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Estimating the Prevalence of United States Women with Alcohol-exposed Pregnancies and Births

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A B S T R A C T

Aims: Researchers at the U.S. Centers for Disease Control and Prevention (CDC) recently estimated the number of women at risk for alcohol-exposed pregnancies (AEPs) as 3.3 million per month. The number of women at risk was widely interpreted as the actual number of AEPs. The actual number of AEPs may be easier to interpret and may be more a more relevant public health metric for evaluating efforts to reduce AEPs. We estimated the expected actual number of AEPs among U.S. women 15–44 years of age and the expected actual number of alcohol-exposed births (AEBs).
Methods: Like the CDC researchers, we used data about women aged 15–44 years who were neither pregnant nor sterile from the 2011–2013 National Survey of Family Growth. We identified women who had had sex without contraception in the last 4 weeks and reported binge drinking or drinking on more than 7 of the last 30 days. We then estimated the expected actual number of AEPs and AEBs, accounting for the chances of becoming pregnant and for pregnancy outcomes (birth, miscarriage, and abortion). We also conducted sensitivity analyses with varying assumptions.
Results: Estimated prevalences of AEPs and AEBs were 1.2% (95% confidence interval, 0.9–1.7) and 0.8% (95% confidence interval, 0.5–1.2), respectively. During a 1-month period, we estimate 731,000 U.S. women had AEPs and 481,000 resulted in AEBs. Sensitivity analyses indicate expected actual AEP estimates ranging from 104,000 to 1,242,000 and AEBs from 79,000 to 816,000.
Conclusions: Under our assumptions, the estimated expected actual number of AEPs is 2.5 million less than the CDC estimate of the number at risk of an AEP. By using evidence-informed assumptions for the chances of becoming pregnant and common pregnancy outcomes, our estimate of the expected actual number of AEPs is only 22% as large as the CDC's estimate of number at risk, and our estimate of expected actual number of AEBs only 15% as large. The evidence-informed assumptions used here should inform future efforts to estimate expected actual numbers of AEPs and AEBs.

In February 2016, the Centers for Disease Control and Prevention (CDC) released a new report, infographic, and press release that, in effect, advised sexually active women to not drink unless they were using contraception (CDC, 2016b; Green, McKnight-Eily, Tan, Mejia, & Denny, 2016). The public reaction included multiple op-eds, parodied infographics, and social media retorts (e.g., Donnelly, 2016; Petri, 2016; Victor, 2016). In response, the CDC revised the infographic to clarify that its concern was aimed at women who drank while trying to become pregnant (CDC, 2016a; Ferguson, 2016). Some commentators argued that the report and infographic caused backlash that diverted attention away from actual harms associated with alcohol use during pregnancy (Golden, 2016).

Despite the reaction, little media attention was directed at the analysis that formed the basis for the other CDC materials, that is, its estimate that 3.3 million women each month are at risk for alcohol-exposed pregnancies (AEPs) in the United States (Green et al., 2016). To arrive at this number, the CDC researchers used data from the 2011–2013 National Survey on Family Growth and

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considered a woman at risk for an AEP in the past month if she had sex with a male, drank any alcohol, did not use contraception in the past month, and was not sterile or had a partner(s) not known to be sterile. Although the report clearly described their estimate as the number of women at risk for an AEP, reporting about the new estimate as well as some of the CDC's own publicity materials seemed to interpret the 3.3 million as the actual number of AEPs (CDC, 2017a; Crawford, 2016; Victor, 2016). The actual number of AEPs may be easier to interpret and also may serve as a more relevant metric for evaluating efforts to reduce AEPs. Thus, we build on the CDC's approach to provide estimates of what we argue is the more relevant public health metric, the expected actual number of AEPs. We also estimate the expected actual number of AEPs that result in alcohol-exposed births (AEBs), another relevant public health metric. To arrive at these estimates, we made four key modifications to the CDC researchers' approach.

