Sexual Orientation Disparities in Longitudinal Alcohol Use Patterns Among Adolescents

Findings From the Growing Up Today Study

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Objective: To compare sexual orientation group differences in the longitudinal development of alcohol use behaviors during adolescence.

Design: Community-based prospective cohort study.

Setting: Self-reported questionnaires.

Participants: A total of 13,450 Growing Up Today Study participants (79.7% of the original cohort) aged 9 to 14 years at baseline in 1996 were followed up for more than 7 years.

Main Exposure: Self-reported sexual orientation classified as heterosexual, mostly heterosexual, bisexual, or gay/lesbian.

Main Outcome Measures: Age at alcohol use initiation, any past-month drinking, number of alcoholic drinks usually consumed, and number of binge drinking episodes in the past year.

Results: Compared with heterosexual participants, youth reporting any minority sexual orientation reported having initiated alcohol use at younger ages. Greater risk of alcohol use was consistently observed for mostly heterosexual males and females and for bisexual females, whereas gay and bisexual males and lesbians reported elevated levels of alcohol use on only some indicators. Gender was an important modifier of alcohol use risk; mostly heterosexual and bisexual females exhibited the highest relative risk. Younger age at alcohol use initiation among participants with minority sexual orientations significantly contributed to their elevated risk of binge drinking.

Conclusions: Our findings suggest that disparities in alcohol use among youth with a minority sexual orientation emerge in early adolescence and persist into young adulthood. Health care providers should be aware that adolescents with a minority sexual orientation are at greater risk of alcohol use.


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DOLESCENT ALCOHOL USE IS a significant public health concern that contributes to preventable morbidity and mortality.1 Adverse consequences include alcohol-related motor vehicle crashes; unintentional injuries; increased risk of suicide, homicide, and assault; increased likelihood of engaging in high-risk sexual behaviors; and diminished academic performance.2 Evidence suggests that heavy alcohol use during adolescence has deleterious and enduring effects on brain development and impairs neurocognitive functioning.3 Exposure to alcohol during adolescence, as opposed to during adulthood, may be especially harmful because the adolescent brain is actively undergoing development.4 Not all adolescent populations share equivalent risk of alcohol use. Involvement in alcohol use is increasingly recognized as disproportionately affecting the population of adolescents who identify themselves as lesbian, gay, or bisexual or who report same-sex sexual attractions and/or relationships. These youth are referred to in the literature as being a “sexual minority” group. Research using school-based samples indicates that sexual minority adolescents are more likely than heterosexuals to report younger age at alcohol use initiation,5 frequent alcohol use including daily use,6,8 and heavy alcohol use (eg, binge drinking).7,9 Some research suggests that bisexuals may display the highest risk of alcohol use10 and that there may be gender differences in alcohol use with disparities accentuated for sexual minority females as compared with males.12,13 However, most studies did not formally test for statistical interactions between sexual orientation and gender in estimating alcohol use.14 Further investigations to identify how gender and sexual orientation may be related to risk of alcohol involvement is warranted.

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Previous research demonstrating that sexual minority youth are at high risk for consuming alcohol has mostly been cross sectional.5-8,13,15 A recent meta-analysis on sexual orientation and substance use underscored the dearth of research comparing trajectories of substance use over time in sexual minority and heterosexual youth.14 Longitudinal studies of adolescents are crucial because adolescence is the developmental period when alcohol use is commonly initiated and when behaviors influencing patterns of use in adulthood are established.16 Consequently, we undertook the current study to estimate and compare the development of alcohol use behaviors over time in a longitudinal cohort study of adolescents who reported their sexual orientation as heterosexual, mostly heterosexual, bisexual, or gay/lesbian.

