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ORIGINAL RESEARCH

The effectiveness of a brief intervention to reduce alcohol consumption in pregnancy: a controlled trial

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Objectives. Alcohol consumption during pregnancy potentially has significant effects on both mother and baby. The aim of the study was to determine the effectiveness of a brief intervention to reduce alcohol consumption during pregnancy.

Methods. This study was performed at the outpatient antenatal clinics of a large academic maternity teaching hospital in Dublin city centre. Six hundred and fifty-six women who drank alcohol before pregnancy were recruited at their first antenatal clinic visit. Drinking patterns before pregnancy, since becoming pregnant, and in later pregnancy (at ~ 32 weeks of gestation) were assessed using the Alcohol Use Disorders Identification Test (AUDIT). A controlled study was conducted – participants were allocated to either the brief intervention group (screening and 5 minutes of non-directive discussion of their drinking pattern) or a control group (screening and treatment as usual).

Results. Before pregnancy, 57% of women consumed five or more units of alcohol per drinking occasion (i.e. binge drinking); during pregnancy, the rate of binge drinking fell to 4.8%. Sixty per cent of women who drank before pregnancy ceased drinking when pregnant, and a further 9% reduced their intake substantially. Four hundred and ninety-nine women were followed up in later pregnancy. The brief intervention did not produce any significant reduction in alcohol consumption above that attributable to pregnancy and comprehensive screening in antenatal care. Larger reductions in alcohol intake during pregnancy were associated with younger age, non-Irish nationality and greater intake of alcohol before first antenatal clinic visit.

Conclusion. Pregnancy itself produces abstinence and large reductions in alcohol consumption, even among women who drink relatively heavily. Consequently, a universal screening and brief intervention programme is not warranted but screening and targeted interventions could be appropriate such as repeated interventions for those who continue to binge drink. Future research could include evaluating interventions for those women who continue to binge drink during pregnancy and exploring ways of maintaining reductions in alcohol consumption among women who decreased consumption during pregnancy.

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Key words: Alcohol, brief intervention, pregnancy.

Introduction

Such is the concern about the potential harmful effects of heavy alcohol use during pregnancy, that the Surgeon General of the United States and the British Department of Health advise that women do not drink alcohol at all during pregnancy. However, alcohol is consumed in pregnancy with reported prevalence rates varying from 6% (Nilsen *et al.* 2008) to 71% (Kesmodel *et al.* 2003) and controversy exists as to the level, if any, of safe drinking in pregnancy.

Heavy alcohol use during pregnancy is associated with a range of problems including increased rates of spontaneous abortion, intrauterine growth retardation, low birth weight, foetal alcohol syndrome (Abel 1998) and foetal alcohol spectrum disorder (Sokol *et al.* 2003). The prevalence of foetal alcohol syndrome is reported as 0.5–2 per 1000 live births (May & Gossage 2001) whereas the prevalence of foetal alcohol spectrum disorder is much higher at 9–10 per 1000 live births (Sampson *et al.* 1997).

To date, four randomised controlled trials of brief interventions to reduce alcohol use in pregnant women have been published. Three of the trials reported no statistically different difference between the study and control groups (Chang *et al.* 1999, 2005; Handmaker *et al.* 1999). Handmaker *et al.* (1999) conducted a pilot study involving 42 pregnant women who reported alcohol use. After a comprehensive alcohol use assessment, women were randomised to receiving either written

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information about the risks of drinking during pregnancy or a 1-hour motivational interview, focusing on the health of the unborn baby. The participants were followed-up after 2 months and no statistically significant difference was found between the groups.

Chang *et al.* (1999) conducted a randomised clinical trial of 250 antenatal, alcohol screening questionnaire positive women comparing comprehensive assessment of alcohol use and comprehensive assessment with a brief intervention. The brief intervention lasted about 45 minutes; each woman was given a take home manual and informed of the US Surgeon General's recommendation that prenatal abstinence was the most prudent drinking goal. Both groups reduced their alcohol use and there was no statistically significant difference found between the groups.

