



# Maternal alcohol use during pregnancy and offspring trajectories of height and weight: A prospective cohort study<sup>☆</sup>



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## ABSTRACT

**Background:** Previous studies have examined associations between alcohol use in pregnancy and offspring birth size but evidence on whether associations persist during childhood is limited.

**Methods:** We examined the association between maternal drinking during pregnancy and trajectories of offspring weight and height from 0 to 10 years in 7597 mother–child pairs in the Avon Longitudinal Study of Parents and Children. To strengthen the inference, we compared the maternal alcohol–offspring growth association with the partner alcohol–offspring growth association, to partially control for unmeasured confounding. We also performed sensitivity analyses restricting our analysis to women of white ethnicity and participants with three or more growth measures.

**Results:** Maternal occasional or light daily drinking during pregnancy was not associated with reduced birth weight, birth length or offspring growth trajectories up to age 10 years. The infants of heavy drinking mothers were born 0.78 cm shorter (95% CI –1.34, –0.22) and 0.22 kg lighter (95% CI –0.34, –0.09) than infants of pregnancy abstainers but by age 10, offspring of heavy drinking mothers were of comparable height (mean difference 0.59 cm, 95% CI –0.93, 2.11) and weight (mean difference 0.41 kg, 95% CI –0.70, 1.52). These associations were not observed for heavy partner drinking and were not altered in sensitivity analyses.

**Conclusion:** Maternal occasional or light daily drinking is not associated with birth weight, birth length or postnatal growth, but residual confounding may persist. Maternal heavy drinking may have an intrauterine association with reduced birth weight and length but this association is overcome during childhood.

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## 1. Introduction

Upwards of 35% of women in contemporary European birth cohorts and cross sectional studies report alcohol use during pregnancy (Andersen et al., 2012; Bakker et al., 2010; Colvin et al., 2007; Kelly et al., 2009; McCarthy et al., 2013; Mullally et al., 2011; O’Keeffe et al., 2013, 2015). Public health guidelines are polarized on the existence of a safe alcohol consumption threshold during pregnancy. Guidelines from Canada (Butt et al., 2011),

the United States (Department of Health and Human Services, 2005), Ireland (Health Services Executive Ireland (HSE), 2009) and New Zealand (Ministry of Health, 2010) advise complete abstinence from alcohol during pregnancy while the National Institute of Health and Care Excellence (NICE) (2015) and Royal College of Obstetricians and Gynecologists (2006) in the United Kingdom advise an upper limit of 1–2 unit [28 g] not more than once or twice per week.

A recent systematic review demonstrated that heavy alcohol consumption in pregnancy was associated with preterm birth, lower birth weight and size for gestational age, but found little evidence of harm at moderate levels (Patra et al., 2011). However, whether the smaller size at birth associated with heavy alcohol consumption persists into childhood or is overcome with age is not known. Moreover, the safety of lower consumption levels set out in the NICE guidelines is not established in relation to postnatal growth trajectories.

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Given evidence of strong social patterning of alcohol use in pregnancy, there is the potential for residual confounding in its association with offspring outcomes because simple adjustment for one or two measures of socioeconomic position (as is often done in studies that have explored its relationship to perinatal and later outcomes) is likely to be inadequate to fully capture this confounding (Howe et al., 2013a). Specifically, studies that have shown modest consumption to be unrelated to outcomes might be masking a detrimental effect of even low levels of consumption since this pattern of exposure is common amongst those from more affluent and middle-class backgrounds in whom adverse outcome are likely to be low (Lewis et al., 2012). By contrast any influence of heavy consumption might be exaggerated as this pattern of consumption is more common amongst those from lower socioeconomic positions. Comparisons of maternal and partner associations can be used to investigate the likelihood that residual confounding might explain associations of maternal pregnancy exposures with offspring outcomes (Alati et al., 2006; Howe et al., 2012). These comparisons assume that the confounding structure for maternal and partner drinking in pregnancy is the same and that the association of maternal drinking and partner drinking with later offspring anthropometry (partly through later drinking and parenting styles) are similar. With respect to the question of intrauterine effects of maternal alcohol consumption in pregnancy, if associations with offspring growth trajectories are similar for maternal and partner alcohol consumption, this may be indicative of residual confounding by shared familial environmental or genetic factors. A stronger maternal, compared with partner, alcohol consumption–offspring growth trajectory association could be explained by maternal intrauterine effects, which are not plausible for partner consumption.