**METHODS**

**STUDY DESIGN AND PARTICIPANTS**

Self-administered questionnaire data are from the Growing Up Today Study (GUTS), a US community-based longitudinal cohort study of 9039 female and 7843 male children of women participating in the Nurses’ Health Study II.17 Approximately 93% of the cohort self-identified as non-Hispanic white. After maternal consent was obtained, baseline questionnaires were mailed in 1996 to potential participants between ages 9 and 14 years. The children were invited to return a completed questionnaire if they agreed to participate in the study. Follow-up data collection occurred annually from 1997 through 2001 and in 2003. Because recruitment occurred at the family level, some participants were siblings. Additional information about GUTS methodology is available elsewhere.18 Institutional review board approval for this study was obtained by Brigham and Women’s Hospital.

Included in the present analysis were 13,430 participants (7750 females and 5700 males) who provided information on sexual orientation and alcohol use in 1 or more waves in survey years 1997 through 2003. The analysis sample represents 79.7% of the original GUTS cohort. Compared with participants excluded from the analysis, participants included in the analysis were more likely to be female (85.7% of females included; 72.7% of males included; P < .001) and younger (mean baseline age, 11.3 vs 11.8 years; P < .001). Participants residing in the western region of the United States were more likely to be in the analysis (83.3% included) than were participants residing in the Midwest (79.5% included; P < .001) and the northeast (78.7% included; P < .001). No differences in participation rates were found with respect to race/ethnicity (P = .77), baseline reports of past-year monthly alcohol use (P = .20), or baseline current smoking status (P = .23) when respondents included vs excluded from analysis were compared. Among the analysis sample, 51.1% of participants responded to all 6 waves occurring between 1997 and 2003, 20.7% responded to 5 waves, 13.8% responded to 4 waves, 8.8% responded to 3 waves, 4.0% responded to 2 waves, and 1.3% responded to 1 wave.

**MEASURES**

**Sexual Orientation**

A sexual orientation measure tapping the domains of attraction and identity was included in waves 1999, 2001, and 2003. The question, adapted from the Minnesota Adolescent Health Survey,19 asks participants, “Which one of the following best describes your feelings?” Response options are completely heterosexual (attracted to persons of the opposite sex); mostly heterosexual; bisexual (equally attracted to men and women); mostly homosexual; completely homosexual (gay/lesbian, attracted to persons of the same sex); and not sure. We combined mostly homosexual and completely homosexual responses into a single gay/lesbian category owing to their small sample sizes.

**Outcome Measures of Alcohol Use**

Four alcohol use questions adapted from the Massachusetts Youth Risk Behavior Survey were included in the study.20 Age at first whole alcoholic drink was assessed on 5 survey waves from 1997 through 2001. Participants were asked to indicate whether and at what age they first had a whole drink of alcohol. A drink was defined as “a whole glass, can, or bottle of beer; a whole glass of wine; or a whole ‘mixed drink’ or shot of liquor.” Response options ranged from 7 years or younger to the maximum age of participants at each wave; therefore, the variable ranged from 7 years or younger (coded as 7) to 21 years. Any drinking in the past month, coded as a binary variable, was assessed on 5 waves from 1997 through 2001. Number of drinks usually consumed, assessed on 6 waves from 1997 through 2003, was indexed by querying participants, “When you drink alcohol, how much do you usually drink at one time?” Response options for this ordinal variable ranged from 0 to 6 or more drinks (coded as 6). Finally, on 5 waves from 1998 through 2003, participants were asked how often they engaged in binge drinking in the past year. Binge drinking was defined as drinking 5 or more alcoholic drinks over a few hours, except among girls in 2001 and 2003, when it was defined as drinking 4 or more alcoholic drinks over a few hours. Response options were none, 1, 2, 3 to 5, 6 to 8, 9 to 11, and 12 or more times. In analyses, we assigned the midpoint value to categories with ranges (eg, 4 for category 3-5) and the value 13 to the “12 or more” category.

**Other Covariates**

Potential confounders included were age when the questionnaire was returned (grouped into categories of 10-13, 14-15, 16-17, 18-19, and 20-23 years), race/ethnicity self-reported at baseline (coded as non-Hispanic white, other, or missing), region of residence (coded as Midwest, Northeast, South, West, and other [included international and military addresses]), and any report of an adult living in the household who drank alcohol (coded as yes, no, or missing).

