



Cohort effects on gender differences in alcohol use in the United States: How much is explained by changing attitudes towards women and gendered roles?

Katherine M. Keyes^{a,*}, Jonathan Platt^a, Caroline Rutherford^a, Megan E. Patrick^b, Deborah D. Kloska^b, John Schulenberg^{b,c}, Justin Jager^d

^a Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, USA

^b Institute for Social Research, University of Michigan, Ann Arbor, MI, USA

^c Department of Psychology, University of Michigan, Ann Arbor, MI, USA

^d T. Denny Sanford School of Social and Family Dynamics, Arizona State University, Tempe, AZ, USA

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ABSTRACT

Gender differences in binge drinking have converged in recent cohorts, due in part to faster decreases in consumption among boys in adolescence, and faster increases in consumption among women in young to middle adulthood. Changes in education and occupation explain a portion, but not all, of these differences; the present study examines how attitudes about gender, religion and family additionally explain cohort effects in binge drinking by sex. Data were drawn from the Monitoring the Future panel studies, including >54,000 participants who were high school seniors from 1976 through 2006, followed to age 29/30 from 1988 through 2016. The main effect relationship between cohort and binge drinking was assessed, and 28 items on gender, religion and family were evaluated to determine if mediation criteria were met; mediation models assessed direct and indirect effects. Results indicated that gender, religion and family attitudes and beliefs among US adults across the 20th and 21st centuries have shifted dramatically but not monotonically. US adolescents and adults have largely become less religious; some attitudes on women and family have become less conservative and some more. Among men, views on marriage showed the largest mediation effects; agreeing with the statement ‘one partner is too restrictive’ mediated 3.35% of the cohort effect (95% C.I. 2.42, 4.31) and ‘couples should live together before they are married’ mediated 1.6% of the cohort effect (95% C.I. -2.37, -0.8). Among women, declines in religious service attendance mediated 2.0% of cohort effects in binge drinking (95% C.I. -3.03, -1.09), as well as similar family attitudes as men. In conclusion, changes in social roles, as well as some gender, and religious views, partially mediate cohort effects on binge drinking for men and women. The dynamic changes in how adolescents and adults view family and gender are important components of alcohol epidemiology.

1. Introduction

Alcohol use continues to be an important cause of morbidity and mortality. Approximately 10% of annual deaths are attributable to alcohol use in the US (Stahre, Roeber, Kanny, Brewer, & Zhang, 2014), and evidence indicates that there is no level of alcohol use that is beneficial for health (Burton & Sheron, 2018; Gallagher et al., 2017; Hartz et al., 2017, 2018; Voskoboinik et al., 2019). Patterns of drinking that include binge episodes (consuming 4 or 5 alcoholic drinks in a row) is associated with particularly deleterious health outcomes, including

injury, cancer, cardiovascular disease, and liver disease (Gmel, Kuntsche, & Rehm, 2011). Historically, the health consequences of drinking are concentrated among men in the United States (White, Castle, Hingson, & Powell, 2020), as they are more likely to consume alcohol and consume at high quantities, compared with women (Hasin, Stinson, Ogburn, & Grant, 2007). However, an accumulating literature indicates that gender differences are dynamically converging in recent decades (Gruzza et al., 2018; Keyes, Li, & Hasin, 2011). The reasons that gender differences are converging remains an open area of inquiry; in the present paper, we present an argument that social roles, gender, religion

* Corresponding author. Associate Professor of Epidemiology Columbia University, Department of Epidemiology Mailman School of Public Health, 722 West 168th Street, Suite 724, New York, NY, 10032, USA.

E-mail address: kmk2104@columbia.edu (K.M. Keyes).

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and family attitudes are strong historical determinants of alcohol use and binge drinking; that they have also been changing in profound ways during the end of the 20th century and the beginning of the 21st, and that they therefore are plausible mediators of cohort effects in binge drinking. We then test the extent to which changes in social roles, gender, religion and family attitudes statistically mediate cohort effects in binge drinking, by gender, using national longitudinal cohort data from Monitoring the Future.

Men have traditionally consumed more alcohol than women primarily for social reasons. While there is evidence that biological (Frezza et al., 1990; Lieber, 1997) (though not genetic (Nolen-Hoeksema & Hilt, 2006; Prescott, 2003)); average differences between men and women (e.g. body weight, metabolism) contribute to differences in alcohol use, such biological effects are small in magnitude (R. W. Wiltschko et al., 2000). Most literature focuses on social factors such as gendered roles as well as attitudes and beliefs about gender (Chomak & Collins, 1987; Huselid & Cooper, 1992; Snell, Belk, & Hawkins, 1987). Women have historically had social sanctions against heavy alcohol use (Seedat et al., 2009; R. W.; Wiltschko et al., 2000), and normative gendered roles to conduct unpaid childcare and domestic labor in the home precluded engagement in social outlets to drink for women, but not men (Greenfield & Room, 1997). Normative views of womanhood and femininity have been juxtaposed with leitmotifs of women who drink as deviant and associated with other characteristics such as sexual promiscuity and other so-called moral hazards.

Yet alcohol use and binge drinking are dynamic over time and across development, and additionally, the gender differences in consumption are themselves dynamic. In adolescence and young adulthood, alcohol consumption and binge drinking have largely been declining in prevalence since the mid-1980s (Patrick et al., 2017; Schulenberg et al., 2020); gender differences are converging because declines among boys and men have been greater than declines among girls and women (Jager, Keyes, & Schulenberg, 2015; Keyes et al., 2019; Miech et al., 2020; Patrick et al., 2019; Schulenberg et al., 2020). After the transition to adulthood and in mid-life, alcohol consumption and binge drinking have been increasing since approximately 2010 (Gruza et al., 2018; Keyes et al., 2019; White et al., 2015), with the increases almost exclusively concentrated among women in mid-life (creating another gender convergence) and those with the highest levels of family income, education, and occupational prestige (McKetta & Keyes, 2019, 2020; White et al., 2015). In summary, gender differences in alcohol consumption and binge drinking are converging, but this is due to different underlying dynamics in adolescence and adulthood.

Given that gender differences are converging and that social factors largely underlie overall gender differences in alcohol use, it is reasonable to hypothesize that social factors such as social roles and gendered attitudes and beliefs underlie convergence compared with biological factors, as they are more prone to historical variation and thus more likely to underlie historical variation. For social factors and gendered attitudes and beliefs to explain gender convergence over time, it stands to reason that there should be historical variation in such factors, and importantly, the nature of that variation should differ by gender.

Indeed, there is substantial evidence to indicate that social roles are historically varying. Within industrialized countries, such as the U.S., life course options and social structures have become far less differentiated by gender across the last four decades (Arnett, 1998; Maggs, Jager, Patrick, & Schulenberg, 2012; Mayer, 2004; Settersten & Ray, 2010). Historical changes in labor force structures mean today's young adults of different genders are more likely to hold social roles that are associated with more alcohol consumption, e.g. attending college, not working full-time, and remaining single and childless (Arnett, 2000; Bachman, Wadsworth, O'Malley, Johnston, & Schulenberg, 1997; Jager et al., 2015; Settersten, 2007). However, these historical trends have been sharply more pronounced for women than for men (Brückner & Mayer, 2005; Fussell & Furstenberg, 2005; Lopez & Gonzalez-Barrera Ana, 2014; Mathews & Hamilton, 2016; Mortimer, 2015). For

example, college attendance is associated with increased alcohol consumption, and women in recent cohorts are much more likely to attend college compared with women in previous generations and are now more likely than men to attend college. Additionally, women are increasingly delaying or declining entirely social roles that are associated with lower alcohol use such as marriage or cohabitation with a romantic partner, as well as parenting. Our previous work has demonstrated that historical increases in social roles linked to more alcohol consumption lead to gender convergence in alcohol consumption (Jager et al., 2015; Patrick et al., 2019), and that changes in social roles explain approximately 20% of the variance in gender differences in alcohol use across cohorts.

Thus, while historical changes in social roles explain a substantial portion of historical shifts in gender differences in drinking, the partial mediation suggests that there are additional mediating factors that explain differences, and further, the mechanisms through which changes in these social roles themselves may impact gender differences remains inadequately understood. Considered through the lens of conceptual models such as Bronfenbrenner's ecological model of human development (Bronfenbrenner, 1977, 1994), the social ecology consists of nested contexts ranging from the proximal to distal, and the larger social role changes are connected to more proximal social ecological mechanisms that may impact alcohol consumption. One set of potential proximal mechanisms is through changes in gender, religion and family attitudes and beliefs about the role of women in society, the labor force, and the family.

Indeed, society's views about the women and men's roles in family life, including the value of women's labor contributions, have been changing in many parts of the United States, with concomitant increases in women in high socioeconomic occupations, representation in political office, and changing views about gendered norms and roles (Goodwin-White, 2018; Okahana & Zhou, 2018; US Bureau of Labor Statistics, 2019). While women continue to spend more time on unpaid domestic labor compared with men, rates are converging in time (Bianchi, Sayer, Milkie, & Robinson, 2012; Sayer, 2005), and the proportion of households comprised of man-woman couples in which women are the sole or primary income earner has increased (Boushey, 2009; Livingston, 2018a, 2018b; Ruggles, 2015). These trends also underlie broader shifting in the meaning and importance of cultural institutions such as marriage; cohabitation without marriage, and non-monogamous partnerships and consensual non-monogamy are increasing in the US (Daugherty & Copen, 2016; Kuperberg, 2019; Sizemore & Olmstead, 2017; Thornton & Young-DeMarco, 2001), and those who approve of cohabitation and non-monogamy have more socially liberal views in general (Axinn & Thornton, 2000; Kuperberg, 2019), which may move in historically concomitant ways to fewer social sanctions towards alcohol use. Alcohol may be becoming increasingly accepted within roles such as marriage and parenting, as potentially indicated by the growth of advertising and marketing efforts towards 'moms' with alcohol positioned as an appropriate coping response to and reward for stress (Harding, Whittingham, & McGannon, 2021). Furthermore, the importance of religion and religious service attendance are reliable predictors of lower alcohol consumption (Koenig, King, & Carson, 2012), especially among women, and themselves have been declining among young adults in the US for more than a decade (Twenge, Exline, Grubbs, Sastry, & Campbell, 2015).

