Predictors of antenatal alcohol use among Australia women: A prospective cohort study

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Title: Predictors of antenatal alcohol use among Australian women: a prospective cohort study

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Running Title: Predictors of antenatal alcohol use among Australian women

Abstract

Objective: To identify predictors of antenatal alcohol consumption among women who usually consume alcohol.

Design: Prospective cohort study.

Setting: Australian Longitudinal Study on Women's Health (ALSWH).

Population or Sample: 1969 women sampled from the ALSWH 1973-78 cohort.

Methods: Women were included if they were pregnant in 2000, 2003, 2006, or 2009. The relationship between antenatal alcohol consumption and socio-demographics, reproductive health, mental health, physical health, health behaviours, alcohol guidelines and health care factors was investigated using a multivariate logistic regression model.

Main Outcome Measures: Alcohol use during pregnancy.

Results: Most (82.0%) women continued to drink alcohol during pregnancy. Women were more likely to drink alcohol during pregnancy if they had consumed alcohol on a weekly basis prior to pregnancy (OR=1.47; 95%CI =1.13-1.90), binge drank before pregnancy (OR=2.28; 95%CI=1.76-2.94), or if they were pregnant while alcohol guidelines recommended low alcohol versus abstinence (OR=1.60; 95%CI=1.26-2.03). Drinking during pregnancy was less likely if women had a Health Care Card (OR=0.63;95%CI=0.45-0.88) or

if they ever had fertility problems (OR=0.64; 95%CI=0.48-0.86).

Conclusions: Most Australian women that drink alcohol continue to do so during pregnancy. Pre-pregnancy alcohol consumption is one of the main predictors of antenatal alcohol use. Alcohol guidelines, fertility problems, and Health Care Card status also impact antenatal alcohol consumption.

Keywords: Pregnancy, Alcohol drinking, Health behaviour, Women's health.

Introduction

A large proportion of pregnant women in Australia,[1,2] as well as France[3] and the United Kingdom (UK),[4] have been found to consume alcohol during pregnancy. Heavy antenatal alcohol use can cause a number of adverse birth outcomes.[5-8] The effects of low to moderate alcohol use are less clear.[9] Although a number of studies have shown no harm,[7,10] a recent review of systematic reviews and meta-analyses reported that 30-40g of alcohol on one occasion, or 70g per week, increases the risk of neuro-developmental problems and preterm birth.[9] Adding to the confusion, genetic factors appear to vary the outcomes of antenatal alcohol use.[11,12] To identify women at risk of an alcohol-exposed pregnancy and potential negative outcomes, there is a need to first determine what factors predict alcohol consumption by pregnant women.

The literature has been inconsistent in identifying the predictors of antenatal alcohol use. Studies have been limited by relying on non-population-based samples,[13-15] univariate analysis,[6,14,15] retrospective measures[16] and inappropriate comparison groups (e.g. women not of legal age to purchase or consume alcohol).[13] To overcome individual study limitations, Skagerstrom et al (2011) conducted a systematic review.[17] Pre-pregnancy alcohol consumption and experiencing abuse were the only consistent predictors of antenatal alcohol use.[17] Unfortunately these findings may not generalise to all pregnant women as included studies only sampled from antenatal care populations. Australian studies suggest that factors such as older age,[15,16] higher income,[15,16] pre-pregnancy alcohol consumption,[1,2] previous pregnancy losses[14] and being partnered[15] increase a pregnant woman's likelihood of consuming alcohol.

There has yet to be an examination of a comprehensive set of multiple predictors in one analysis using a population-based sample. Population-based studies have been conducted in Norway,[18] the United States (US),[19] Denmark[20] and Australia[16]. Their results supported previous findings that prior alcohol consumption is a consistent predictor of alcohol use during pregnancy;[17] however prior consumption was not measured in the Australian study. The Danish study examined a number of predictors of binge drinking. None of the above studies examined a wide range of factors together such as socio-demographics, reproductive health, mental health, physical health, health behaviours, alcohol guidelines and health care factors to predict any alcohol use during pregnancy.

Objective

The purpose of this study was to identify the multiple predictors of antenatal alcohol consumption, from a large range of potential variables, among Australian women using prospective data from a population-based cohort study.

