



## ORIGINAL ARTICLE

# Do women give the same information on binge drinking during pregnancy when asked repeatedly?

K Strandberg-Larsen<sup>1</sup>, A-MN Andersen<sup>1</sup>, J Olsen<sup>2</sup>, NR Nielsen<sup>1,2</sup> and M Grønbæk<sup>1</sup>

<sup>1</sup>National Institute of Public Health, Copenhagen, Denmark and <sup>2</sup>Department of Epidemiology, UCLA School of Public Health, Los Angeles, CA, USA

**Objective:** To study if pregnant women give the same answers to questions on frequency and timing of binge drinking when asked more than once during and after pregnancy.

**Design:** Cohort study.

**Setting:** The Danish National Birth Cohort.

**Subjects:** The study is based on 76 307 pregnant women with repeated information on binge drinking during the early part of pregnancy and 8933 pregnant women with information on binge drinking during pregnancy weeks 30–36, obtained while pregnant and 6 months after delivery.

**Results:** More women reported binge drinking, if the interview took place close to the period in question. As the report of binge drinking was highest in the first of two interviews referring to the same period, as well as women who participated in the first interview in pregnancy week 12 or earlier reported more binge drinking compared to women who participated in the interview later in pregnancy.

**Conclusions:** Self-reported information on binge drinking is more frequently under-reported when the recall period is long. To improve the validity of data on binge drinking, future birth cohorts should obtain information several times during pregnancy.

**Sponsorship:** The Danish National Board of Health and the Health Insurance Foundation.

*European Journal of Clinical Nutrition* (2006) **60**, 1294–1298. doi:10.1038/sj.ejcn.1602451; published online 24 May 2006

**Keywords:** alcohol drinking; bias; interviews; pregnancy; recall

## Introduction

Animal models have indicated that sporadic high intake of alcohol (binge drinking) is more harmful to the developing fetus than if the same amount of alcohol is spread out over several days (Pierce and West, 1986; Bonthius *et al.*, 1988;

West *et al.*, 1990; Goodlett and Eilers, 1997). Almost none of the existing studies of the association between binge drinking and adverse pregnancy outcomes have included information on number and timing of binge episodes even though the effects of binge drinking are hypothesized to be time-specific (Allebeck and Olsen, 1998). Leaving out timing of binge drinking may lead to serious underestimates of the effects of binge drinking in periods of gestation where the fetus is, owing to its developmental status, especially vulnerable to harmful effects of binge drinking. If such periods exist, it may explain why previous studies have failed to find any association between binge drinking and birth weight, length at birth, head circumference, gestational age, Apgar score and malformations. (Tolo and Little, 1993; Olsen and Tuntiseranee, 1995; Passaro *et al.*, 1996; Kesmodel, 2001; Whitehead and Lipscomb, 2003).

Valid data on when in pregnancy binge drinking occurs are needed, if we want to clarify the potential time-specific health hazards of binge drinking. The Danish National Birth Cohort of approximately 100 000 pregnant women and their

Correspondence: K Strandberg-Larsen, Centre for Alcohol Research, National Institute of Public Health, Øster Farimagsgade 5 A, 2nd floor, DK-1399 Copenhagen K, Denmark.

E-mail: [kal@niph.dk](mailto:kal@niph.dk)

**Guarantor:** K Strandberg-Larsen.

**Contributors:** KS-L contributed to the conception and design of the study, analysis and interpretation of data, and drafting the paper. A-MNA, JO, NRN, and MG contributed to the conception and design of the study and to critically revising the manuscript. A-MNA and JO contributed to the design of the Danish National Birth Cohort and acquisition of data. A-MNA, JO and MG have designed the questions on number and timing of binge drinking used in the present study. All contributors have approved the final version of the manuscript.

Received 25 August 2005; revised 17 December 2005; accepted 15 February 2006; published online 24 May 2006

pregnancy outcomes covers information on number and point(s) in pregnancy of binge drinking. These data constitute an excellent opportunity to study the potential deleterious effects of binge drinking and time-specific hazards, provided that the women gave valid information. In this paper, we assess the validity of the collected data by examining if women give the same information on binge drinking during pregnancy when asked repeatedly, and if the length of the recall period influences the self-reported occurrence of binge drinking.

