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Rapid transition from drinking to alcohol dependence among adolescent and young-adult newly incident drinkers in the United States, 2002–2013

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ABSTRACT

Background: To study male-female and age differences in estimates of rapid transition from first full drink to alcohol dependence among youthful newly incident drinkers in the United States (US).
Method: The study population included 12-to-25-year-old non-institutionalized US civilian residents, sampled for US National Surveys on Drug Use and Health 2002–2013, with assessments via confidential computer assisted self-interviews. Newly incident drinkers are those who had their first full drink soon before the assessment (n = 32,562 12-to-25- year- olds). Alcohol dependence (AD) criteria are from DSM-IV.
Results: For 12-to-25-year-old females, the peak risk for making a rapid transition from first full drink to alcohol dependence is seen during adolescence, followed by declining estimates (meta-analysis summary = 3% at 12–17 years of age, 95% CI = 2%, 3%). Among males, corresponding estimates fluctuate around 2%, with no appreciable differences across age strata. Among 12-to-17-year-old newly incident drinkers, there is a *female excess* in the rapid transition to alcohol dependence; a male excess is observed among young adult newly incident drinkers. Evaluated cohort-wise, using an epidemiological mutoscope view, individual cohorts show a congruent pattern, with age at first drink held constant.
Conclusions: Studying multiple replication samples of young newly incident drinkers, we discovered a clear *female excess* in the risk of a rapid transition from first full drink to alcohol dependence among adolescents, with age patterns differing across males and females.

1. Introduction

Alcohol dependence (AD) causes substantial health and social burdens. Rapid-onset AD occurring soon after the first drink is a marker for what may become a chronically disabling condition, and is linked to adverse physical, mental, and socioeconomic consequences (Schuckit, 2009). Rapid-onset AD can be seen as early as childhood, and might be termed 'early rapid-onset AD' when seen before the middle adolescent years, in which case there would be concern about permanent brain, behavioral, and social adaptational changes, with potentially exacerbated adverse consequences (Hall et al., 2016; Schuckit, 2009).

There is a growing number of population-based studies on the transition from drinking to alcohol dependence. For example, in the classic longitudinal Lundby Sweden study, an estimated 4% of the initial cohort developed an alcohol related disorder over a course of 15 years (Ojesjo et al., 2000). More recent estimates from two benchmark cross-sectional studies in the United States (US) found that 14–23% of adult drinkers developed alcohol dependence within a span of ten years after their first drink, and 1–2% did so during the first two years (Lopez-Quintero et al., 2011; Wagner and Anthony, 2002, 2007). Estimates published by Anthony and Petronis (1995), as well as Behrendt et al. (2009), draw attention to the importance of 'time since first drink' or other drug use when estimating transition probabilities of this type.

Several prior studies with US adult population samples suggest that earlier-onset drinking is linked to greater AD transition probabilities (Dawson et al., 2008; Grant and Dawson, 1997; Grant et al., 2001; Reardon and Buka, 2002). To illustrate, Dawson et al. (2008) found a three-fold increase in the risk of developing alcohol dependence among individuals with early-adolescent-onset drinking compared to adult-onset drinkers. Nonetheless, these US studies generally show that a large proportion of drinkers have taken their first drink before the 18th birthday. Therefore, these

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studies have to rely heavily upon long-term memories about ages of first drink and first problem. The result is a limited capacity to produce age-specific estimates; recall bias possibilities are prominent, tend to be proportionate to the elapsed time interval from first drink to survey assessment, and create what are known as 'telescoping' problems in the general survey research methods literature (Brown et al., 2009; Cheng et al., 2016a; Shillington et al., 2012).

If the goal is to avoid methods problems of this type, there are two common remedies. One remedy is longitudinal research with short between-assessment intervals, as illustrated in Behrendt et al. (2009). Studying young people in Germany, they found evidence suggesting a modestly greater risk of developing alcohol dependence within the first two years of drinking among early-onset drinkers as compared to those who started drinking after age 13 (Behrendt et al., 2009). The other remedy is cross-sectional research with large samples of newly incident drinkers and with AD assessment relatively quickly after drinking starts, irrespective of drinking onset age (Vsevolozhskaya and Anthony, 2016).

With respect to male-female differences in AD risk, surveys of adults have disclosed a consistent male excess in the prevalence of alcohol dependence and a higher transition probability from use to dependence (Keyes et al., 2008, 2011, 2010; Kuntsche et al., 2015; Wagner and Anthony, 2007). A male excess risk for transitioning from first drink to alcohol dependence also was found in the German longitudinal research project that is noteworthy for its avoidance of the methodological 'telescoping' problem just mentioned (Wittchen et al., 2008). In contrast, using multiparametric Hill functions, Vsevolozhskaya and Anthony turned to the large sample remedy and found null male-female differences in the transition from use to dependence within a year, holding constant frequencies of use among all newly incident drinkers (Vsevolozhskaya and Anthony, 2016).

