

Links between adolescent binge drinking and midlife alcohol use behaviors by age, sex, and race/ethnicity

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Abstract

Background: Alcohol use is increasing among adults in midlife (i.e., ages 35–60), but few studies examine specific alcohol use behaviors in this age group. We examined measures of typical drinks, maximum drinks, binge drinking, and high-intensity drinking by age, sex, and race/ethnicity among midlife adults, as well as the prospective association between age 18 binge drinking and midlife behaviors.

Methods: Data from 5180 respondents participating in the national Monitoring the Future Panel study who were aged 35–60 in 2022 (followed since they were in 12th grade in 1980–2005) were used to estimate past 30-day midlife drinking behaviors (i.e., typical drinks, maximum drinks, binge, and high-intensity drinking) by age group, sex, and race/ethnicity. Associations between age 18 binge drinking status and midlife drinking outcomes were examined, as well as moderation by sociodemographic characteristics.

Results: Across ages 35–60, the mean typical number of drinks on drinking days within the past month ranged from 1.4 to 1.8; the mean maximum drinks ranged from 2.3 to 3.2. Past-month binge and high-intensity drinking prevalence ranged from 19.1% to 31.2% and 3.6% to 8.1%, respectively. Estimates of drinking behaviors were generally higher among respondents aged 35–40 (vs. older age groups), males (vs. females), those identifying as White (vs. other racial/ethnic groups), and those who reported age 18 binge drinking (vs. not). Adolescent binge drinking was a stronger predictor of high-intensity drinking among females than males and of typical and maximum drinks among older (age 60) than younger (age 35) respondents.

Conclusion: Binge and high-intensity drinking were reported by a meaningful percentage of the US midlife adults. Binge drinking in adolescence was a predictor of subsequent alcohol-related risks. These long-term connections were especially strong among females. Age 18 binge drinking was a stronger predictor of high-intensity drinking at age 60 than earlier in midlife, underscoring that adolescent binge drinking is a key indicator of risk across the lifespan.

KEYWORDS

binge drinking, high-intensity drinking, maximum drinks, midlife, typical drinks

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INTRODUCTION

Alcohol is the most prevalent substance used across the life course (Miech et al., 2024; Patrick et al., 2024), with use often beginning in adolescence and peaking in young adulthood around the early 20s (Patrick et al., 2024). Given these age patterns, most research has focused on alcohol use behaviors and associated dysfunction, risk factors, and consequences among adolescents and young adults (Ryan et al., 2019; White, 2020). However, alcohol use remains relatively common among people in midlife (i.e., ages 35–60) and appears to be on the rise (Grant et al., 2017; Gruzca et al., 2018; Patrick et al., 2024). In 2022, in the Monitoring the Future Panel Study, 71.3% of adults aged 35–50 reported past 30-day alcohol use and 29.2% reported binge drinking. These were the highest prevalence levels recorded since age 35–50 estimates were first available in 2008, when 30-day and binge drinking were reported by 65.9% and 23.4% of respondents, respectively (Patrick et al., 2024). Heavier use of alcohol during midlife is particularly concerning given the increased risk for adverse consequences, including major health concerns (e.g., cancer and liver disease), accidents, injuries, and legal problems (NIAAA, 2024a). Furthermore, alcohol use remains one of the primary threats for morbidity and mortality across adulthood (Zucker et al., 2016). In the US, alcohol is among the leading causes of preventable deaths (NIAAA, 2024b; Pilar et al., 2020), and alcohol-related deaths are on the rise among adults (Karaye et al., 2023). Such alcohol-associated risks to public health, coupled with increasing prevalence of drinking among adults, have led to calls to investigate alcohol use behaviors, specifically during midlife (e.g., Lee et al., 2023; Patrick, Pang, et al., 2023), and the extent to which adolescent behavior is a precursor to midlife drinking.

One method of measuring high-risk alcohol use involves using dichotomous measures that specify drinking cutoffs such as binge and high-intensity drinking (Patrick & Azar, 2018). Midlife binge drinking is at historically high prevalence levels (Patrick, Pang, et al., 2023). While high-intensity drinking has rarely been examined in midlife, Linden-Carmichael et al. (2017) found that approximately 10%–20% of midlife adults participating in the National Epidemiologic Survey on Alcohol and Related Conditions-III in 2012–2013 reported past-year high-intensity drinking, and such drinking was associated with the concurrent presence of an alcohol use disorder.

