoholics were ever diagnosed,

TABLE 3. Descriptive statistics (percentage or means, and standard deviations) of sociodemographic variables for the full alcohol-dependence (AD) sample and by latent AD class

Variable	Total AD sample ($N = 293$) M (SD) or %	Latent AD class SC ($n = 31$) M (SD) or %	SNC ($n = 42$) M (SD) or %	LO ($n = 82$) M (SD) or %	YA ($n = 138$) M (SD) or %	Test statistic F or χ^2	p
African American	17.7%	22.6%	16.7%	19.5%	15.9%	0.99	.80
Completed high school	73.0%	38.7%	78.6%	78.0%	76.1%	18.4	<.001
Education post-high school	29.7%	22.6%	23.8%	35.4%	29.7%	2.7	.43
Completed college	7.8%	0%	4.8%	7.3%	10.9%	7.3	.06
Employed (at assessment)	70.3%	54.8%	69.0%	70.7%	73.9%	4.2	.24
Years employed	20.3 (6.6)	17.3 (8.7)^{a}	19.8 (6.9)^{a,b}	20.9 (5.5)^{b}	20.8 (6.5)^{b}	2.7	.04
Married (at assessment)	65.9%	54.8%	73.8%	46.3%	77.5%	24.9	<.001
Years married	16.5 (7.5)	12.8 (7.7)^{a}	16.0 (8.3)^{a,b}	15.4 (8.0)^{a}	18.2 (6.4)^{b}	5.9	<.001
With biological children	78.2%	61.3%	78.6%	80.5%	80.4%	5.2	.16
No. of biological children	1.9 (1.5)	1.5 (1.7)	2.4 (1.7)	1.9 (1.5)	1.8 (1.3)	2.4	.07

Notes: SC = severe chronic; SNC = severe nonchronic; LO = late onset; YA = young adult. Test statistic is chi-square for categorical variables, F for continuous variables. F statistics are all on 3 and 289 *df.* Chi-square statistics are all on 3 *df.* Means with different superscripts are significantly different from one another.

the differences for this variable (as well as number of years depressed) were not significant. Regarding posttraumatic stress disorder, the groups did not differ on amount of combat experience; however, significant differences emerged for both posttraumatic stress disorder diagnostic history and number of years with posttraumatic stress disorder. Post hoc tests indicated significantly more years with posttraumatic stress disorder for individuals in the severe chronic group than in the young-adult group. Antisocial personality disorder and drug dependence were also highly significant predictors of class membership, with severe chronic alcoholics exhibiting both a higher rate of diagnosis and more years with these diagnoses than individuals in the other alcohol-dependence classes. In addition, severe chronic alcoholics had a significantly greater number of drug-dependence diagnoses than alcoholics from the late-onset and young-adult groups.

Discussion

The aim of the current study was to replicate and extend our earlier findings on differences in the course of alcohol dependence from drinking onset to midlife. In contrast with our analyses of twins from the VETR, participants in the VES were nontwins and were at high risk for SUDs and other psychiatric conditions. Moreover, VES sample members, unlike the VETR, had not participated in VES data collections since 1974 and, as such, were relatively unburdened by participation in longitudinal studies and multiple assessments over time.

Application of LGMM to these nontwin data identified four trajectories that were highly similar to those identified in our earlier analyses with twins. The relative distributions of the alcohol-dependence classes, for example, were very similar in the nontwin and twin samples (see Jacob et al.,

TABLE 4. Descriptive statistics (percentage or means, and standard deviations) for health problems, initial alcohol-dependence (AD) severity, and psychiatric variables for the full AD sample and by latent (AD) class

