

Characteristics of women who binge drink before and after they become aware of their pregnancy

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Abstract *Background* Consumption of high doses of alcohol on a single occasion (binge drinking) may harm the developing foetus and pregnant women are advised to avoid binge drinking while pregnant. We present characteristics of Danish women who binge drank in the pre- and post-recognised part of their pregnancy. *Methods* During the years 1996–2002 approximately 100,000 pregnant women were enrolled into the Danish National Birth Cohort. Women with information on binge drinking, time of recognition of pregnancy, age, reproductive history, marital status, smoking, occupational status, pre-pregnancy BMI, alcohol consumption before pregnancy, and mental disorders ($n = 85,334$) were included in the analyses. *Results* Approximately one quarter of the women reported binge drinking at least once during pregnancy; most of these in the pre-recognised part of pregnancy. Weekly alcohol consumption before pregnancy, single status and smoking were predictors for binge drinking in both the unrecognised and recognised part of pregnancy. Moreover, binge drinking in the pre-recognised part of

pregnancy was more common among women aged 25–29 years, who were nulliparous, well educated in good jobs or skilled workers. Binge drinking after recognition of pregnancy was more common among women who were unintended pregnant, multiparous unskilled workers, had been unemployed for more than one year, or had mental/neurotic disorder. *Conclusions* In order to prevent binge drinking during pregnancy, health care providers should target their efforts towards pregnant women as well as pregnancy-planners. It is important to be aware that women who binge drink before versus after the pregnancy is recognised have different social characteristics.

Keywords Alcohol · Binge drinking · Pregnancy · Prevention

Introduction

In many westernised countries, consumption of five or more drinks of alcohol on one occasion—binge drinking—is frequent among women at childbearing age [1–4]. However, animal models as well as epidemiological studies have suggested that intermittent exposure to high levels of alcohol, as would be expected with maternal binge drinking, may harm the offspring and cause important neurological damages [5–8]. Despite this knowledge and official warnings against binge drinking in pregnancy, binge drinking among pregnant women is increasing in the US and around 50% of pregnant Danes have at least one episode of binge drinking [9–14]. In order to develop targeted prevention strategies we need to know which women are prone to engage in this behaviour while pregnant, but we do not. The aim of this study is to identify lifestyles, socio-demographic factors, and aspects of reproductive history that are associated with binge

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drinking in the pre- and post-recognised part of pregnancy among Danish women.

Methods

Study population

The Danish National Birth Cohort (DNBC) is a population-based cohort of pregnant women and their children [15]. During 1996–2002 pregnant women were approached at the first antenatal visit by the general practitioners who handed out information about the cohort as well as an informed consent form. To be eligible to participate in the DNBC the women had to be pregnant, intend to carry their pregnancy to term, have a permanent address in Denmark, and speak Danish well enough to participate in telephone interviews. The women were registered as participants when the study centre received the signed informed consent form. Participants provided information on exposures during the early part of pregnancy by means of a computer-assisted telephone interview, scheduled to occur around 12th–16th weeks of gestation. An English translation of the interview guide is available at <http://www.bsmb.dk>. For this study, we used data on the 90,165 women who participated in the interview. We excluded participants with no information on binge drinking ($n = 343$), timing of at least one of the binge episode ($n = 836$), time of pregnancy recognition ($n = 403$), parity ($n = 81$), marital status ($n = 33$), time to pregnancy ($n = 287$), smoking ($n = 221$), occupational status ($n = 833$), pre-pregnancy BMI ($n = 1,391$), mental disorders or neurosis ($n = 65$), or alcohol consumption prior to pregnancy ($n = 338$). Thus, the remaining 85,334 participants were included in the analyses.

Information on binge drinking

The women were asked: “Think of your entire pregnancy—including the very first period of pregnancy—and tell me how many times have you consumed five or more drinks on one occasion?”. If the women reported any binge drinking they were asked to state the week in which each binge drinking episode occurred. The interviewers were instructed to clarify that the pregnancy was calculated from the first day of the last menstrual period and when reporting on time in pregnancy this estimation of gestational age should be used. Besides giving information on timing of each binge drinking episodes the women also reported in what week the pregnancy was recognised. Information on timing of binge drinking and pregnancy recognition was combined to define whether binge drinking had occurred (yes or no) in the pre-recognised and recognised part of pregnancy. These categories are not mutually exclusive.