- The chances of becoming pregnant. The first step in going from the number of women at risk of an AEP to an estimate of expected actual AEPs is to account for the chances of becoming pregnant from unprotected sex. The best available evidence indicates that, among samples of women trying to become pregnant, the peak probability of becoming pregnant from unprotected sex during the fertile window ranges from 0.097 with one act of intercourse (Li, Wilcox, & Dunson, 2015) to 0.38 with at least three acts (Gnoth, Godehardt, Godehardt, Frank-Herrmann, & Freundl, 2003). For any random act of sex, the monthly probability of becoming pregnant is 0.045 (Li et al., 2015).
- Alcohol exposure once a pregnancy is established. The second step is including only those who are likely to have consumed alcohol after a pregnancy was established. The CDC estimate included women who had as few as one drink in the previous 30 days. For women with typical menstrual cycles, pregnancy begins with implantation of a fertilized egg around day 22 (American College of Obstetricians and Gynecologists, 2017). To expose a pregnancy to alcohol, a woman would have to drink after implantation, meaning in the last 6 days of a cycle. Women who drank infrequently during the same month they became pregnant may not have drunk on days after a pregnancy was established.
- The level of alcohol consumption considered harmful. The third step includes focusing on levels of alcohol use with clearly documented harm during pregnancy, which are typically addressed in programs the CDC recommends to reduce AEPs (CDC, 2017c; Velasquez, von Sternberg, & Parrish, 2013). The CDC estimate included women who had as few as one drink per month, which is in line with clinical and public health guidance that recommend abstinence from alcohol during pregnancy (CDC, 2017b; Williams, Smith, & Committee on Substance Abuse, 2015). Although research is unlikely to ever definitely establish whether there is a safe level of alcohol use during pregnancy, there is no conclusive evidence that drinking as few as one drink per month during pregnancy causes harm (O'Leary & Bower, 2012). There is clearly documented harm from drinking three to four drinks per week and binge drinking during pregnancy (Flak et al., 2014; O'Leary & Bower, 2012; Strandberg-Larsen et al., 2008). The program the CDC recommends to reduce AEPs focuses on binge drinking and drinking more than seven drinks per week (CDC, 2017c; Velasquez et al., 2013).
- Pregnancy outcomes include birth, miscarriage, and abortion. The fourth step includes incorporating common pregnancy outcomes. Although the CDC researchers discussed AEP estimates as births, the CDC's estimate actually included women with common pregnancy outcomes other than birth, namely, miscarriage and abortion. Based on published estimates of the number of pregnancies, births, and abortions in 2011, estimates for U.S. pregnancy outcomes are 18.3% ending in miscarriage, 17.3% in abortion, and 64.4% in birth (Finer & Zolna, 2016; Jones & Jerman, 2014; Martin, Hamilton, Ventura, Osterman, & Mathews, 2013).

The main purpose of our study was to establish an estimate of the expected actual number of AEPs and an estimate of the expected actual number of AEBs in the United States, which we argue are the more relevant public health metrics than the number at risk. A secondary purpose was to assess the impact on estimates of different assumptions about the chances of becoming pregnant, the timing and level of drinking, and miscarriage and abortion rates. A third purpose was to provide a methodological approach to estimate of AEPs and AEBs that could be used by other researchers in the future.

Methods

We used data on women of reproductive age (15–44 years) who were neither pregnant nor sterile from the 2011–2013 National Survey on Family Growth to estimate the expected actual number of AEPs and AEBs in the United States. The National Survey on Family Growth sample design has been described elsewhere (Green et al., 2016). To account for the complex sample design, we applied post-stratification weights to reflect the female household population of the United States from 2011 to 2013.

We used the same variables as the CDC to determine current pregnancy, sterility, sex with a male in the last 4 weeks, and contraception use at last sex (Green et al., 2016; Figure 1). For our main analyses, we used the following variables and approach. For drinking, we created a dichotomous variable of whether a woman consumed alcohol on more than 7 days in the past 30 days or binge drank in the last 30 days. We focused on binge drinking because the program recommended by the CDC to reduce AEPs (Project CHOICES; CDC, 2017c; Velasquez et al., 2013) focuses on this level of drinking. We considered focusing on drinking more than 14 days, because it would correspond with drinking on at least one-half of the days in the past month. However, only 5% of the sample who were not pregnant, not sterile, had had sex with a male in the last 4 weeks, and did not use contraception at last sex reported drinking at that level. We thus focus on drinking on more than 7 days in the past month, which corresponds with approximately 10% of those who met the other criteria. Although we recognize that it is an imperfect estimate of the timing of drinking relative to implantation (i.e., after a pregnancy was established), it seemed plausible that someone who drank on more than 7 days in the past 30 days would have had at least one drink after implantation. We categorized women as at risk of an AEP if they binge drank or drank on more than 7 of the last 30 days, reported vaginal sex with a male at least once in the last 4 weeks, and did not use contraception at last sex. We then used a random number generator to randomly assign women in our at-risk sample to become pregnant or not using two probabilities of pregnancy. The first probability is the maximum established in the literature with