Chang *et al.* (2005) conducted a randomised trial of 304 pregnant women who were alcohol screening questionnaire positive to test the effectiveness of a brief intervention to reduce alcohol consumption when a partner was included. The brief intervention consisted of a single session delivered over 25 minutes by a clinician with at least a Master's degree. Both treatment and control groups reduced their alcohol use and no statistically significant difference was found. However, the effects of the brief intervention were enhanced significantly when a partner participated. A tentative recommendation was made to use a patient–partner brief intervention for the heaviest drinkers.

The fourth study (O'Connor & Whaley 2007) examined the efficacy of a brief intervention to help women achieve abstinence in pregnancy. The trial compared assessment only and assessment with a brief intervention of 10–15 minutes duration repeatedly delivered by a nutritionist using a scripted manual at monthly prenatal visits. It was a community-based trial involving 255 low income, minority women who were involved in a food assistance programme. It concluded that the study group were five times more likely to report abstinence than the controls.

We studied the effectiveness of a brief intervention aimed at reducing alcohol consumption during pregnancy, among women attending outpatient antenatal clinics at a large academic maternity teaching hospital in Dublin's city centre.

Methodology

Background and setting

This study was conducted in the outpatient antenatal clinics of The Rotunda Hospital, a large academic maternity teaching hospital in Dublin's city centre. In 2008, 8597 women delivered 8799 babies >500 g at the hospital, and the overall perinatal mortality rate was 8.1 per 1000 births (Rotunda Hospital 2009).

The study was a controlled trial of a brief intervention aimed at reducing alcohol consumption during pregnancy. The control group was assessed using a screening questionnaire but was not offered the brief intervention. Ethical approval was obtained from the Research Ethics Committee of the Rotunda Hospital before commencement.

Recruitment

All women attending the public and private (fee-paying) clinics for their first antenatal visit were requested to participate in the study. Exclusion criteria included (a) being <18 years of age; (b) inability to speak or comprehend English; (c) not consuming alcohol; or (d) being alcohol or drug dependent. Written informed consent was obtained from each study subject.

Assessments

At each woman's first antenatal clinic visit, we recorded demographic, personal and obstetric variables including age (years), gestational age (weeks), country of birth, nationality, educational attainment and employment status. A woman was described as 'employed full-time' if she worked for 30 hours or more per week; other categories included 'employed part-time' (i.e. working for fewer than 30 hours per week), parenting, on social welfare, in third-level education, looking for work, attending secondary school, engaged in volunteering activities and other (e.g. carer).

Alcohol use was measured using the Alcohol Use Disorders Identification Test (AUDIT), developed by the World Health Organisation (WHO) (Saunders *et al.* 1993). The AUDIT was designed for the early identification of harmful drinking rather than alcohol disorders such as alcohol abuse or dependence. The questionnaire comprises 10 items relating to levels and patterns of alcohol consumption. The first eight items are rated on a scale of 0–4, and the final two items are rated on a scale of 0–2. For all items, higher scores reflect higher levels of harmful drinking. In women, a score of 6 or greater is considered hazardous drinking. The AUDIT questionnaire has been widely validated in a range of different settings (Babor *et al.* 1992; Saunders *et al.* 1993; Babor & Higgins-Biddle 2001). The WHO defines binge drinking as the consumption of five units of alcohol or more at a single drinking episode (WHO 2004).

Participants were asked to complete the AUDIT three times in total during the study. At the first antenatal visit, each woman was asked to complete the AUDIT questionnaire twice, first based on her alcohol consumption in the 12 months before becoming

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pregnant (time 1) and second, based on her alcohol consumption since discovering she was pregnant (time 2). The AUDIT was completed for the third time at 32 weeks of gestation or more (time 3) at the woman's antenatal clinic visit.

Design

After completing the AUDITS at the first antenatal visit, it was planned that women would be randomly assigned to one of two groups: a brief intervention group or a control group (i.e. obstetric care as usual with no specific intervention in relation to alcohol). The principal investigator (J.S.) planned that the researcher would conduct the intervention on every other participant using the clinic list for the names of those attending.