The number of binge episodes in the recognised part of pregnancy was categorised as 1, 2–3, 4+ binge episodes.

Analytic methods

We used logistic regression models to estimate to what degree socio-demographic factors, reproductive history, and lifestyle factors are associated with binge drinking prior to and subsequent to pregnancy recognition. Age at conception, prior reproductive history, time to pregnancy, marital status, smoking during pregnancy, occupational status, weight status before pregnancy, alcohol consumption before pregnancy, week of pregnancy recognition, and self-reports on mental/neurotic disorders were categorised as in Table 1. All characteristics were included in univariate models as well as in multiple regressions. Separate analyses were made for binge drinking in the pre- and post-recognised part of pregnancy. The analyses regarding binge drinking in the pre-recognised part of pregnancy was stratified according to whether or not the pregnancy was planned. This stratification was made to assess if differences in motivations to change lifestyle, and thereby attenuate alcohol behaviour may affect characteristics of women who binge drink prior to pregnancy recognition among planned vs. unplanned pregnancy. Finally, all analyses were stratified according to parity to assess if the associations differed for nulliparous and multiparous women.

Results

A total of 20,557 (24.1%) women reported binge drinking during pregnancy and 1,216 (5.8%) of these women reported four or more episodes of binge drinking. The majority of binge drinking took place in the pre-recognised part of pregnancy, since 18,436 women reported binge drinking prior to pregnancy recognition, while only 2,999 women reported binge drinking subsequent to their recognition of pregnancy.

Characteristics of women who binge drink in the pre-recognised part of pregnancy

Binge drinking in the pre-recognised part of pregnancy were more common in unplanned pregnancies (27.6%) than in the 88.8% planned pregnancies (20.9%). Binge drinking in the pre-recognised part of pregnancy correlates with women’s age, prior reproductive history, time to pregnancy, marital status, smoking habits, occupational status, women’s pre-pregnancy weight status, weekly average alcohol consumption before pregnancy, and week of pregnancy recognition, but not with presence of mental disorders or neurosis (Table 1). Women aged 25–29 years

Table 1 Characteristics of women who binge drink in the pre-recognized part of pregnancy, according to planning-status of pregnancy