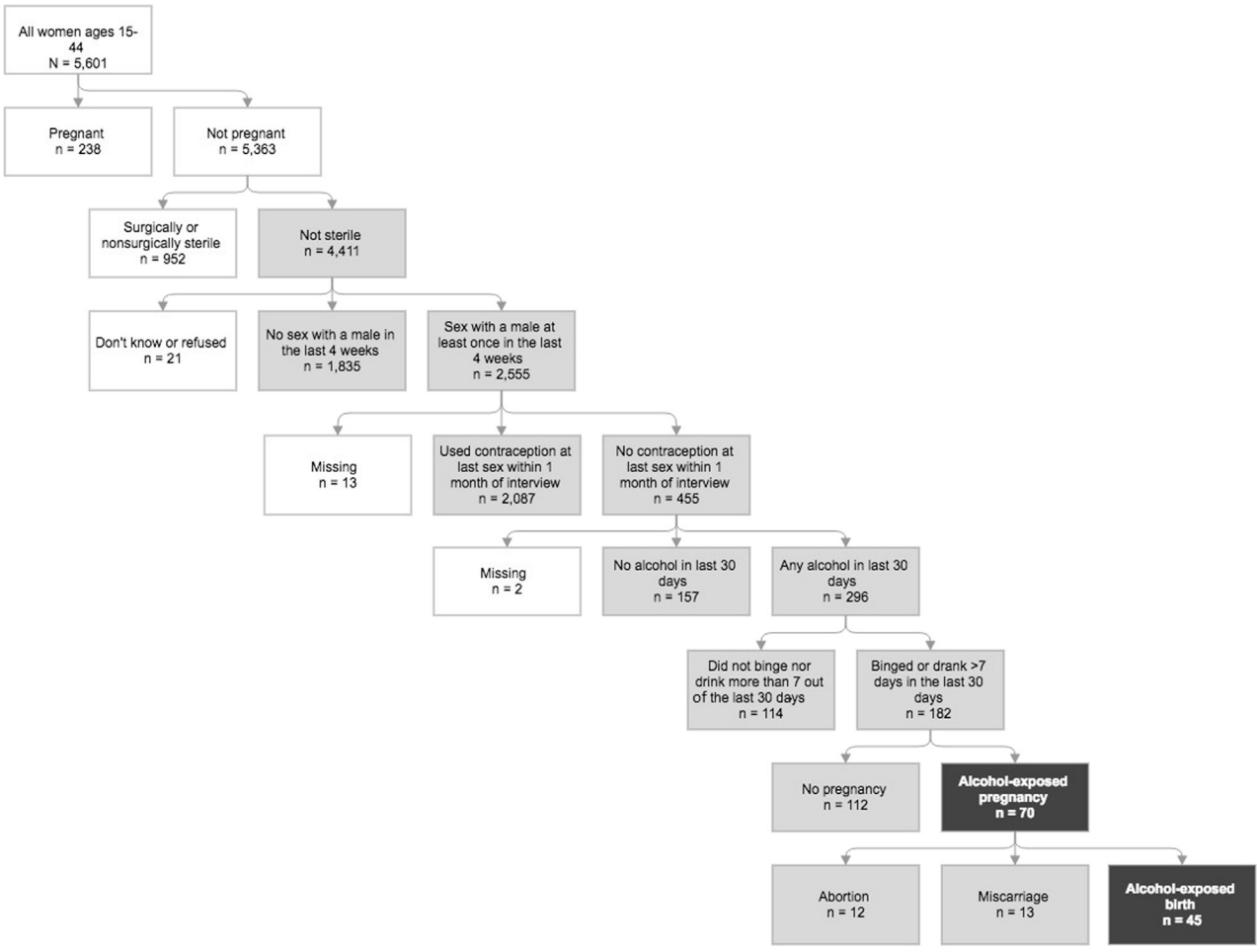

Figure 1. Study flow diagram. Numbers represent actual unweighted *n* in the dataset.