Beliefs and attitudes about gendered roles in family life, including the importance of marriage, monogamy, religion, and women's roles, have differentiated and explained gender differences in drinking in prior literature. Therefore, it is plausible that changes in these beliefs become manifest in individual-level attitudes about social and gendered roles and the roles of women and men in society. This may be especially the case in the context of cohorts of young adults for whom religious beliefs are increasingly less relevant to forming attitudes about social roles. These individual-level gender-related attitudes and beliefs may underlie changes in gender differences in drinking, over and above that which is

mediated by social roles such as educational attainment, employment, marriage, and parenthood. While social identities intersect with gender in complex and heterogeneous ways vis a vis additional axes of race, class, sexual orientation, and gender identity, the ways in which average differences in social roles, gender, religion and family attitudes at a national level explain national trends in alcohol consumption has not been fully explored.

The present study examines the role of social roles, gender, religion and family attitudes and beliefs in mediating historical trends in binge drinking in the United States. We build on and extend our previous work using national panel data on more than 54,000 participants who were in the 12th grade from 1976 through 2006, and followed to age 29/30 from 1988 through 2016. We examine cohort effects on gender differences in binge drinking across distinct developmental age bands from adolescence through the transition to adulthood; the extent to which gender, religion and family attitudes and beliefs vary by birth cohort and across development from adolescence through the transition to adulthood; and the extent to which they mediate cohort effects on gender differences in binge drinking over and above historical and development variation in social roles.

2. Methods

Data source. The Monitoring the Future (MTF) study includes nationally representative samples of approximately 15,000 US high school seniors (12th grade) surveyed annually since 1976 (Miech et al., 2020). From the annual survey, 2450 students are randomly selected for longitudinal follow-up, with oversampling for students who report drug use (Schulenberg et al., 2020) and weighting algorithms to account for oversampling. Those selected begin follow-up assessments either one (modal age 19) or two (modal age 20) years later, and are followed biennially thereafter; included in the present analysis is data through modal age 29/30 (Miech et al., 2020; Schulenberg et al., 2020). Subsequent follow-ups were not included in the present analysis as it would restrict the number of cohorts followed. An Institutional Review Board of University of Michigan approved the study.

Respondents were grouped by cohort. Cohorts were defined based on the year that respondents were in the 12th grade. Observed cohort values ranged from 1976 to 2006. Within and across cohort groups, we also analyzed data by age. Age was defined over the study period as the modal age(s) of respondents at: baseline (age 18), first follow-up (age 19/20), second follow-up (age 21/22), third follow-up (ages 23/24), fourth follow-up (ages 25/26), fifth follow-up (ages 27/28), and sixth follow-up (ages 29/30). [Supplementary Table 1](#) shows sample sizes by cohort and follow-up and [Supplementary Table 2](#) provides descriptive characteristics of the imputed sample.

There was attrition of respondents over the course of the study, and attrition has increased across historical time. Most attrition occurs between baseline and the first follow-up, for which attrition ranged from 16.34% for those who were in 12th grade in 1979 to 51.33% in for those who were in 12th grade in 2005. Among the cohorts who had the chance to be followed up to age 29/30, attrition ranged from 45.23% in for those who were in 12th grade in 1977 to 78.08% in for those who were in 12th grade in 2006. Attrition was more likely among men, non-white respondents, respondents with lower average GPA, and respondents who reported binge drinking. Although there is differential attrition across cohort within MTF; those who were lost-to-follow-up or left the study did not meaningfully vary by cohort (in terms of race/ethnicity, gender, H.S. GPA, binge drinking; i.e., all $R^2 < 0.003$). Thus, although the amount of retention within MTF did vary by cohort, the socio-demographic characteristics of those retained did not meaningfully vary by cohort. Our previous work has demonstrated through quantitative bias analysis that the magnitude of attrition does not have a substantial impact on the validity of results for binge drinking in the MTF cohorts (Keyes et al., 2020), and we mitigated the effects of attrition by using attrition weights in our imputation models. Attrition

weights were calculated as the inverse probability of participation at each follow up based on the following covariates measured at age 18: gender, race/ethnicity, college plans, truancy, high school grades, number of parents in the home, religiosity, parental education, alcohol use, cigarette use, marijuana use, other illicit drug use, region, cohort, and sampling weight correcting for over-sampling of age 18 substance users.

Measures. A Directed Acyclic Graph of the hypothesized mediational model as well as observed and unobserved covariates is shown in [Supplementary Fig. 1](#). The MTF questionnaire includes five or six survey forms (depending on cohort) that are randomized at 12th grade; each form includes a common core set of questions. Not all items were on the same randomized survey forms by design (i.e., planned missingness) (Little & Rhemtulla, 2013).

Binge drinking. Binge drinking was defined at each wave based on the question, “How many times have you had five or more drinks in a row over the past two weeks?” Due to heavily skewed distributions, responses at each wave were dichotomized as any occasion versus none. Binge drinking is a core question asked of all respondents. Note that binge drinking for women is often defined as 4+ drinks (National Institutes of Health, 2020), thus this measure may have less sensitivity for detecting binge drinking among women. However, because any potential differential sensitivity by gender introduced by this measure would be systematic or consistent across age and cohort, our measure of binge drinking should not obscure estimates of age and cohort trends.

Gender, religion and family attitudes and beliefs. We evaluated 28 items that captured gender, religion and family attitudes and beliefs. The full question for each item is provided in [Supplementary Table 3](#), as well as which of the six subforms in the MTF questionnaire these items were found within. Briefly, items captured attitudes such as “Mothers should spend more time with their children”, “People will have fuller lives if they choose legal marriage” and “How much are women discriminated against in getting equal pay?” Items were coded so that they were in the same direction as trends over time in binge drinking, which involved reverse coding some items so that higher score was indicative of lower alcohol consumption. All items were evaluated to determine whether they met basic criteria for mediation, i.e. that they were associated with binge drinking, and that cohort time trends in each were associated the cohort time trends in binge drinking. Thus, only those items in [Supplementary Table 3](#) that met both criteria were included in the final analysis.

Social roles. At each wave we dichotomized indicators of respondent residential independence, marital status, full-time college status, full-time employment status (e.g., working 35 or more hours per week), and parenthood. All indicators were self-report, and all indicators were available at each wave, with the exception of full-time college status and full-time employment, because all participants at that age were surveyed in high school. A more detailed summary of the social role measures can be found in Jager et al. (2015). All social role items were core questions.

Other covariates. All demographic items were core questions and respondent reported. These included gender, race/ethnicity (Black, White, Hispanic, Asian, Other), maximum parental education (some high school, finished high school/some college, finished college or greater), and average grades in high school (B- or lower, B or greater).

2.1. Statistical methods and analysis

Planned missing imputation. Gender, religion and family attitudes and beliefs were not all included on the same survey form due to the planned missing design. We began by including respondents who were assigned to one of the three forms that included at least one gender, religion and family attitude and belief variable. We then imputed data for what the respondent’s likely response would be to indicators on forms for which they were not assigned. For example, only some respondents were asked “How much are women discriminated against in getting equal pay?”. For respondents who were not asked this question, but were asked other

questions about gender, religion and family attitudes and beliefs, responses to this indicator were multiply imputed, with imputed datasets combined using Rubin's rules for analysis. Multiple Imputation by Chained Equations (MICE) was used to impute missing data and 10 imputed values were pooled for each respondent. Our imputation models included items from previous waves to predict values at the current wave. Variables used to impute results included cohort, survey form, sex, GPA, parental education, race, all attitude variables that were candidates for mediators (Supplementary Table 3), social roles, and items about alcohol, marijuana, and cigarette use. The proportion of the sample that had imputed data on gender, religion and family attitudes and beliefs ranged from 6.16% for the question about religious attendance at baseline to 87.39% for the question asking about gender discrimination in pay at follow up 6. There is a substantial evidence base underlying the validity and utility of this type of imputation approach (Little & Rhemtulla, 2013; Noble & Nakagawa, 2018; Rhemtulla & Little, 2012; Wood, Matthews, Pellowski, & Harel, 2019), especially in a planned missing design where data are assumed to be missing completely at random (which is the case here). For example, Madley-Dowd, Hughes, Tilling, and Heron (2019) demonstrated through simulation that minimal bias is introduced even in situations with upwards of 80–90% missing data when auxiliary information such as that which is available in a planned missing design is used for imputation (Madley-Dowd et al., 2019). In almost all cases, bias and Type II error in using only those with available observed data is greater than when imputing data, even in situations with large amounts of missing. Moreover, the imputation approach allowed us to assess quantitative mediation by gendered attitudes and beliefs maximizing the available sample, even when items were on different survey forms.

2.2. Descriptive analysis

All descriptive analyses were stratified by respondent-reported gender. Two primary descriptive analyses were conducted prior to building the mediation models.

First, we examined the association between birth cohort and binge drinking. Using a regression model with binge drinking as the outcome, we assessed an unadjusted regression model with birth cohort as the predictor variable. Models were stratified by age, allowing us to assess the historical trend in binge drinking for each age.