	Binge drinking in the pre-recognized part of pregnancy					
	Pregnancy-planners			Non-planners		
	<i>N</i>	% Binge drinkers	OR (95% CI) ^a	<i>N</i>	% Binge drinkers	OR (95% CI) ^a
Total population	75,798	20.9		9,536	27.6	
<i>Age in years</i>						
<20	413	14.8	0.41 (0.31–0.55)	399	28.1	0.58 (0.45–0.75)
20–24	8,244	22.1	0.89 (0.84–0.95)	1,695	32.1	0.95 (0.82–1.10)
25–29	32,512	23.3	1.00 (Reference)	2,944	29.2	1.00 (Reference)
30–34	26,384	18.9	0.88 (0.84–0.92)	2,854	25.0	0.86 (0.75–0.98)
≥35	8,245	16.7	0.77 (0.71–0.82)	1,644	24.6	0.75 (0.64–0.88)
<i>Prior reproductive history</i>						
First-time pregnant women	26,629	27.7	1.76 (1.68–1.84)	3,014	37.2	1.80 (1.59–2.04)
Nulliparous, history of induced abortion	3,899	30.1	1.79 (1.65–1.93)	691	41.2	1.88 (1.56–2.26)
Nulliparous, history of spontaneous abortion	5,449	19.4	1.18 (1.09–1.27)	415	31.3	1.32 (1.04–1.67)
Multiparous	39,821	15.6	1.00 (Reference)	5,416	20.2	1.00 (Reference)
<i>Time to pregnancy (months)</i>						
≤2	37,787	21.0	1.00 (Reference)			
3–5	14,933	22.5	1.03 (0.98–1.08)			
6–12	11,775	22.0	1.01 (0.96–1.07)			
>12	11,303	17.2	0.79 (0.74–0.84)			
<i>Marital status</i>						
Married/cohabiting	75,142	20.8	1.00 (Reference)	8,510	26.6	1.00 (Reference)
Single	656	24.7	1.21 (1.00–1.46)	1,026	36.2	1.24 (1.07–1.45)
<i>Smoking during pregnancy</i>						
Smoker	17,937	27.1	1.65 (1.58–1.72)	3,748	32.9	1.53 (1.38–1.70)
Non-smoker	57,861	18.9	1.00 (Reference)	5,788	24.2	1.00 (Reference)
<i>Occupational status</i>						
Higher grade professionals	7,364	22.1	0.93 (0.87–0.99)	581	32.4	0.96 (0.78–1.19)
Lower grade professionals	21,665	21.9	1.00 (Reference)	1,948	30.4	1.00 (Reference)
Skilled workers	14,641	20.5	0.94 (0.89–0.99)	1,408	27.7	0.90 (0.77–1.06)
Unskilled workers	18,810	18.4	0.87 (0.82–0.91)	2,813	24.8	0.73 (0.63–0.85)
Students	9,544	25.6	1.07 (1.01–1.14)	1,817	32.9	0.90 (0.76–1.05)
Unemployed > 1 year	3,774	13.7	0.76 (0.68–0.84)	969	17.0	0.63 (0.51–0.78)
<i>Weight status before pregnancy (BMI)</i>						
Underweight (<18.5)	3,225	18.4	0.85 (0.77–0.93)	587	26.2	0.90 (0.73–1.11)
Normal (18.5–24)	51,511	22.0	1.00 (Reference)	6,365	29.4	1.00 (Reference)
Overweight (25–29)	14,805	19.5	0.98 (0.93–1.02)	1,722	24.6	0.95 (0.83–1.09)
Obese (≥30)	6,257	15.9	0.89 (0.83–0.96)	862	21.5	0.95 (0.79–1.14)
<i>Weekly alcohol consumption prior to pregnancy in drinks</i>						
0	9,566	6.6	1.00 (Reference)	1,627	7.0	1.00 (Reference)
½–1½	24,659	14.5	2.40 (2.19–2.62)	2,979	18.9	3.07 (2.48–3.81)
2–3½	18,810	21.4	3.87 (3.54–4.23)	1,923	28.9	5.33 (4.28–6.65)
4+	22,763	33.3	6.91 (6.33–7.55)	3,007	46.6	10.62 (8.60–13.11)
<i>Week of recognition of pregnancy</i>						
<4	4,888	9.3	0.45 (0.41–0.50)	378	16.4	0.55 (0.41–0.75)
4–5	46,094	18.7	1.00 (Reference)	4,334	25.5	1.00 (Reference)
6–7	18,986	26.1	1.51 (1.45–1.57)	2,875	30.0	1.28 (1.14–1.44)
≥8	5,830	30.4	2.07 (1.95–2.21)	1,949	30.8	1.58 (1.39–1.80)

^a Odds ratios from a multivariate model including all the characteristics in the table

old binge drank more often in the pre-recognised part of pregnancy than younger or older women. Among planned pregnancies the association with age differed for nulliparous and multiparous women, since age less than 25 decreased the odds of binge drinking among nulliparous women, while multiparous women at this age were as likely to binge drink in the pre-recognised part of pregnancy as multiparous women aged 25–29 years old (results not shown). Irrespective of whether or not the pregnancy was planned, first-time expectant mothers were more likely to binge drink in the pre-recognised part of pregnancy than multiparous women. Women who had tried for more than 12 months to get pregnant were less likely to binge drink in the pre-recognised part of pregnancy than women who became pregnant within two months of trying OR = 0.79 (95% CI: 0.74–0.84). The lower odds of binge drinking were confined to nulliparous women with a time to pregnancy of more than 12 months, whereas multiparous with the same time to pregnancy were as likely to binge drink as women who became pregnant within two months of trying (results not shown). Single status increased the odds of binge drinking both among pregnancy-planners and non-pregnancy-planners, OR = 1.21 (95% CI: 1.00–1.46) and OR = 1.24 (95% CI: 1.07–1.45). Irrespective of planning-status, smoking, alcohol consumption before pregnancy, and week of pregnancy recognition correlates with binge drinking in the pre-recognised part of pregnancy. Women of normal weight status were more likely to binge drink in the pre-recognised part of pregnancy among pregnancy planners, whereas no association were seen among non-planners (Table 1).