## Materials and methods

### *Study population*

The study used data from the Danish National Birth Cohort (DNBC). Enrolment into the cohort was organized through the general practitioners, and from 1996 to 2002, approximately 100 000 pregnant women and their outcomes of pregnancy were recruited to the cohort. Women provided information on exposures during pregnancy by means of three computer-assisted telephone interviews, scheduled to take place in pregnancy weeks 12 and 30 (first and second interview), and 6 months after delivery (third interview). The interviews were given up if the pregnancy had ended before the scheduled interviews or if no contact was established within four attempts. Details on the DNBC regarding study design, recruitment and procedures have been published elsewhere (Olsen *et al.*, 2001; Nybo Andersen and Olsen, 2002). The present study was based on two subgroups of women. The first consisted of the 76 307 women who gave information on binge drinking during the early part of pregnancy in the first and again in the second interview. The second subgroup consisted of the 8933 women who, in the second and third interview, gave information on binge drinking during pregnancy weeks 30–36.

### *Information on binge drinking*

The questions on number and points in pregnancy of binge drinking, including the very first part of pregnancy, were identical in the first and second interview. Binge drinking was defined as an alcohol intake of five or more drinks on one occasion or on an evening. Points in pregnancy of binge drinking were reported in commenced gestational weeks (pregnancy weeks). The question in the third interview was the same, but asked about binge drinking in the period from pregnancy week 30 until delivery. Women were categorized as binge drinkers if they reported at least one episode of binge drinking. Number of binge episodes reported in the first and second interview was categorized as 0, 1, 2 and 3+ episodes.

### *Statistical analysis*

The agreement was assessed by four methods: proportion of agreement, kappa value and two separate indices for positive and negative proportion of agreement. The denominator of the separate index for positive proportion of agreement was the average of the positive responses in the two succeeding interviews, as the denominator of the negative proportion of agreement was similar to the average of the negative responses. Furthermore, a measure of bias in disagreement between two succeeding interviews was calculated as  $((\text{Yes}_{\text{Interview 1}}, \text{No}_{\text{Interview 2}}) - (\text{Yes}_{\text{Interview 2}}, \text{No}_{\text{Interview 1}})) / N$  (Kesmodel and Frydenberg, 2004). The influence of the length of the recall period on the reporting of binge drinking was examined by comparing the proportion of binge drinkers among women who answered the first interview early (in pregnancy week 12 or earlier) to the proportion of binge drinkers among those who were interviewed later (after pregnancy week 12). We further stratified the analyses of agreement between the first and second interview according to the time gap between answering the interviews (10 weeks or less versus more than 10 weeks). The week-by-week analyses were stratified according to changed or unchanged gestational age, to assess if changes in the estimation of gestational age between the first and second interview explained the potential disagreement between the reported points in pregnancy of binge drinking. The disagreement between the number of binge episodes reported in the first and second interview was analysed and described by the rank-invariant method (Svensson, 1997, 1998). Systematic inter-interview differences were divided into relative position (RP) and relative concentration (RC), which display the disagreement attributable to a consequent underestimation of number of episodes in one of the interviews relative to the other and the disagreement attributable to if the classification in one of the interviews is concentrated to a limited part of the number of episodes relative to the other. Possible values of RP and RC range from  $-1$  to  $1$  and values close to zero indicate negligible bias between the interviews. The standard errors (s.e.) of the RP and RC were estimated by the jackknife technique (Svensson, 1998).

## Results

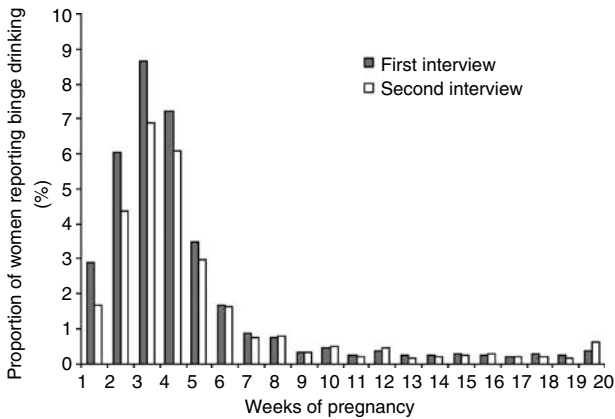
The agreement of information on binge drinking given in the first and second interview was 0.85, with a kappa value of 0.56 and a positive agreement of 0.65 (Table 1). More women reported binge drinking in the first interview compared to in the second interview, the estimate of bias = 5.9%. Very few women reported binge drinking in the period from pregnancy weeks 30–36; in the second interview, 84 women reported binge drinking compared to only 37 women in the third interview (Table 1).