Another method of measuring alcohol use behaviors involves using continuous measures that allow respondents to self-report discrete numbers of standard drinks, such as the number they typically consume or the maximum number they have consumed in a particular time frame (e.g., Patrick & Terry-McElrath, 2021). Resulting continuous measures can then be converted into binary thresholds that allow for precise modeling of risk across different age groups. Such flexibility may hold particular relevance for midlife given that the physiological impacts from alcohol are experienced at lower levels of consumption as age increases (NIAAA, 2024c) due to age-related changes in lean body mass,

and the ability of enzymes to process alcohol (Meier & Seitz, 2008; Vestal et al., 1977). The generally accepted cutoff of 4+ drinks for females and 5+ drinks for males for binge drinking aims to approximate a BAC of 0.08% (i.e., the US legal limit of intoxication; Perkins et al., 2001) but may correspond to higher BACs as individuals reach the end of midlife. Therefore, continuous measures of typical and maximum drinks may be particularly useful across adulthood.

Although individual changes in alcohol use occur across the lifespan, substance use in adolescence is a known risk factor for later use and problems (Patrick et al., 2010, 2011; Patrick, Pang, et al., 2023; Schulenberg et al., 2016). The onset of alcohol use is rare in midlife, so heavy drinking in midlife is likely part of a pattern of alcohol use across the lifespan (Wu & Blazer, 2014). However, most prior research has not been able to examine connections over long time periods (such as from age 18 to age 60) or how associations between adolescent binge drinking and midlife alcohol use behaviors may differ by the type of alcohol use measure examined or by age during midlife. A focus on alcohol use among those currently in midlife is especially important because those now in midlife were adolescents in the late 1970s and early 1980s, when age 18 alcohol use prevalence was notably higher than for individuals born in later years (Kerr et al., 2013; Keyes et al., 2011; Miech et al., 2024). Individuals who were 12th grade students during the late 1970s and early 1980s might be at greater risk for continued alcohol use and negative consequences. Identifying these connections is particularly relevant for public health.

Historically, females report drinking less than males, though this gap has been narrowing for several years (Patrick et al., 2024) based on unprecedented increases in past 30-day alcohol use prevalence and binge drinking among females in midlife (Keyes et al., 2019; McKetta & Keyes, 2020). Multiple studies of midlife adults have found either decreases or no change in alcohol use across historical time for males but steady and significant increases in use among females (Grant et al., 2017; Gruzca et al., 2018; Polcin et al., 2014). Reasons for these increases remain speculative, but explanations include relaxed drinking norms for midlife females (Keyes et al., 2011, 2012), changes in social roles (Keyes et al., 2021), multiple role strain (Sumra & Schillaci, 2015), and marketing practices that target female drinkers and mothers (Kindy & Keating, 2016; Petticrew et al., 2017).

In contrast, racial/ethnic differences in alcohol use have been more consistent across time (Patrick et al., 2024). Recent estimates of past 30-day alcohol use and past 2-week binge drinking prevalence were lowest for Black adults ages 35–50, followed by White adults, then Hispanic adults (Patrick et al., 2024). White individuals also appear to have lower rates of abstinence from alcohol, initiate alcohol use earlier, drink more frequently, and consume a higher quantity of drinks than Black individuals (Zapolski et al., 2014). White adults also appear to be at greater risk for DSM-5 alcohol use disorder symptoms and alcohol-related mortality and morbidity, compared to those from Black or other racial/ethnic backgrounds (Jager et al., 2021).

The current study is among the first to document the prevalence of binge and high-intensity drinking among midlife adults, in addition to mean typical and maximum drinks. Furthermore, we examine the extent to which adolescent drinking is predictive of midlife alcohol use. To add to our understanding of these shifts over time, we examine whether adolescent alcohol use is differentially associated with midlife alcohol use among females compared to males, as well as across racial/ethnic background. Specifically, we used data from the Monitoring the Future (MTF) Panel Study to examine alcohol use behaviors in midlife. Our aims were to examine: (1) the prevalence and mean levels of midlife alcohol use behaviors, including typical drinks, maximum drinks, binge drinking, and high-intensity drinking in the past 30 days, by age, sex, and race/ethnicity and (2) age 18 binge drinking as a prospective predictor of midlife alcohol use outcomes and whether associations varied by age, sex, or race/ethnicity.

MATERIALS AND METHODS

Data sources and participants

Data were obtained from the MTF Panel Study (Patrick et al., 2024). Since 1976, new nationally representative samples of 12th grade students (modal age 18) in the US have been recruited yearly (Miech et al., 2023). From each annual 12th grade cohort, approximately 2450 individuals have been selected for longitudinal follow-up, which is randomized to begin 1 or 2 years after high school (i.e., modal ages 19 or 20; Patrick et al., 2024). Six biennial young adult surveys are collected between the modal ages (hereafter referred to as "age") of 19 and 30 (i.e., 19/20, 21/22, 23/24, 25/26, 27/28, and 29/30). Midlife follow-up surveys are collected every 5 years thereafter (ages 35, 40, 45, 50, 55, and 60). For the current study, data were obtained from all age 35 to 60 follow-up surveys completed in 2022 (including individuals from the 12th grade cohorts of 1980, 1985, 1990, 1995, 2000, and 2005) using mailed and web-based questionnaires (Patrick et al., 2024). The study was approved by a University of Michigan Institutional Review Board.

