

A public health intervention to change knowledge, attitudes and behaviour regarding alcohol consumption in pregnancy

Abstract

Objective: To evaluate the effectiveness of a public health intervention aimed at changing knowledge, attitudes and behaviour with respect to alcohol consumption during pregnancy.

Design: A non-blinded parallel group randomised controlled trial.

Population: Pregnant women over 18 years of age.

Methods: Women were recruited in second trimester. Participants were assigned to one of two treatment groups. Both groups completed an initial questionnaire assessing knowledge, attitudes, and practices relating to alcohol consumption during pregnancy. The intervention group then received a mocktail recipe booklet and were asked to share the information with their partner. The control group received standard antenatal care. A follow-up questionnaire was conducted four weeks post birth.

Main Outcome Measures: Primary outcome measures were a knowledge score of the health risks associated with alcohol consumption during pregnancy and an attitude score toward drinking during pregnancy. Secondary outcome measures included whether or not the woman and her partner abstained from drinking during the pregnancy.

Results: 161 participants were recruited at baseline (intervention=82, control=79) and 96 participants completed the trial (intervention=49, control=47). The findings suggest that the mocktail booklet was effective at improving knowledge ($p < 0.001$; Effect size 0.80) and improving attitudes towards drinking during pregnancy ($p = 0.017$; Effect size 0.43) in the intervention group compared to the control group. Although women in the intervention group were 30% more likely to abstain from drinking than in the control group (RR=1.3, 95% CI 0.97 – 1.75), this result was not statistically significant ($p = 0.077$).

Conclusions: Knowledge regarding the effects of alcohol consumption as well as attitudes towards drinking significantly improved as a result of a mocktail recipe booklet. Improving knowledge and changing attitudes has the potential to change health behaviour and therefore this intervention may reduce the percentage of women who continue to drink alcohol while they are pregnant and improve outcomes for infants and children.

Keywords: alcohol, FASD, pregnancy, health promotion

Trial registration: Australian New Zealand Clinical Trials

Registry: ACTRN12614001182684.

Funding for this project was received from University of South Australia as part of the PhD program.

Introduction

Alcohol is a teratogen that can cross the placenta and pass from mother to baby. Consuming alcohol during pregnancy can cause miscarriage, stillbirth, and a range of lifelong physical, behavioural, and intellectual disabilities known as fetal alcohol spectrum disorders (FASD) (Sokol et al., 2003, O'Leary, 2002, Centers For Disease Control and Prevention, 2014).

Despite this, significant percentages of women around the world continue to consume alcohol. Worldwide estimates suggest that between 40% and 80% of pregnant women consume alcohol at some stage of their pregnancy (Malet et al., 2006, O'Keeffe et al., 2015, Centers For Disease Control and Prevention, 2014). In Australia, almost half of pregnant women were found to have consumed alcohol before knowing of their pregnancy with 19.5% continuing to consume alcohol after learning of conception (Callinan and Room, 2012). One major barrier to preventing FASD may be a lack of awareness of the risks associated with alcohol consumption during pregnancy. Additionally, conflicting advice from different sources can lead to confusion about what are safe drinking limits during pregnancy.

Previous evidence has suggested that public health interventions may be an effective way of improving knowledge about specific health behaviours (Noar, 2006, Wakefield et al., 2010).

Public health interventions may include practices such as; introducing warning labels on alcohol containers, as well as advertising campaigns involving posters, leaflets, media advertisements and more. With regards to alcohol consumption during pregnancy, studies from the USA have suggested that brief clinical interventions have the potential to reduce the risk of harm from alcohol consumption during pregnancy (Gilinsky et al., 2011, Stade et al., 2009); however, studies examining the effectiveness of public health interventions to reduce alcohol consumption during pregnancy have been inconclusive (Crawford-Williams et al., 2015a). Studies in South Africa, USA, and Canada have used a variety of public awareness and health education campaigns to inform women about the harmful effects of consuming

alcohol in pregnancy, including: social marketing campaigns; warning labels on alcohol containers; television commercials; pamphlets; posters; and text messaging interventions (Casiro et al., 1994, Hanson et al., 2012, Kaskutas and Graves, 1994, Glik et al., 2001, Chersich et al., 2012, Evans et al., 2012, Lowe et al., 2010). These studies suggest that public health interventions may be effective at improving knowledge, yet there is much variability in the findings and there is a paucity of literature in this area particularly in countries outside of North America.