Characteristics of women who binge drink in the recognised part of pregnancy

Binge drinking in the recognised part of pregnancy was not related to age (Table 2). First-time pregnant women were less likely to binge drink subsequent to pregnancy recognition than multiparous women OR = 0.65 (95% CI: 0.59–0.72). Women with unplanned pregnancies were more likely to continue binge drinking in the recognised part of pregnancy OR = 1.32 (95% CI: 1.18–1.48), whereas women with a time to pregnancy of more than 12 months were less likely to binge drink OR = 0.81 (95% CI: 0.71–0.92). The lower odds of binge drinking subsequent to pregnancy recognition were confined to nulliparous women, whereas multiparous women with a time to pregnancy of more than 12 months were as likely to binge drink in the recognised part of pregnancy as multiparous women who became pregnant within two months of trying (results not shown). Single status and smoking were correlated with binge drinking subsequent to pregnancy recognition OR = 1.88 (95% CI: 1.57–2.25) and OR = 2.28 (95% CI: 2.11–2.46),

respectively. Binge drinking in the recognised part of pregnancy were less common among lower grade professionals, whereas unskilled workers and women who have been unemployed for more than one year were most likely to binge drink subsequent to recognition of pregnancy. Overweight and obese women were more likely to binge drink in the recognised part of pregnancy than women who were underweight or of normal weight status. Weekly alcohol consumption before pregnancy was a strong predictor of binge drinking also in the recognised part of pregnancy. Women who became aware of their pregnancy before week 4 were more likely to binge drink in the recognised part of pregnancy compared with women in which the pregnancy was confirmed later. Finally, self-reported presence of mental disorder or neurosis was correlated with binge drinking in the recognised part of pregnancy (Table 2). Women with a high number of binge episodes in the recognised part of pregnancy were more often multiparous, unintended pregnant, singles, had been unemployed for more than one year, had a higher alcohol consumption before pregnancy, and had more often mental disorder or neurosis compared to women with only one episode of binge drinking in the recognised part of pregnancy (Table 3).

Discussion

Approximately one quarter of the participants in the DNBC binge drank at least once during pregnancy; most often in the unrecognised part of pregnancy. Weekly alcohol consumption before pregnancy, single status and smoking was associated with binge drinking both in the unrecognised and recognised part of pregnancy. Besides that different characteristics were associated with binge drinking before versus after pregnancy recognition. Women who binge drank in the unrecognised part of pregnancy seemed to be somewhat more advantaged, since binge drinking in this phase of pregnancy was more common among nulliparous women aged 25–29 years, and well educated with good jobs. Whereas, women who binge drank once the pregnancy was recognised are more likely to be unintended pregnant, multiparous, overweight or obese, have a mental disorder or neurosis, being an unskilled worker, or unemployed for more than one year.

The proportion of binge drinkers in the DNBC is substantially lower than the 50% found in a sample of nearly 400 pregnant women seeking antenatal care in Aarhus, Denmark [13]. The reasons for differences in the proportion of binge drinkers could be that binge drinking is place and time sensitive, or that different forces of selection apply to the two studies. The Aarhus sample was recruited in 1998, which is almost in the middle of the DNBCs recruitment period, and therefore the discrepancy seems

Table 2 Characteristics of women who binge drink in the recognized part of pregnancy