Methods

Sample

This study utilised data from the Australian Longitudinal Study on Women's Health (ALSWH). The longitudinal study began in 1996 with the recruitment of three age cohorts (women born between 1973-1978, 1946-1951, and 1921-1926). Women were recruited via the national Australian health insurer, Medicare. Women were randomly sampled, with the exception that women from rural and remote areas were sampled at twice the rate. Informed consent was provided by all participants. Surveys were mailed to the different cohorts on an interval basis every three years. Detailed methods of the ALSWH have been previously published.[21,22]

The sample for this study was drawn from the 1973-78 cohort. This cohort was aged 18-23 when recruited in 1996 and were broadly representative of the population of similarly aged Australian women at that time.[21] Participants completed surveys in 1996, 2000, 2003, 2006, and 2009 which have been referred to as surveys one, two, three, four and five, respectively. Women were eligible for the current analysis if they indicated they were pregnant at survey two, three, four or five. The target survey was defined as the first survey from surveys two to five that the participant reported being pregnant and the respective pregnancy was referred to as the target pregnancy. This approach was taken to enable examination of pre-pregnancy behaviours (such as alcohol use) based on previously completed surveys prior to the target survey. Exclusion criteria for the current analysis are presented in Figure 1.

Measures

Thirty-six variables were investigated as potential predictors of antenatal alcohol use. The types of variables that were included in the analysis included socio-demographics, reproductive health, mental health, physical health, health behaviours, alcohol guidelines and health care variables. The variables and their response categories are presented in Table 1 and Table S1. As some variables had slightly different wording or response formats in the different surveys, it was necessary to harmonise the data by reformatting these variables. For categorical variables, some categories were collapsed to prevent problems resulting from small cell sizes. General Practitioner (GP) use in the last 12 months was categorised into tertiles at the different surveys and labelled as low, moderate, or high use. A number of original items were reduced using exploratory factor analysis to create composite scores for health symptoms and perceived access to health care [results not shown]. Fourteen symptoms comprised five factors representing; (i) menstrual health (four symptoms); (ii) bowel health

(three symptoms); (iii) head and back issues (two symptoms); (iv) vaginal and urinary health (two symptoms); and (v) mental health (three symptoms). The two variables about perceived access to health care were created from six original access items. Access to general medical care included four items, whereas access to after-hours or hospital care included two items. Possessing a Health Care Card was considered an indicator of socio-economic status, as this card provides additional government assistance for health care costs for individuals receiving other government concessions.

Alcohol guidelines during the time of pregnancy were based on the Australian National Health and Medical Research Council (NHMRC) guidelines. The 1992[23] and 2009[24] guidelines promoted abstinence, while the 2001[25] guidelines condoned light drinking. The 2001 guidelines recommended pregnant women or those who may become pregnant:

- *"may consider not drinking at all;*

- *most importantly, should never become intoxicated;*

- *if they choose to drink, over a week, should have less than 7 standard drinks, AND, on any one day, no more than 2 standard drinks (spread over at least two hours);*

- *should note that the risk is highest in the earlier stages of pregnancy, including the time from conception to the first missed period."* [25]

Women who completed survey two (2000) or survey five (2009) were classified under the "no alcohol" guidelines, whereas women who filled out surveys three (2003) and four (2006) were pregnant during the "low alcohol" guidelines. Pre-pregnancy alcohol consumption was measured with regards to frequency ("How often do you usually drink alcohol?"), quantity ("On a day when you drink alcohol, how many standard drinks do you usually have?"), and

binge drinking ("How often do you have five or more standard drinks of alcohol on one occasion?"). Other pre-pregnancy measures included previous mental health, physical health, and smoking status.

Primary Outcome

The main outcome was alcohol use during pregnancy. For all women who reported a pregnancy at the target survey, their alcohol consumption at that time was coded as either "no alcohol intake" or "some alcohol intake". This was determined by using the alcohol frequency item, which had the following response format: I never drink alcohol, less than once a month, less than once a week, on 1 or 2 days a week, on 3 or 4 days a week, on 5 or 6 days a week, everyday. Responses were dichotomised into "I never drink alcohol" versus all other responses. The frequency and quantity of alcohol use were identified for descriptive purposes for participants that reported some alcohol intake during pregnancy. The item used to identify the quantity of alcohol use had the following response format originally: 1 or 2 drinks per day, 3 or 4 drinks per day, 5 to 8 drinks per day, 9 or more drinks per day.

Statistical Analysis

Analyses were conducted using SPSS (version 19). Descriptive statistics were calculated for items in the target survey, except for pre-pregnancy measures, which were taken from the survey prior to the target survey. Univariate logistic regression was used to assess the relationships between alcohol use during pregnancy and the 36 variables. All variables which demonstrated a statistically significant ($p<0.05$) association with the outcome variable were subsequently used in a multivariate logistic regression model using a backwards stepwise approach with an inclusion cut-point of $p<0.01$. The prevalence of antenatal alcohol use was

then calculated for the different levels of the final predictors to see how it varied for each predictor.