Second, we used a similar approach to examine the historical trend in each gender, religion and family attitudes and beliefs item (see Supplementary Table 3). We modeled the time trend in each variable by birth cohort, stratified by age. We also estimated an overall change score, that is, the difference in the prevalence from the first time point to the last time point of included data collection (which varied by cohort). The purpose of this change score was to provide a straightforward indicator of whether the trend in the gendered attitudes and beliefs across cohort was generally similar to the trend in binge drinking across the same cohorts. Only those variables that were associated with mediators (positive or negative) were considered for possible mediation, since only gender, religion and family attitudes and beliefs that varied in a historically similar way (either in the same direction or inverse direction) as the cohort effect in binge drinking could plausibly explain the cohort effect in drinking.

2.3. Mediation models

Once we identified the social roles, and the gender, religion and family attitudes and beliefs variables that would be potential mediators, we proceeded with the mediation analysis. Our primary interest was in estimating the extent to which observed cohort effects on binge drinking (i.e., total cohort effects when collapsed or averaged across age) were mediated by the attitudes and beliefs, and whether this mediation explained gender differences in alcohol use. We began by estimating the total association between birth cohort and binge drinking, controlling

for age, which yielded the total cohort effect collapsed across age (i.e., the total cohort effect independent of age). We then entered demographics and social roles into the model, given that previous analyses from the MTF data have indicated that historical trends in social roles explain approximately 20% of gender differences in historical trends in binge drinking (Jager et al., 2015; Patrick et al., 2019). We then entered gendered attitudes and beliefs that were a) associated with binge drinking (at $p < 0.05$); and b) historically varying similarly as binge drinking (based on direction of the association).

To implement the mediation analysis, we first tested for additive statistical interaction between cohort and each mediator, to determine the method needed to estimate a valid indirect effect (VanderWeele, 2015). Next, we specified a logistic mediator model to estimate the conditional distribution of the mediator given the exposure, and a logistic outcome model to estimate the conditional distribution of the outcome given the exposure, mediator, and observed confounders. Each model's estimated parameters were used to decompose the direct and mediated (indirect) parameter estimates in the total mediation model and calculate the proportion of the total cohort effect explained by each mediator (Imai, Keele, & Tingley, 2010). This approach estimates standard errors using quasi-Bayesian Monte Carlo methods based on normal approximation, to construct 95% confidence intervals around both the direct and indirect parameter estimates and the proportion of the total effect that was mediated (Imai, Keele, & Tingley, 2010) for both linear and binary outcomes (Imai, Keele, & Tingley, 2010; Imai, Keele, & Tingley, 2010). The methods appendix provides more detail on the mediation analysis.

We then estimated the proportions of the total cohort effect explained by each mediator as well as the remaining total effect – or “direct” effect – left unexplained by the mediators. The proportion explained could be positive or negative. This arises when the indirect effect is positive and thus has the opposite sign of the negative total effect (e.g., positive indirect effect/negative total effect = negative percent mediated). The interpretation of mediators with negative proportions (and thus positive indirect effects) varies at older and younger ages: at younger ages (when the effect of cohort is negative) negative proportions indicate that cohort effects on binge drinking would have been more pronounced (declines across cohort would have been even greater) in the absence of historical variation in these mediators; however, at older ages (when the effect of cohort is positive) negative proportions indicate that cohort effects on binge drinking would have been less pronounced (increases across cohort would have been less) in the absence of historical variation in these mediators. Mediators with positive proportions explained arises when the indirect effect is negative and thus has the same sign of the negative total effect (e.g., negative indirect effect/negative total effect = negative percent mediated). Again, the interpretation of mediators with positive proportions (and thus negative indirect effects) varies at older and younger ages: at younger ages (when the effect of cohort is negative) positive proportions indicate that cohort effects on binge drinking would have been less pronounced (declines across cohort would have been less) in the absence of historical variation in these mediators; however, at older ages (when the effect of cohort is positive) positive proportions indicate that cohort effects on binge drinking would have been more pronounced (increases across cohort would have been even greater) in the absence of historical variation in these mediators. To summarize, for mediators with negative proportions explained, their historical variation suppressed historical variation in binge drinking at ages characterized by historical declines in binge drinking but contributed to historical variation in binge drinking at ages characterized by historical increases in binge drinking, whereas the opposite was true for mediators with positive proportions explained.

All statistical analyses were conducted in R (version 3.5.1). Mediation models were implemented using the “mediation” package (Tingley, Yamamoto, Hirose, Keele, & Imai, 2014) using a maximum likelihood estimator robust to non-normality (Jager, Schulenberg, O'Malley, & Bachman, 2013).

3. Results

3.1. Cohort and age trends in binge drinking

Fig. 1 shows the predicted cohort effect in binge drinking for each cohort. Each solid line represents the cohort effect (the year in which the student was in the 12th grade increases as the line moves to the right) at a particular age. Solid lines are for the predicted values, dotted lines are predicted values after controlling for mediators; results for mediated models discussed below. Each line represents the historical trend (i.e. cohort effect) in binge drinking at a specific age range. Estimated proportions are from a regression model adjusted for demographics, age, linear, quadratic, and cubic terms for cohort, and the interaction between cohort and age. In terms of the cohort effect, from base year 1976 through 2016, binge drinking declined as each cohort was aged 19/20; in the predicted models, prevalence decreased from 60.0% among men who were in the 12th grade in 1976 to 34.55% among men who were in the 12th grade in 2016 and from 38.47% among women who were in the 12th grade in 1976 to 24.95% among women who were in the 12th grade in 2016. For men, the cohort effects in binge drinking declined across historical time at other ages as well, although the magnitude of the decline also slowed across developmental age. In terms of the age effect, by the sixth follow up (age 29/30), the predicted prevalence of binge drinking is low, and the negative trend in slope across historical time is negligible. The age effect was also apparent for women, as there is an increasing predicted prevalence of binge drinking across historical time for all age groups after follow up 1 (age 19/20). The age group with the highest magnitude of increase is women who are 25/26, observed in these data from 1983 to 2016.

3.2. Selection of mediator variables

Eight variables met criteria to possibly mediate cohort effects in binge drinking: frequency of religious service attendance, importance of religion, and the following attitudes: “Most mothers should spend more time with their children than they do now”, “Most people will have fuller and happier lives if they choose legal marriage rather than staying single ...”, “Most fathers should spend more time with their children than they do now”, “Having a close intimate relationship with only one partner is too restrictive ...”, “It is usually a good idea for a couple to live together before getting married ...”, and “To what extent are women discriminated against in getting equal pay for equal work”. Historical time trends in these variables are available in Supplementary Figs. 2–8. As is clear

from the figures, there is both marked historical variation in all indicators, as well as substantial variation across indicators. Supplementary Table 4 provides the mean values of each potential mediator at the first and last observation period, along with standard deviation, to provide information on the magnitude of the changes over time. Magnitudes varied across indicators, with the largest magnitude of change for “fathers should spend more time with their children”, which decreased 37% of a standard deviation among 12th grade male respondents, and religious attendance, which decreased 50% of a standard deviation among 29/30 year old female respondents. Religious affiliation and involvement declined across age and cohort. However, not all attitudes follow similar patterns. For example, Supplementary Fig. 7 indicates that across time, for all ages and birth cohorts, more respondents agreed that it is a good idea for a couple to live together before marriage. However, per Supplementary Fig. 4, young adults at 18 increasingly believed that people live fuller and happier lives if they choose legal marriage rather than staying single or living with someone. Generally respondents were less likely to believe that women are discriminated against in getting equal pay over time.

An example of one variable that met criteria for mediation is shown in Fig. 2, which asks respondents how much they agree with the statement “Having a close intimate relationship with only one partner is too restrictive for the average person.” Responses were reverse coded, so higher scores were associated with lower levels of alcohol consumption. Across historical time, respondents at younger ages were more likely to disagree that one partner is too restrictive, whereas at older ages, respondents were less likely to disagree that one partner is too restrictive. This is in line with trends in binge drinking, with younger ages engaging in less binge drinking over time, and older ages engaging in more binge drinking over time.

3.3. Results of mediation models

Mediation analyses are shown in Table 1 among women, and Table 2 among men. As indicated in Table 1, for men the unadjusted total effect of cohort on binge drinking was -0.011 (95% Confidence Interval [C.I.] $-0.011, -0.010$) and the adjusted total effect was -0.010 (95% C.I. $-0.011, -0.010$). As indicated in Table 2, for women the unadjusted total effect of cohort on binge drinking was -0.009 (95% C.I. $-0.010, -0.008$) and the adjusted total effect of cohort was -0.010 (95% C.I. $-0.011, -0.009$). Although the direction of cohort effects differed by age (i.e., cohort effects were negative at younger ages when binge drinking declined across cohort but positive at older ages when binge

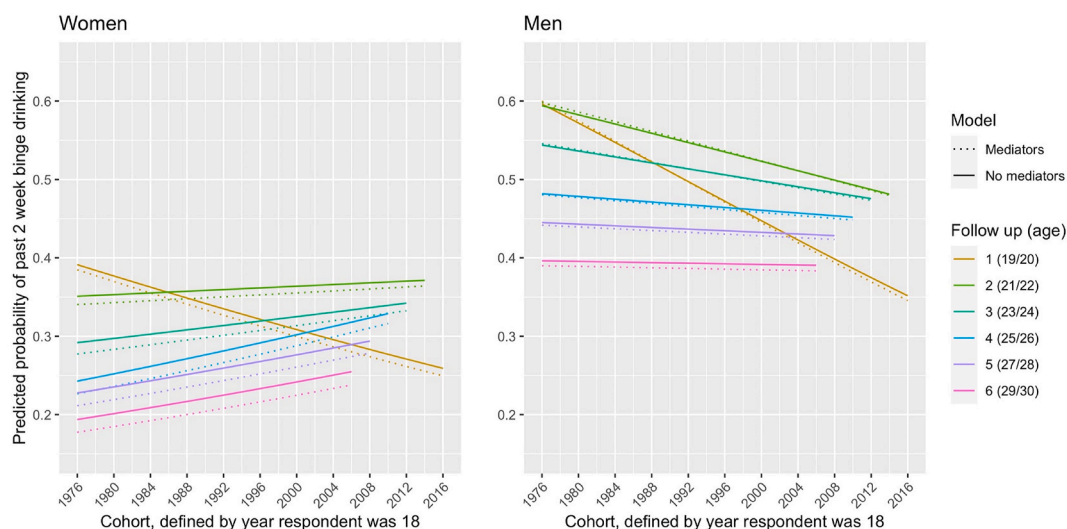


Fig. 1. Predicted cohort effect (solid line) in binge drinking; predicted cohort effect in binge drinking after all mediators are in model (dotted line; both models adjusted for demographics) stratified by gender.