	Binge drinking in recognized part of pregnancy		
	N	% Binge drinkers	OR (95% CI) ^a
Total population	85,334	3.5	
<i>Age in years</i>			
<20	812	5.9	1.23 (0.90–1.68)
20–24	9,939	3.6	1.04 (0.91–1.18)
25–29	35,456	3.1	1.00 (Reference)
30–34	29,238	3.6	1.04 (0.95–1.14)
≥35	9,889	4.4	1.09 (0.96–1.23)
<i>Prior reproductive history</i>			
First-time pregnant women	29,643	2.8	0.65 (0.59–0.72)
Nulliparous, history of induced abortion	4,590	4.7	0.87 (0.75–1.01)
Nulliparous, history of spontaneous abortion	5,864	3.3	0.72 (0.61–0.84)
Multiparous	45,237	3.9	1.00 (Reference)
<i>Time to pregnancy (months)</i>			
Unplanned pregnancy	9,536	5.5	1.32 (1.18–1.48)
≤2	37,787	3.3	1.00 (Reference)
3–5	14,933	3.4	1.07 (0.96–1.19)
6–12	11,775	3.3	1.00 (0.89–1.13)
>12	11,303	3.0	0.81 (0.71–0.92)
<i>Marital status</i>			
Married/cohabiting	83,652	3.4	1.00 (Reference)
Single	1,682	9.9	1.88 (1.57–2.25)
<i>Smoking during pregnancy</i>			
Smoker	21,685	6.3	2.28 (2.11–2.46)
Non-smoker	63,649	2.6	1.00 (Reference)
<i>Occupational status</i>			
Higher grade professionals	7,945	3.2	1.19 (1.02–1.38)
Lower grade professionals	23,613	2.6	1.00 (Reference)
Skilled workers	16,049	3.5	1.37 (1.22–1.54)
Unskilled workers	21,623	4.6	1.75 (1.57–1.95)
Students	11,361	3.2	1.21 (1.05–1.39)
Unemployed >1 year	4,743	4.5	1.59 (1.35–1.88)
<i>Weight status before pregnancy (BMI)</i>			
Underweight (<18.5)	3,812	3.6	0.95 (0.79–1.13)
Normal (18.5–24)	57,876	3.4	1.00 (Reference)
Overweight (25–29)	16,527	3.7	1.14 (1.04–1.25)
Obese (≥30)	7,119	3.7	1.24 (1.09–1.42)
<i>Weekly alcohol consumption prior to pregnancy in drinks</i>			
0	11,193	1.6	1.00 (Reference)
½–1½	27,638	2.9	2.34 (1.98–2.77)
2–3½	20,733	3.2	2.87 (2.41–3.40)
4+	25,770	5.2	4.58 (3.88–5.39)
<i>Week of recognition of pregnancy</i>			
<4	5,266	7.1	2.38 (2.11–2.69)
4–5	50,428	3.3	1.00 (Reference)
6–7	21,861	3.2	0.93 (0.85–1.02)
≥8	7,779	3.5	0.92 (0.80–1.05)
<i>Self-reported mental disorder or neurosis</i>			
Yes	6,078	5.5	1.35 (1.19–1.52)
No	79,256	3.4	1.00 (Reference)

^a Odds ratios from a multivariate model including all the characteristics in the table

Table 3 Characteristics of binge drinkers in the recognized part of pregnancy according to number of episodes

	1 Binge episode (<i>N</i> = 2,312)	2–3 Binge episodes (<i>N</i> = 607)	4 + Binge episodes (<i>N</i> = 80)
Age in years (means)	29.5 (4.7)	30.0 (4.7)	29.8 (4.0)
Nulliparous (%)	41.4	40.0	38.8
Unintended pregnancy (%)	16.8	18.3	26.3
Single (%)	5.5	5.3	7.5
Smoker (%)	43.3	52.6	46.3
Unemployed >1 year (%)	6.7	7.9	11.3
Pre-pregnancy BMI (mean)	23.9 (4.3)	23.6 (4.2)	23.9 (4.6)
Weekly alcohol consumption prior to pregnancy (mean)	4.2 (4.4)	5.7 (6.6)	6.9 (5.5)
Week of recognition of pregnancy (mean)	5.2 (1.8)	5.0 (1.6)	5.1 (1.9)
Self-reported mental disorder or neurosis	10.7	11.5	18.8