Variable	Total AD sample ($N = 293$)	Latent AD class SC ($n = 31$)	SNC ($n = 42$)	LO ($n = 82$)	YA ($n = 138$)	Test statistic F or χ^2	p
No. of serious health problems	1.6 (1.7)	2.2 (2.3)	1.6 (1.6)	1.8 (1.8)	1.4 (1.4)	2.9	.04
No. of AD symptoms in 1972	1.6 (2.0)	2.8 (2.1)^{a}	4.3 (1.3)^{b}	0.3 (0.6)^{c}	1.4 (1.8)^{d}	67.3	<.001
Ever depressed, %	14.3%	9.7%	19.0%	19.5%	10.9%	4.4	.22
No. of years with depression	2.7 (7.2)	2.2 (6.8)	4.2 (9.3)	3.7 (8.3)	1.7 (5.7)	2.0	.11
Combat experiences	13.5 (5.5)	14.3 (5.5)	15.0 (5.6)	13.0 (5.5)	13.1 (5.4)	1.7	.17
Ever PTSD, %	35.5%	51.6%	35.7%	45.1%	26.1%	12.2	<.01
No. of years with PTSD	5.0 (9.0)	8.4 (10.9)^{a}	6.7 (10.5)^{a,b}	5.8 (9.4)^{a,b}	3.2 (7.4)^{b}	4.1	<.01
Ever ASP, %	48.5%	77.4%	45.2%	45.1%	44.9%	12.2	<.01
No. of years with ASP	6.2 (8.7)	13.1 (10.2)^{a}	5.0 (7.4)^{b}	6.4 (9.1)^{b}	4.9 (7.8)^{b}	8.4	<.001
Ever drug dependent, %	51.2%	80.6%	45.2%	43.9%	50.7%	14.0	<.01
No. of years with drug dependence	4.9 (7.5)	11.2 (10.2)^{a}	5.5 (7.8)^{b}	2.6 (5.3)^{b}	4.6 (7.0)^{b}	10.9	<.001
No. of drug dependence diagnoses	1.3 (1.6)	2.2 (1.8)^{a}	1.3 (1.7)^{a,b}	1.0 (1.4)^{b}	1.2 (1.6)^{b}	4.0	<.01

Notes: SC = severe chronic; SNC = severe nonchronic; LO = late onset; YA = young adult; PTSD = posttraumatic stress disorder; ASP = antisocial personality. Test statistic is chi-square for categorical variables, F for continuous variables. F statistics are all on 3 and 289 *df.* Chi-square statistics are all on 3 *df.* Means with different superscripts are significantly different from one another.

2005, 2009)—that is, in both samples, the young-adult alcoholics had the highest percentage of alcohol-dependence cases (47% in nontwins, 44% in twins) followed by the late-onset (28%, 24%), the severe nonchronic (14%, 18%), and the severe chronic (11%, 13%) alcoholics. These distributions are also consistent with past research, which has found that the most prevalent course of substance use is desistance in young adulthood, whereas the least prevalent course is severe chronicity (Muthén and Muthén, 2000b; Schulenberg et al., 2005). In addition, there were similarities in the VETR and VES samples in terms of the covariates that differentiated trajectories. Hence, our VETR-based findings were clearly replicated when analyses were conducted on an independent sample of nontwins.

As before, four statistically distinct alcoholism trajectories were identified, which have clear counterparts in the extant literature; an exception is the severe nonchronic group, which has not often been described as a separate and distinct alcoholism subgroup. It is of interest to note that when our LGMM is limited to a three-class solution, individuals in the severe nonchronic group are most often classified as young-adult alcoholics. Although individuals in the severe nonchronic compared with the young-adult group have a higher likelihood of receiving a diagnosis during the young-adult years, the trajectories of the two classes are quite similar and differ primarily in terms of the decade in which the transition to more normative drinking begins (i.e., in the 20s for individuals in the young-adult group and a decade later [mid-30s] for individuals in the severe nonchronic group). Assessing more diverse samples should help identify factors that serve to delay the normative pattern of desistance of problem drinking in young adulthood for severe nonchronic alcoholics (e.g., not entering into traditional social roles, poor quality of interpersonal relationships; Kearns-Bodkin and Leonard, 2005; Littlefield et al., 2009).

The severe chronic group maps onto descriptions of antisocial alcoholism characterized by early onset, greater severity and chronicity, behavioral undercontrol (McGue et al., 1997, 2001), academic and occupational underachievement, disrupted martial/family/interpersonal relationships, strong genetic underpinnings, and substantial genetic covariance with other externalizing disorders (Iacono et al., 2003). Consistent with these descriptions, results from the current study indicated that the severe chronic alcoholics, relative to the other groups, were less likely to have completed high school or to be married or employed; more likely to report serious health problems; and more likely to have had co-occurring posttraumatic stress disorder, antisocial personality disorder, and/or drug dependence. For the young-adult group, these individuals exhibited higher rates of completing college and being married for a greater number of years, which is consistent with Zucker's descriptions of the developmentally limited alcoholics as entering adult social roles earlier than antisocial alcoholics in their study (Zucker et al., 1995; Zucker and Gomberg, 1986). Findings provided only weak support for the expectation that the late-onset class would be characterized by internalizing features (e.g., the presence of an affective disorder; Crum et al., 2005); that is, although the late-onset class had the highest proportion of individuals with a lifetime diagnosis of major depressive disorder, scores were not significantly different from those in the other classes. On the other hand, the late-onset group had the lowest rate of marriage and fewest years married at time of assessment—noteworthy differences given the impact of marital status and quality of marriage on mortality risk among alcoholics (e.g., Timko et al., 2006).