From the eligible 12th grade cohorts, 14,770 respondents were selected for panel participation. Of these, 5450 (36.9% of 14,770) participated in 2022. Cases with user-missing data on binge drinking at age 18 were excluded ($n=153$, 2.8% of 5450). Of the 5297 remaining cases, 165 (3.1% of 5297) were missing on typical drinks, 92 (1.7% of 5297) were missing on maximum drinks (which was also used to code binge and high-intensity drinking), and 38 were missing on race/ethnicity (0.7% of 5297). The final analytic samples were 5098 respondents (96.2% of 5297) for typical drinks and 5168 (97.6% of 5297) for maximum drinks, binge drinking, and high-intensity drinking. Of the two analytic samples combined ($n=5180$), approximately half (52.0%) of all cases were reported by females; the sample was equally distributed by midlife age group (17.1% aged 35, 14.9% aged 40, 16.8% aged 45, 16.5% aged 50, 17.4% aged 55, and 17.3% aged 60). For race/ethnicity, 74.6% of respondents identified as White, 11.0% as Black, 3.3% as Asian, 7.0% as Hispanic, and 4.1% as Other.

Measures

Midlife drinking outcomes

Respondents were asked, "On those days that you drank in the last 30 days, about how many drinks did you usually have per day?" Response options included *did not drink in last 30 days*, *1 drink per day*, *2, 3, 4, 5, 6–8, 9–11, 12 or more drinks per day*. For analysis, *typical drinks* were coded as a continuous outcome with values of 0, 1, 2, 3, 4, 5, 7, 10, and 12.

For *maximum drinks*, respondents were asked, "During the last 30 days, what was the largest number of drinks that you had in a row? (Give your best estimate.)" Response options ranged from 0 to 20 or more. Responses were coded into three variables: (a) *maximum drinks*, continuous from 0 to 20; (b) *binge drinking*, a dichotomous indicator of 4+ drinks for females and 5+ drinks for males; and (c) *high-intensity drinking*, a dichotomous indicator of 8+ drinks for females and 10+ drinks for males (NIAAA, 2018; Patrick, 2016).

Predictors of interest

Age was coded as the modal age at which each survey was completed (i.e., 35, 40, 45, 50, 55, and 60). Sex (male and female) and race/ethnicity (White, Black, Asian, Hispanic, and Other [American Indian or Alaska Native, Other, or bi/multiracial]) were self-reported at 12th grade. *Binge drinking status at age 18* indicated whether they reported having 5+ drinks in a row (for males and females) in the past 2 weeks at baseline in 12th grade.

Analytic approach

Analyses were conducted using SAS v.9.4 (SAS Institute Inc., Cary, NC, USA) using survey commands. All analyses used MTF panel analysis weights to account for the panel sample selection process and attrition (Patrick et al., 2022). For aim 1 (midlife drinking behaviors overall and by age, sex, and race/ethnicity), mean typical and maximum drinks across age groups, sex, and race/ethnicity were estimated using PROC SURVEYMEANS; the CLDIFF option was specified to compare sex differences. Binge and high-intensity drinking prevalence were estimated using PROC SURVEYFREQ. To examine age differences in mean typical and maximum drinks, negative binomial regression models were fitted (PROC GENMOD), regressing mean typical or maximum drinks on age (using dichotomized indicators, with age 35 as a referent). Similarly, PROC SURVEYLOGISTIC was used to examine age group and racial/ethnic differences in binge and high-intensity drinking prevalence.

For aim 2 (associations between age 18 binge drinking status and midlife drinking outcomes), PROC SURVEYMEANS and SURVEYFREQ were used to estimate midlife mean of typical and maximum drinks, as well as binge and high-intensity drinking prevalence, by age 18 binge drinking status (all ages combined). Second,

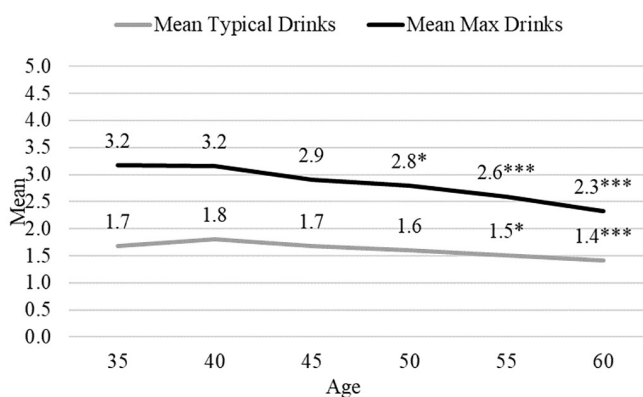
midlife alcohol behaviors were regressed on age 18 binge drinking status using negative binomial regression (PROC GENMOD) for typical and maximum drinks and logistic regression with maximum likelihood estimation (PROC SURVEYLOGISTIC) for binge and high-intensity drinking prevalence. Third, models tested interactions between age 18 binge drinking status and one of age, sex, or race/ethnicity by regressing the specified midlife drinking outcome on: (a) age 18 binge drinking status, sex, and a sex \times age 18 binge drinking status interaction term; (b) age 18 binge drinking status, age (using dummy indicators with age 35 as referent), and interaction terms for each midlife age group \times age 18 binge drinking status; or (c) age 18 binge drinking status, race/ethnicity (using dummy indicators with White as referent), and interaction terms for each racial/ethnic group \times age 18 binge drinking status. If statistically significant interactions were observed, models were run separately by sex, age, or racial/ethnic groups to compare group-specific associations.