**STATISTICAL ANALYSES**

Analyses were stratified on gender owing to differences commonly found in alcohol use among males and females.21 We also developed models that included both genders and gender × sexual-orientation interaction terms to test for effect measure modification by gender in the relationship between sexual orientation and alcohol use.

Longitudinal descriptive analyses were conducted to examine age-related trajectories in alcohol use across sexual orientation groups. Longitudinal multivariate statistical methods varied by outcome. To model age at first whole drink across sexual orientations, we used proportional hazards survival analysis. To adjust the standard errors to account for nonindependent sibling clusters, we used the robust sandwich covariance matrix approach.22
we used multivariate generalized estimating equations (GEE) repeated-measures linear regression to account for the non-independence of the repeated measures within an individual and the sibling clusters. These models estimate the average effect size over the repeated measures. To model any past-month alcohol use, we used the modified Poisson method to estimate risk ratios with GEE adjustment for repeated measures and sibling clusters. All multivariate statistical models adjust for age, race/ethnicity, region of residence, and the presence of an adult in the household who drank alcohol. The heterosexual group served as the reference group. Statistical significance was set at the $P < .05$ criterion.

Multivariate GEE repeated-measures linear regression was used to examine whether younger age at alcohol initiation (defined as age 14 years or younger) contributed to sexual orientation disparities in longitudinal binge drinking. These analyses were restricted to individuals for whom information on whether they had initiated alcohol use before age 14 years was available.

Handling of sexual orientation, age, and region of residence varied by model type. In the survival analyses, baselines of age and region of residence were used. We used a hierarchical coding scheme to classify sexual orientation over time into a single variable composed of 4 mutually exclusive categories. Individuals who indicated that they were “mostly homosexual” or “completely homosexual” on any of the 3 assessments of sexual orientation (1999, 2001, and 2003) were coded as gay/lesbian; individuals who indicated that they were “bisexual” at any wave, but never “mostly homosexual” or “completely homosexual,” were coded as bisexual; individuals who indicated that they were “mostly heterosexual” on any wave, but never “bisexual,” “mostly homosexual,” or “completely homosexual,” were coded as mostly heterosexual; and individuals who indicated only that they were “completely heterosexual” were coded as heterosexual. A sensitivity analysis to examine how results changed when using first or last report of sexual orientation, we observed increases in alcohol use as par-separated in longitudinal binge drinking. These analyses were restricted to individuals for whom information on whether they had initiated alcohol use before age 14 years was available.

In the GEE repeated-measures regressions, all variables in the model were measured concurrently whenever possible. Age group and region of residence were updated at each assessment. Sexual orientation was also updated and allowed to vary by wave. Sexual orientation reported in 1999 was assigned to the 1997 and 1998 waves and sexual orientation reported in 2001 was assigned to the 2000 wave because sexual orientation was not assessed in 1997, 1998, or 2000. For those not responding to the 2001 wave, sexual orientation reported in 1999 was used for the 2000 wave. For both sexual orientation coding methods, findings related to individuals “not sure” of their sexual orientation were excluded owing to instability in estimation because these individuals were concentrated in the youngest age categories. This included 10 males and 26 females for survival analyses and 279 male observations and 516 female observations for repeated-measures analyses.

## RESULTS

Gender-specific distributions of sexual orientation by hierarchical coding used in survival analysis and by observations included in the repeated-measures analyses are shown in Table 1. Overall, 8.5% of males and 16.1% of females reported a minority sexual orientation (ie, mostly heterosexual, bisexual, or gay/lesbian). When gender differences in the distribution of sexual orientation based on hierarchical coding were compared, females were significantly more likely to have identified themselves as bisexual, mostly heterosexual, or unsure, whereas males were more likely to have identified themselves as gay ($P < .001$).