not to be attributable to a time difference [13, 15, 16]. Around 30% of all Danish women who were pregnant during the recruitment period were enrolled into the DNBC. About half of the non-participation was caused by a lack of participation by the general practitioners, whereas the other 60% was attributable to pregnant women who declined the invitation [15]. The decision to participate may correlate with social, educational, and health conditions which again may correlate with risky health behaviour during pregnancy and it has been shown that participants in the DNBC were somewhat healthier than all pregnant mothers in Denmark [17]. However, the differential participation in the DNBC has been found to be modest and to cause very little if any bias in studies based upon internal comparisons within the cohort [17]. The potential for bias in our study is, however, a bigger issue since it is possible that the decision to participate is correlated with both binge drinking as well as other of the identified characteristics. Still, the majority of pregnancies occur among women alike the participants in the DNBC and this is presumably a group of women that health care providers pay less attention to because these are classified as low risk pregnancies, and even among this kind of women who presumably represents the healthiest: one out of four have had a binge drinking episodes while being pregnant as well as 3.5% of the women continue to binge drink after recognition of pregnancy. This proportion of pregnancy-aware binge drinkers is similar to the approximately 4% of US women who are estimated to binge drink after recognition of pregnancy [18]. As well as the identified characteristics in our study are consistent with those seen in other surveys that did not distinguish the pre- and post-recognised part of pregnancy [2, 4, 11–13, 19–21]. Nulliparous women were more likely to binge drink in the pre-recognised part of pregnancy than multiparous women. This was both the case for intended and unintended pregnancies and this implies that pregnancy-planners does not alter their drinking habits much, before confirmation of

pregnancy. However, once pregnancy recognition occurred, women having their first child were those least likely to report binge drinking, as well as women with a high number of binge episodes in the recognised part of pregnancy were more often multiparous than women with only one episode in the recognised part of pregnancy. In light of women's awareness of the negative effects of alcohol on the ability to get pregnant as well as pregnancy outcome [22], it is not surprising that women with a time to pregnancy of more than one year were less likely to binge drink in the pre- and post recognised part of pregnancy than women with a shorter time to pregnancy. Contrary to our results occupational status, socioeconomic position, and education have not been found to be associated with binge drinking during pregnancy in previous studies [13, 19, 20]. The existing results concerning age are contradicting [19, 20, 23]. In this study, the associations between age and binge drinking were different for nulliparous and multiparous women as well as for binge drinking in the un- versus recognised part of pregnancy and none of the previous studies have stratified the analyses according to these factors. Our results is further supported by the fact that one of the studies that showed that women who engaged in binge drinking were older than non-binge drinking women was restricted to parous women and focused on binge drinking after recognition of pregnancy [23].

A number of study limitations are worth mentioning. Because less than 4% of all participants reported binge drinking in the recognised part of pregnancy, we had a relatively small number of persistent binge drinkers available for multivariate analyses. Moreover, the heaviest (binge) drinkers may neither participate in the DNBC nor admit the actual alcohol consumption and/or number of binge episodes. Unfortunately, no biomarkers exist that is able to provide information on how many times and when in pregnancy binge drinking had occurred and our study is therefore based on self-reported information on binge drinking. These self-reports may be affected by the

perceived social desirability of a negative or attenuated response to questions on agreed health hazards, such as binge drinking [5]. Approximately three quarters of pregnant Danish women regards binge drinking in pregnancy as a potential health hazard [22]. Lack of recall may also have affected the quality of the information on binge drinking. In a previous study we showed that the reports on binge drinking were affected by the length of the recall period and information obtained in early pregnancy resulted in a higher proportion of binge drinkers [24]. Around one-third of the participants in the DNBC were interviewed in the second half of pregnancy and may have forgotten actual episodes of binge drinking. However, compared with other studies, the information in the DNBC is obtained early in pregnancy and our study also includes pregnancies that do not result in live born infants. Interviews have been shown to be a reliable method to obtain information on alcohol intake among pregnant Danish women [25] and the questions on binge drinking have been shown to yield valid and reliable information, and is the only validated method for the collection of data on timing of binge drinking [16, 26]. The number of potential risk factors may seem rather small in our study, and factors such as ethnicity, religion and use of prenatal care are lacking. The participants in the DNBC have uniform access to free and comprehensive health care and are presumed to be predominately of Danish origin and thereby Caucasians.

While significant reduction in binge drinking were reported by women in the DNBC once the pregnancy was confirmed, many had experienced a binge drinking episode during the pre-recognised part of pregnancy, which is of concern since the foetus is suspected to be particularly vulnerable in the early phase of pregnancy [27]. Therefore, prevention of binge drinking in early pregnancy should not only target pregnant women, but also women at “risk” of becoming pregnant. This will require preventive activities targeted pregnancy-planners. The general practitioners could disseminate education on alcohol use to pregnancy-planners, when discussing birth control and sexual activity. Else, this information could be included in oral contraceptive packets. Health care providers should pay special attention to women at highest risk and this may vary from time to time and from place to place. However, we expect that some factors will play a role in most places such as social problems and/or mental problems, previous unhealthy behaviours, such as smoking indicate higher odds of binge drinking, especially if more than one characteristic is present.