Printed materials are a commonly used public health intervention utilised to improve knowledge, attitudes, and patient outcomes (Paul et al., 1998, Farmer et al., 2008). These have been found to be effective in health behaviour change, particularly in the areas of smoking cessation, physical activity and alcohol consumption in the general population (Ley, 1988, Redman and Paul, 1997). Unfortunately, many health education materials targeted towards pregnant women have not been evaluated for their effectiveness. In Australia, a plethora of print materials relating to alcohol consumption during pregnancy exist, yet the majority of these have been found to be of low to moderate quality based on the DISCERN quality assessment instrument for assessing the quality of written health information (Crawford-Williams et al., 2015b, Charnock et al., 1999). The low to moderate quality of many of these health education materials has the potential to undermine the evidence, and may be contributing to the high percentages of women continuing to consume alcohol during pregnancy. Given that printed materials are inexpensive, accessible, and convenient to use they could be an effective intervention within health settings (Farmer et al., 2008).

Public health interventions are often heavily theory driven and based on the knowledge, attitudes, and practice (KAP) model which recognises the important connection between knowledge, attitudes, and behaviour (Médicins du Monde, 2011). Knowledge is an important aspect of health behaviour as it is necessary for individuals to be properly informed of risks

and benefits. However, having knowledge of particular health behaviour does not necessarily mean this behaviour will be adhered to. Attitudes can be described as tendencies towards certain behaviour, often based on peer influence and social context. These also play a key role in an individual's decision to perform certain health behaviour or not. Therefore improving health education and providing the public with greater health knowledge, and changing public attitudes towards health behaviours may have the best result in changing health behaviour. The KAP model was taken into consideration during the development of this study as it is recognised that targeting pregnant women's knowledge about alcohol consumption may then lead to a change in attitudes and influence behaviour change.

Research aims

This study aims to assess the effectiveness of a printed health education document to improve knowledge about alcohol consumption among pregnant women, change attitudes to drinking during pregnancy, and reduce alcohol consumption among pregnant women.

Methods

Trial Design

A two-armed randomised controlled trial (RCT) was conducted to evaluate the effectiveness of a public health intervention to change knowledge, attitudes, and behaviour concerning the effects of alcohol consumption among pregnant women. The paper is guided by the CONSORT statement (Schulz et al., 2010). The trial was registered with the Australian New Zealand Clinical Trials Registry (Trial ID: ACTRN12614001182684). This trial is a multicentre, non-blinded, parallel group RCT comparing a public health intervention with standard antenatal care. Baseline data collection began in November 2014 to July 2015, and follow-up data collection concluded in January 2016.

Participants

Inclusion criteria

Pregnant women aged 18 years and over, resident in South Australia, in second trimester of pregnancy, and agreed to be followed up post-delivery to complete a questionnaire.

Exclusion criteria

Unable to comprehend English, current substance abuse problem, severe, uncontrolled mental illness, or cognitive impairment that could interfere with their ability to consent. The exclusion criteria were assessed with a brief screening survey before participants were invited to participate in the trial.

Setting

The trial was conducted at the women's outpatients clinic in the Women's and Children's Hospital (WCH), South Australia, and the Birthing and Assessment unit at the Lyell McEwin Hospital (LMH), South Australia. WCH is the largest maternity and obstetric service in South Australia with approximately 5,000 births annually. LMH is a leading teaching hospital in the northern suburbs of Adelaide. The inclusion of two main sites allowed for a larger and more diverse sample population. Recruitment occurred at the two sites concurrently so that women at each site had an equivalent chance of being allocated to the control or intervention group.

Development of the intervention

The intervention was a recipe booklet of non-alcoholic beverages known as 'mocktails'. The development of the booklet occurred in two stages. Firstly, it was informed by a document analysis of existing printed health education materials in order to ensure the newly developed booklet was of high quality (Crawford-Williams et al., 2015b). Particular consideration was given to the language and reading grade level, as well as text structure, style, layout, colour, and images of the booklet. The booklet also included a publication date, links to further

information, and facts based on evidence; all aspects found to increase the quality of health education documents (Crawford-Williams et al., 2015b). The second stage involved focus groups held with women and their partners (Crawford-Williams et al., 2015c). Focus group participants were shown copies of existing documents relating to alcohol consumption during pregnancy and asked what was effective and what design elements worked best. From this it was determined that the booklet needed to: be easy to read; stand out; provide information on why to avoid alcohol; contain general facts about healthy nutrition during pregnancy; provide alternatives to alcohol; and include positive messages (Crawford-Williams et al., 2015b, France et al., 2014). The final intervention took the form of a 10 page booklet containing five mocktail recipes; four pages providing information on the reasons to avoid alcohol during pregnancy, how the baby may be affected, and general nutritional facts for a healthy pregnancy; as well as a page targeted at partners.