### LONGITUDINAL PATTERNS OF ALCOHOL USE BY SEXUAL ORIENTATION

Gender-specific cumulative incidence plots comparing age at initiation of alcohol use by sexual orientation are displayed in Figure 1. Males and females reporting a minority sexual orientation indicated a younger age at first consuming a whole alcoholic drink than their same-gender heterosexual counterparts. After controlling for covariates, males classified as mostly heterosexual (hazard ratio [HR], 1.35; 95% confidence interval [CI], 1.09-1.56) and bisexual (HR, 1.58; 95% CI, 1.09-2.30) reported a younger age at first consuming a whole drink than did heterosexual males. Gay males also reported a younger age at first whole drink consumption than did heterosexual males, but findings were not statistically significant (HR, 1.21; 95% CI, 0.96-1.54). Among females, mostly heterosexual (HR, 1.62; 95% CI, 1.49-1.77), bisexual (HR, 2.02; 95% CI, 1.72-2.38), and lesbian (HR, 1.66; 95% CI, 1.14-2.43) participants were more likely than heterosexuals to report a younger age at consuming their first whole drink.

Gender-specific plots of age trajectories of prevalence of any past-month drinking and means for number of drinks usually consumed and number of past-year binge drinking episodes by sexual orientation are shown in Figure 2. As expected, regardless of sexual orientation, we observed increases in alcohol use as participants aged. Table 2 presents results of multivariate repeated regression analyses estimating relative risks for any past-month drinking and unstandardized regression coefficients ($\beta$) for number of drinks usually consumed on an occasion and number of binge drinking episodes in the past year. Mostly heterosexual males and

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**Table 1. Distribution of Sexual Orientation by Hierarchical Coding and by Repeated-Measures Observations Among Male and Female Adolescent Participants in the Growing Up Today Study (1997-2003)**

<table>
<thead>
<tr>
<th>Sexual Orientation</th>
<th>Males (%)</th>
<th>Females (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hierarchical sexual orientation coding</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total No. of Subjects</td>
<td>5700 (100.0)</td>
<td>7750 (100.0)</td>
</tr>
<tr>
<td>Heterosexual</td>
<td>5206 (91.3)</td>
<td>6474 (83.5)</td>
</tr>
<tr>
<td>Mostly heterosexual</td>
<td>340 (6.0)</td>
<td>980 (12.6)</td>
</tr>
<tr>
<td>Bisexual</td>
<td>56 (1.0)</td>
<td>212 (2.7)</td>
</tr>
<tr>
<td>Gay/lesbian</td>
<td>88 (1.5)</td>
<td>58 (0.7)</td>
</tr>
<tr>
<td>Not sure</td>
<td>10 (0.2)</td>
<td>26 (0.3)</td>
</tr>
<tr>
<td><strong>Repeated-measures observations of sexual orientation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total No. of Observations</td>
<td>23 850 (100.0)</td>
<td>36 402 (100.0)</td>
</tr>
<tr>
<td>Heterosexual</td>
<td>22 308 (93.5)</td>
<td>32 489 (89.3)</td>
</tr>
<tr>
<td>Mostly heterosexual</td>
<td>895 (3.8)</td>
<td>2785 (7.7)</td>
</tr>
<tr>
<td>Bisexual</td>
<td>138 (0.6)</td>
<td>502 (1.4)</td>
</tr>
<tr>
<td>Gay/lesbian</td>
<td>230 (1.0)</td>
<td>110 (0.3)</td>
</tr>
<tr>
<td>Not sure</td>
<td>279 (1.2)</td>
<td>516 (1.4)</td>
</tr>
</tbody>
</table>

aBecause of rounding, percentages may not total 100.
females and bisexual females reported greater alcohol use on all 3 outcomes than that of their same-gender heterosexual peers. Bisexual males reported greater alcohol use than that of heterosexual males, but associations were statistically significant only for any past-month drinking. Gay males reported consuming a larger number of drinks than did heterosexual males. Compared with heterosexual females, lesbians reported a greater number of drinks usually consumed and binge drinking episodes, although the latter did not reach statistical significance.