three or more acts of intercourse during the fertile window (38%; estimate 1; Gnoth et al., 2003), whereas the second is the probability of becoming pregnant with one act of intercourse during the fertile window (9.7%; estimate 2; Li et al., 2015). Among these randomly assigned pregnancies, we then used a random number generator to assign pregnancy outcomes (miscarriage, abortion, or birth). We categorized women as having an AEB if they met the criteria for an AEP and were randomly allocated to give birth using a national estimate for this pregnancy outcome (64%; Finer & Zolna, 2016; Jones & Jerman, 2014; Martin et al., 2013). To develop national estimates, we then multiplied the weighted proportion of at-risk women in each outcome category by the size of the household population the sample is designed to represent. In cases where outcome category numbers were too small, that is, where only one or two women were in that group, we considered population estimates to be unstable. We rounded our population estimates to the nearest 1,000 and report national estimates for AEPs and AEBs with 95% confidence intervals (CIs).

We also conducted a series of sensitivity analyses with varying assumptions. Estimate 3 used a lower chance of becoming pregnant, based on one random act of unprotected sex (4.5%; Li et al., 2015). Estimate 4 again used the maximum chance of becoming pregnant (38%), but assumed that women who drank more than seven drinks or binge drank in the past month and became pregnant would be more likely than average to have a miscarriage (Avalos, Roberts, Kaskutas, Block, & Li, 2014) or an abortion (Roberts, Avalos, Sinkford, & Foster, 2012). Estimate 5 used the maximum chance of becoming pregnant (38%), but relaxed the assumption about level of drinking of concern, including women who reported any drinking in the past month, as did the CDC researchers in their original estimates. Estimate 6 was similar to estimate 5, but included only women who reported drinking on more than 3 days in the past month. Finally, we attempted to estimate the expected actual number of AEPs and AEBs among women who became pregnant while using a method of contraception, based on the monthly probability of contraceptive failure among hormonal contraception, intrauterine device, and condom users (Sundaram et al., 2017). However, the number of women in the sample was too small to provide stable estimates, given the low probability of becoming pregnant while using contraception.

Results

For estimate 1, among U.S. women aged 15–44 years who were neither pregnant nor sterile, the weighted AEP prevalence was 1.2% (95% CI, 0.9–1.7), or 731,000 women in the past month (Table 1). The weighted prevalences of pregnancy outcomes for women estimated to have an AEP in the past month were:

Table 1
Estimated Weighted Prevalence and Population Estimates of Past Month AEPs and Pregnancy Outcomes from AEPs among U.S. Women

	Estimate 1. Probability of Becoming Pregnant with ≥3 Acts of Intercourse during Fertile Window (0.38)				Estimate 2. Probability of Becoming Pregnant with 1 Act of Intercourse during Fertile Window (0.097)			
	Estimated Prevalence (%)	95% CI	Population estimate	95% CI	Estimated Prevalence (%)	95% CI	Population estimate	95% CI
AEP	1.2	0.9–1.7	731,000	548,000–1,035,000	0.3	0.2–0.6	183,000	122,000–365,000
AEP ending in miscarriage	0.2	0.1–0.5	134,000	61,000–304,000	0.1	0.0–0.3	UE	UE
AEP ending in abortion	0.2	0.1–0.4	116,000	61,000–244,000	0.0	0.0–0.1	UE	UE
AEB	0.8	0.5–1.2	481,000	304,000–731,000	0.2	0.1–0.5	128,000	61,000–304,000

Abbreviations: AEB, AEP ending in birth; AEP, alcohol-exposed pregnancy; CI, confidence interval; UE, unstable estimate owing to small n in model.
Estimates based on 2011–2013 National Survey on Family Growth data. AEP estimate 1 is women of reproductive age who were not pregnant, not sterile, had sex with a man in the past 4 weeks, did not use contraception at last sex, and drank >7 days or binge drank in the past month. Survey weights were used to get prevalence estimates, which were then multiplied by the population size to get population estimates of the percent of all women of reproductive age having an AEP in the past month. Pregnancy outcomes are allocated based on 2011 estimates of the different pregnancy outcomes.