Brief intervention

Before the study, the researcher (A.G.) was trained over 2 days in brief interventions and she conducted a pilot study that involved audiotaping brief interventions, which were subsequently validated by her trainer. The brief intervention itself comprised a 5-minute discussion of alcohol consumption between the woman and a single researcher (A.G.). This discussion involved asking the woman about her drinking pattern; attitudes towards drinking; and any previous attempts to change drinking habits, including strategies used in the past. The brief intervention did *not* involve the provision of written information, advice or recommendations of any sort.

Statistical analysis

Data were stored, described and analysed using the Statistical Package for the Social Sciences (SPSS Inc. 2003). We used the Student *t*-test for comparison of normally distributed continuous variables and the χ^2 test for comparison of categorical variables. We performed two multi-variable linear regression analyses in order to identify potential predictors of (a) AUDIT score at time 3 and (b) change in AUDIT score between times 2 and 3 (i.e. change in AUDIT score over the period during which the woman either received the brief-intervention or was screened but had treatment as usual). Potential predictor variables analysed in the models were: age, nationality, educational attainment, employment status, gestation, AUDIT score (time 2) and group (brief intervention or control).

Results

Sample characteristics

One thousand, one hundred and twelve women were invited to participate in the study. Four hundred and fifty-six (42%) were excluded: 14 were underage; 39 did not speak English; 364 (33%) did not drink alcohol; nine were drug dependent; 24 refused to participate and six interviews were interrupted. Six hundred and fifty-six (59%) women participated in the study. Mean age of participants was 27.8 years (standard deviation 5.7, range 18–46). All women were assessed at their first antenatal clinic visit, at which time they were at a mean of 16.1 weeks gestation (standard deviation 3.8, range 9–35).

Table 1. *Regions of origin of participants (**n** = 656)*

World region of origin	*n*	%
Republic of Ireland	501	76.4
Europe (European Union)	111	16.9
Asia/Australasia	17	2.6
Africa	15	2.3
Europe (non-European Union)	8	1.2
Americas	4	0.6
Total	656	100

Table 2. *Educational attainment of participants (**n** = 656)*

Educational level attained	*n*	%
No education	1	0.2
Primary school only	7	1.1
Secondary school only	347	52.9
Third level (vocational)	138	21.0
Third level (university)	162	24.7
Unknown	1	0.2
Total	656	100

The majority of participants (76.4%) were born in the Republic of Ireland; the majority of the remainder were born in other countries in the European Union (16.9%) (Table 1). Approximately one participant in every two (52.9%) had educational attainment to the level of secondary school only, and almost one in four (24.7%) had completed a third level university degree (Table 2). Almost one participant in every two (47.9%) was employed full-time; of those who were not employed full-time, 148 (43.4%) were engaged in parenting and 96 (28.2%) were working part-time (i.e. fewer than 30 hours per week) (Table 3).

Mean AUDIT score for the entire sample (n = 656) at time 1 (relating to alcohol consumption in the 12 months before pregnancy) was 6.1 (standard deviation 3.5, range 1–26). In the 12 months before pregnancy, 57% had consumed five or more units of alcohol per drinking occasion (i.e. binge drinking) (Table 4).

The original design of the study was a randomised controlled study. However, the study was conducted in

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a very busy antenatal clinic. The intention was to recruit all the women attending – up to 60 women at a time – and conduct the intervention on every other participant. However, women are not given individual appointment times at the antenatal clinic and assessments are conducted by both midwives and doctors who use every available room space. Assessments are conducted efficiently and speedily with women and often their partners going in and out of the examination rooms in an organised but hectic manner. In such an environment, it was not feasible to follow the randomisation protocol. With several examination rooms operating, a number of women were called for examination to different rooms at the same time and others left rooms having completed their examinations at the same time. In essence, randomisation was impractical. Consequently, as there was no set pattern, we deemed the allocation to be 'arbitrary'.

Participants were arbitrarily allocated into two groups: brief intervention group (n = 312) and control group (n = 344). Participants in the brief intervention group were slightly younger than those in the control group (mean age 27.0 years, standard deviation 5.6, and mean 28.5, standard deviation 5.6, respectively; $p < 0.001$) and were at a slightly later stage of gestation (mean 17.0 weeks, standard deviation 3.4, and 15.3, standard deviation 4.0; $p < 0.001$), but the two groups did not differ in terms of country of origin (χ^2 4.2, $p = 0.514$) or employment status (χ^2 5.4, $p = 0.066$). The two groups differed slightly in terms of educational attainment (χ^2 26.4, $p < 0.001$); 19.5% of women in the brief intervention group had attended university, compared with 29.4% of women in the control group.