Procedure

An information sheet explaining trial details, how to contact the researcher, and the right to withdraw was given to women by the principal researcher (FCW) at an antenatal appointment during their second trimester. Women were recruited during the second trimester as pregnant women, particularly first-time mothers, are provided with an often overwhelming amount of information in the first trimester and it was thought that the current intervention may prove more effective if provided at a time when less information is received by the participating women. Participants who were eligible for the trial were asked to complete a baseline questionnaire upon enrolment. This questionnaire took approximately 15 minutes to complete; control and intervention group participants were administered the same baseline questionnaire. Upon allocation to the intervention group, participants were given a copy of the booklet and asked to read it thoroughly, share the information with their partner and family, and make use of the recipes throughout their pregnancy. Participants in the control

group received standard antenatal care. Participants were followed up four weeks post-delivery. At this time, participants were phoned to remind them of the trial and request a follow-up questionnaire; follow-up questionnaires were then emailed or posted to all participants.

Measures

The questionnaire contained information on participant knowledge of the effects of alcohol consumption during pregnancy; attitudes towards pregnant women drinking alcohol; personal alcohol consumption before and during pregnancy; partner's alcohol consumption before and during the pregnancy; partner's influence on the woman's drinking; and basic demographic information. Sections of the questionnaire were based on a previously used "Alcohol and Pregnancy Questionnaire" (Environics Research Group, 2006, Peardon et al., 2011); however, questions were added on the influence of the partner, and partner's alcohol consumption. The final modified questionnaire ("Drinking in pregnancy") comprised a total of 52 questions and took approximately 15-20 minutes to complete.

The questionnaire was assessed for content validity by a panel of 5 experts in the fields of: substance use in pregnancy; midwifery; psychology; biostatistics; and questionnaire development. Based on this assessment changes were made to the section on alcohol consumption to align with standard questions from the National Drug Strategy Household Survey (Australian Institute of Health and Welfare, 2011). Additionally, the questionnaire underwent assessment of test-retest reliability with 10 pregnant women who were administered an identical questionnaire on two separate occasions one week apart. The reliability of the items, as measured by the Intraclass Correlation Coefficient (ICC), average measure for agreement was 0.88 ($p < 0.05$, range $r = 0.55$ to 0.92). This was considered to be a moderate to high level of agreement and the items were unchanged. Finally, the

questionnaire was pilot tested by 4 pregnant women. Minor changes to the wording of attitude questions were made based on this assessment.

The follow-up questionnaire was identical to the baseline questionnaire; however, participants in the intervention group were asked their opinion of the mocktail recipe booklet design and the information it contained. The purpose of the follow-up questionnaire was to identify a difference in main outcome measures between the intervention and control groups due to exposure to the developed public health intervention.

Randomisation

Sequence generation

A computer-generated list of random numbers was used for participant allocation. This allowed each woman an equal chance of being allocated to either the intervention or control group. Participants were randomly assigned to one of the two treatment groups on a 1:1 allocation ratio.

Allocation concealment

The allocation sequence was concealed from the researcher enrolling participants (FCW) by using sequentially numbered, opaque, sealed envelopes. Corresponding envelopes were opened only after the enrolled participants completed the baseline questionnaire and it was time to allocate the intervention. The researcher generating the allocation sequence was not involved in participant recruitment.

Implementation

Participants were informed of the purpose of the trial at recruitment; however, participants were only allocated a treatment group after they had provided consent and completed the baseline questionnaire.

Blinding

Given the nature of the intervention participants, researchers, and data analysts were aware of the group allocation.

Outcome measures

The primary outcome measures were knowledge regarding the effects of alcohol consumption during pregnancy, and attitudes towards alcohol consumption in pregnancy. Secondary outcomes were women's and partner's alcohol consumption. Knowledge was measured as a continuous variable, using percentage of correct answers to thirteen true/false/unknown statements. Attitudes were measured on a 5-point Likert scale with questions such as "I would have positive feelings towards a pregnant woman who was drinking alcohol" and answers from *strongly agree* to *strongly disagree*. These were summed to create an attitudes score ranging from 8 to 40, with higher overall attitude scores indicate negative attitudes towards alcohol consumption during pregnancy. Consumption was measured using standard questions from the National Drug Strategy Household Survey (Australian Institute of Health and Welfare, 2011). For this analysis, only women who drank alcohol pre-pregnancy were included (n=112), and the percentage abstaining during pregnancy compared between the two groups. Data were also collected on variables thought to be associated with increased risk of alcohol consumption during pregnancy such as gestation, maternal age; socio-economic status; education level; past drinking habits; as well as partner's drinking habits.

In order to assess the acceptability of the booklet, women in the intervention group were asked at follow-up if they had read the booklet, found it useful, if it motivated them to cut down their alcohol consumption, and any improvements they would suggest. Further free text comments were invited.

Sample size estimation

The study was powered to detect a medium effect size for change in knowledge and attitude scores between study groups. Given that recruitment was fairly late in pregnancy (16 – 26 weeks gestation) we felt that there would not be sufficient time between recruitment and birth to see a change in drinking behaviour that would allow us to power on this outcome measure, however due to the association between knowledge, attitudes and behaviour we included drinking behaviour as an outcome measure (Médicins du Monde, 2011). In order to detect a medium effect size (Cohen's $d = 0.5$) in change scores between the intervention and control groups, a sample size of 64 women in each group was required, based two-sided t-test with type 1 error set at 0.05 and power at 80%. In fact, the trial aimed to recruit a total sample of 154 women to allow for an attrition rate of 20%.