miscarriage 0.2% (95% CI, 0.1–0.5) or 134,000 women; abortion 0.2% (95% CI, 0.1–0.4) or 116,000 women; and birth 0.8% (95% CI, 0.5–1.2) or 481,000 women. For estimate 2 (using a lower probability of becoming pregnant), among U.S. women aged 15 to 44 who were neither pregnant nor sterile, the weighted AEP prevalence was 0.3% (95% CI, 0.2–0.6) or 183,000 women in the past month (Table 1). The weighted prevalence of AEBs was 0.2% (95% CI, 0.1–0.5) or 128,000 births in the past month. The population estimates for miscarriage and abortion for estimate 2 were unstable.

Sensitivity analyses showed that estimates of AEPs ranged from 103,500 for estimate 3—with the lowest chance of becoming pregnant—to 1,242,000 for estimate 5, which assumed the maximum chance of becoming pregnant and considered any drinking in past month a risk (Table 2). Estimates of AEBs ranged from 79,000 for estimate 3 to 816,000 for estimate 5.

Discussion

As a way to offer what we argue are more relevant public health metrics regarding AEPs, this study estimated the expected actual number of AEPs and AEBs and compared these estimates with the CDC's estimate of the number of U.S. women at risk of an AEP. Under our assumptions, the estimated expected actual number of AEPs in the United States is 2.5 million fewer and AEBs 2.8 million fewer women per month than the CDC researchers' estimate of the number of women at risk of an AEP. For our estimates, we made three assumptions notably different from the CDC analysis. First, we only included women likely to have drunk alcohol after pregnancy was established and women binge drinking regardless of frequency. Second, we only included women likely to have become pregnant during a month when both drinking and unprotected sex occurred. Third, we accounted for three common pregnancy outcomes: miscarriage, abortion, and birth. Under our evidence-informed assumptions, we arrived at an expected actual AEP estimate that is only 22% as large and an expected actual AEB estimate that is only 15% as large as the CDC researchers' estimate of women at risk. Our findings strongly suggest that it is not appropriate to interpret estimates from the CDC's at-risk approach as the actual number of AEPs.

We also conducted sensitivity analyses to assess the impact of different assumptions on expected actual AEP and AEB estimates. We found that the estimates are not robust to these assumptions. Although our lowest estimate of AEPs (104,000) is 3% of the CDC's estimate of women at risk for an AEP, even our maximum estimate of 1.2 million expected actual AEPs is approximately

Table 2
Sensitivity Analyses Assessing the Impact of Model Assumptions on AEP and AEB Estimates

	Original CDC Estimate	Estimate 1	Estimate 2	Estimate 3	Estimate 4	Estimate 5	Estimate 6
Model assumptions							
Chance of becoming pregnant	1.0	0.38*	0.097‡	0.045§	0.38*	0.38*	0.38*
Proportion of live births	100%	64.4%†	64.4%†	64.4%†	46.6%‖	64.4%†	64.4%†
Amount of alcohol use	Any amount	>7 days per month or binge drinking	>7 days per month or binge drinking	>7 days per month or binge drinking	>7 days per month or binge drinking	Any amount	>3 days per month or binge drinking
Includes alcohol use after implantation?	Unlikely	Likely	Likely	Likely	Likely	Unlikely	Likely, but less likely than >7 days
Model estimates							
AEPs	3.3 million	731,000	183,000	104,000	731,000	1,242,000	798,000
AEBs	No estimate provided	481,000	128,000	79,000	359,000	816,000	524,000

Abbreviations: AEB, AEP ending in birth; AEP, alcohol-exposed pregnancy; CDC, Centers for Disease Control and Prevention.
* Based on ≥3 acts of unprotected sex during the fertile window.
† Based on U.S. proportions of miscarriage, abortion, and birth.
‡ Based on 1 act of unprotected sex during the fertile window.
§ Based on 1 randomly timed act of unprotected sex.
‖ Assumes that women who drank at risky levels had a 1.5 × higher proportion of pregnancies resulting in abortion and miscarriage.

one-third of the CDC's estimate of women at risk. More research can better inform the accuracy of assumptions underlying estimation of AEPs and AEBs. Until then, estimates should be reported as a range, and the assumptions underlying estimates should be explicit. Our main estimates of expected actual AEPs and AEBs (estimate 1) are solidly in the middle of the range of our sensitivity analyses.