INTERACTIONS OF GENDER AND SEXUAL ORIENTATION

In some instances, we observed a gender x sexual-orientation statistical interaction indicating that differences in alcohol use between sexual minority and heterosexual females were larger than differences observed between sexual minority and heterosexual males. A gender x sexual-orientation interaction for younger age at first whole drink was statistically significant for mostly heterosexual females (HRinteraction = 1.18; 95% CI, 1.00-1.40), but not for bisexual females (HR, 1.26; 95% CI, 0.84-1.90) or lesbians (HR, 1.54; 95% CI, 0.85-2.08).

A gender x sexual-orientation interaction for greater number of drinks usually consumed was observed for bisexual females (HRinteraction = 0.54; P = .01). A gender x sexual-orientation interaction for greater number of binge drinking episodes was observed for mostly heterosexual females (β = 0.46; P = .02) and was suggestive for bisexual females (β = 0.86; P = .12).

CONTRIBUTIONS OF YOUNGER AGE AT ALCOHOL INITIATION TO BINGE DRINKING PATTERNS

Younger age at alcohol initiation among sexual minority participants appeared to explain some of their excess risk for longitudinal alcohol use. Among males, when age at alcohol use initiation was entered into the multivariate repeated measures regression analyses predicting binge drinking, the regression coefficients attenuated among mostly heterosexuals (from β = 0.37 [P = .03] to β = 0.19 [P = .25]), bisexuals (from β = 0.70 [P = .15] to β = 0.43 [P = .37]), and gay males (from β = 0.71 [P = .13] to β = 0.49 [P = .25]). Among females, entering age at alcohol use initiation into the regression models estimating differences in binge drinking also resulted in the coefficients attenuating for mostly heterosexuals (from β = 0.81 [P < .001] to β = 0.50 [P < .001]), bisexuals (from β = 1.68 [P < .001] to β = 1.27 [P < .001]), and lesbians (from β = 0.74 [P = .17] to β = 0.36 [P = .47]).

The results of this prospective study provide further evidence that some sexual minority youth are at disproportionate risk for using alcohol. Our findings extend the literature by estimating sexual orientation group differences across multiple assessments during the critical developmental period when substance use patterns are generally established. Furthermore, sexual orientation identity develops during adolescence and young adulthood and is expected to be more fluid during this period.22 Our estimates were able to account for this variability by updating sexual orientation and allowing it to change across waves.

In our study, mostly heterosexual and bisexual males indicated a younger age at alcohol use initiation. Sexual minority males also reported heavier drinking (indexed by number of drinks usually consumed on an occasion and binge drinking episodes), but findings were significant only for mostly heterosexual and gay males. Findings for bisexual males should be interpreted with caution owing to lower statistical power.

Differences between heterosexual and sexual minority subgroups in longitudinal alcohol use were larger in females than in males; findings were strongest for mostly heterosexual and bisexual females. A meta-analysis of sexual orientation and adolescent substance use made similar conclusions.14 A previous cross-sectional analysis of GUTS data collected in 1999 when participants were in early to middle adolescence also found that gender modified associations between sexual orientation and alcohol use.13 The current analysis suggests that alcohol use disparities among sexual minority females may extend beyond early and middle adolescence and into later adolescence.

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The alcohol consumption patterns of the sexual minority female participants in GUTS are concerning because females are more susceptible than males to alcohol-related health problems at any degree of alcohol use. Females are more vulnerable to alcohol's negative effects due to increased bioavailability of alcohol, which is linked to increased risk of liver damage. Females experience more acute sedation and memory deficits and are more likely to “black out” (ie, experience amnesia for the events of any part of a drinking episode, without loss of consciousness) than are males who drink comparable amounts of alcohol.