Statistical methods

Descriptive statistics of baseline characteristics are presented by treatment group. Due to randomisation, any imbalance at baseline can only occur by chance. As such, no formal testing of baseline differences was undertaken. Linear mixed effects models (LMM) were used to examine intervention effects on the primary outcome measures. In these models, the outcome measure was the dependent variable, with group, time and a group-time interaction term as fixed effects. The trial participant was the random effect. The formal test of an intervention effect was the level of significance of the interaction term, which represents a group comparison of change scores. Our approach to missing values for the primary outcomes included two further analyses. Firstly, we imputed missing data using a last observation carried forward (LOCF) approach. Secondly, we imputed the missing data using multiple imputation with ten datasets. Regression models were then undertaken with the post-intervention outcome measure as the dependent variable, with group and baseline value of the outcome measure as independent variables. Further, adjusted models were run which

included gestation, and ‘trying to conceive’ as covariates, since these variables were somewhat imbalanced between groups at baseline. Secondary outcome measures, namely drinking behaviour in the women and their partners were analysed by calculating the rate ratios with 95% confidence intervals. Analyses were undertaken using the statistical packages SPSS Statistics 21 (IBM Corp, 2012) and Stata 14 (StataCorp., 2011).

Ethical considerations

The trial protocol was approved by the Human Research Ethics Committees of the Women’s and Children’s Health Network, Adelaide, South Australia (protocol no: HREC/13/WCHN/121), and the University of South Australia Human Research Ethics Committee (protocol no: 0000031358).

Results

Flow of participants

A flow diagram of randomisation and recruitment of trial participants is shown in Figure 1. The majority (452) of individuals screened were ineligible, including women who did not meet the inclusion criteria for gestation (301), and acceptable level of English (151). A further 78 refused to participate after being informed about the trial. Therefore 161 eligible, consenting women participated in the trial. Of these 161 women, 82 were randomised to the intervention group and 79 to the control group. Overall, 96 women (59.6%) completed the follow-up questionnaire: 47 in the control, and 49 in the intervention group.

Baseline characteristics

Demographics

Table 1 shows demographic characteristics by study group. Overall, participants had a mean age of 29.2 years, were predominately Caucasian (80.7%), lived with their partner or partner

and children (93.8%), and were employed as professionals (54.7%). Half of participants had a university degree, with 91.9% having grade 12 education or higher. The majority of participants' average income was over \$50,000 per year (79.5%). Additionally 46.0% of participants were first-time mothers, and 62.7% of the pregnancies had been planned. The intervention group appeared to be at somewhat longer gestation and less likely to be trying to conceive.

Knowledge and attitudes

Baseline results (Table 2) indicated that several knowledge statements were incorrectly answered by more than half of all participants. These included: “small amounts of alcohol during pregnancy will not cause harm to a baby”; “the risk of harm to a baby from drinking alcohol during pregnancy is the same for all women”; “drinking spirits will cause more harm to a baby than wine”; and “alcohol causes the most harm to the baby when consumed in the second or third trimester”.

The majority of respondents believed that pregnant women should not drink alcohol and no participant believed that it is ok for pregnant women to consume four or more drinks on one occasion. The majority of participants felt that information should be readily available to pregnant women about the effect that drinking alcohol during pregnancy may have on the unborn baby and that health professionals should ask pregnant women how much and how often they drink at their first antenatal visit and at each additional antenatal visit.

Nevertheless, only 40.4% of participants thought that all women were aware of the effects that drinking alcohol during pregnancy can have on a baby.

Alcohol consumption

More than half of the sample had consumed alcohol in the 12 months previous to the pregnancy (Table 3). Of those women, 83.0% consumed an average of seven drinks or less

per week. The mean number of drinks for women who consumed alcohol was 4.65 standard drinks per week. Wine was the most commonly named beverage (68.7%), followed by beer and then spirits. Twenty three percent of drinkers had never consumed more than four drinks on a single occasion (binge drinking), while 14.3% reported binge drinking once or twice a week before pregnancy. Of the women who reported drinking before pregnancy, 15% reported drinking in a previous pregnancy and 84% had stopped drinking since learning that they were pregnant.

One hundred and twenty three (76.4%) of the women had partners who consumed alcohol on a regular basis (Table 4). The mean number of standard drinks per week for partners was 6.64. For the partners, the most commonly consumed beverage was beer (85.4%), followed by wine. A similar number of partners reported binge drinking at least once or twice a week as the women (14.9%); however, a smaller percentage reported never binge drinking (10.6%). Since learning of the current pregnancy, the majority of partners had made no changes to their drinking behaviour (57.1%) while others had reduced the amount of alcohol they consumed (8.7%) or reduced the number of times a week they consumed alcohol (29.8%).