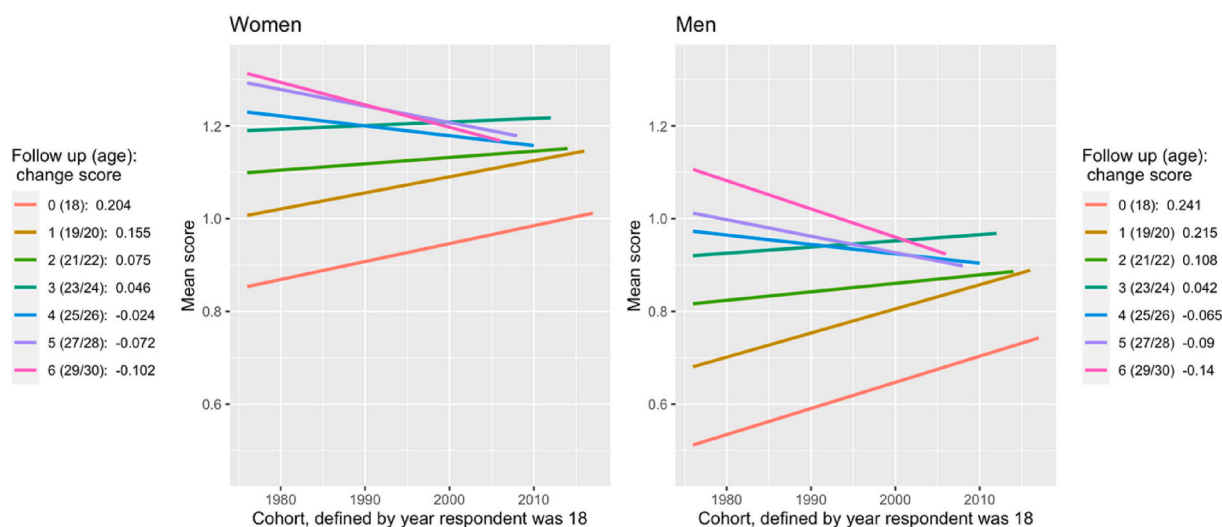


Fig. 2. Trends in attitudes towards monogamy over time and across age by gender: Response options were 1 = “Disagree” 2 = “Mostly Disagree” 3 = “Neither” 4 = “Mostly Agree” 5 = “Agree”. Responses were centered and standardized to calculate score, and regression lines fit through mean scores. Change score is mean score at most recent year minus mean score in earliest year, by wave.

drinking increased across cohort; Fig. 1), the fact that the total effects of cohort are all negative (regardless of gender or whether adjusted or unadjusted) indicates that cohort effects *when combined across age* are negative. Thus, when collapsing across the 18 to 30 age band examined here, binge drinking declined across cohort regardless of gender and adjustments for demographics and all other mediators. Furthermore, it should be noted that while the unadjusted and adjusted total effects were small for the effect of a single year change on binge drinking, they are relatively large effects when considered across a longer band of historical time.

Provided in Tables 1 and 2 are the proportions of the total cohort effect explained by each mediator as well as the remaining total effect – or “direct” effect – left unexplained by the mediators. Indirect effect sizes are provided in Supplementary Tables 5 and 6. Among men (Table 1), the proportions of the total effect of cohort explained by social roles were generally negative (with the exception of full-time employment status). For some mediators the proportion explained was negative—religious attendance, agreeing that it’s good for a couple to live together before marriage (reverse coded), living with parents, marital status, and full-time college. This indicates that for ages characterized by historical declines in binge drinking, historical declines would have been more pronounced if it were not for historical variation in social roles, while for ages characterized by historical increases in binge drinking, historical increases would have been less pronounced if it were not for historical variation in social roles. Social roles varied in the proportion of the total effect of cohort that they explained, with marital status mediating the largest portion of the cohort effect, with -7.2% (95% C.I. $-9.44, -5.34$) in the fully adjusted model. In contrast to social roles, for gendered attitudes and social norms the proportions of the total effect explained were generally positive (with the exception of couple’s should live together before marriage, which was reverse-coded). This indicates that for ages characterized by historical declines in binge drinking, historical declines would have been less pronounced if it were not for historical variation in gender attitudes and social norms, while for ages characterized by historical increases in binge drinking, historical increases would have been more pronounced if it were not for historical variation in gender attitudes and social norms. The gender attitudes and social norms also varied in the proportion of total effect explained. The largest mediation effect was found for agreeing with the statement ‘one partner is too restrictive’ (reverse coded), mediating 3.35% of the effect (95% C. I. 2.42, 4.31). Among men, neither religious service attendance nor religion importance explained an appreciable portion of the cohort

effect. There was also a substantial mediation effect in the opposite direction for ‘couples should live together before they are married’ (reverse coded), mediating 1.6% of the cohort effect (95% C.I. $-2.37, -0.8$).

Among women (Table 2), the same countervailing pattern held for social roles (proportions of total effects explained were generally negative) and gendered roles and attitudes (proportions of total effects explained were generally positive). However, among women there were larger mediating effects for social roles, with marital status (-12.84 , 95% C.I. $-16.76, -9.49$), full-time college (-1.71% 95% C.I. $-2.16, -1.33$), and full-time employment (1.14%, 95% C.I. 0.6, 1.68) each mediating a substantial portion of the cohort effect on binge drinking. Among women religious service attendance also explained a negative proportion of total effects, with declines in religious service attendance mediating 2% of cohort effects in binge drinking (95% C.I. $-3.03, -1.09$). Similarly to men, gender attitudes and social roles did not provide substantial additional mediation, and also similarly to men, the largest mediating effects were found for ‘one partner is too restrictive’ (reverse coded) (4.75%, 95% C.I. 3.75, 5.77), and ‘couples should live together before they are married’, mediating 2.1% of the cohort effect (95% C.I. $-2.92, -1.22$).

To summarize, although more pronounced for women, for different genders historical variation in social roles is linked to an upward shift in the effect of cohort on binge drinking regardless of age: it is linked to *less of a decline* in binge drinking across cohort at younger ages and *more of an increase* in binge drinking across cohort at older ages. The same pattern held for historical variation in religious service attendance, but only for women. However, for different genders the opposite pattern generally held for historical variation in gendered roles and attitudes: it is linked to *more of a decline* in binge drinking across cohort at younger ages and *less of an increase* in binge drinking across cohort at older ages. As a result of these countervailing patterns, the collective effects of the mediators was modest for women and inconsequential for men. Indeed, returning to Fig. 1, the dashed line indicates predicted binge drinking after controlling for the mediators including social roles and gendered attitudes and belief, and thus can be interpreted as the direct effect of cohort that is not mediated by social roles or gendered attitudes and beliefs. The results indicate that there remained a substantial portion of the effect that was not explained by variables we examined. The association between cohort and binge drinking was reduced on average by 0.6% among men and 4.7% among women in magnitude after controlling for all mediators, including attitudes, religiosity, and social roles.

Table 1

Estimated proportions of cohort effect mediated and average direct cohort effects and from causal mediation analysis (Men), base years 1976–2016, N = 21,297.