Many disciplines have theories and evidence pertinent to the widely documented male excess in alcohol dependence. From biology, toxicology and other biomedical sciences, these theories and evidence stress neurocognitive differences, ethanol metabolism and other forms of biotransformation, as well as hormonal differences affecting sensitivity to alcohol. From the behavioral and social sciences, emphasis has been given to sex-differentiated social roles which can promote male drinking and stigmatize female drinking (Kuhn, 2015; Schulte et al., 2009). Despite the complex interplay of determining influences of this type, evidence from multi-country studies tends to support a major influence of socioenvironmental conditions and processes (Rahav et al., 2006; Wilsnack et al., 2009). In this context, we also note that male-female differences in alcohol drinking can vary across developmental stages as individuals experience pubertal and other biological changes, concurrent with acquisition of new social roles during adolescence. A small but growing epidemiological body of evidence from studies of adolescents tends to show smaller, and sometimes null, male-female differences in prevalence estimates for drinking-related outcomes, which can be set against the larger body of adult population evidence about the male excess in these outcomes (Schulte et al., 2009; White et al., 2015).

In a recent study, our research team documented a *female excess* in the risk of becoming a new drinker among adolescents; this female excess is not present in adults (Cheng et al., 2016b). A previous study found null male-female differences in the cumulative incidence of alcohol dependence before the age of 18, and a male excess afterwards (Young et al., 2002). Nonetheless, cumulative incidence in all individuals conveys little information about the transition from use to dependence. In this context, a sex-specific estimate in the estimated probability of making a rapid transition from first full drink to AD across different developmental stages is a fundamental but currently missing piece of epidemiologic evidence in contemporary alcohol research.

This gap in evidence led our research group to specify a major research aim for epidemiological field survey research – namely, to estimate sex-specific rapid transition probabilities that lead from drinking onset toward alcohol dependence across developmental stages among 12-to-25-year-old newly incident drinkers in the United States. Based on findings from previous prevalence-oriented surveys, we posited a male excess in the rapid transition from drinking to alcohol dependence across all developmental stages, with a smaller male excess among adolescents compared to adults. In these estimates, a tight focus on the period just prior to survey assessment helps constrain 'telescoping' and other errors already noted. As might be compared with corresponding longitudinal studies, the use of cross-sectional national surveys constrains potential biases due to attrition (sample losses over time) and to response reactivity (Cheng et al., 2016a).

2. Materials and methods

2.1. Study population and sample

The study population is that of the US National Surveys on Drug Use and Health (NSDUH), conducted each year from 2002 through 2013. Originating with a sampling frame that encompasses all 50 States and the District of Columbia, the NSDUH multi-stage probability sampling plan sought a nationally representative sample of non-institutionalized community residents of the US aged 12 years and above, with oversampling of 12-to-17-year-olds. In contrast to school or household surveys of adolescents, the NSDUH sample includes young people irrespective of school attendance, and its sampling frame includes non-household group quarters such as homeless shelters and college dormitories. All NSDUH participants were recruited via child assent and parental or adult consent, based upon protocols approved by cognizant human subjects protection committees (SAMHSA, 2012). More than 30,000 12-to-25-year-old participants are included in each year's NSDUH sample (SAMHSA, 2012).

2.2. Assessment and measures

In general, most often within the participant's home, NSDUH assessments have been completed as confidential audio computer-assisted self-interviews (ACASI) designed to promote reliability, accuracy, and truthfulness of participant reports about potentially sensitive behaviors and characteristics. During the assessment, each participant has been asked about the history of drinking experiences, including questions for newly incident drinkers about the month and year when the first full drink was consumed.

The key response variable in this study is alcohol dependence based on diagnostic criteria of the American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) (American Psychiatric Association, 1994). It was measured via ACASI questions about the seven clinical features of DSM-IV alcohol dependence. Alcohol dependence (AD) cases were newly incident users with dependence manifestations characterized by at least some persistence of use and at least three DSM-IV-aligned AD clinical features observed during the 12 months prior to assessment.

Age and age at first full drink have been derived via self-reports (e.g., date of birth relative to assessment date). Sex is based on participant responses that indicate male or female (with no allowance for gender identities such as trans-gender). NSDUH drew upon dwelling unit roster information to create variables for age and sex when survey items were skipped.