Table 3. *Main activity if not employed full-time (**n** = 341)*

Main activity	*n*	%
Parenting	148	43.4
Part-time working	96	28.2
Social welfare	43	12.6
Third level education	16	4.7
Looking for work	5	1.5
Secondary school	2	0.6
Volunteering	1	0.3
Other	30	8.9
Total	341	100

AUDIT scores before pregnancy (time 1) and since becoming pregnant (time 2) (pre-intervention)

Participants in the two groups did not differ in terms of AUDIT score for alcohol consumption in the year before pregnancy (time 1); mean score in those who were later to receive the brief intervention was 6.4 (standard deviation 3.7) and mean score in the control group was 5.9 (standard deviation 3.4) ($t = -1.5$, $p = 0.136$) (Table 5). AUDIT scores decreased substantially in both groups since becoming pregnant (time 2), but this did not differ between groups: mean score in those who were later to receive the brief intervention was 1.0 (standard deviation 1.6) and mean score in the control group was 0.9 (standard deviation 1.5) ($t = -0.9$, $p = 0.358$) (Table 6).

Overall, by the time of first antenatal clinic visit, 53% of women had ceased drinking alcohol since becoming pregnant (Table 4). The rate of binge drinking had also fallen: in the 12 months before pregnancy (time 1), 57% of women consumed five or more units of alcohol per drinking occasion (i.e. binge drinking) but since becoming pregnant (time 2), only 4.8% of women

Table 4. *Units of alcohol consumed on a typical drinking occasion among women*

Units of alcohol consumed on a typical drinking occasion	Time 1 (12 months before pregnancy)		Time 2 (after becoming pregnant)		Time 3 (at ~32 week gestation)			
					Brief intervention group		Non-brief intervention group	
	n	%	*n*	%	*n*	%	*n*	%
0	0	0	348	53.0	154	49.4	151	43.9
1–2	117	17.8	211	32.2	60	19.2	73	21.2
3–4	164	25.0	65	9.9	25	8.0	11	3.2
5–6	121	18.4	20	3.0	6	1.9	4	1.2
7–8	133	20.3	8	1.2	3	1.0	2	0.6
9 plus	120	18.3	4	0.6	1	0.3	3	0.9
Unknown	1	0.2	0	0	63	20.2	100	29.1
Total	656	100	656	100	312	100	344	100

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Table 5. *AUDIT score regarding alcohol consumption in the year before pregnancy (time 1, pre-intervention)*

Questions		Response	Score	Brief intervention group	Non-brief intervention group	χ^2	*p*-value
1	How often did you have a drink containing alcohol in the last 12 months before becoming pregnant	Monthly or less	1	76 (24.4%)	90 (26.6%)	0.786	0.853
		2–4 times per month	2	129 (41.3%)	133 (38.7%)		
		2–3 times per week	3	100 (32.1%)	111 (32.3%)		
		4 or more times per week	4	7 (2.2%)	10 (2.9%)		
2	How many drinks containing alcohol did you have on a typical day when you were drinking	1 or 2	0	49 (15.7%)	68 (19.8%)	7.071	0.215
		3 or 4	1	86 (27.6%)	78 (22.7%)		
		5 or 6	2	54 (17.3%)	67 (19.5%)		
		7 or 8	3	71 (22.8%)	62 (18%)		
		9 or more	4	52 (16.7%)	68 (19.8%)		
3	How often did you have six or more drinks on one occasion	Never	0	89 (28.5%)	117 (34%)	4.691	0.455
		Less than monthly	1	68 (21.8%)	78 (22.7%)		
		Monthly	2	52 (16.7%)	57 (16.6%)		
		Weekly	3	101 (32.4%)	91 (26.5%)		
		Daily or almost daily	4	1 (0.3%)	1 (0.3%)		
4	How often during the last year have you found you were not able to stop drinking once you had started	Never	0	296 (94.9%)	323 (93.9%)	0.578	0.902
		Less than monthly	1	10 (3.2%)	12 (3.5%)		
		Monthly	2	2 (0.6%)	4 (1.2%)		
		Weekly	3	4 (1.3%)	5 (1.5%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
5	How often during the last year have you failed to do what was normally expected of you, because of drinking?	Never	0	286 (91.7%)	327 (95.1%)	10.206	0.017
		Less than monthly	1	17 (5.4%)	17 (4.9%)		
		Monthly	2	7 (2.2%)	0 (0.0%)		
		Weekly	3	2 (0.6%)	0 (0.0%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
6	How often during the last year have you needed a drink first thing in the morning to get yourself going after a heavy drinking session?	Never	0	309 (99%)	342 (99.4%)	2.451	0.294
		Less than monthly	1	1 (0.3%)	2 (0.6%)		
		Monthly	2	0 (0.0%)	0 (0.0%)		
		Weekly	3	2 (0.6%)	0 (0.0%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		