**Table 1** Agreement of self-reported binge drinking during the early part of pregnancy and pregnancy weeks 30–36

	Binge drinking in the first interview		Binge drinking in the second interview
	Yes	No	
Yes	10 603	7923	18 526
No	3450	54 331	57 781
Total	14 053	62 254	76 307
Proportion of agreement			0.85
Kappa value			0.56
Positive proportion of agreement			0.65
Negative proportion of agreement			0.91
Bias			5.9

	Binge drinking in the second interview		Binge drinking in the third interview
	Yes	No	
Yes	7	77	84
No	30	8819	8849
Total	37	8896	8933
Proportion of agreement			0.99
Kappa value			0.11
Positive proportion of agreement			0.12
Negative proportion of agreement			0.99
Bias			0.5



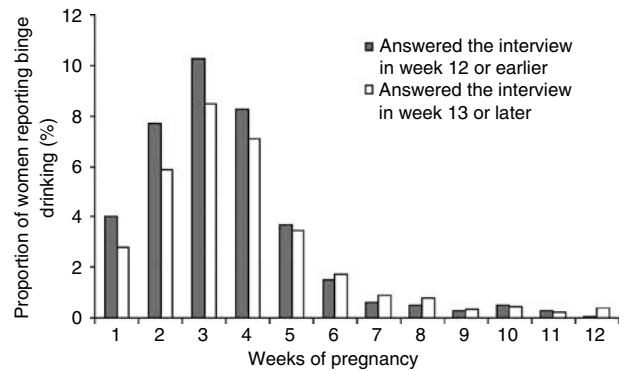
**Figure 1** Proportion of women who reported binge drinking during the first 20 weeks of pregnancy, among women for whom information was available in the two interviews during pregnancy.

*Reports on points in pregnancy of binge drinking*

A higher proportion of women reported at least one episode of binge drinking during the early weeks of pregnancy in the first interview compared to in the second interview (Figure 1). The agreement of the reported timing of binge episodes in the first and second interview was assessed by the week-by-week agreement. The proportion of agreement ranged from 0.90 to 1.00, whereas the kappa values ranged from 0.10 to 0.54 (data not shown). Changes in the estimation of the gestational age in the period between

**Table 2** The joint frequency distribution of the number of binge drinking episodes reported in the two interviews during pregnancy

Number of binge episodes in the first interview	Number of binge episodes in the second interview				Total
	0	1	2	3+	
3+	780	247	376	965	2368
2	1523	804	1374	390	4091
1	5620	5396	859	192	12 067
0	54 331	2578	620	252	57 781
Total	62 254	9025	3 229	1799	



**Figure 2** Proportion of binge drinkers in the first interview among women interviewed in pregnancy week 12 or earlier and women interviewed later than pregnancy week 12.

answering the first and second interview had no influence on the week-by-week agreement (data not shown).

*Reports on number of binge drinking episodes*

The joint frequency distribution of the reported number of binge episodes obtained in the first and second interview is shown in Table 2. Eighty-one per cent of the women reported the same number of binge drinking episodes in the first and second interview. The marginal distributions between the first and second interview differed, which implies systematic difference between the two interviews, which were attributable to a slight underestimation of binge drinking in the second interview compared to the first interview (RP = 0.058, s.e. = 0.001). The reported number of binge drinking episodes in one of the interviews was not concentrated to a limited part of the reported number of binge episodes in the other interview (RC = 0.007, s.e. = 0.001).

*Importance of the length of the recall period*

Women who answered the first interview in pregnancy week 12 or earlier reported more often binge drinking during the first 4 weeks of pregnancy compared to women who were interviewed later during pregnancy (Figure 2).

The agreement of the information on binge drinking given in the first and second interview was also influenced by the time gap between the two interviews. The agreement was higher among women with a time gap of 10 weeks or less compared with women where the time gap was greater than 10 weeks, kappa = 0.63 versus kappa = 0.54 ( $P < 0.0001$ ) (data not shown).

## Discussion

These results show that pregnant women recall binge drinking better if the data collection takes place close in time to the reported binge episodes. In our study, the pregnant women reported differently on number and timing of binge drinking episodes in two interviews placed in mid- and late pregnancy. The lack of repeatability of self-reported information on binge drinking obtained in two subsequent interviews is presumably attributable to the variant recall periods in the interviews.