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March of Dimes Birth Defects Foundation, and the Augustinus Foundation. Sources of support: Grants from the Danish Ministry of Health and the Health Insurance Foundation.

Keypoints

- Binge drinking is common in the pre-recognised part of pregnancy.
- Women who binge drink before versus after pregnancy recognition have different social characteristics.
- Binge drink in the pre-recognised part of pregnancy is more common among first-time mothers, aged 25–29 years, who are educated or skilled workers.
- Binge drinking subsequent to pregnancy recognition is more common among women who are unintended pregnant, multiparous, have a mental disorder or neurosis, in unskilled works or have been unemployed for more than one year.
- Advisories on binge drinking in pregnancy should in addition to pregnant women be targeted pregnancy-planners.

References

1. Babor T, Caetano R, Casswell S, Edwards G, Giesbrecht N, Graham K, et al. *Alcohol: no ordinary commodity research an public policy*. 1st ed. New York: Oxford University Press; 2003.
2. Naimi TS, Brewer RD, Mokdad A, Denny C, Serdula MK, Marks JS. Binge drinking among US adults. *JAMA*. 2003;289(1):70–5.
3. Ingersoll KS, Ceperich SD, Nettleman MD, Karanda K, Brocksen S, Johnson BA. Reducing alcohol-exposed pregnancy risk in college women: initial outcomes of a clinical trial of a motivational intervention. *J Subst Abuse Treat*. 2005;29(3):173–80. doi: [10.1016/j.jsat.2005.06.003](https://doi.org/10.1016/j.jsat.2005.06.003).
4. Kuntsche E, Rehm J, Gmel G. Characteristics of binge drinkers in Europe. *Soc Sci Med*. 2004;59(1):113–27. doi: [10.1016/j.socscimed.2003.10.009](https://doi.org/10.1016/j.socscimed.2003.10.009).
5. Gladstone J, Nulman I, Koren G. Reproductive risks of binge drinking during pregnancy. *Reprod Toxicol*. 1996;10(1):3–13. doi: [10.1016/0890-6238\(95\)02024-1](https://doi.org/10.1016/0890-6238(95)02024-1).
6. Streissguth AP, Barr HM, Sampson PD. Moderate prenatal alcohol exposure: effects on child IQ and learning problems at age 7½ years. *Alcohol Clin Exp Res*. 1990;14(5):662–9. doi: [10.1111/j.1530-0277.1990.tb01224.x](https://doi.org/10.1111/j.1530-0277.1990.tb01224.x).
7. Jacobson JL, Jacobson SW, Sokol RJ, Ager JW Jr. Relation of maternal age and pattern of pregnancy drinking to Functionally significant cognitive deficit in infancy. *Alcohol Clin Exp Res*. 1998;22(2):345–51. doi: [10.1111/j.1530-0277.1998.tb03659.x](https://doi.org/10.1111/j.1530-0277.1998.tb03659.x).
8. Bailey BN, Delaney-Black V, Covington CY, Ager J, Janisse J, Hannigan JH, et al. prenatal exposure to binge drinking and cognitive and behavioral outcomes at age 7 years. *Am J Obstet Gynecol*. 2004;191(3):1037–43. doi: [10.1016/j.ajog.2004.05.048](https://doi.org/10.1016/j.ajog.2004.05.048).
9. Royal College of Obstetricians and Gynaecologists (RCOG). *Alcohol consumption and the outcomes of pregnancy*. RCOG Statement No. 5-March 2006.
10. Kesmodel U. Alcohol in pregnancy. *Ugeskr Laeger*. 1999; 161(36):4989–94. [Article in Danish].
11. Ebrahim SH, Luman ET, Floyd RL, Murphy CC, Bennett EM, Boyle CA. Alcohol consumption by pregnant women in the