Missing Data Analysis

The majority (91.6%) of women did not have any missing observations on the 36 potential predictor variables, with approximately 1% of the sample having three or more missing variables. The Pearson's chi-squared test that was run to examine the impact of missing data was not statistically significant (χ^2=0.38, df=1, p=0.06), suggesting there was no bias in the outcome variable. Full Information Maximum Likelihood estimation was then used to impute missing data, as this has been found to be less biased and more efficient than other methods.[26]

Results

Of the 2496 women who indicated they were pregnant at survey two, three, four or five, 1969 (78.9%) women were included in the analyses (see Figure 1). Of those 1969 participants, 388 (19.7%), 451 (22.9%), 612 (31.1%), 518 (26.3%) were pregnant at survey two, three, four or five, respectively. The women's ages ranged from 22 to 37 years. Most participants had a tertiary education or higher (72.4%; n=1426) and were in a relationship with a partner (96.1%; n=1893). About half the women lived in major cities (52.0%; n=1024) and nearly two-thirds (64.1%; n=1263) were not at all or only somewhat stressed about money. Table 1 and Table S1 contain the descriptive characteristics of the 1969 participants.

A large proportion (82.0%; n=1614) of the 1969 participants consumed some alcohol during pregnancy, while the remaining 355 (18.0%) women indicated abstinence. Of the women who were pregnant during the times that the alcohol guidelines promoted abstinence, 22.0% did not drink during pregnancy, whereas 14.7% of women under the low alcohol guidelines

chose to abstain (p<0.001). The women who drank alcohol during pregnancy (n=1614) reported low alcohol usage (Table 2). Most often drinking no more than one to two days per week (90.3%; n=1457) and consuming one to two drinks per drinking day (76.9%; n=1241).

Univariate logistic regression revealed the following 12 of 36 potential predictor variables were significantly (p<0.05) related to alcohol use during pregnancy (Table 1): age, previous general health, highest educational attainment, area of residence, GP use, possessing a Health Care Card, having had fertility problems, having ever been in a violent relationship with a partner, ever using illicit drugs, frequency of previous alcohol consumption, previous binge alcohol use, and the alcohol guidelines that were in place during pregnancy. These variables were then examined together in a multivariate logistic regression model. Variables that were not found to be significantly related to antenatal alcohol use are contained in Table S1.

Factors retained in the final model of predictors of alcohol use during pregnancy are shown in Figure 2. Prior drinking behaviour was found to have a significant impact on drinking during pregnancy, even after controlling for other influencing factors. Women who drank weekly prior to pregnancy were around 50% more likely to continue to drink during pregnancy than women who drank less than weekly (87.0% vs 78.1%, OR=1.47, 95%CI=1.13-1.90, p=0.004). Participants who indicated binge drinking prior to pregnancy were more than two times more likely to consume alcohol during pregnancy compared to women who did not report a previous history of binge drinking (85.9% vs 70.3%, OR=2.28, 95%CI= 1.76-2.94, p<0.001). Women who were pregnant during the period of low alcohol guidelines were 60% more likely to drink during pregnancy when compared to women who were pregnant during the period of no alcohol guidelines (OR=1.60, 95%=1.26-2.03, p<0.001).

In contrast, pregnant women who had reported fertility problems were 36% less likely to consume alcohol during pregnancy compared to women who did not report fertility problems (75.4% vs 83.3%; OR=0.64; 95%=0.48-0.86, p=0.003). Compared to women without a Health Care Card, women with a Health Care Card were 37% less likely to drink during pregnancy (OR=0.63, 95%CI=0.45-0.88, p=0.008).

Discussion

Main Findings

This study is the first to assess a wide range of predictors of drinking during pregnancy amongst Australian women by using a population-based sample with prospective measures of alcohol use and pregnancy. For women who drink alcohol before pregnancy, the majority (82%) continue to drink during pregnancy. The probability of women drinking during pregnancy increased if they had previously consumed alcohol on a weekly basis or through binge drinking, or if they were pregnant during the time of the low alcohol guidelines. Possessing a Health Care Card or having reported fertility problems reduced the likelihood of drinking during pregnancy. However, regardless of the women's characteristics the prevalence of alcohol use during pregnancy remained high (over 70%).