Mediator	Unadjusted model Total cohort effect: 0.010 (−0.011, −0.010)		Model adjusted for demographics and all other mediators Total cohort effect: 0.010 (−0.011, −0.010)	
	Proportion of the total effect mediated (%)	Direct cohort effect that is not through the mediator	Proportion of the total effect mediated (%)	Direct cohort effect that is not through the mediator
Social roles				
Residential independence	−0.32 (−0.97, 0.33)	−0.010 (−0.011, −0.010)	−0.48 (−1.43, 0.53)	−0.010 (−0.011, −0.010)
Marital status	−4.57 (−5.19, −3.15)	−0.011 (−0.011, −0.011)	−7.19 (−9.44, −5.34)	−0.011 (−0.011, −0.010)
Parenthood	0.28 (−0.73, 1.36)	−0.011 (−0.011, −0.010)	0.13 (−0.41, 0.6)	−0.010 (−0.011, −0.010)
Full-time college status	−0.54 (−0.78, −0.32)	−0.010 (−0.011, −0.010)	−0.55 (−0.85, −0.31)	−0.010 (−0.011, −0.010)
Full-time employment status	0.3 (0.14, 0.5)	−0.010 (−0.011, −0.010)	0.69 (0.37, 1.07)	−0.010 (−0.011, −0.010)
Religious involvement				
Religious service attendance	−2.46 (−4.73, −0.35)	−0.011 (−0.011, −0.010)	−0.55 (−1.54, 0.48)	−0.010 (−0.011, −0.010)
Religious importance	0.46 (−1.62, 2.43)	−0.011 (−0.011, −0.010)	0.36 (−0.54, 1.29)	−0.010 (−0.011, −0.010)
Gender roles and attitudes				
People have fuller lives if they choose legal marriage	0.73 (−0.8, 2.09)	−0.011 (−0.011, −0.010)	0.08 (−0.73, 0.85)	−0.010 (−0.011, −0.010)
Fathers should spend more time with their children	0.09 (−1.16, 1.25)	−0.011 (−0.011, −0.010)	0.58 (−0.07, 1.24)	−0.010 (−0.011, −0.010)
Mothers should spend more time with their children	3.18 (2.2, 4.07)	−0.010 (−0.011, −0.010)	0.5 (0.3, 0.72)	−0.010 (−0.011, −0.010)
One partner is too restrictive (reverse coded)	4.56 (3.39, 5.74)	−0.010 (−0.011, −0.010)	3.35 (2.42, 4.31)	−0.010 (−0.011, −0.010)
Couples should live together before marriage (reverse coded)	−2.5 (−3.87, −1.11)	−0.011 (−0.011, −0.010)	−1.56 (−2.37, −0.8)	−0.010 (−0.011, −0.010)
How much are women discriminated against in getting equal pay	0.15 (−0.2, 0.48)	−0.011 (−0.011, −0.010)	0.31 (−0.05, 0.74)	−0.010 (−0.011, −0.010)

Note: the direct cohort effect is the cohort effect that is not explained by the mediator. For all models, the direct cohort effect was consistently −0.010 (95% CI: 0.011, 0.010).

Table 2

Estimated proportions of cohort effect mediated and average direct cohort effects and from causal mediation analysis (Women), base years 1976–2016, N = 22,090.

Mediator	Unadjusted model Total cohort effect: 0.009 (−0.009, −0.008)		Model adjusted for demographics and all other mediators Total cohort effect: 0.010 (−0.010, −0.009)	
	Proportion of the total effect mediated (%)	Direct cohort effect that is not through the mediator	Proportion of the total effect mediated (%)	Direct cohort effect that is not through the mediator
Social roles				
Residential independence	−0.08 (−0.89, 0.75)	−0.008 (−0.009, −0.007)	−0.05 (−1.32, 1)	−0.010 (−0.011, −0.009)
Marital status	−8.82 (−14.08, −7.05)	−0.010 (−0.010, −0.009)	−12.84 (−16.76, −9.49)	−0.010 (−0.011, −0.009)
Parenthood	−1.52 (−4.14, 0.72)	−0.009 (−0.010, −0.008)	−0.89 (−1.92, 0.36)	−0.010 (−0.011, −0.009)
Full-time college status	−2.66 (−3.33, −2.05)	−0.009 (−0.009, −0.008)	−1.71 (−2.16, −1.33)	−0.010 (−0.011, −0.009)
Full-time employment status	1.76 (0.98, 2.6)	−0.008 (−0.009, −0.007)	1.14 (0.6, 1.68)	−0.010 (−0.011, −0.009)
Religious involvement				
Religious service attendance	−6.93 (−10.23, −3.94)	−0.009 (−0.010, −0.009)	−2.04 (−3.03, −1.09)	−0.010 (−0.011, −0.009)
Religious importance	−1.59 (−4.73, 1.37)	−0.009 (−0.010, −0.008)	−0.85 (−2.14, 0.44)	−0.010 (−0.011, −0.009)
Gender roles and attitudes				
People have fuller lives if they choose legal marriage	−0.78 (−2.91, 1.18)	−0.009 (−0.010, −0.008)	−0.5 (−1.43, 0.36)	−0.010 (−0.011, −0.009)
Fathers should spend more time with their children	0.48 (−1.04, 1.76)	−0.009 (−0.010, −0.008)	0.57 (0, 1.17)	−0.010 (−0.011, −0.009)
Mothers should spend more time with their children	4.49 (3.29, 5.81)	−0.008 (−0.009, −0.008)	0.63 (0.41, 0.9)	−0.010 (−0.011, −0.009)
One partner is too restrictive (reverse coded)	8 (6.26, 9.78)	−0.008 (−0.009, −0.007)	4.75 (3.75, 5.77)	−0.010 (−0.011, −0.009)
Couples should live together before marriage (reverse coded)	−5.09 (−7.23, −3.34)	−0.009 (−0.010, −0.008)	−2.13 (−2.92, −1.22)	−0.010 (−0.011, −0.009)
How much are women discriminated against in getting equal pay	0.5 (0.31, 0.73)	−0.009 (−0.009, −0.008)	0.79 (0.5, 1.1)	−0.010 (−0.011, −0.009)

Note: the direct cohort effect is the cohort effect that is not explained by the mediator. For all models, the direct cohort effect was consistently −0.010 (95% CI: 0.011, 0.009).

Among men, social roles and gendered attitudes and beliefs collectively explained almost none of the observed cohort effects. However, it should be noted that the overall cohort trends are quite substantial, given that the estimates are the associations for a one year increase in cohort.

4. Discussion

The present study documents the role of changing social, family and religious views on binge drinking across 20th and 21st century cohorts of young adults using multi-cohort longitudinal panel data from Monitoring the Future. The background for this investigation is that alcohol consumption and binge drinking are dynamically changing in prevalence across both historical and developmental time by cohort, as are gender differences (Keyes et al., 2019). In particular, while binge drinking is rapidly declining among adolescents, it is rapidly increasing in those same cohorts at accelerated rates across young adulthood, more so for women than for men, suggesting that women are increasingly an at-risk group for heavy alcohol use. Within this background, we document three central findings of the present analyses. First, adolescents' and adults' views on gender and social roles, and the importance of religiosity, have changed substantially across both historical and developmental time, and many of these views are associated with cohort effects on binge drinking. Religious affiliation and attendance are rapidly decreasing across both age and cohort, but attitudes and views on gender and family, which are typically more restrictive among those who participate actively in religious practices, are not changing at uniformly similar rates. Views on motherhood, monogamy, and women's roles in society are shifting, and indicate greater endorsement that women should spend more time with their children (whereas there is less endorsement that men should spend more time with children), and fewer respondents in recent years believe that women are discriminated against in getting equal pay. Thus, the assumption that one reason women are increasing alcohol consumption more than men is due to a loosening of attitudes towards gender and greater women's liberation is not uniformly supported in the data.

Second, gender, social role, and religious views are situated within changing statuses and roles for women in the US, including increased college attendance, and delayed and/or foregone transitions into union formation and child rearing. These statuses and roles are also historically linked to binge drinking (Jager et al., 2015). Third, we documented that changes in social roles, as well as some gender, social role, and religious views, partially mediate cohort effects on binge drinking. Views on parenthood and female discrimination explain small portions of cohort effects. Taken together, these results indicate that explanations for the dynamic changes in alcohol consumption by gender and developmental age across historical time include not only changing social roles but how those roles potentially influence historically socially constricting views.

Religious involvement, both service attendance and salience, was among the factors that was the strongest mediator of cohort effects on binge drinking for women. Our results, which align with other surveys, indicate that the salience of religion is declining across men and women in the US (Twenge et al., 2015). Given that religious involvement is historically strongly associated with higher rates of alcohol abstinence and lower binge drinking (Castaldelli-Maia & Bhugra, 2014; Koenig, 2009), it is consistent with the existing literature that declines in the salience of religion to many people in the US would mediate the acceleration of binge drinking in the US. Furthermore, within the social norms of many religious groups in the US, there are additional sanctions on women's roles, sexuality, and occupational attainment (Cassese & Holman, 2016). The declining religiosity in the US may thus impact women to a greater extent than men in terms of loosening social restrictions overall, underlying a greater increase in alcohol use. The impact of additional views on gender and gendered social roles may also be a reflection of changing religious salience; for example, changing views on monogamy and parental involvement with children were

among the strongest mediators of the cohort effect on binge drinking. Sexual sanctions and gendered roles within families are strongly patterned by religion (Cochran, Chamlin, Beeghley, & Fenwick, 2004; Lefkowitz, Gillen, Shearer, & Boone, 2004; McFarland, Uecker, & Regnerus, 2011), suggesting that, overall, recent historical changes towards a more secular society may impact view of women, family, and have downstream effects on norms around health behaviors such as alcohol use.

There has been substantial speculation that increases in alcohol use among women may be driven by changing attitudes in other domains, for which we found less support. Factors such as historical trends in attitudes toward discrimination against women in the workplace, women spending time with children and family do not in any meaningful proportion explain trends in binge drinking in recent cohorts. Other literature documents that increased alcohol use among women in mid-life is primarily concentrated among those with high prestige and high wage occupations (McKetta, Prins, Bates, Platt, & Keyes, 2021), those with the highest levels of education (McKetta & Keyes, 2020), and those without children (McKetta & Keyes, 2019). Our results suggest that the underlying reasons for increases in drinking among these women may be primarily driven by factors such as increased income and resources, rather than changes in attitudes. Additionally, these results highlight that alcohol policies to reduce potential population health consequences of increased alcohol use may be optimally focused universally on price and access (Chaloupka, Grossman, & Saffer, 2002; Wagenaar, Tobler, & Komro, 2010), rather than high-risk approaches such as reducing alcohol use among certain groups (e.g. women) or diffuse approaches such as changing attitudes.