Partner's influence on alcohol consumption in pregnancy

The majority of women reported that their partners' behaviour would not influence their alcohol consumption in pregnancy even if their partner continued to drink (62.1%) or if their partner stopped drinking (56.5%). However, over one quarter said they would be less likely to drink alcohol in pregnancy if their partner encouraged them to stop or cut back (28.6%) and one in ten said they would be more likely to drink if their partner offered them alcohol (11.2%).

Trial outcomes

Knowledge and attitude

The results for knowledge and attitude scores are presented in Table 5. For knowledge score, the intervention group improved by an average of 9% in correct answers compared to the control group. This was a highly statistically significant difference ($p < 0.001$), and represents a large effect size; imputing missing values and adjusting the models by gestation and intention to conceive made little difference to this result. Similarly, the intervention group improved in mean attitude score compared to the control group, with the difference of 1.4 points being statistically significant ($p = 0.023$). The effect size of 0.43 reflects a medium difference. Again, the other models provided similar results.

Women and partner's drinking

Of women who consumed alcohol before pregnancy 80.6% ($n = 25/31$) of the intervention group stopped drinking during pregnancy compared to 61.9% ($n = 26/42$) of the control group, a rate ratio (95% CI) of 1.30 (0.97 – 1.75), $p = 0.077$. This percentage represents all women who stopped drinking including those who stopped drinking prior to the intervention. For partners who consumed alcohol before the pregnancy 8.1% ($n = 3/37$) of the intervention group stopped drinking during the pregnancy compared to 11.6% (5/43) of the control group, a rate ratio (95% CI) of 0.70 (0.18 – 2.72), $p = 0.604$.

Appraisal of intervention

Responses to questions soliciting comments on the practicality, effectiveness and design of the mocktail booklet revealed adequate acceptance of the intervention: 96% of women in the intervention group read the booklet and 92% found the booklet helpful; however, only 12% of women in the intervention group had shared the information with their partner. Over 73% of participants reported that the booklet did not motivate them to cut down their alcohol

consumption as they had already chosen not to drink during pregnancy. All participants reported that it was an interesting and useful information package that was a great size and enticing style. Other comments included: the booklet reaffirmed the need to stop drinking; it provided good recipes and creative ideas for non-alcoholic drinks; women did not feel left out when everyone else is drinking; the booklet stimulated discussions about drinking during pregnancy; however, some women tended to drink wine so were not interested in cocktail alternatives.

Discussion

This RCT is the first study assessing a public health intervention in Australia in the area of alcohol consumption during pregnancy. A trial of this kind was deemed important as despite a number of public health campaigns and government warnings about the risk associated with drinking during pregnancy, many of these interventions are not evaluated for their effectiveness. This trial examined the effects of a public health intervention on knowledge, attitudes, and alcohol consumption among pregnant women. The findings of this trial suggest that a printed booklet is effective at improving knowledge on the topic of alcohol consumption during pregnancy, as well as changing attitudes of pregnant women. We found that the mocktail recipe booklet significantly increased knowledge among the intervention group compared to women in the control group. It also significantly changed attitudes of the women in the intervention group. The intervention did not have a statistically significant effect on changing alcohol consumption behaviour; however, a higher percentage of women in the intervention group compared to the control group abstained from alcohol throughout the pregnancy which may be as a consequence of the intervention.

Despite overall knowledge scores improving in the intervention group, baseline data showed that several knowledge statements were incorrectly answered by the majority of participants.

This suggests that future interventions may need to focus on specific details that are not as widely known or understood regarding alcohol consumption during pregnancy. It has been previously reported that although pregnant women are aware that alcohol has the potential to cause harm to unborn babies, they lack knowledge of the specific details of the effects. Furthermore, women have reported that the information received from various sources regarding safe levels of drinking in pregnancy is often confusing and contradictory (Crawford-Williams et al., 2015c, Elek et al., 2013, Raymond et al., 2009).

Attitudes towards pregnant women consuming alcohol were generally negative, which is consistent with past research (Raymond et al., 2009, Peadon et al., 2010). A moderate but statistically significant increase in negative attitudes was seen in the intervention group which suggests that a printed health education booklet is appropriate to change attitudes about alcohol consumption during pregnancy. The findings of this trial also demonstrated that the majority of pregnant women already have negative attitudes towards excessive alcohol consumption in pregnancy, and this may be the reason that many women had already chosen to stop drinking alcohol before participation in this trial.