RESULTS

Overall midlife drinking behaviors across age, sex, and race/ethnicity

Mean typical and maximum drinks, as well as binge and high-intensity drinking prevalence, across midlife age groups are shown in [Figure 1](#). All estimates are on the full sample; those who reported 0 drinks are included in the denominator. For all drinking behaviors, estimates were generally higher among respondents aged 35 and 40 than older age groups—particularly ages 55 and 60. Compared to age 35 respondents:

1. mean typical drinks (1.7 at age 35) was lower for those aged 55 (1.5) and 60 (1.4);
2. mean maximum drinks (3.2 at age 35) was lower for those aged 50 (2.8), 55 (2.6), and 60 (2.3);
3. binge drinking prevalence (31.2% at age 35) was lower for those aged 50 (24.3%), 55 (22.0%), and 60 (19.1%); and



4. high-intensity drinking prevalence (8.1% at age 35) was lower for those aged 60 (3.6%).

[Figure 2](#) presents estimates for mean typical and maximum drinks, as well as binge and high-intensity drinking, prevalence by sex (all ages combined). Males had significantly higher values than females for all four alcohol use behaviors.

[Figure 3](#) presents alcohol use behavior estimates by race/ethnicity (ages combined). Compared with respondents who identified as White: (a) identifying as Black, Asian, or Hispanic was associated with significantly lower mean typical and maximum drinks; (b) identifying as Black, Asian, or Other was associated with significantly lower binge drinking prevalence; and (c) identifying as Black was associated with significantly lower high-intensity drinking prevalence.

Associations between age 18 binge drinking status and midlife drinking

[Figure 4](#) presents associations between midlife alcohol use behaviors and age 18 binge drinking status (all ages combined). Compared to those who did not report any age 18 binge drinking, respondents who reported binge drinking at age 18 had significantly higher mean typical (2.3 vs. 1.3) and maximum (4.0 vs. 2.3) drinks in midlife, as well as higher binge (39.8% vs. 19.1%) and high-intensity drinking (10.5% vs. 4.4%) prevalence.

Moderation by midlife age group

For mean typical drinks, midlife age group \times age 18 binge drinking status interactions were significant for all midlife age groups (age 40 IRR=1.53, 95% CI [1.25, 1.89], $p < 0.001$; age 45 IRR=1.52, 95% CI [1.23, 1.86], $p < 0.001$; age 50 IRR=1.33, 95% CI [1.09, 1.64], $p = 0.006$; age 55 IRR=1.23, 95% CI [1.00, 1.51], $p = 0.048$; age 60 IRR=1.45, 95% CI [1.19, 1.77], $p < 0.001$). As shown in [Table 2](#), midlife mean typical drinks was significantly higher among respondents

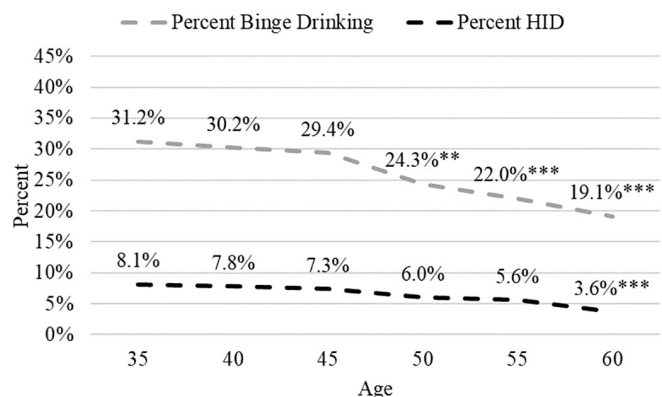


FIGURE 1 Age differences in past 30-day midlife alcohol behaviors: Mean typical and maximum drinks, and prevalence of binge and high-intensity drinking. Midlife binge and high-intensity drinking were defined using sex-specific thresholds (i.e., 4/5+ and 8/10+ for females/males). Significant age differences (compared with age 35) indicated by * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