Further, the present analytical results should be considered alongside other results from Monitoring the Future and other data sources which document the substantial historical and developmental shifts in role and status among men and women in the US (Jager et al., 2015; Patrick, Schulenberg, & O'Malley, 2016), and the impact of those role and status changes on alcohol and other substance use (Jager et al., 2013, 2015; Patrick et al., 2019). College attendance is increasing, especially for women, and traditional roles such as living independently of parents, getting married, and having children, are being delayed or foregone altogether (Bianchi, Robinson, & Milke, 2006; Goldin, Katz, & Kuziemko, 2006; Goldin & Katz, 2002; Rosenzweig & Schultz, 1985; Rosenzweig & Seiver, 1982). These factors mediate approximately 20% of gender differences historical changes in alcohol use, and a substantial proportion of other drug use as well (Jager et al., 2013, 2015). It is these role and status changes, perhaps, rather than the downstream effects on social and gender attitudes, that have the greatest influence on alcohol use among US emerging adults.

The present study focused on the gender, religion and family attitudes and beliefs reported by men and women, but an important future direction of our work is to examine how non-binary and gender-nonconforming identities, as well as men and women who experience gender transitions, influence attitudes and beliefs and subsequent alcohol use. While understudied, available evidence indicates that non-binary and gender-nonconforming adolescents and adults are at higher risk than cisgender young adults for heavy alcohol use (Gilbert, Pass, Keuroghlian, Greenfield, & Reisner, 2018), although the literature base suffers from methodological limitations. Further, gender and social identities interact with and are dynamic across many other identities, including race, ethnicity, sexual orientation and class that affect social roles, attitudes and beliefs about family, and social sanctions towards alcohol use. The present study is an average across these groups, but interrogating how the intersection of multiple identities shape world-views and subsequently alcohol use is critical as a next step. Additionally, establishing the timing of population changes in social attitudes and events and the functional form of population changes (e.g., do social changes predict population variation in binge drinking at time lags, and if so which lag is most predictive; do social changes produce changes in binge drinking at a tipping point, or is a continuous relationship) in

alcohol use is important future research to inform public health.

Limitations should be considered. First, while the MTF study has a range of variables capturing social and gender attitudes across a long historical period, these variables have not been psychometrically tested, their meanings may change across historical time and age and become more or less relevant, and the construct capture is not comprehensive. However, the MTF is the only US national study to our knowledge that includes any attitudinal measures with the combined historical time scale back to the 1970s as well as developmental longitudinal timescale spanning adolescence to adulthood. Additionally, binge drinking commonly defined in recent years as 4+ drinks in a drinking session for women (National Institutes of Health, 2020). Although the MTF measure of binge drinking has the advantage of being invariant across time, it may undercount binge drinking among women. In total, while additional measures would be valuable, the study and the present variables are uniquely informative. Second, all measures are based on self-report, including alcohol use; alcohol use is likely under-reported substantially, and there may be trends over time in the quality of reporting that cannot be captured in self-reported data. Third, there is substantial attrition and losses to follow-up in the MTF study across time. However, we have conducted extensive quantitative bias analysis in binge drinking measures which document that it is not the amount of attrition that has an impact on bias, but the relationship between exposure variables and binge drinking outcomes among those lost to follow-up (Keyes et al., 2020). Our previous results demonstrate that conclusions regarding associations with binge drinking are largely robust to various assumptions about the distributions of binge drinking in those lost to follow-up, limiting concerns about implications for bias. Third, the sample excludes adolescents who dropped out of high school or were absent on the day of the initial 12th grade survey; thus, the results can only be generalized to high school attending adolescents. Finally, our analytic plan averaged the magnitude of the mediating effects across age; mediating effects may themselves be moderated by age, and therefore these analyses are foundational and can be probed for further interaction effects in future work.

In summary, the dynamics of alcohol use and binge drinking vary according to gender, and within gender, by social roles and attitudes about women, family, and society. The way in which these social roles and attitudes have changed over time have implications for alcohol consumption, and underlie increases among women, along with declining levels of religiosity that traditionally sanction drinking. Other attitudes that may be impacted by these overall societal shifts contribute less to cohort effects on alcohol use, such as changing views of families and the roles of women within them. However, the results of the present study should not deter from broader public health messaging. The most effective interventions to reduce the population health consequences of excessive alcohol use are those that are universal in their impact and coverage (Anderson, Chisholm, & Fuhr, 2009; Burton et al., 2017), such as price increases through taxation and limiting hours and days of sale, thus increasing interventions to reduce alcohol access should be considered. As we consider regulation of alcohol as a commodity that can cause substantial harm to population health, reconsidering the risk groups who consume alcohol to increasingly include women is important for public health resource allocation.

Conflict of interest statement

The authors report no conflicts of interest.

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Author statement

Katherine Keyes: Conceptualization; methodology; Writing -

Original Draft, **Jonathan Platt:** Conceptualization; methodology; Formal analysis; Investigation; Validation; Writing - Review & Editing, **Caroline Rutherford:** Formal analysis; software; Visualization, **Megan Patrick:** Conceptualization; methodology; Writing - Review & Editing, **Deborah Kloska:** Conceptualization; methodology; Data Curation; Writing - Review & Editing, **John Schulenberg:** Conceptualization; methodology; Writing - Review & Editing, **Justin Jager:** Conceptualization; methodology; Writing - Review & Editing.

Ethical statement

Ethical approval was granted by both University of Michigan ethical review board and the ethical review board of Columbia University Medical Center, Mailman School of Public Health.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmph.2021.100919>.

References

- Anderson, P., Chisholm, D., & Fuhr, D. C. (2009). Effectiveness and cost-effectiveness of policies and programmes to reduce the harm caused by alcohol. *The Lancet*, 373(9682), 2234–2246. [https://doi.org/10.1016/S0140-6736\(09\)60744-3](https://doi.org/10.1016/S0140-6736(09)60744-3)
- Arnett, J. J. (1998). Learning to stand alone: The contemporary American transition to adulthood in cultural and historical context. *Human Development*, 41(5–6), 295–315. <https://doi.org/10.1159/000022591>
- Arnett, J. J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist*, 55(5), 469–480. <https://doi.org/10.1037/0003-066X.55.5.469>
- Axinn, W., & Thornton, A. (2000). The transformation in the meaning of marriage. In L. Waite, C. Bachrach, M. Hindin, E. Thomson, & A. Thornton (Eds.), *The ties that bind* (pp. 147–165). Aldine de Gruyter.
- Bachman, J. G., Wadsworth, K. N., O'Malley, P. M., Johnston, L. D., & Schulenberg, J. E. (1997). *Smoking, drinking, and drug use in young adulthood: The impacts of new freedoms and new responsibilities*. Lawrence Erlbaum Associates, Inc. https://books.google.com/books?hl=en&lr=&id=Ku3s0dWFHaYC&oi=fnd&pg=PP1&ots=sVVPd_k3w4&sig=mpRaL4N7DYquXoG41j18ih7uSM1#v=onepage&q&f=false
- Bianchi, S. M., Robinson, J. P., & Milke, M. A. (2006). *The changing rhythms of American family life*. Russell Sage Foundation.
- Bianchi, S. M., Sayer, L. C., Milkie, M. A., & Robinson, J. P. (2012). Housework: Who did, does or will do it, and how much does it matter? *Social Forces*, 91(1), 55–63. <https://doi.org/10.1093/sf/sos120>
- Boushey, H. (2009). The new breadwinners. In H. Boushey, & A. O'Leary (Eds.), *The shriver report: A woman's nation changes everything*. Maria Shriver and Center for American Progress.
- Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist*, 32(7), 513–531. <https://doi.org/10.1037/0003-066X.32.7.513>
- Bronfenbrenner, U. (1994). Ecological models of human development. In *International encyclopedia of education* (Vol. 3).
- Brückner, H., & Mayer, K. U. (2005). De-standardization of the life course: What it might mean? And if it means anything, whether it actually took place? *Advances in Life Course Research*, 9, 27–53. [https://doi.org/10.1016/S1040-2608\(04\)09002-1](https://doi.org/10.1016/S1040-2608(04)09002-1)
- Burton, R., Henn, C., Lavoie, D., O'Connor, R., Perkins, C., Sweeney, K., et al. (2017). A rapid evidence review of the effectiveness and cost-effectiveness of alcohol control policies: An English perspective. *Lancet*, 389(10078), 1558–1580. [https://doi.org/10.1016/S0140-6736\(16\)32420-5](https://doi.org/10.1016/S0140-6736(16)32420-5)
- Burton, R., & Sheron, N. (2018). No level of alcohol consumption improves health. *Lancet*, 392(10152), 987–988. [https://doi.org/10.1016/S0140-6736\(18\)31571-X](https://doi.org/10.1016/S0140-6736(18)31571-X)
- Cassese, E. C., & Holman, M. R. (2016). *Religion, gendered authority, and identity in American politics. Religion and politics*.
- Castaldelli-Maia, J. M., & Bhugra, D. (2014). Investigating the interlinkages of alcohol use and misuse, spirituality and culture-Insights from a systematic review. In *International review of psychiatry*. <https://doi.org/10.3109/09540261.2014.899999>
- Chaloupka, F. J., Grossman, M., & Saffer, H. (2002). The effects of price on alcohol consumption and alcohol-related problems. *Alcohol Research & Health*, 26(1), 22–34.
- Chomak, S., & Collins, R. (1987). Relationship between sex-role behaviors and alcohol consumption in undergraduate men and women. *Journal of Studies on Alcohol*, 48(3), 194–201. <https://doi.org/10.15288/jsa.1987.48.194>
- Cochran, J. K., Chamlin, M. B., Beeghly, L., & Fenwick, M. (2004). Religion, religiosity, and nonmarital sexual conduct: An application of reference group theory. *Sociological Inquiry*, 74(1), 70–101. <https://doi.org/10.1111/j.1475-682X.2004.00081.x>
- Daugherty, J., & Copen, C. (2016). Trends in attitudes about marriage, childbearing, and sexual behavior: United States, 2002, 2006–2010, and 2011–2013. *National Health Statistics Reports*, 92, 1–10.