Pregnancy is a key time to promote change in health behaviours such as smoking and drinking in both mothers and their partners (Waterson et al., 1990). Recent studies have suggested that between 20 and 40% of pregnant women in Australia continue to consume alcohol even after learning that they are pregnant (Callinan and Room, 2012, O'Keeffe et al., 2015). The majority of women consuming alcohol during pregnancy in Australia do so in the first trimester, which is a time that has the potential to have the most severe consequences on the fetus (O'Keeffe et al., 2015). This suggests that early in the pregnancy is the time when most women need to alter their drinking behaviour. In the current trial it was decided to recruit pregnant women during the second trimester as pregnant women, particularly first-time mothers, are provided with an often overwhelming amount of information in the first

trimester (Crawford-Williams et al., 2015c). It was proposed that the effectiveness of the current intervention may be more evident at a time when less information is received by the participating women; however, many women in the current trial may have made the decision to stop drinking early in pregnancy and therefore the intervention was less effective in changing drinking behaviour. Future trials in this area would be enhanced by recruiting pregnant women as early as possible in the pregnancy in order to have more success in reducing alcohol consumption.

The intervention did not have a significant impact on reducing alcohol consumption for partners. The findings of the trial indicated that the majority of pregnant women in the intervention group did not share the mocktail recipe booklet with their partner which may have contributed to the lack of change in partner's alcohol consumption. Modifications may need to be made to the intervention in a future trial, in order to make the printed document effective at changing alcohol consumption behaviour, and to further target the information to partners. Additionally, future research may like to include partners as well as pregnant women in the trial, rather than relying on the women's perception of partner's alcohol consumption.

The findings from this trial suggest that a public health intervention is an acceptable method of providing information to pregnant women. It is easy to implement, and received positive feedback from all women in the intervention group. In order to improve certain aspects of the mocktail booklet for use in a larger trial, it is recommended that printed materials are targeted towards women who consume wine in particular as this was the most commonly consumed beverage by women in the current sample. Additionally, it would be beneficial to include information about attitudes towards alcohol consumption pregnancy in the intervention in order to see a larger effect in the change in attitudes between groups.

Strengths and limitations

The larger than expected number of non-returned follow up questionnaires reduced the amount of data available for statistical analysis. However, imputation of missing data produced very similar results. The sample consisted of predominantly Caucasian, well educated, high income women making generalisation problematic. It was difficult to demonstrate a change in drinking behaviour with such small numbers of drinkers in our sample. Clearly, in future research, it is necessary to replicate this study with a much larger sample size, and to exclude women who never consume alcohol.

Conclusion

This trial shows that printed health education material can achieve significant improvements in overall knowledge of the effects of alcohol consumption in pregnancy, and can change attitudes towards pregnant woman who consume alcohol, although these findings need to be considered in light of the relatively small numbers who completed the follow-up study. The success of this small scale trial provides incentive for a larger trial to be conducted in future. Furthermore, future research should be conducted with populations of women who are continuing to consume alcohol during pregnancy in order to determine the effectiveness of a public health intervention on changing drinking behaviour. Given that printed health education documents are common, inexpensive, and convenient to use the findings presented here demonstrate substantial support for these interventions to be used within health settings.

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TABLES

Table 1. Baseline group characteristics

Parameter	Control n (%)	Intervention n (%)
Age (years)		
18-25	9 (11.4)	21 (25.6)
26-30	29 (36.7)	38 (46.3)
31-35	38 (48.1)	11 (13.4)
36 and over	3 (3.8)	12 (14.7)
Total	79 (100)	82 (100)
Gestation (weeks)		
< 20	30 (37.9)	6 (7.3)
20-23	34 (43.1)	46 (56.2)
24-27	11 (13.9)	21 (25.6)
≥ 28	4 (5.1)	9 (10.9)
Total	79 (100)	82 (100)
Ethnicity		
Caucasian	62 (78.5)	68 (82.9)
Asian	16 (20.3)	13 (15.9)
Other	1 (1.3)	1 (1.2)
Total	79 (100)	82 (100)
Baby's paternal ethnicity		
Caucasian	61 (77.2)	70 (85.4)
Asian	15 (19.0)	8 (9.8)
ATSI	2 (2.5)	2 (2.4)
Other	1 (1.3)	2 (2.4)
Total	79 (100)	82 (100)
Education (highest level completed)		
Year 11	7 (8.9)	6 (7.3)
Year 12	11 (13.9)	22 (26.8)
TAFE/apprenticeship	21 (26.6)	12 (14.6)
University degree	40 (50.6)	40 (48.8)
Other	-	2 (2.4)
Total	79 (100)	82 (100)
Living arrangements		
Live with partner	36 (45.6)	38 (46.3)
Couple with children	38 (48.1)	39 (47.6)
Single parent with children	3 (3.8)	-
Non-related adults sharing	2 (2.5)	3 (3.7)
Other	-	2 (2.4)
Total	79 (100)	82 (100)
Employment status		
Professional	44 (55.7)	44 (53.7)
Student	9 (11.4)	6 (7.3)
Skilled/trade	2 (2.5)	9 (11.0)
Home duties	13 (16.5)	6 (7.3)
Unemployed	-	7 (8.5)
Other	11 (13.9)	10 (12.2)
Total	79 (100)	82 (100)