Table 5: (*Continued*)

Questions		Response	Score	Brief intervention group	Non-brief intervention group	χ^2	*p*-value
7	How often during the last year have you had a feeling of guilt or remorse after drinking?	Never	0	267 (85.6%)	307 (89.2%)	4.961	0.175
		Less than monthly	1	37 (11.9%)	35 (10.2%)		
		Monthly	2	5 (1.6%)	1 (0.3%)		
		Weekly	3	3 (1%)	1 (0.3%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
8	How often during the last year have you been unable to remember what happened the night before you had been drinking?	Never	0	260 (83.3%)	293 (85.2%)	4.354	0.226
		Less than monthly	1	44 (14.1%)	49 (14.2%)		
		Monthly	2	5 (1.6%)	1 (0.3%)		
		Weekly	3	3 (1.0%)	1 (0.3%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
9	Have you or someone else been injured as a result of your drinking	No	0	295 (94.6%)	327 (95.1%)	0.602	0.740
		Yes, but not in the last year	1	10 (3.2%)	12 (3.5%)		
		Yes, during the last year	2	7 (2.2%)	5 (1.5%)		
10	Has a relative or a friend or a doctor or another healthcare worker been concerned about your drinking or suggested you cut down?	No	0	299 (95.8%)	340 (98.8%)	6.256	0.044
		Yes, but not in the last year	1	7 (2.2%)	3 (0.9%)		
		Yes, during the last year	2	6 (1.9%)	1 (0.3%)		
Mean total score (S.D.)				6.37 (3.705)	5.95 (3.385)	$t = -1.499$	0.136

AUDIT, Alcohol Use Disorders Identification Test.

Table 6. *AUDIT score regarding alcohol consumption since becoming pregnant (time 2, pre-intervention)*

Questions		Response	Score	Brief intervention group	Non-brief intervention group	χ^2	*p*-value
1	How often did you have a drink containing alcohol since you discovered you were pregnant?	Never	0	162 (51.9%)	190 (55.2%)	2.953	0.707
		Monthly or less	1	96 (30.8%)	99 (28.8%)		
		2-4 times per month	2	44 (14.1%)	45 (13.1%)		
		2-3 times per week	3	10 (3.2%)	8 (2.3%)		
		4 or more times/week	4	0 (0.0%)	1 (0.3%)		
2	How many drinks containing alcohol did you have on a typical day when you were drinking	None	0	161 (51.6%)	187 (54.4%)	1.941	0.857
		1 or 2	0	99 (31.7%)	112 (32.6%)		
		3 or 3	1	36 (11.5%)	29 (8.4%)		
		5 or 6	2	10 (3.2%)	10 (2.9%)		
		7 or 8	3	4 (1.3%)	4 (1.2%)		
		9 or more	4	2 (0.6%)	2 (0.6%)		
3	How often did you have six or more drinks on one occasion	Never	0	293 (93.9%)	334 (97.1%)	4.967	0.291
		Less than monthly	1	8 (2.6%)	5 (1.5%)		
		Monthly	2	6 (1.9%)	2 (0.6%)		
		Weekly	3	4 (1.3%)	3 (0.9%)		
		Daily or almost daily	4	1 (0.2%)	0 (0.0%)		
4	How often during the last year have you found you were not able to stop drinking once you had started	Never	0	312 (100%)	343 (99.7%)	0.908	0.341
		Less than monthly	1	0 (0.0%)	0 (0.0%)		
		Monthly	2	0 (0.0%)	0 (0.0%)		
		Weekly	3	0 (0.0%)	1 (0.3%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
5	How often during the last year have you failed to do what was normally expected of you, because of drinking?	Never	0	312 (100%)	344 (100%)	-	-
		Less than monthly	1	0 (0.0%)	0 (0.0%)		
		Monthly	2	0 (0.0%)	0 (0.0%)		
		Weekly	3	0 (0.0%)	0 (0.0%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
6	How often during the last year have you needed a drink first thing in the morning to get yourself going after a heavy drinking session?	Never	0	312 (100%)	344 (100%)	-	-
		Less than monthly	1	0 (0.0%)	0 (0.0%)		
		Monthly	2	0 (0.0%)	0 (0.0%)		
		Weekly	3	0 (0.0%)	0 (0.0%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		