- Frezza, M., di Padova, C., Pozzato, G., Terpin, M., Baraona, E., & Lieber, C. S. (1990). High blood alcohol levels in women. The role of decreased gastric alcohol dehydrogenase activity and first-pass metabolism. *New England Journal of Medicine*, 322(2), 95–99.
- Fussell, E., & Furstenberg, F. (2005). The transition to adulthood during the twentieth century: Race, nativity, and gender. In R. A. Settersten, F. Furstenberg, & R. Rumbaut (Eds.), *On the frontier of adulthood: Theory, research and public policy*. Chicago Scholarship Online.
- Gallagher, C., Hendriks, J. M. L., Elliott, A. D., Wong, C. X., Rangnekar, G., Middeldorp, M. E., et al. (2017). Alcohol and incident atrial fibrillation - a systematic review and meta-analysis. *International Journal of Cardiology*, 246, 46–52. <https://doi.org/10.1016/j.ijcard.2017.05.133>
- Gilbert, P. A., Pass, L. E., Keuroghlian, A. S., Greenfield, T. K., & Reiser, S. L. (2018). Alcohol research with transgender populations: A systematic review and recommendations to strengthen future studies. *Drug and Alcohol Dependence*, 186, 138–146. <https://doi.org/10.1016/j.drugalcdep.2018.01.016>
- Gmel, G., Kuntsche, E., & Rehm, J. (2011). Risky single-occasion drinking: Bingeing is not bingeing. *Addiction*, 106(6), 1037–1045. <https://doi.org/10.1111/j.1360-0443.2010.03167.x>
- Goldin, C., & Katz, L. F. (2002). The power of the pill: Oral contraceptives and women's career and marriage decisions. *Journal of Political Economy*, 110(4), 730–770.
- Goldin, C., Katz, L. F., & Kuziemko, I. (2006). The homecoming of American college women: The reversal of the college gender gap. *The Journal of Economic Perspectives*, 20(4), 133–156. <https://doi.org/10.1257/jep.20.4.133>
- Goodwin-White, J. (2018). "Go West, young woman?": The geography of the gender wage gap through the Great Recession. *Economic Geography*, 94(4), 331–354. <https://doi.org/10.1080/00130095.2018.1427505>
- Greenfield, T. K., & Room, R. (1997). Situational norms for drinking and drunkenness: Trends in the US adult population, 1979–1990. *Addiction*, 92(1), 33–47. <https://doi.org/10.1111/j.1360-0443.1997.tb03636.x>
- Gruza, R., Sher, K., Kerr, W., Krauss, M., Lui, C., McDowell, Y., et al. (2018). Trends in adult alcohol use and binge drinking in the early 21st-century United States: A meta-analysis of six national survey series. *Alcoholism: Clinical and Experimental Research*, 42(10), 1939–1950. <https://doi.org/10.1111/acer.13859>
- Harding, K. D., Whittingham, L., & McGannon, K. R. (2021). #sendwine: An analysis of motherhood, alcohol use and #winemom culture on Instagram. *Substance Abuse: Research and Treatment*, 15, Article 11782218211015196. <https://doi.org/10.1177/11782218211015196>
- Hartz, S. M., Oehlert, M., Horton, A. C., Gruza, R. A., Fisher, S. L., Culverhouse, R. C., et al. (2018). Daily drinking is associated with increased mortality. *Alcoholism: Clinical and Experimental Research*, 42(11), 2246–2255. <https://doi.org/10.1111/acer.13886>
- Hartz, S. M., Oehlert, M., Horton, A. C., Gruza, R., Fisher, S. L., Nelson, K. G., et al. (2017). Components of alcohol use and all-cause mortality. *BioRxiv*, 129270. <https://doi.org/10.1101/129270>
- Hasin, D., Stinson, F., Ogburn, E., & Grant, B. (2007). Prevalence, correlates, disability, and comorbidity of DSM-IV alcohol abuse and dependence in the United States: Results from the national epidemiologic survey on alcohol and related conditions. *Archives of General Psychiatry*, 64(7), 830–842. <https://doi.org/10.1001/archpsyc.64.7.830>
- Huselid, R. F., & Cooper, M. L. (1992). Gender roles as mediators of sex differences in adolescent alcohol use and abuse. *Journal of Health and Social Behavior*, 33(4), 348–362. <https://doi.org/10.2307/2137313>
- Imai, K., Keele, L., & Tingley, D. (2010). A general approach to causal mediation analysis. *Psychological Methods*, 15(4), 309–334. <https://doi.org/10.1037/a0020761>
- Imai, K., Keele, L., Tingley, D., & Yamamoto, T. (2010). Causal mediation analysis using R. *Advances in Social Science Research Using R*, 129–154.
- Jager, J., Keyes, K. M., & Schulenberg, J. E. (2015). Historical variation in young adult binge drinking trajectories and its link to historical variation in social roles and minimum legal drinking age. *Developmental Psychology*, 51(7), 962–974. <https://doi.org/10.1037/dev0000022>
- Jager, J., Schulenberg, J. E., O'Malley, P. M., & Bachman, J. G. (2013). Historical variation in drug use trajectories across the transition to adulthood: The trend toward lower intercepts and steeper, ascending slopes. *Development and Psychopathology*, 25(2), 527–543. <https://doi.org/10.1017/S0954579412001228>
- Keyes, K. M., Jager, J., Mal-Sarkar, T., Patrick, M. E., Rutherford, C., & Hasin, D. S. (2019). Is there a recent epidemic of women's drinking? A critical review of national studies. *Alcoholism: Clinical and Experimental Research*, 43(7). <https://doi.org/10.1111/acer.14082>
- Keyes, K. M., Jager, J., Platt, J., Rutherford, C., Patrick, M. E., Kloska, D. D., et al. (2020). When does attrition lead to biased estimates of alcohol consumption? Bias analysis for loss to follow-up in 30 longitudinal cohorts. *International Journal of Methods in Psychiatric Research*, 29(4), 1–9. <https://doi.org/10.1002/mpr.1842>
- Keyes, K. M., Li, G., & Hasin, D. (2011). Birth cohort effects and gender differences in alcohol epidemiology: A review and synthesis. *Alcoholism: Clinical and Experimental Research*, 35(12), 2101–2112.
- Koenig, H. G. (2009). Research on religion, spirituality, and mental health: A review. *Canadian Journal of Psychiatry*, 54(5), 283–291. <https://doi.org/10.1177/070674370905400502>
- Koenig, H. G., King, D., & Carson, V. (2012). *Handbook of religion and health* (2nd ed.). Oxford University Press.
- Kuperberg, A. (2019). Premarital cohabitation and direct marriage in the United States: 1956–2015. *Marriage & Family Review*, 55(5), 447–475. <https://doi.org/10.1080/01494929.2018.1518820>
- Lefkowitz, E. S., Gillen, M. M., Shearer, C. L., & Boone, T. L. (2004). Religiosity, sexual behaviors, and sexual attitudes during emerging adulthood. *The Journal of Sex Research*, 41(2), 150–159. <https://doi.org/10.1080/00224490409552223>
- Lieber, C. (1997). Gender differences in alcohol metabolism and susceptibility. In R. Wilnsack, & S. Wilnsack (Eds.), *Gender and alcohol: Individual and social perspectives* (pp. 77–89). Rutgers Center of Alcohol Studies.
- Little, T. D., & Rhemtulla, M. (2013). Planned missing data designs for developmental researchers. *Child Development Perspectives*, 7(4), 199–204. <https://doi.org/10.1111/cdep.12043>
- Livingston, G. (2018a). Most dads say they spend too little time with their children; about a quarter live apart from them. Pew Research Center <https://www.pewresearch.org/fact-tank/2018/01/08/most-dads-say-they-spend-too-little-time-with-their-children-about-a-quarter-live-apart-from-them/>.
- Livingston, G. (2018b). Stay-at-home moms and dads account for about one-in-five U.S. parents. Pew Research Center <https://www.pewresearch.org/fact-tank/2018/09/24/stay-at-home-moms-and-dads-account-for-about-one-in-five-u-s-parents/>.
- Lopez, M. H., & Gonzalez-Barrera, A. (2014). Women's college enrollment gains leave men behind. Pew Research Center <http://www.pewresearch.org/fact-tank/2014/03/06/womens-college-enrollment-gains-leave-men-behind/>.
- Madley-Dowd, P., Hughes, R., Tilling, K., & Heron, J. (2019). The proportion of missing data should not be used to guide decisions on multiple imputation. *Journal of Clinical Epidemiology*, 110, 63–73. <https://doi.org/10.1016/j.jclinepi.2019.02.016>
- Maggs, J. L., Jager, J., Patrick, M. E., & Schulenberg, J. (2012). Social role patterning in early adulthood in the USA: Adolescent predictors and concurrent wellbeing across four distinct configurations. *Longitudinal and Life Course Studies*, 3(2), 190–210. <http://www.ncbi.nlm.nih.gov/pubmed/23155366%5Cnhttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3495328>.
- Mathews, T., & Hamilton, B. E. (2016). Mean age of mothers is on the rise: United States, 2000–2014. NCHS data brief No. 232. <https://www.cdc.gov/nchs/data/databriefs/db232.htm>.
- Mayer, K. U. (2004). Whose lives? How history, societies, and institutions define and shape life courses. *Research in Human Development*, 1(3), 161–187. https://doi.org/10.1207/s15427617rhd0103_3
- McFarland, M. J., Uecker, J. E., & Regnerus, M. D. (2011). The role of religion in shaping sexual frequency and satisfaction: Evidence from married and unmarried older adults. *The Journal of Sex Research*, 48(2–3), 297–308. <https://doi.org/10.1080/00224491003739993>
- McKetta, S. C., & Keyes, K. M. (2019). Heavy and binge alcohol drinking and parenting status in the United States from 2006 to 2018: An analysis of nationally representative cross-sectional surveys. *PLoS Medicine*, 16(11), Article e1002954. <https://doi.org/10.1371/journal.pmed.1002954>
- McKetta, S. C., & Keyes, K. M. (2020). Trends in U.S. women's binge drinking in middle adulthood by socioeconomic status, 2006–2018. *Drug and Alcohol Dependence*, 212, 108026. <https://doi.org/10.1016/j.drugalcdep.2020.108026>
- McKetta, S. C., Prins, S. J., Bates, L. M., Platt, J., & Keyes, K. M. (2021). *US trends in binge drinking by gender, occupation, and work structure among adults in the midlife, 2006–2018. Under review.*
- Miech, R., Johnston, L., O'Malley, P., Bachman, J., Schulenberg, J., & Patrick, M. (2020). *Monitoring the Future national survey results on drug use, 1975–2019: Volume I, Secondary school students*. Institute for Social Research.
- Mortimer, J. T. (2015). Social change and entry to adulthood. *Emerging Trends in the Social and Behavioral Sciences*, 1–17. <https://doi.org/10.1002/9781118900772.etrds0305>
- National Institutes of Health. (2020). *Drinking levels defined*. National Institute on Alcohol Abuse and Alcoholism (NIAAA). <https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/moderate-binge-drinking>
- Noble, D. W. A., & Nakagawa, S. (2018). Planned missing data design: Stronger inferences, increased research efficiency and improved animal welfare in ecology and evolution. *BioRxiv*, 247064. <https://doi.org/10.1101/247064>
- Nolen-Hoeksema, S., & Hilt, L. (2006). Possible contributors to the gender differences in alcohol use and problems. *The Journal of General Psychology*, 133(4), 357–374. <https://doi.org/10.3200/GENP.133.4.357-374>
- Okahana, H., & Zhou, E. (2018). Graduate enrollment and degrees: 2007 to 2017. https://cgsnet.org/ckfinder/userfiles/files/CGS_GED17_Report.pdf.
- Patrick, M. E., Schulenberg, J. E., & O'Malley, P. M. (2016). High school substance use as a predictor of college attendance, completion, and dropout: A national multi-cohort longitudinal study. *Youth & Society*, 48(3), 425–447. <https://doi.org/10.1177/0044118X13508961>
- Patrick, M. E., Terry-McElrath, Y. M., Lanza, S. T., Jager, J., Schulenberg, J. E., & O'Malley, P. M. (2019). Shifting age of peak binge drinking prevalence: Historical changes in normative trajectories among young adults aged 18 to 30. *Alcoholism: Clinical and Experimental Research*, 43(2), 287–298.
- Patrick, M. E., Terry-McElrath, Y. M., Miech, R. A., Schulenberg, J. E., O'Malley, P. M., & Johnston, L. D. (2017). Age-specific prevalence of binge and high-intensity drinking among U.S. Young adults: Changes from 2005 to 2015. *Alcoholism: Clinical and Experimental Research*, 41(7), 1319–1328. <https://doi.org/10.1111/acer.13413>
- Prescott, C. A. (2003). *Sex differences in the genetic risk for alcoholism*. NIAAA. <https://pubs.niaaa.nih.gov/publications/arb26-4/264-273.htm>.
- Rhemtulla, M., & Little, T. (2012). Tools of the trade: Planned missing data designs for research in cognitive development. *Journal of Cognition and Development*, 13(4). <https://doi.org/10.1080/15248372.2012.717340>
- Rosenzweig, M. R., & Schultz, T. P. (1985). The demand for and supply of births: Fertility and its life cycle consequences. *The American Economic Review*, 75(5), 992–1015. <http://www.jstor.org/stable/1818641>.