Household income		
Less than \$20000	2 (2.5)	4 (4.9)
\$20001 to \$30000	-	2 (2.4)
\$30001 to \$50000	13 (16.5)	12 (14.6)
\$50001 to \$100000	36 (45.6)	35 (42.7)
More than \$100000	28 (35.4)	29 (35.4)
Total	79 (100)	82 (100)
Parental status		
Primiparous	34 (43.0)	40 (48.8)
Multiparous	43 (54.4)	42 (51.2)
Total	77 (97.4)	82 (100)
Trying to conceive		
Yes	60 (75.9)	41 (50.0)
No	19 (24.1)	41 (50.0)
Total	79 (100)	82 (100)
Current smoker		
Yes	2 (2.5)	5 (6.1)
No	77 (97.5)	77 (93.9)
Total	79 (100)	82 (100)
HADS depression score		
0-7 (normal)	67 (84.7)	82 (100.0)
8-10 (borderline abnormal)	10 (12.6)	-
11-21 (abnormal)	2 (2.5)	-
Total	79 (100)	82 (100)
HADS anxiety score		
0-7 (normal)	50 (63.3)	63 (76.9)
8-10 (borderline abnormal)	21 (26.6)	13 (15.8)
11-21 (abnormal)	8 (10.1)	6 (7.3)
Total	79 (100)	82 (100)
Health literacy (range 8-40)		
≤ 20	-	-
21-25	8 (10.1)	3 (3.7)
26-30	27 (34.1)	14 (17.1)
31-35	22 (27.9)	40 (48.8)
36-40	22 (27.9)	23 (28.0)
Total	79 (100)	80 (97.6)

Table 2. Baseline comparison of groups for knowledge and attitude

Knowledge statement	Control (n=79) n (%) correct	Intervention (n=82) n (%) correct
Small amounts of alcohol during pregnancy will not cause harm to a baby (Correct answer = UNKNOWN)	37 (46.8)	21 (25.6)
Drinking alcohol during pregnancy may cause physical birth defects (Correct answer = TRUE)	68 (86.1)	74 (90.2)
Any amount of alcohol drunk during pregnancy has the potential to harm a baby (Correct answer = TRUE)	56 (70.9)	75 (91.5)
Drinking a glass of wine once or twice during pregnancy will cause harm to a baby (Correct answer = UNKNOWN)	45 (57.0)	37 (45.1)
The more alcohol a pregnant woman drinks, the more likely that the baby will be harmed (Correct answer = TRUE)	70 (88.6)	74 (90.2)
The risk of harm to a baby from drinking alcohol during pregnancy is the same for all women (Correct answer = FALSE)	11 (13.9)	10 (12.2)

Drinking spirits (such as vodka, rum, scotch etc) will cause more harm to a baby than wine	19 (24.1)	21 (25.6)
(Correct answer = FALSE)		
Alcohol causes the most harm to the baby when consumed in the second or third trimester	38 (48.1)	27 (32.9)
(Correct answer = FALSE)		
A baby affected by drinking alcohol during pregnancy will be affected for life	44 (55.7)	47 (57.3)
(Correct answer = TRUE)		
Drinking alcohol during pregnancy may cause behavioural problems in a child that are undetected at birth	39 (49.4)	62 (75.6)
(Correct answer = TRUE)		
Binge drinking is especially harmful in pregnancy	74 (93.7)	77 (93.9)
(Correct answer = TRUE)		
Partners have an influence on how much alcohol a pregnant woman drinks	48 (60.8)	48 (58.5)
(Correct answer = TRUE)		
Drinking alcohol in the first 3 months of pregnancy increases the risk of miscarriage	45 (57.0)	52 (63.4)
(Correct answer = TRUE)		

Attitude statement	N (% agree)	N (% agree)
Pregnant women should not drink alcohol	68 (86.0)	74 (90.2)
All women are aware of the effects that drinking alcohol during pregnancy can have on a baby	25 (31.7)	40 (48.7)
I would have positive feelings towards a pregnant woman who was drinking alcohol	2 (2.5)	3 (3.7)
I would not feel bothered if I saw a pregnant woman drink a whole glass of wine/beer in public	12 (15.2)	17 (20.7)
Information should be readily available to women about the effect that drinking alcohol during pregnancy may have on the unborn baby	70 (88.6)	74 (90.3)
It is okay for pregnant women to drink more than four standard alcoholic drinks on one occasion (binge drinking)	0 (0.0)	0 (0.0)
Health professionals should ask pregnant women how much and how often they drink alcohol at their first antenatal visit	71 (89.9)	82 (100.0)
Health professionals should ask pregnant women how much and how often they drink alcohol at each antenatal visit	60 (76.0)	69 (84.1)