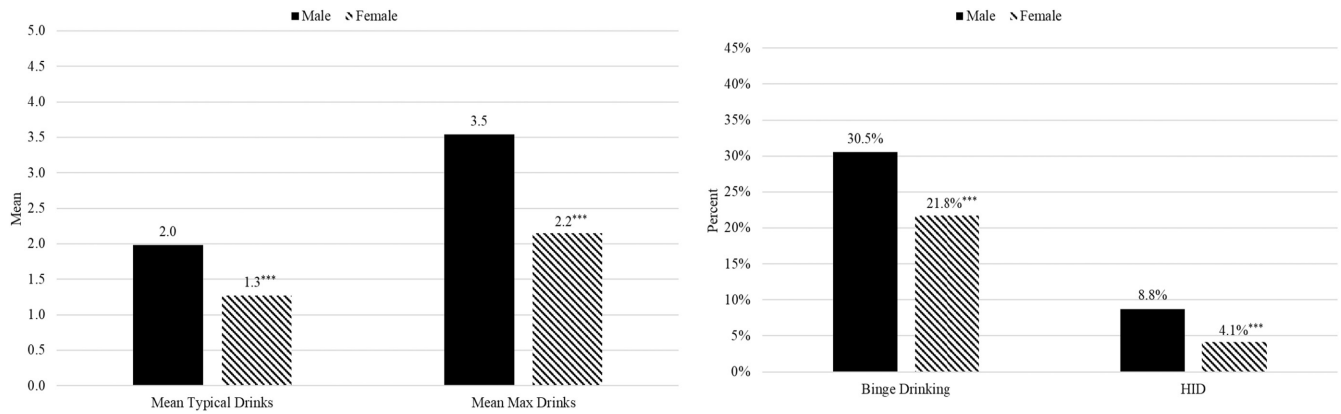


FIGURE 2 Sex differences in past 30-day midlife alcohol behaviors (ages 35–60): Mean typical and maximum drinks, and prevalence of binge and high-intensity drinking. Midlife binge and high-intensity drinking were defined using sex-specific thresholds (i.e., 4/5+ and 8/10+ for females/males). *** $p < 0.001$.

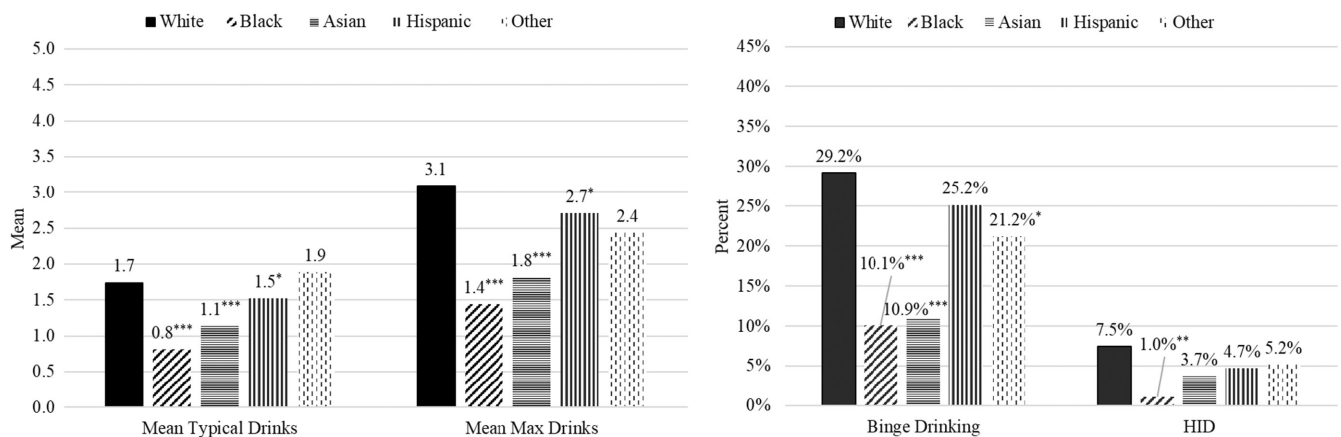


FIGURE 3 Racial/ethnic differences in past 30-day midlife alcohol behaviors (ages 35–60): Mean typical and maximum drinks, and prevalence of binge and high-intensity drinking. Midlife binge and high-intensity drinking were defined using sex-specific thresholds (i.e., 4/5+ and 8/10+ for females/males). Significant age differences (compared with age 35) indicated by * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