Our desire to estimate the expected actual numbers of AEPs and AEBs does not question the importance of alcohol use during pregnancy as a public health problem or deny that public health efforts should be expended on this problem. We are concerned that the CDC estimates have been incorrectly interpreted as actual AEBs, which overestimates the scope of the problem. Overestimating the scope of the problem can contribute to moral panic about alcohol use during pregnancy (Armstrong & Abel, 2000), which can in turn lead to more stigmatizing and punitive policy approaches to alcohol use during pregnancy. Research shows that stigmatizing and punitive policy approaches lead to increases in adverse birth outcomes and less prenatal care use (Subbaraman et al., 2018). We are also concerned that the at-risk estimates are not specific to AEPs, but could rather describe the size of the population at risk for any type of risk related to unprotected sex (e.g., a sexually transmitted infection). Finally, we are concerned that the CDC's decision to not account for the chances of becoming pregnant from unprotected sex, when a pregnancy is established, or the proportion of pregnancies that result in a birth reinforces inaccurate information about pregnancy and abortion.

Furthermore, ignoring the role of abortion in AEP outcomes undermines the ability of public health programs to effectively address alcohol consumption during pregnancy. Ensuring that pregnant women who drink alcohol are neither coerced to end their pregnancies nor continue them is of the utmost ethical importance. Yet it is inappropriate to ignore the fact that some pregnant women who have an AEP will have an abortion, because it overestimates the number of AEBs. Ignoring the role of abortion may also indirectly contribute to policies that restrict abortion access for pregnant women who use alcohol, especially in problematic patterns. This is of concern because evidence shows that restricting pregnant women's ability to obtain abortions does not lead them to stop drinking in problematic patterns (Roberts, Foster, Gould, & Biggs, 2018).

In terms of a way forward, this approach to studying AEPs and AEBs could be improved on in the future. Estimates could be more precise if we had large enough samples to account for age, race/ethnicity, or education-specific chances of becoming pregnant and pregnancy outcomes. Research could provide more precise estimates of the chances of becoming pregnant among women who drink more heavily and the chances of giving birth among women who have an AEP. However, greater precision for these models may be moot if we do not address the larger questions about what timing and quantity of alcohol use during pregnancy should be the focus of public health intervention and the role of abortion in relation to alcohol use during pregnancy.

There are limitations to our analyses. First, some factors likely affect the precision of our estimates. We used overall rather than age-specific chances of becoming pregnant from unprotected sex and proportions of pregnancy outcomes, despite chances of becoming pregnant varying by age (Dunson, Colombo, & Baird, 2002; Finer & Zolna, 2016). Although more precise estimates would account for age-specific chances of becoming pregnant and giving birth, the estimates we currently report are not robust to model assumptions. Thus, adding age-specific chances of pregnancy would not necessarily make estimates more accurate. For similar reasons, we did not account for race/ethnicity- or education-specific chances of becoming pregnant, having a miscarriage, or having an abortion, which could also contribute to a lack of precision in our estimates. Second, our main estimates of expected actual AEPs and AEBs assumed that all acts of unprotected sex occurred during the fertile window. The impact of assuming all acts occurred during the fertile window can be seen in sensitivity analyses (estimates 2 and 3), with AEPs 25% and 14% lower than our main estimate. Third, we, like the CDC, did not account for women who became pregnant while using contraception (Sundaram et al., 2017). We were unable to do this owing to sample size constraints and the low monthly probability of becoming pregnant while using contraception (Sundaram et al., 2017). Finally, animal and human research is examining alcohol exposures beginning at conception (Feldman et al., 2012) and exploring whether alcohol use before ovulation and fertilization have any effects (Klonoff-Cohen, Lam-Kruglick, & Gonzalez, 2003). If results from this research show that alcohol use before ovulation, fertilization, or implantation causes harms, we would need to revisit our assumptions about the timing of drinking that affects a pregnancy and, thus, our estimates.