Another concerning finding of this study is the younger age at alcohol use initiation reported by the sexual minority participants relative to their same-gender heterosexual peers. Younger onset of adolescent alcohol use has been linked to greater risk of violence, injury, drinking and driving, and substance abuse. One study found that respondents who began drinking at younger ages were more likely to meet criteria for lifetime DSM-IV alcohol dependence. Furthermore, participants meeting diagnostic criteria for lifetime alcohol dependence who initiated alcohol use at younger ages had a longer duration of a dependence episode than did individuals with a history of dependence who initiated alcohol use at later ages. In our study, younger age at alcohol use initiation among the sexual minority participants was linked to their higher frequency of binge drinking when compared with heterosexual participants.

Figure 2. Alcohol use across age by sexual orientation among male (A, C, and E) and female (B, D, and F) participants in the Growing Up Today Study (1997-2003).
drinking is a marker of heavy alcohol use associated with alcohol dependence. Studies in adults suggest that sexual minority women are more likely than heterosexual women to meet criteria for an alcohol use disorder; sexual orientation differences observed in men are less pronounced for alcohol use disorders, but sexual minority men may be more likely than heterosexual men to experience drug use disorders. Further research is needed to determine whether younger age at alcohol use initiation contributes to increased risk of substance disorders among individuals with a minority sexual orientation. Research is also needed to understand the reasons sexual minority youth begin drinking at younger ages.

Two reasons have been considered to explain higher alcohol use among sexual minority youth. First, these youth may use alcohol to cope with gay-related stress (ie, internal and external stressors associated with stigmatization of homosexuality), or social anxiety associated with entry into the lesbian, gay, and bisexual community. This explanation is consistent with the self-medication theory in which individuals use alcohol or other substances to alleviate negative feelings associated with psychiatric morbidity. Second, socializing in the gay community, even for youth, may still occur primarily in settings where these substances are prevalent (eg, bars or community pride events), at least initially until alternative settings are identified.

**LIMITATIONS**

Several potential limitations of the study should be noted. GUTS is not a representative probability sample and participants are children of women with nursing degrees, which precludes generalizability of findings. However, the distribution of sexual orientation in GUTS is comparable to that of other youth cohort studies using a similar measure of sexual orientation. Because GUTS participants are predominantly non-Hispanic white, we were unable to examine possible racial/ethnic differences. One potential source of bias is that information collected was based on self-reports. The accuracy of adolescent self-reports is influenced by multiple cognitive (eg, question comprehension and retrieval of information) and situational (eg, privacy and confidentiality) factors. The self-administered questionnaire format used in GUTS has been shown to result in higher rates of reported substance use than the interview format in adolescents. Furthermore, our data were gathered annually or biannually and are presumably less likely to be influenced by recall bias than are data gathered retrospectively in adulthood.

Another possible source of bias in longitudinal studies is loss to follow-up. Although it is not known how attrition may bias estimates, the sample included responses from 79.7% of the original GUTS cohort, and most of these individuals provided responses over multiple waves. Also, attrition was not associated with baseline reports of alcohol or tobacco use. Finally, because only 1 item tapping attraction/identity was used to assess sexual orientation, this study was unable to account for other dimensions of sexual orientation (eg, behavior) and to determine how minority sexual orientation developmental factors (eg, timing and stage) are related to alcohol use. Despite the limitations, this cohort study adds to the body of knowledge on sexual orientation and the development of alcohol use because information is based on 7 years of data collection across multiple waves of assessment during the critical periods of adolescence and young adulthood.

**IMPLICATIONS**

Individuals working with adolescents (eg, health care providers, teachers, and parents) should be aware that youth who report same-sex attractions regardless of how they identify themselves, including youth describing them-
selves as mostly heterosexual, may be at high risk for alcohol use at relatively young ages. It is critical that interventions targeting these youth be developed, implemented, and tested for efficacy for the purpose of delaying alcohol initiation and reducing alcohol use. Focusing on sexual minority adolescent males is important because alcohol use contributes to greater sexual risk taking and risk of human immunodeficiency virus infection.25–27 The necessity to reduce or eliminate alcohol-related problems demands interventions targeting this population beginning in early adolescence, if not earlier.

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