- United States during 1988–1995. *Obstet Gynecol.* 1998;92(2): 187–92. doi:[10.1016/S0029-7844\(98\)00205-1](https://doi.org/10.1016/S0029-7844(98)00205-1).
12. Ebrahim SH, Diekman ST, Floyd RL, Decoufle P. Comparison of binge drinking among pregnant and nonpregnant women, United States, 1991–1995. *Am J Obstet Gynecol.* 1999;180(1 Pt 1):1–7. doi:[10.1016/S0002-9378\(99\)70139-0](https://doi.org/10.1016/S0002-9378(99)70139-0).
 13. Kesmodel U, Kesmodel PS, Larsen A, Secher NJ. Use of alcohol and illicit drugs among pregnant Danish women, 1998. *Scand J Public Health.* 2003;31(1):5–11. doi:[10.1080/14034940210134202](https://doi.org/10.1080/14034940210134202).
 14. Floyd RL, Decoufle P, Hungerford DW. Alcohol use prior to pregnancy recognition. *Am J Prev Med.* 1999;17(2):101–7. doi:[10.1016/S0749-3797\(99\)00059-8](https://doi.org/10.1016/S0749-3797(99)00059-8).
 15. Olsen J, Melbye M, Olsen SF, Sorensen TI, Aaby P, Andersen AM, et al. The Danish national birth cohort—its background, structure and aim. *Scand J Public Health.* 2001;29(4):300–7.
 16. Kesmodel U. Binge drinking in pregnancy—frequency and methodology. *Am J Epidemiol.* 2001;154(8):777–82.
 17. Nohr EA, Frydenberg M, Henriksen TB, Olsen J. Does low participation in cohort studies induce bias? *Epidemiology.* 2006;17(4):413–8. doi:[10.1097/01.ede.0000220549.14177.60](https://doi.org/10.1097/01.ede.0000220549.14177.60).
 18. Floyd RL, Sidhu JS. Monitoring prenatal alcohol exposure. *Am J Med Genet.* 2004;127C(1):3–9.
 19. Naimi TS, Lipscomb LE, Brewer RD, Gilbert BC. Binge drinking in the preconception period and the risk of unintended pregnancy: implications for women and their children. *Pediatrics.* 2003; 111(5 Part 2):1136–41.
 20. Gladstone J, Levy M, Nulman I, Koren G. Characteristics of pregnant women who engage in binge alcohol consumption. *CMAJ.* 1997;156(6):789–94.
 21. Flynn HA, Marcus SM, Barry KL, Blow FC. Rates and correlates of alcohol use among pregnant women in obstetrics clinics. *Alcohol Clin Exp Res.* 2003;27(1):81–7.
 22. Kesmodel U, Schioler, Kesmodel P. Drinking during pregnancy: attitudes and knowledge among pregnant Danish women, 1998. *Alcohol Clin Exp Res.* 2002;26(10):1553–60.
 23. Pascoe JM, Kokotailo PK, Broekhuizen FF. Correlates of multigravida women's binge drinking during pregnancy. A longitudinal study. *Arch Pediatr Adolesc Med.* 1995;149(12): 1325–9.
 24. Strandberg-Larsen K, Nybo Andersen AM, Olsen J, Rod Nielsen N, Grønbaek M. Do women give the same information on binge drinking during pregnancy when asked repeatedly? *Eur J Clin Nutr.* 2006;60:1294–8. doi:[10.1038/sj.ejcn.1602451](https://doi.org/10.1038/sj.ejcn.1602451).
 25. Kesmodel U, Olsen SF. Self reported alcohol intake in pregnancy: comparison between four methods. *J Epidemiol Community Health.* 2001;55(10):738–45. doi:[10.1136/jech.55.10.738](https://doi.org/10.1136/jech.55.10.738).
 26. Kesmodel U, Frydenberg M. Binge drinking during pregnancy— is it possible to obtain valid information on a weekly basis? *Am J Epidemiol.* 2004;159(8):803–8.
 27. Allebeck P, Olsen J. Alcohol and fetal damage. *Alcohol Clin Exp Res.* 1998;22(7 Suppl):329S–32S. doi:[10.1111/j.1530-0277.1998.tb04387.x](https://doi.org/10.1111/j.1530-0277.1998.tb04387.x).