The results suggest that conservative drinking guidelines may influence the behaviour of pregnant women. However, even under the abstinence guidelines, 78% of women continued to drink alcohol while pregnant. Considering this proportion appears to be only slightly lower than the 85% of pregnant women consuming alcohol under the low alcohol guidelines, it is understandable that previous studies have not detected a significant change in drinking behaviour as a result of a change in alcohol guidelines.[2,27] More effective dissemination of guideline recommendations, such as mass media campaigns, may be useful in reducing the

high prevalence of antenatal alcohol use in Australia that was observed under abstinence guidelines.

Similar to prior research,[20] this study found that women who had fertility problems were less likely to consume alcohol during pregnancy. Whether this was due to self-education, advice from a health professional, fear of potential negative outcomes, or is reflective of a general adoption of a healthy lifestyle, is unknown and more research is needed. There is some evidence to suggest that alcohol use may reduce a woman's chances of falling pregnant.[28,29] Therefore, if a woman seeks help from a health care professional when having problems falling pregnant, she might be more likely to be advised of the behavioural changes she can make to increase her chances of conceiving as recommended by evidence-based guidelines and protocols.[30,31]

Socio-economic status also appears to influence the risk of antenatal alcohol consumption, as this study found that pregnant women with a Health Care Card (a marker for lower income) were less likely to drink alcohol. This is consistent with previous findings that some Australian health professionals were more likely to address alcohol use with women they saw to be at higher risk, such as those from lower socio-economic backgrounds.[32] Additionally, previous research found that women from higher income groups are more likely to consume alcohol during pregnancy.[15,16] Health care professionals have been found to be the preferred source for receiving information about antenatal alcohol use.[33] Antenatal health care professionals should avoid assumptions of their client's knowledge, especially women of higher socioeconomic status, informing all pregnant women about alcohol use. Educational and psychological interventions have been found to be effective strategies in reducing alcohol consumption among pregnant women,[34] and could therefore be delivered by health care professionals when warranted.

Risky and regular alcohol use by women of childbearing age that may become pregnant should be addressed, as this study found that weekly alcohol intake and a tendency to binge drink prior to pregnancy increased the likelihood of antenatal alcohol consumption. This is consistent with the literature to date which has found that pre-pregnancy alcohol consumption is one of the best indicators of drinking during pregnancy.[17] Brief motivational interviewing aimed at increasing effective contraception use and reducing risky drinking could help prevent alcohol-exposed pregnancies in this population.[35] Considering the prevalence of unplanned pregnancies may range from about 30-50%,[36,37] such interventions would be ideal for primary prevention. Additionally, advice for those planning on becoming pregnant should focus on the fact that the first trimester is a particularly sensitive time, and teratogens such as alcohol should be avoided to prevent risks to crucial development during this stage.[38]

Strengths and Weaknesses

Including only previous drinkers in this study helped to ensure the effects of pre-pregnancy drinking were not inflated due to the inclusion of non-drinkers. By utilising a large population-based cohort study, a multitude of potential predictors were able to be investigated within one analysis providing a comprehensive view of the determinants of alcohol intake amongst a broad range of pregnant Australian women. The use of longitudinal data meant the impact that changing alcohol guidelines have had on women's antenatal alcohol use could be investigated. The results are strengthened by the fact that alcohol use was measured at the same time the women reported being pregnant, thereby allowing us to identify those who drank during pregnancy without using a retrospective measure or a specific question about alcohol consumed during pregnancy.

This study is not without limitations. Due to variations in survey items across time and inconsistencies in the data, it was not possible to investigate certain variables that may be of interest such as gravidity and stage of pregnancy. These factors have been measured in previous studies with no consistent evidence to suggest they would have had a significant impact on the outcome.[17] The study was limited by its reliance on self-report measures which lends itself to bias. However, self-report has been found to be more effective than other methods of assessing antenatal alcohol use, such as medical reports.[39] Previous research has found self-report to be a reliable measure of smoking among pregnant women when validated using biological measures.[40] Considering the stigma about antenatal smoking, it is likely that women's self-report is also a good indicator of other behaviours. Observational cohort studies are often prone to attrition bias. Previous analyses of this longitudinal study found that the relationships between variables in the longitudinal study are unlikely to be significantly biased by attrition rates.[41]

Interpretation

This study has provided a strong level of evidence for the predictive value of pre-pregnancy drinking on antenatal alcohol use. The findings infer that women drinking alcohol on a weekly basis or through risky episodic drinking are more likely to continue drinking during pregnancy. Within the scope of the Hill's criteria,[42] this association is enhanced by the strength of the association (i.e. women that binged were more than two times more likely to continue drinking), the temporal relationship ensured by longitudinal data, and the consistency with previous studies findings. It is also plausible that an underlying biological component may be contributing to the association, as neuroimaging studies have found differences in brain region activation between people with different drinking behaviours.[43]