Previous work in the Avon Longitudinal Study of Parents and Children (ALSPAC) cohort has shown that infants born to women who reported drinking one to two drinks daily with at least one binge, or three or more drinks daily with or without binges had a mean birth weight approximately 150 g less than infants whose mothers drank prior to pregnancy but reported abstinence during pregnancy (Passaro et al., 1996). Building on this work, we describe the association between maternal alcohol use during pregnancy and individual trajectories of height and weight between birth and 10 years of age. Second, we investigate potential residual confounding of estimates by comparing the associations of maternal drinking during pregnancy with that of her partner’s drinking during pregnancy.

## 2. Methods

ALSPAC is a prospective birth cohort study in Southwest England. Pregnant women resident in one of the three Bristol-based health districts with an expected delivery date between April 1, 1991 and December 31, 1992 were invited to participate and the study has been described elsewhere in detail (Boyd et al., 2012; Fraser et al., 2012). ALSPAC initially enrolled a cohort of 14,451 pregnancies of which 13,867 live births occurred representing 13,761 unique women. Follow-up has included parent and child completed questionnaires, links to routine data and clinic attendance. Ethical approval was obtained from the ALSPAC Law and Ethics Committee and the local research ethics committees and written consent for participation in ALSPAC was obtained for all participants. Please note that the study website contains details of all the data that is available through a fully searchable data dictionary (University of Bristol, 2013).

### 2.1. Exposure classification

**Maternal alcohol consumption:** Postal questionnaires at 18 weeks gestation collected information on the mother’s and partner’s alcohol consumption before pregnancy and during the first trimester. Response categories were never, less than once a week, at least once a week, one to two glasses every day, three to nine glasses every day, or 10 glasses a day. Examples were provided to specify that one glass was equivalent to one unit (8 g) of alcohol. Questions also asked about the number of binge days occurring during the preceding month which corresponded to approximately the fourth month of pregnancy. A binge was defined as consumption of the equivalent of two pints of beer, four glasses of wine or four pub measures of spirit on a single day (approximately four standard sized alcohol drinks or 40–45 g of absolute alcohol). In line with the summary index of maternal drinking created previously in the ALSPAC cohort (Passaro et al., 1996), we combined the information on binge behavior in the second trimester and drinking patterns in early pregnancy. The final categories for women and their partners were:

- (i) *Pregnancy abstainer:* drank alcohol pre-pregnancy, abstained in early pregnancy and did not binge mid pregnancy [women only];
- (ii) *General non-drinkers:* reported not drinking three months prior to conception, not drinking in early pregnancy and not bingeing mid pregnancy;
- (iii) *Occasional pregnancy drinker:* drank less than daily in early pregnancy and did not binge mid pregnancy;
- (iv) *Occasional binge drinkers during pregnancy:* drank less than daily in early pregnancy and binged at least once in mid pregnancy;
- (v) *Light daily pregnancy drinker:* drank one or two drinks per day in early pregnancy, did not binge in mid pregnancy; and
- (vi) *Heavy pregnancy drinker:* drank one or two drinks per day in early pregnancy and binged at least once in mid pregnancy, or drank at least three drinks per day in early pregnancy with or without any reported binged in mid pregnancy.

Due to evidence of poorer birth outcomes in non-drinkers compared with alcohol consumers (Mullally et al., 2011; Whitehead and Lipscomb, 2003), for all analyses of maternal alcohol consumption pregnancy abstainers were the reference group and for partner drinking, occasional drinkers served as the reference group. Only participants who provided information on their drinking habits both before and in early pregnancy (i.e., data available for both mother and her partner), with infants born after 23 weeks gestation, valid data on birth weight and birth length and complete data on all confounders were included, leading to a total sample of 7957 women–partner–offspring trios.

Height and weight were available for ALSPAC offspring from research clinics, routine healthcare records, and parent-reports (full details of measurements in Supporting material S1<sup>1</sup>). Height and weight at birth, 3 months, 1, 3, 7 and 10 years was predicted for all individuals from multilevel models, details of which are provided in the online supplement and have been published previously (Howe et al., 2013b). We included maternal and partner alcohol in the multilevel models, and estimated at each age the mean height/weight differences for each category of alcohol consumption compared with the reference category. Analyses were carried

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