Implications for Policy and/or Practice

Although the updated estimates of expected actual AEPs and AEBs are lower than the estimates of women at risk for an AEP that the CDC published and publicized, they are still substantial and do not indicate that there needs to be a change in the amount of public attention to reducing harms owing to alcohol use during pregnancy. Rather, they point to the importance and relevance of basing estimates of the scope of public health problems on the best available scientific evidence, even when there may be political controversy about the topics—such as abortion—covered in the scientific evidence.

Conclusions

By more realistically accounting for conception probabilities and common pregnancy outcomes, our estimates of the expected actual numbers of AEPs and AEBs are lower than CDC estimates of women at risk, although still substantial. These estimates provide an important alternative to the CDC estimates and the approach we used should inform future efforts to estimate AEPs and AEBs, which may be more relevant public health metrics.

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References

American College of Obstetricians and Gynecologists (ACOG) (2017). Prenatal development: How your baby grows during pregnancy. Available: www.acog.org/Patients/FAQs/Prenatal-Development-How-Your-Baby-Grows-During-Pregnancy#how. Accessed January 2018.

Armstrong, E. M., & Abel, E. L. (2000). Fetal alcohol syndrome: The origins of a moral panic. *Alcohol and Alcoholism*, 35(3), 276–282.
Avalos, L. A., Roberts, S. C. M., Kaskutas, L., Block, G., & Li, D. K. (2014). Volume and type of alcohol during early pregnancy and the risk of miscarriage. *Substance Use and Misuse*, 49(11), 1437–1445.
Centers for Disease Control and Prevention (CDC) (2016a). Alcohol and pregnancy questions and answers. Available: www.cdc.gov/ncbddd/fasd/faqs.html. Accessed January 2018.
Centers for Disease Control and Prevention (CDC) (2016b). More than 3 million US women at risk for alcohol-exposed pregnancy. Available: www.cdc.gov/media/releases/2016/p202-alcohol-exposed-pregnancy.html. Accessed January 2018.
Centers for Disease Control and Prevention (CDC) (2017a). Alcohol and pregnancy: Why take the risk?. Available: www.cdc.gov/media/dpk/alcohol/alcohol-pregnancy/dpk-vs-alcohol-pregnancy.html. Accessed January 2018.
Centers for Disease Control and Prevention (CDC) (2017b). Alcohol use in pregnancy. Available: www.cdc.gov/ncbddd/fasd/alcohol-use.html. Accessed January 2018.
Centers for Disease Control and Prevention (CDC) (2017c). CHOICES frequently asked questions. Available: www.cdc.gov/ncbddd/fasd/choices-faq.html#highrisk. Accessed January 2018.
Crawford, C. (2016). Dissecting the CDC's advice to avoid alcohol-exposed pregnancies. AAFP News. Available: www.aafp.org/news/health-of-the-public/20160216cdcalcoholpreg.html. Accessed January 2018.
Donnelly, T. (2016). The CDC's new alcohol guidelines for women, updated for men. Available: http://brokelyn.com/cdc-alcohol-guidelines-for-a-violent-man/. Accessed January 2018.
Dunson, D. B., Colombo, B., & Baird, D. D. (2002). Changes with age in the level and duration of fertility in the menstrual cycle. *Human Reproduction*, 17(5), 1399–1403.
Feldman, H. S., Jones, K. L., Lindsay, S., Slymen, D., Klonoff-Cohen, H., Kao, K., … Chambers, C. (2012). Prenatal alcohol exposure patterns and alcohol-related birth defects and growth deficiencies: A prospective study. *Alcoholism, Clinical and Experimental Research*, 36(4), 670–676.
Ferguson, C. (2016). CDC keeps quietly changing that booze and pregnancy infographic. Available: www.buzzfeed.com/catferguson/the-brief-and-wonderous-life-of-a-cdc-infographic?utm_term=.emPkZmnKex#.grGykrzE1J. Accessed January 2018.
Finer, L. B., & Zolna, M. R. (2016). Declines in unintended pregnancy in the United States, 2008-2011. *New England Journal of Medicine*, 374(9), 843–852.