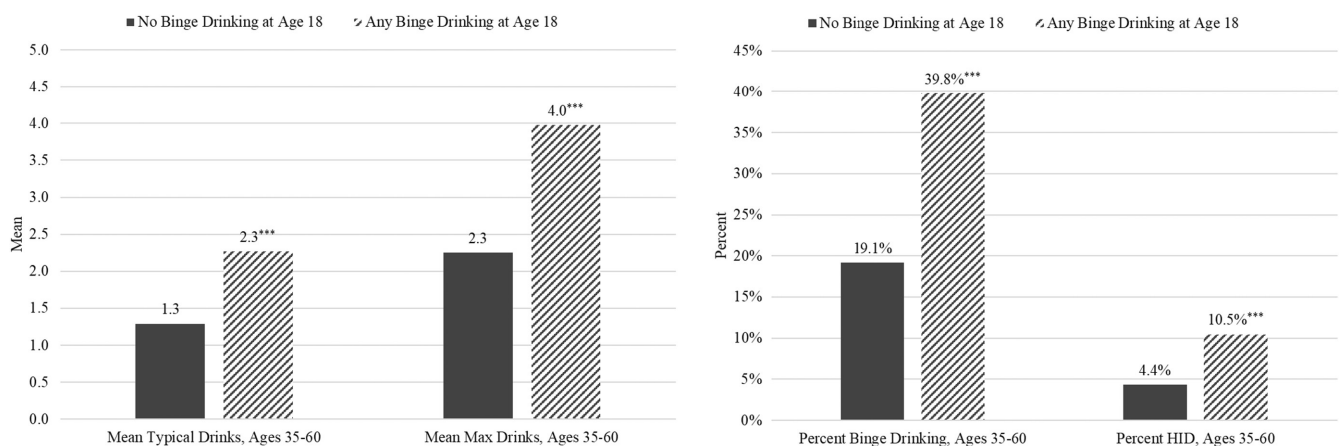


FIGURE 4 Differences in past 30-day midlife alcohol behaviors (mean typical and maximum drinks, binge and high-intensity drinking prevalence at ages 35–60) by age 18 binge drinking status. Midlife binge and high-intensity drinking were defined using sex-specific thresholds (i.e., 4/5+ and 8/10+ for females/males). Age 18 binge drinking was defined using a universal threshold of 5+ drinks. *** $p < 0.001$.

who reported any age 18 binge drinking (vs. none) across midlife age groups, but the association was significantly stronger for respondents aged 40 (IRR=1.98), 45 (IRR=1.97), 50 (IRR=1.72), 55 (IRR=1.58), and 60 (IRR=1.87) compared to respondents aged 35 (IRR=1.29).

For maximum drinks, the midlife age group \times age 18 binge drinking status interaction was significant only for respondents aged 60 versus 35 ($p=0.028$). As shown in Table 2, the midlife mean maximum drinks was higher among respondents reporting age 18 binge drinking compared to those who did not for all midlife age groups. However, the association was significantly stronger for respondents aged 60 (IRR=1.96) compared to those aged 35 (IRR=1.56).

No significant interactions between midlife age group and age 18 binge drinking status were observed for either midlife binge or high-intensity drinking prevalence.

Moderation by sex

A significant interaction between sex and age 18 binge drinking status was observed for midlife high-intensity drinking (AOR=0.49, 95% CI [0.28, 0.84], $p=0.009$). Group-specific models (see Table 1) showed that age 18 binge drinking was associated with higher odds of high-intensity drinking for both males and females, but the association was stronger among females (OR=3.60) than males (OR=1.75). Specifically, males who reported age 18 binge drinking had significantly higher high-intensity drinking prevalence (11.4% vs. 6.8%), but this difference was even more pronounced among females (8.9% vs. 2.7%). That is, high-intensity drinking was over three times as prevalent among females who reported binge drinking at 18 compared to those who did not.

No significant interactions between sex and age 18 binge drinking status were observed for midlife typical or maximum drinks or for midlife binge drinking prevalence.

Moderation by race/ethnicity

For mean typical drinks, race/ethnicity \times age 18 binge drinking status interactions were significant only for those identifying as Other

versus White (IRR=1.51, 95% CI [1.12, 2.06], $p=0.008$). As shown in Table 2, mean midlife typical drinks were higher among respondents reporting age 18 binge drinking compared to those who did not for all racial/ethnic groups. However, the association was significantly stronger for those identifying as Other (IRR=2.49) versus White (IRR=1.57).

No significant interactions between race/ethnicity and age 18 binge drinking status were observed for midlife maximum drinks, binge drinking, or high-intensity drinking prevalence.

DISCUSSION

Using national data, the current study documented midlife alcohol use behaviors and long-term connections between binge drinking in adolescence and alcohol use from ages 35 to 60. Mean typical drinks ranged from 1.4 at age 60 to 1.8 at age 40, and mean maximum drinks ranged from 2.3 at age 60 to 3.2 at age 35 and 40. Binge drinking (4+ for females, 5+ for males) in the past 30 days ranged from 19.1% at age 60 to 31.2% at age 35. High-intensity drinking (8+ for females, 10+ for males) in the past 30 days was reported by 3.6% at age 60 to 8.1% at age 35.