Conclusion

Health care professionals play a vital role in advising women on health behaviours before and during pregnancy to increase the likelihood of optimal outcomes. To ensure women can make informed decisions about alcohol use during pregnancy, health care professionals should be providing all women with information about the potential harms of alcohol use and the reasons why abstinence is safest, as currently recommended by best-practice clinical guidelines.[44,45] Further investigation should explore the advice and information women are receiving from health care professionals, and reasons why such a high proportion of Australian women continue to consume alcohol once they become pregnant.

Disclosure of Interests: The authors declare that they have no competing interests.

Contribution to Authorship: All authors made substantial contributions to the conception and design of the study. AA conducted the analysis under guided supervision by PF, JP, AH and DL. AA, AH, PF, JP and DL made substantial contributions to the interpretation of the data. AA drafted the manuscript. All authors contributed to the revision of the manuscript. All authors read and have given approval for the final manuscript.

Details of Ethics Approval: The ALSWH has been granted ethical clearance by the Universities of Newcastle and Queensland (Ethics approvals H0760795 and 2004000224). Ethics for the longitudinal study was approved on the 26 July 1995.

Supporting Information: Additional supporting information about the variables contained

in this study can be found online:

    Table S1. Non-significant univariate predictors of alcohol use during pregnancy for

the Australian Longitudinal Study on Women's Health 1973-1978 cohort (N=1969)

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Figure 1. Flowchart of the sample obtained from the Australian Longitudinal Study on Women's Health (ALSWH) 1973-1978 cohort.
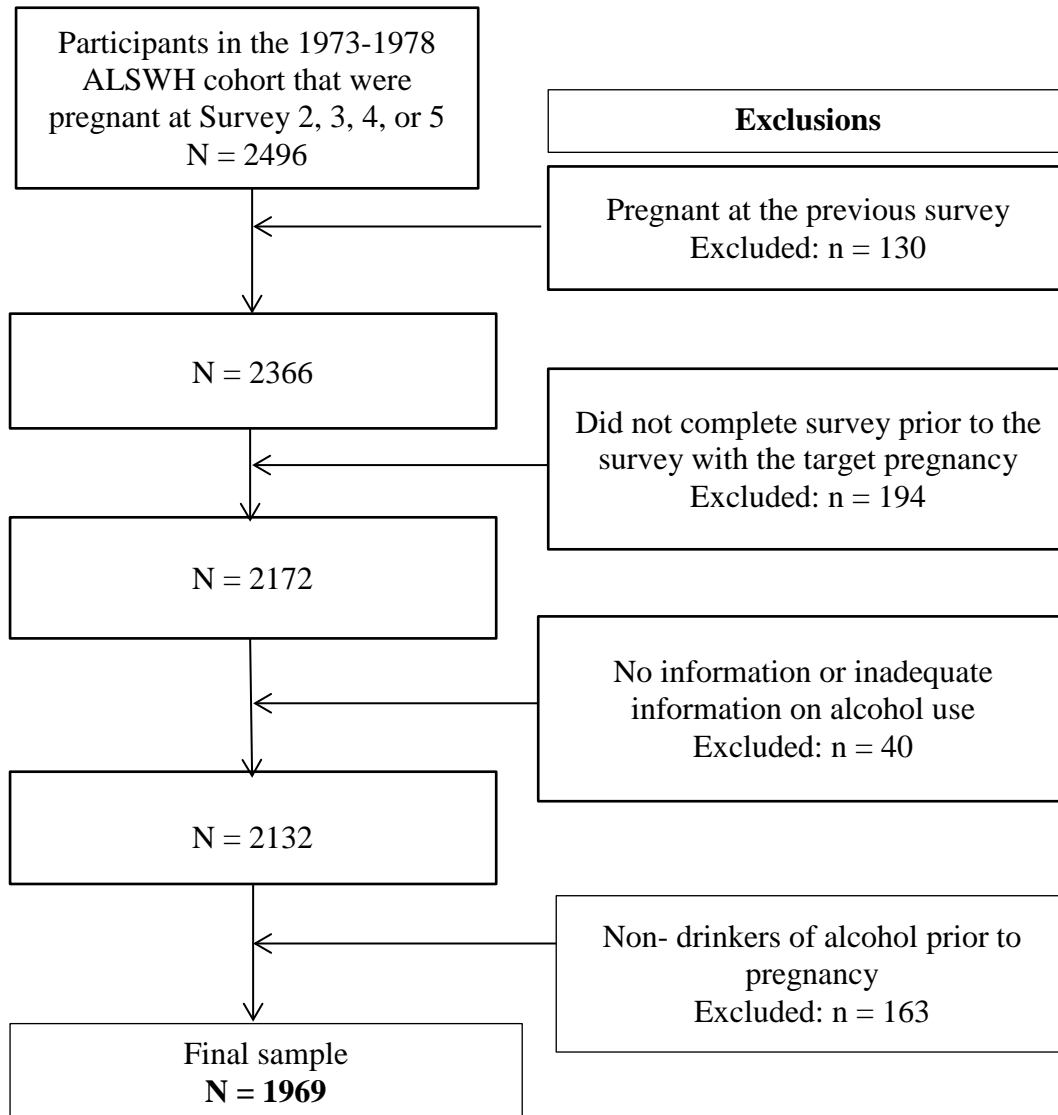
Table 1. Significant univariate predictors of alcohol use during pregnancy for the Australian