Flak, A. L., Su, S., Bertrand, J., Denny, C. H., Kesmodel, U. S., & Cogswell, M. E. (2014). The association of mild, moderate, and binge prenatal alcohol exposure and child neuropsychological outcomes: A meta-analysis. *Alcoholism, Clinical and Experimental Research*, 38(1), 214–226.
Gnoth, C., Godehardt, D., Godehardt, E., Frank-Herrmann, P., & Freundl, G. (2003). Time to pregnancy: Results of the German prospective study and impact on the management of infertility. *Human Reproduction*, 18(9), 1959–1966.
Golden, J. (2016). Women and alcohol: Let's talk about the real problem. Available: http://nursingclio.org/2016/02/06/women-and-alcohol-lets-talk-about-the-real-problem/. Accessed January 2018.
Green, P. P., McKnight-Eily, L. R., Tan, C. H., Mejia, R., & Denny, C. H. (2016). Vital signs: Alcohol-exposed pregnancies–United States, 2011-2013. *MMWR*, 65(4), 91–97.
Jones, R. K., & Jerman, J. (2014). Abortion incidence and service availability in the United States, 2011. *Perspectives on Sexual and Reproductive Health*, 46(1), 3–14.
Klonoff-Cohen, H., Lam-Kruglick, P., & Gonzalez, C. (2003). Effects of maternal and paternal alcohol consumption on the success rates of in vitro fertilization and gamete intrafallopian transfer. *Fertility and Sterility*, 79(2), 330–339.
Li, D., Wilcox, A. J., & Dunson, D. B. (2015). Benchmark pregnancy rates and the assessment of post-coital contraceptives: An update. *Contraception*, 91(4), 344–349.
Martin, J. A., Hamilton, B. E., Ventura, S. J., Osterman, M. J., & Mathews, T. J. (2013). Births: Final data for 2011. *National Vital Statistics Report*, 62(1), 1–69, 72.
O'Leary, C. M., & Bower, C. (2012). Guidelines for pregnancy: What's an acceptable risk, and how is the evidence (finally) shaping up? *Drug and Alcohol Review*, 31(2), 170–183.
Petri, A. (2016). The CDC's incredibly condescending warning to young women. Available: www.washingtonpost.com/blogs/compost/wp/2016/02/03/the-cdcs-incredibly-condescending-warning-to-young-women/?utm_term=.fc2acf7e9efb Washington Post. Accessed January 2018.
Roberts, S. C. M., Avalos, L. A., Sinkford, D., & Foster, D. G. (2012). Alcohol, tobacco and drug use as reasons for abortion. *Alcohol and Alcoholism*, 47(6), 640–648.
Roberts, S. C. M., Foster, D. G., Gould, H., & Biggs, M. A. (2018). Changes in alcohol, tobacco, and other drug use over five years after receiving versus being denied a pregnancy termination. *Journal of Studies on Alcohol and Drugs*, 79(2), 293–301.
Strandberg-Larsen, K., Nielsen, N. R., Gronbaek, M., Andersen, P. K., Olsen, J., & Andersen, A. M. (2008). Binge drinking in pregnancy and risk of fetal death. *Obstetrics & Gynecology*, 111(3), 602–609.
Subbaraman, M. S., Thomas, S., Treffers, R., Delucchi, K., Kerr, W. C., Martinez, P., & Roberts, S. C. M. (2018). Associations between state-level policies regarding alcohol use among pregnant women, adverse birth outcomes, and prenatal care utilization: Results from 1972-2013 Vital Statistics. *Alcoholism, Clinical and Experimental Research*, 42(8), 1511–1517.
Sundaram, A., Vaughan, B., Kost, K., Bankole, A., Finer, L., Singh, S., & Trussell, J. (2017). Contraceptive Failure in the United States: Estimates from the 2006-2010 National Survey of Family Growth. *Perspectives on Sexual and Reproductive Health*, 49(1), 7–16.
Velasquez, M. M., von Sternberg, K., & Parrish, D. E. (2013). CHOICES: An integrated behavioral intervention to prevent alcohol-exposed pregnancies among high-risk women in community settings. *Social Work and Public Health*, 28(3-4), 224–233.
Victor, D. (2016). C.D.C. defends advice to women on drinking and pregnancy. The New York Times. Available: www.nytimes.com/2016/02/06/health/cdc-defends-advice-to-sexually-active-women-about-drinking.html?_r=2. Accessed January 2018.
Williams, J. F., Smith, V. C., & Committee on Substance Abuse. (2015). Fetal alcohol spectrum disorders. *Pediatrics*, 136(5), e1395–e1406.

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