Males reported a greater number of typical and maximum drinks, and they showed a higher prevalence of binge and high-intensity drinking. This was especially true for high-intensity drinking, which was more than twice as prevalent among males (8.8%) than among females (4.1%) across ages 35–60. Alcohol use among females in midlife has risen dramatically in recent years, while use among males has not changed (Grant et al., 2017; Grucza et al., 2018; Keyes et al., 2019). Since we found clear sex differences in alcohol use behaviors among midlife adults, it will be important to continue to track these behaviors over time to assess changes in alcohol-related risk between males and females during midlife.

Overall, respondents identifying as White reported a greater number of typical and maximum drinks, and higher binge and high-intensity prevalence than other racial/ethnic groups. This is consistent with the vast majority of prior work demonstrating that White adults display higher rates of alcohol use frequency, quantity, and alcohol use disorder symptoms than individuals from non-White and/or Hispanic backgrounds (Jager et al., 2021; Patrick

TABLE 1 Sex-specific associations between age 18 binge drinking status and midlife (ages 35–60) past 30-day high-intensity drinking.

Sex	High-intensity drinking								
	No binge drinking at age 18		Any binge drinking at age 18		Bivariate association				
	%	SE	%	SE	Logit Est.	OR	95% CI	p-Value	
Male	6.8%	0.82	11.4%	1.13	0.56	1.75	1.25	2.46	0.001
Female	2.7%	0.36	8.9%	1.34	1.28	3.60 ^a	2.36	5.49	<0.001

Note: Midlife high-intensity drinking were defined using sex-specific thresholds (i.e., 8/10+ for females/males). Age 18 binge drinking was defined using a universal threshold of 5+ drinks.

^aSignificantly stronger association than that observed among males.

TABLE 2 Age group-specific and race/ethnicity-specific associations between age 18 binge drinking status and mean midlife past 30-day typical and maximum drinking.

Variables	Typical drinks						Max drinks										
	No binge drinking at age 18			Any binge drinking at age 18			No binge drinking at age 18			Any binge drinking at age 18							
	Mean	SE	p-Value	IRR	95%CI	SE	Mean	SE	IRR	95%CI	SE	Mean	SE	IRR	95%CI	p-Value	
Age																	
Age 35	1.57	0.10	0.001	1.29	1.72	2.28	0.001	2.73	0.16	1.56	1.33	1.83	0.35	1.56	1.33	1.83	<0.001
Age 40	1.35	0.10	<0.001	1.98 ^a	1.70	2.28	<0.001	2.52	0.16	1.80	1.56	2.09	0.31	1.80	1.56	2.09	>0.001
Age 45	1.23	0.07	<0.001	1.97 ^a	1.49	1.99	<0.001	2.22	0.12	1.92	1.65	2.24	0.33	1.92	1.65	2.24	<0.001
Age 50	1.29	0.08	<0.001	1.72 ^a	1.39	1.81	<0.001	2.21	0.14	1.80	1.55	2.09	0.25	1.80	1.55	2.09	<0.001
Age 55	1.22	0.08	<0.001	1.58 ^a	1.65	2.12	<0.001	2.08	0.13	1.66	1.44	1.91	0.24	1.66	1.44	1.91	>0.001
Age 60	1.02	0.06	<0.001	1.87 ^a	1.72	2.28	<0.001	1.65	0.10	1.96 ^a	1.72	2.23	0.16	1.96 ^a	1.72	2.23	<0.001
Race/Ethnicity																	
White	1.43	0.04	<0.001	1.57	1.48	1.67	<0.001	- ^b	-	-	-	-	-	-	-	-	-
Black	0.73	0.08	<0.001	2.17	1.53	3.07	<0.001	-	-	-	-	-	-	-	-	-	-
Asian	1.03	0.15	<0.001	1.89	1.09	3.26	<0.001	-	-	-	-	-	-	-	-	-	-
Hispanic	1.21	0.13	<0.001	2.05	1.51	2.78	<0.001	-	-	-	-	-	-	-	-	-	-
Other	1.28	0.23	<0.001	2.49 ^c	1.66	3.72	<0.001	-	-	-	-	-	-	-	-	-	-

Note: Age 18 binge drinking status was defined using a universal threshold of 5+ drinks.

^aSignificantly stronger association than that observed at age 35.

^bNon-significant interactions by race/ethnicity. Thus, data not shown.

^cSignificantly stronger association than White.

et al., 2024; Zapolski et al., 2014). Although White midlife adults appear to display higher alcohol use across a number of metrics, non-White and/or Hispanic individuals who do drink may be at increased risk for negative alcohol-related outcomes (i.e., negative health and social outcomes; Zapolski et al., 2014). Furthermore, there are disparities in substance use treatment outcomes for those from minoritized backgrounds (Jordan et al., 2022), which have been attributed to factors such as diminished access to care (Cook et al., 2017) and experiencing racism and discrimination (Glass et al., 2020). Given these findings, alcohol consumption metrics alone may not be enough to adequately assess alcohol-related risk alone among adults from racial and ethnic minoritized backgrounds.