Longitudinal Study on Women's Health 1973-1978 cohort (N=1969)[a]

Univariate predictors	n (%)	OR (95% CI)	p-value
Highest education attained			
School certificate (year 10) or less	177 (9.0)	0.58 (0.39-0.87)	0.008*
Higher school certificate (year 12)	366 (18.6)	0.83 (0.59-1.17)	0.28
Trade/apprenticeship/certificate/diploma	513 (26.1)	0.77 (0.57-1.04)	0.92
University degree	637 (32.4)	Ref	Ref
Higher university degree (eg Masters, PhD)	276 (14.0)	0.96 (0.65-1.40)	0.82
Violent relationship with a partner (ever)			
No	1770 (89.9)	Ref	Ref
Yes	199 (10.1)	0.68 (0.48-0.97)	0.031*
Area of residence			
Major cities	1024 (52.0)	Ref	Ref
Inner regional	570 (28.9)	0.83 (0.63-1.08)	0.16
Outer regional	305 (15.5)	0.70 (0.51-0.96)	0.029*
Remote/very remote	70 (3.6)	1.34 (0.65-2.75)	0.43
Age (mean ± SD):			
Years	29.6 ± 3.3	0.96 (0.93-1.00)	0.035*
General practitioner (GP) use			
Low	1004 (51.0)	Ref	Ref
Moderate	505 (25.6)	1.28 (0.96-1.73)	0.10
High	460 (23.4)	0.75 (0.57-0.99)	0.040*
Health Care Card			
No	1749 (88.8)	Ref	Ref

Yes	220 (11.2)	0.60 (0.44-0.84)	0.003*
Previous general health[b] (mean ± SD): Range 0-100; higher score is better rating of general health	73.1 ± 19.1	1.01 (1.00-1.01)	0.016*
Problems with fertility (ever)			
No	1636 (83.1)	Ref	Ref
Yes	333 (16.9)	0.61 (0.46-0.81)	0.001*
Illicit drug use (ever)			
No	814 (41.3)	Ref	Ref
Yes	1155 (58.7)	1.31 (1.04-1.65)	0.022*
Previous frequency of alcohol consumption			
Less than once a week	1116 (56.7)	Ref	Ref
Once a week or more	853 (43.3)	1.87 (1.46-2.39)	<0.001*
Previous binge alcohol use			
Never binged	491 (24.9)	Ref	Ref
Binged	1478 (75.1)	2.57 (2.02-3.28)	<0.001*
Alcohol guidelines during pregnancy			
No alcohol	906 (46.0)	Ref	Ref
Low alcohol	1063 (54.0)	1.64 (1.30-2.06)	<0.001*

* p<0.05

[a] Only includes women who consumed alcohol prior to pregnancy.

[b] From SF-36 subscales (General health).