In examining cross-group differences, it must be recalled that we were assessing a relatively homogeneous sample (i.e., all veterans included in our sample had a lifetime diagnosis of alcohol dependence, similar military experiences, and were of a similar age). Given these characteristics, it may not be surprising that the groups were not differentiated on such study variables as family history of substance abuse or dependence and mental illness. It must be acknowledged, however, that the null findings may have also been the result of a number of other factors, including limitations in the measurement of the family history variables, as well as lack of statistical power to detect significant differences in small samples. These issues notwithstanding, differences in the *course* of alcohol dependence were clearly evident in our sample for a number of clinically significant covariates and even for the small sample of severe chronic alcoholics, thus indicating that a lifetime diagnosis of alcohol dependence can unfold in distinctly different trajectories beginning with drinking onset and progressing into midlife, even among a relatively homogeneous high-risk sample.

Some limitations and future directions should be acknowledged. First, both the VETR and VES samples were limited to men. Thus, it is unclear whether the identified trajectories are equally descriptive of differences in the life course of alcohol dependence among women. On the one hand, one might anticipate similarities in the trajectories of male and female alcoholics given (a) female alcoholism appears as heritable as male alcoholism (Heath et al., 1997) and (b) gender differences in alcohol use, abuse, or dependence have decreased over the past 80 years (Keyes et al., 2008). Others have argued, however, that there are gender-specific moderators that may exert a differential influence on the course of alcoholism in male and female drinkers (Nolen-Hoeksema, 2004; Prescott, 2002; Wilsnack and Wilsnack, 1997; Wilsnack et al., 2009) and that late-onset alcoholism is more often associated with the course of female alcoholism (Zucker et al., 1995; Zucker and Gomberg, 1986). Clearly, further studies of more diverse samples will be needed to determine the generalizability of our findings, which were based on white, middle-age men.

Second, both VETR and VES data, which were obtained from retrospective methods, need to be interpreted with

some caution given difficulties in both reliability and validity with these procedures. Great care was taken in implementing the VES retrospective procedures, however, making use of a Life Chart Interview, for example (Lyketsos et al., 1994), as well as extensive pilot testing of modules. Moreover, we have demonstrated not only that retrospective recall with the Lifetime Drinking History interview exhibits satisfactory reliability but also that information obtained from that interview corresponds to information obtained from prospective procedures for the same points in time (Koenig et al., 2009).

Third, neither the VETR nor VES datasets contained fine-grained measures of individual, interpersonal, and contextual variables that have been hypothesized to influence the course of alcoholism. Measuring such events will have to be accomplished with prospective, longitudinal designs. Further, regarding issues of measurement, future studies in this area would benefit from continuous indices based on quantity and frequency of alcohol use rather than simply categorical diagnoses. Such an approach would be able to describe the course of alcohol use more broadly (i.e., not just among those with alcohol dependence) and would represent an opportunity to apply and test LGMM methods in samples in which diagnostic data are not available.

Fourth, despite our analytic approach of classifying individuals into distinct alcohol-dependence classes, we are not suggesting that these classes are discrete taxons that are categorically distinct from one another. Rather, we acknowledge that it is likely that these alcohol-dependence classes that have been articulated in the clinical—and now empirical—literature are likely demarcated by fuzzy boundaries that are continuous in nature. Nonetheless, consistent with others (Johnson et al., 2007; Nagin and Tremblay, 2005), we believe that LGMM is useful to help parse the extensive heterogeneity between individuals in their alcohol use over time into more homogenous and conceptually meaningful subtypes. Such an approach can be used to establish and test a theoretical framework that allows for more precise identification of the most salient factors that contribute to turning points in problematic alcohol use over time.

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