- Rosenzweig, M. R., & Seiver, D. A. (1982). Education and contraceptive choice: A conditional demand framework. *International Economic Review*, 23(1), 171–198. <https://doi.org/10.2307/2526471>
- Ruggles, S. (2015). Patriarchy, power, and pay: The transformation of American families, 1800–2015. *Demography*, 52(6), 1797–1823. <https://doi.org/10.1007/s13524-015-0440-z>
- Sayer, L. C. (2005). Gender, time and inequality: Trends in women's and men's paid work, unpaid work and free time. *Social Forces*, 84(1), 285–303. <http://www.jstor.org/stable/3598304>.
- Schulenberg, J., Johnston, L., O'Malley, P., Bachman, J., Miech, R., & Patrick, M. (2020). *Monitoring the Future national survey results on drug use, 1975–2019: Volume II, college students and adults ages 19–60*. Institute for Social Research.
- Seedat, S., Scott, K. M., Angermeyer, M. C., Berglund, P., Bromet, E. J., Brugha, T. S., et al. (2009). Cross-national associations between gender and mental disorders in the world health organization world mental health surveys. *Archives of General Psychiatry*, 66(7), 785–795. <https://doi.org/10.1001/archgenpsychiatry.2009.36>
- Settersten, R. A. (2007). Passages to adulthood: Linking demographic change and human development. *European Journal of Population*, 23(3–4), 251–272. <https://doi.org/10.1007/s10680-007-9132-8>
- Settersten, R. A., & Ray, B. (2010). What's going on with young people today? The long and twisting path to adulthood. *The Future of Children*, 20(1), 19–41. <https://doi.org/10.1353/foc.0.0044>
- Sizemore, K. M., & Olmstead, S. B. (2017). A systematic review of research on attitudes towards and willingness to engage in consensual non-monogamy among emerging adults: Methodological issues considered. *Psychology & Sexuality*, 8(1–2), 4–23. <https://doi.org/10.1080/19419899.2017.1319407>
- Snell, W. E., Belk, S. S., & Hawkins, R. C. (1987). Alcohol and drug use in stressful times: The influence of the masculine role and sex-related personality attributes. *Sex Roles*, 16(7–8), 359–373. <https://doi.org/10.1007/BF00289548>
- Stahre, M., Roeber, J., Kanny, D., Brewer, R. D., & Zhang, X. (2014). Contribution of excessive alcohol consumption to deaths and years of potential life lost in the United States. *Preventing Chronic Disease*, 11, E109. <https://doi.org/10.5888/pcd11.130293>
- Thornton, A., & Young-DeMarco, L. (2001). Four decades of trends in attitudes toward family issues in the United States: The 1960s through the 1990s. *Journal of Marriage and Family*, 63(4), 1009–1037. <https://doi.org/10.1111/j.1741-3737.2001.01009.x>
- Tingley, D., Yamamoto, T., Hirose, K., Keele, L., & Imai, K. (2014). *Mediation: R package for causal mediation analysis*.
- Twenge, J. M., Exline, J. J., Grubbs, J. B., Sastry, R., & Campbell, W. K. (2015). Generational and time period differences in American adolescents' religious orientation, 1966–2014. *PLoS One*, 10(5), Article e0121454. <https://doi.org/10.1371/journal.pone.0121454>. e0121454.
- US Bureau of Labor Statistics. (2019). Women in the labor force: A databook. BLS reports. <https://www.bls.gov/opub/reports/womens-databook/2019/home.htm>.
- VanderWeele, T. J. (2015). *Explanation in causal inference: Methods for mediation and interaction*. Oxford University Press.
- Voskoboinik, A., Wong, G., Lee, G., Nalliah, C., Hawson, J., Prabhu, S., et al. (2019). Moderate alcohol consumption is associated with atrial electrical and structural changes: Insights from high-density left atrial electroanatomic mapping. *Heart Rhythm*, 16(2), 251–259. <https://doi.org/10.1016/j.hrthm.2018.10.041>
- Wagenaar, A. C., Tobler, A. L., & Komro, K. A. (2010). Effects of alcohol tax and price policies on morbidity and mortality: A systematic review. *American Journal of Public Health*, 100(11), 2270–2278. <https://doi.org/10.2105/AJPH.2009.186007>
- White, A., Castle, I.-J. P., Chen, C. M., Shirley, M., Roach, D., & Hingson, R. (2015). Converging patterns of alcohol use and related outcomes among females and males in the United States, 2002 to 2012. *Alcoholism: Clinical and Experimental Research*, 39(9), 1712–1726. <https://doi.org/10.1111/acer.12815>
- White, A., Castle, I.-J., Hingson, R., & Powell, P. (2020). Using death certificates to explore changes in alcohol-related mortality in the United States, 1999 to 2017. *Alcoholism: Clinical and Experimental Research*, 44(1), 178–187. <https://doi.org/10.1111/acer.14239>
- Wilsnack, R. W., Vogeltanz, N. D., Wilsnack, S. C., Harris, T. R., Ahlström, S., Bondy, S., et al. (2000). Gender differences in alcohol consumption and adverse drinking consequences: Cross-cultural patterns. *Addiction*, 95(2), 251–265. <https://doi.org/10.1046/j.1360-0443.2000.95225112.x>
- Wood, J., Matthews, G. J., Pellowski, J., & Harel, O. (2019). Comparing different planned missingness designs in longitudinal studies. *Sankhya B*, 81(2), 226–250. <https://doi.org/10.1007/s13571-018-0170-5>