Table S1. Non-significant univariate predictors of alcohol use during pregnancy for the

Australian Longitudinal Study on Women's Health 1973-1978 cohort (N=1969)[a]

Non-significant predictors	n (%)	OR (95% CI)	p-value
Partner status			
Partnered	1893 (96.1)	Ref	Ref
Not partnered	76 (3.9)	1.37 (0.76-2.30)	0.32
Stress about money			
Not applicable or not at all stressed	418 (21.2)	Ref	Ref
Somewhat stressed	845 (42.9)	1.21 (0.89-1.63)	0.22
Moderately stressed	429 (21.8)	1.08 (0.77-1.52)	0.66
Very stressed	199 (10.1)	1.14 (0.74-1.77)	0.55
Extremely stressed	78 (4.0)	0.88 (0.49-1.58)	0.66
Continuity of care (same GP)			
Rarely or Never	41 (2.1)	1.21 (0.50-2.92)	0.67
Sometimes	201 (10.2)	1.02 (0.68-1.52)	0.93
Most of the time	1048 (53.2)	Ref	Ref
Always	679 (34.5)	0.84 (0.65-1.07)	0.16
Private health insurance			
No	819 (41.6)	Ref	Ref
Yes	1150 (58.4)	1.22 (0.97-1.54)	0.09
Perceived access to general medical care (mean ± SD): Range 1-6; higher score better perceived access	4.1 ± 1.1	0.95 (0.86-1.06)	0.36
Perceived access to after-hours or hospital care (mean ± SD):	4.3 ± 1.2	1.02 (0.93-1.13)	0.63

Range 1-6; higher score better perceived access			
Number of diagnoses/conditions (last 3-4 years)			
None	1112 (56.5)	Ref	Ref
One	635 (32.2)	0.92 (0.72-1.19)	0.54
Two or more	222 (11.3)	0.80 (0.56-1.14)	0.22
Menstrual Symptoms (mean ± SD): Range 0-4; higher number more often symptom	1.4 ± 0.6	1.09 (0.90-1.32)	0.37
Bowel symptoms (mean ± SD): Range 0-4; higher number more often symptom	1.4 ± 0.5	0.88 (0.71-1.09)	0.25
Head and back symptoms (mean ± SD): Range 0-4; higher number more often symptom	2.3 ± 0.8	0.98 (0.85-1.14)	0.80
Vaginal and urinary symptoms (mean ± SD): Range 0-4; higher number more often symptom	1.4 ± 0.5	1.00 (0.81-1.23)	0.97
Depression			
No	1825 (92.7)	Ref	Ref
Yes	144 (7.3)	1.24 (0.77-1.98)	0.37
Anxiety			
No	1892 (96.1)	Ref	Ref
Yes	77 (3.9)	1.20 (0.64-2.25)	0.57
Previous mental health[b] (mean ± SD): Range 0-100; higher score is better rating of mental health	71.8 ± 16.2	1.01 (1.00-1.01)	0.81
Level of stress last 12mths not including money (mean ± SD): Range 0-36; higher score more stress	5.6 ± 3.8	1.01 (0.98-1.04)	0.43

Mental health symptoms (mean ± SD): Range 0-4; higher number more often symptom	1.3 ± 0.5	1.16 (0.89-1.51)	0.26
Miscarriages			
None	1530 (77.7)	Ref	Ref
One	343 (17.4)	1.01 (0.74-1.37)	0.96
Two or more	96 (4.9)	0.83 (0.50-1.38)	0.47
Stillbirths			
None	1955 (99.3)	Ref	Ref
One or more	14 (0.7)	2.87(0.38-22.05)	0.31
Pregnancy problems (in last 12mths)			
No	1735 (88.1)	Ref	Ref
Yes	234 (11.9)	0.94 (0.66-1.34)	0.74
Premature births			
None	1882 (95.6)	Ref	Ref
One or more	87 (4.4)	0.64 (0.39-1.05)	0.07
Previous live births			
None	996 (50.6)	Ref	Ref
One	713 (36.2)	0.85(0.67-1.09)	0.21
Two	223 (11.3)	1.13 (0.76-1.68)	0.55
Three or more	37 (1.9)	1.09 (0.45-2.64)	0.86
Pap tests			
Less than two years ago	1567 (79.6)	Ref	Ref
Two or more years ago	372 (18.9)	0.95 (0.71-1.27)	0.74
Never/ not sure	30 (1.5)	0.71 (0.30-1.68)	0.44
Previous smoking			

Non-smoker	1526 (77.5)	Ref	Ref
Smoker	443 (22.5)	1.13 (0.85-1.49)	0.41
Previous quantity of alcohol consumption			
1 or 2 drinks per day	1084 (55.1)	Ref	Ref
3 or 4 drinks per day	582 (29.6)	1.22 (0.94-1.60)	0.14
5 or more drinks per day	303 (15.4)	1.18 (0.84-1.65)	0.34

* p<0.05

[a] Only includes women who consumed alcohol prior to pregnancy.

[b] From SF-36 subscales (Mental health).

Figure 2. Predictors of alcohol use during pregnancy among women from the Australian Longitudinal Study on Women's Health 1973-1978 cohort (N = 1969)[a].