The repeatability of self-reported information on pregnancy-related binge drinking obtained by interview twice during pregnancy has not been studied in detail before. One study examined the week-by-week agreement between information on binge drinking during pregnancy obtained by questionnaire and a subsequent face-to-face interview (Kesmodel and Frydenberg, 2004). In contrast to our results, the variation in time between filling in the questionnaire and answering the interview had no influence on the agreement between these two methods of obtaining information on binge drinking (Kesmodel and Frydenberg, 2004). In line with the results of our study, the week-by-week agreement between the answers in the questionnaire and interview was low. Our results regarding the importance of the recall period are supported by a study based on the Danish Health Interview Survey, which showed that the self-reported average intake of alcohol systematically decreased as the recall period increased among non-pregnant respondents (Ekholm, 2004).

Collecting information on binge drinking by telephone interviews is a strength of the present study because in comparison to self-administered questionnaires, interviews in general result in a higher participation rate and a higher response rate to the specific questions regarding binge drinking (Kesmodel, 2001; Kesmodel and Frydenberg, 2004). It is a strength of the present study that the kappa value is accompanied by separate individual values of positive and negative proportion of agreement as the correction factor in the kappa index adjusts the results for the discrepancies in the positive and negative agreement, which in this study are large and the cause to the fact that the high proportions of agreements are followed by much lower kappa values (Cicchetti and Feinstein, 1990).

None of the interviews are necessarily valid measures of the actual occurrence of binge drinking. For self-reported information on average alcohol intake, it is generally

assumed that the highest reported intake is the most valid measure of the actual intake as few will report an alcohol intake they did not have (Kesmodel and Olsen, 2001). If this assumption also applies to binge drinking during pregnancy, it implies that the answers given in the first interview are the most valid measure of the actual occurrence of binge drinking during the early part of pregnancy. Similarly, the second interview is presumably the most valid measure of binge drinking during pregnancy weeks 30–36. However, the reported number of binge episodes in the first and second interview may be an underestimation of the actual number of binge drinking episodes, especially among women with a high actual occurrence of binge drinking. In the interpretation of the existing epidemiological studies regarding the harmful effects of binge drinking, our conclusion regarding the decline in the accuracy of the reported information on binge drinking as the recall period increases is important. The major part of the existing studies has collected information on binge drinking in the second half of pregnancy or subsequent to birth (Tolo and Little, 1993; Olsen, 1994; Pascoe *et al.*, 1995; Passaro *et al.*, 1996; Iyasu *et al.*, 2002; Whitehead and Lipscomb, 2003) and therefore the information on binge drinking is most likely underestimated. Due to this underestimation, actual exposed women may be categorized as non-exposed and the estimates could probably be biased towards the null-value. This may explain why the existing studies have shown little or no detrimental effects of binge drinking during pregnancy. The severity of underreporting in a follow-up design depends upon the frequency of binge drinking. If this frequency is low, the number of binge drinkers who are miscategorized as not-exposed will be low and will be a small fraction of the not-exposed. Thus, the likelihood of detecting an adverse effect of binge drinking is decreased, but the bias is limited. The lack of ability of women to report the same timing of binge drinking when asked repeatedly is problematic, as it implies that the quality of the data on timing may be low and therefore harm future efforts to identify vulnerable time periods.

To minimize underestimation of binge drinking in future cohort studies, special efforts should be made to obtain information on binge drinking as early as possible in pregnancy and use longitudinal measures to collect information on binge drinking during the remaining period of pregnancy while the women are still pregnant. Such an approach is not without problems, as the more we ask respondents to do, the more difficult it may be to recruit pregnant women to the study, and the more we may influence their way of living. Hence, a very thorough data collection may also in itself influence their drinking behaviour, which could not only limit the number of informative observations, but also cause confounding if the change in health behaviours is restricted to specific groups of women, and this type of confounding may be difficult to adjust for. More accurate data on timing of binge drinking may be obtained by asking for calendar time rather than

pregnancy time, as binge drinking is related to specific occasions that are not recalled in pregnancy time.

## Acknowledgements

This particular study is funded by grants from the Danish National Board of Health and the Health Insurance Foundation. The Danish National Research Foundation has established the Danish Epidemiology Science Centre that initiated and created the Danish National Birth Cohort. The cohort is furthermore a result of a major grant from this foundation. Additional support for the Danish National Birth Cohort is obtained from the Pharmacy Foundation, the Egmont Foundation, the March of Dimes Birth Defects Foundation and the Augustinus Foundation.

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