Table 3. Baseline comparison of groups for women’s alcohol consumption (excluding non-drinkers)

	Control (n=66) N (%)	Intervention (n=46) n (%)
Standard drinks per week before pregnancy		
0-4	42 (63.6)	31 (67.4)
5-7	11 (16.7)	9 (19.6)
8-14	11 (16.7)	3 (6.5)
> 14	2 (3.0)	3 (6.5)
Total	66 (100)	46 (100)
Days per week drinking before pregnancy		
1-2	45 (68.2)	35 (76.1)
3-4	18 (27.3)	6 (13.0)
5-7	3 (4.5)	5 (10.9)
Total	66 (100)	46 (100)
Type of alcohol consumed*		
Wine	45 (68.2)	32 (69.6)
Beer	24 (36.4)	15 (32.6)
Spirits	14 (21.2)	3 (6.5)
Other (cider, premix drinks etc)	10 (15.2)	8 (17.4)
Consumed >4 standard drinks on a single occasion		
Never	14 (21.2)	12 (26.1)
Less than once a month	36 (54.5)	22 (47.9)
Once or twice a month	6 (9.1)	6 (13.0)
Once or twice a week	10 (15.2)	6 (13.0)
Total	66 (100)	46 (100)
Since discovering you were pregnant have you?*		
Reduced number of times drinking alcohol	8 (12.1)	6 (13.0)
Stopped drinking alcohol	57 (86.4)	37 (80.4)
Reduced the amount drunk each occasion	5 (7.6)	6 (13.0)
Made no changes to drinking behaviour	3 (4.5)	0 (0.0)
Consumed alcohol in past pregnancies		
Yes	13 (19.7)	3 (6.5)
No	53 (80.3)	43 (93.5)
Total	66 (100)	46 (100)

*Multiple responses allowed

Table 4. Baseline comparison of groups for partners' alcohol consumption (excluding non-drinkers)

	Control (n=67) N(%)	Intervention (n=56) N (%)
Standard drinks per week during the pregnancy		
0-4	31 (46.3)	19 (33.9)
5-7	15 (22.4)	14 (25.0)
8-14	18 (26.9)	20 (35.7)
> 14	3 (4.4)	3 (5.4)
Total	67 (100)	56 (100)
Days per week drinking during the pregnancy		
1-2	39 (58.2)	31 (55.4)
3-4	19 (28.4)	21 (37.5)
5-7	9 (13.4)	4 (7.1)
Total	67 (100)	56 (100)
Type of alcohol consumed*		
Wine	30 (44.8)	18 (32.1)
Beer	55 (82.1)	50 (89.3)
Spirits	8 (11.9)	3 (5.4)
Consumed > 4 standard drinks on a single occasion		
Never	6 (8.9)	11 (19.7)
Less than once a month	39 (58.2)	20 (35.7)
Once or twice a month	16 (23.9)	7 (12.5)
Once or twice a week	3 (4.5)	18 (32.1)
Most days	3 (4.5)	0 (0.0)
Total	67 (100)	56 (100)
Since discovering you were pregnant has your partner?*		
Reduced number of times drinking alcohol	21 (31.3)	27 (48.2)
Stopped drinking alcohol	0 (0.0)	2 (3.6)
Reduced the amount drunk each occasion	6 (8.9)	8 (14.3)
Made no changes to drinking behaviour	43 (64.2)	26 (48.2)

*Multiple responses allowed

Table 5. Unadjusted and adjusted regression coefficients for primary outcome measures

Model	B	95% CI (B)	Sig.	Sig.*	Effect Size (ES)	95% CI ES
Knowledge – LMM	9.04	4.42 – 13.66	<0.001	<0.001	0.80	0.38 – 1.21
Knowledge – LOCF	5.96	3.22 – 8.69	<0.001	<0.001	0.45	0.14 – 0.76
Knowledge – MI	8.99	5.30 – 12.68	<0.001	<0.001	0.56	0.24 – 0.87
Attitude – LMM	1.43	0.26 – 2.60	0.017	0.023	0.43	0.02 – 0.83
Attitude – LOCF	1.23	0.51– 1.94	0.001	0.011	0.74	0.41 – 1.05
Attitude – MI	1.82	0.50 – 3.14	0.008	0.029	0.25	0.06 – 0.56

LMM: Linear mixed effects model

LOCF: Last observation carried forward

MI: Multiple imputation

B: Regression coefficient representing the difference in mean change score between groups

*Adjusted model with adjustment for intended to conceive and gestation at recruitment

Figure 1: Flow of participants