Predictors of antenatal alcohol use[b]	OR (95% CI)	Decreased Risk	Increased Risk
Health Care Card	0.63 (0.45-0.88)		
Fertility problems	0.64 (0.48-0.86)		
Weekly alcohol use[c]	1.47 (1.13-1.90)		
Binge alcohol use[c]	2.28 (1.76-2.94)		
Low alcohol guidelines	1.60 (1.26-2.03)		
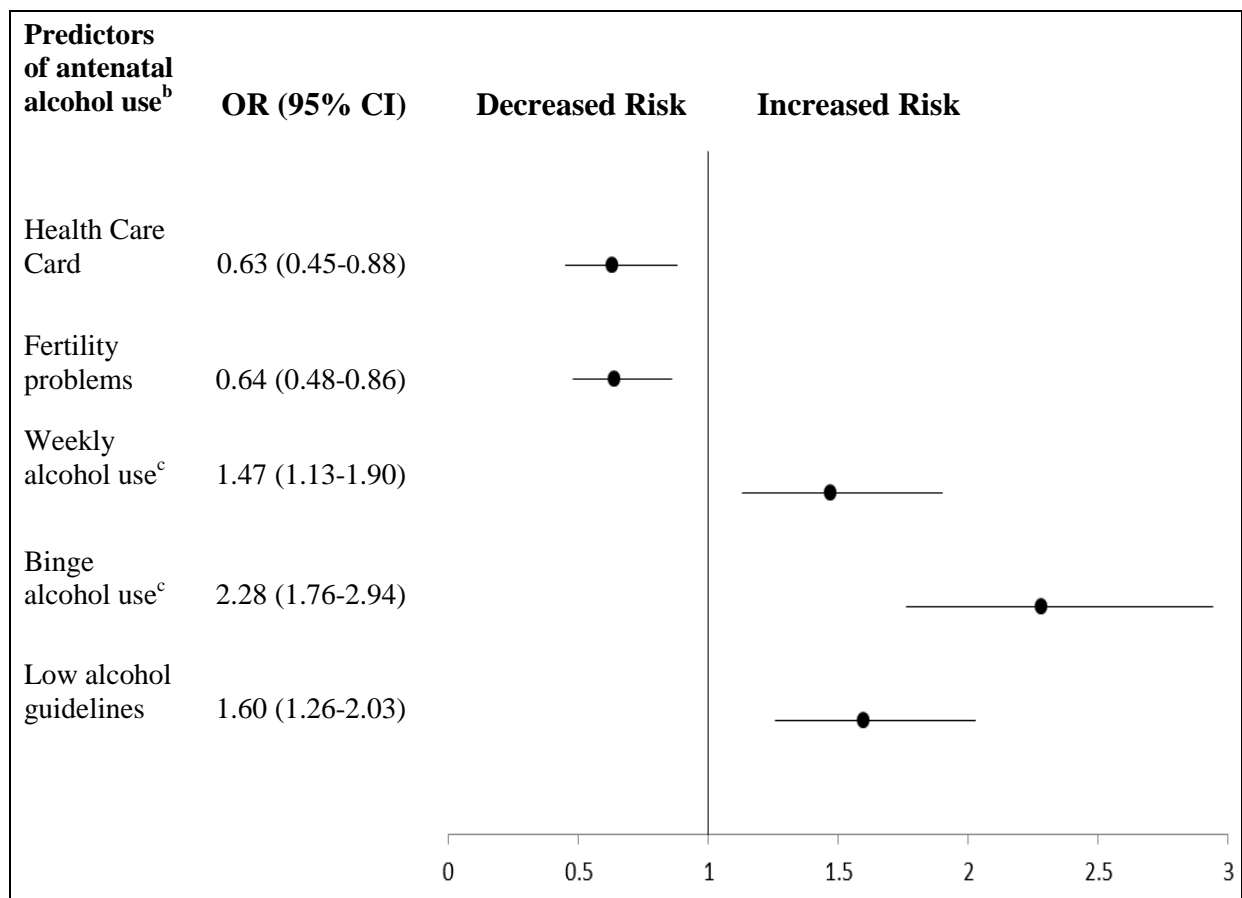
[a] Only includes women who consumed alcohol prior to pregnancy.

[b] Reference categories for categorical variables: Health Care Card = no card; Fertility problems (for 12 months or more) = no problems; Weekly alcohol use = less than once a week; Binge alcohol use = never binge; Low alcohol guidelines = no alcohol.

[c] Alcohol use prior to pregnancy.