Those who reported binge drinking at age 18 had higher midlife mean typical and maximum drinks, as well as higher binge and high-intensity drinking prevalence. In particular, binge and high-intensity drinking prevalence levels were more than twice as high among adults who reported binge drinking at age 18 compared to those who did not. Among those with a history of adolescent binge drinking, two out of five reported binge drinking in midlife and 1 of 10 reported high-intensity drinking in midlife.

Although long-term predictions of adolescent to adult alcohol use behaviors have been shown elsewhere (e.g., through ages 35–55; Patrick et al., 2010, 2011; Patrick, Pang, et al., 2023; Schulenberg et al., 2016), less research has focused on how adolescent drinking may be especially predictive to different points during midlife. Given their proximity, one may think that adolescent alcohol use would be most strongly correlated with alcohol use at younger midlife ages. However, we found the association between age 18 binge drinking and later quantity of alcohol use strengthened across midlife. This is consistent with theories of development that acknowledge time-limited increases in risk behaviors during young adulthood that serve various developmental purposes (Schulenberg & Maggs, 2002). Given the higher prevalence levels of alcohol use in the 30s than at older ages—seen here and elsewhere (Linden-Carmichael et al., 2017; Patrick, Terry-McElrath, et al., 2023)—consuming a higher quantity of drinks at age 35 may be reflective of a developmentally-limited behavior in ways that consuming a higher quantity of drinks at age 55 is not. The fact that adolescent behavior was a prospective predictor across all examined alcohol outcomes—and an even stronger risk to age 60 (vs. age 35) typical and maximum drinks—is a striking example of continuity across the life course (Schulenberg et al., 2014).

We found that the association between age 18 binge drinking and midlife high-intensity drinking was stronger for females than males. While this finding should be considered with some caution as the age 18 binge measure was not sex-specific (i.e., it was defined as 5+ drinks for both females and males), a stronger link between adolescent and midlife behavior among females than males may be explained by adolescent binge drinking and midlife high-intensity drinking being rarer among females than males in these cohorts. For example, in the early 1980s, over 50% of male high school seniors reported binge drinking at age 18 compared with only approximately

30% of female high school seniors (Johnston et al., 2023). Because females who engaged in binge drinking at age 18 were the minority among their peers in the early 1980s, this behavior may be a stronger indicator of risk for subsequent riskier alcohol use during midlife in the 2020s. Such continuity seen across decades can be used as a renewed call for prevention and intervention during adolescence.

Although an age-related decrease in alcohol use was clear from ages 35 to 60, it should be noted that about one in five people reported binge drinking at age 60. This level of alcohol use in later midlife has unique risks due to slowing metabolic rates, a decrease in muscle mass, and an increased likelihood of using medications contraindicated with alcohol use (Moore et al., 2007; NIAAA, 2024c). Furthermore, certain health conditions that are common in later life (e.g., diabetes, hypertension, heart and liver problems, osteoporosis, etc.) can be made worse by drinking at higher levels (Berg et al., 2008; Emanuele et al., 1998; Mayl et al., 2020; Osna et al., 2017; Pietraszek et al., 2010; Roerecke, 2021). There is also mounting evidence that even drinking at moderate levels or consuming any alcohol at all increases risk for negative health outcomes among adults (Cao et al., 2015; Emanuele et al., 1998; Pietraszek et al., 2010; Roerecke et al., 2018).

Limitations of the current study include that the MTF Panel participants are drawn from samples of high-school attending adolescents at age 18 (excluding those who have dropped out of high school). Estimates of midlife alcohol use behaviors are likely conservative, because those who drop out of high school engage in alcohol use more frequently (Tice et al., 2017). The age 18 binge measure was not sex-specific, calling for some degree of caution when interpreting sex comparisons on the effect of age 18 binge drinking on later alcohol behaviors. Thresholds for binge and high-intensity drinking were consistent across midlife. However, additional research is needed to determine whether adjustments with age, especially in later midlife, are needed for the constructs of binge and high-intensity drinking. Future research should explore whether lower thresholds of binge and high-intensity drinking are more appropriate for older individuals (Meier & Seitz, 2008; NIAAA, 2024c).

Alcohol use behaviors associated with higher risk (binge and high-intensity drinking) were reported by a meaningful percentage of U.S. adults in midlife, and the likelihood of such risk was strongly associated with reporting binge drinking in adolescence. These long-term connections were especially strong among females. Age 18 binge drinking was a stronger predictor of high-intensity drinking at age 60 than earlier in midlife, underscoring that adolescent binge drinking is a relevant and key indicator across the lifespan. Understanding alcohol use across the lifespan and characteristics that place individuals at greatest risk can inform public health efforts to mitigate negative consequences of alcohol use from adolescence to midlife.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available through the National Addiction & HIV Data Program at <https://www.icpsr.umich.edu/web/pages/NAHDAP/index.html>.

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