Table 6: (*Continued*)

Questions		Response	Score	Brief intervention group	Non-brief intervention group	χ^2	*p*-value
7	How often during the last year have you had a feeling of guilt or remorse after drinking?	Never	0	312 (100%)	344 (100%)	-	-
		Less than monthly	1	0 (0.0%)	0 (0.0%)		
		Monthly	2	0 (0.0%)	0 (0.0%)		
		Weekly	3	0 (0.0%)	0 (0.0%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
8	How often during the last year have you been unable to remember what happened the night before you had been drinking?	Never	0	312 (100%)	344 (100%)	-	-
		Less than monthly	1	0 (0.0%)	0 (0.0%)		
		Monthly	2	0 (0.0%)	0 (0.0%)		
		Weekly	3	0 (0.0%)	0 (0.0%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
9	Have you or someone else been injured as a result of your drinking	No	0	344 (100%)	312 (100%)	-	-
		Yes, but not in the last year	1	0 (0.0%)	0 (0.0%)		
		Yes, during last year	2	0 (0.0%)	0 (0.0%)		
10	Has a relative, friend, doctor or other healthcare worker been concerned about your drinking or suggested you cut down?	No	0	312 (100%)	343 (99.7%)	0.908	0.341
		Yes, but not in last year	1	0 (0.0%)	0 (0.0%)		
		Yes, during last year	2	0 (0.0%)	1 (0.3%)		
Mean total score (S.D.)				1.04 (1.566)	0.93 (1.535)	$t = -0.920$	0.358

AUDIT, Alcohol Use Disorders Identification Test.

Table 7. *AUDIT score regarding alcohol consumption post-intervention (time 3)*

Questions		Response	Score	Brief intervention group	Non-brief intervention group	χ^2	*p*-value
1	How often did you have a drink containing alcohol since you discovered you were pregnant? (n = 494)	Never	0	161 (64.4%)	153 (62.7%)	0.538	0.911
		Monthly or less	1	58 (23.2%)	63 (25.8%)		
		2–4 times per month	2	24 (9.6%)	21 (8.6%)		
		2–3 times per week	3	7 (2.8%)	7 (2.9%)		
		4 or more times/week	4	0 (0%)	0 (0%)		
2	How many drinks containing alcohol did you have on a typical day when you were drinking? (n = 493)	None	0	154 (61.8%)	151 (61.9%)	8.295	0.141
		1 or 2	0	60 (24.1%)	73 (29.9%)		
		3 or 3	1	25 (10.0%)	11 (4.5%)		
		5 or 6	2	6 (2.4%)	4 (1.6%)		
		7 or 8	3	3 (1.2%)	2 (0.8%)		
		9 or more	4	1 (0.4%)	3 (1.2%)		
3	How often did you have six or more drinks on one occasion? (n = 493)	Never	0	239 (96.0%)	239 (98.0%)	3.616	0.306
		Less than monthly	1	6 (2.4%)	2 (0.8%)		
		Monthly	2	4 (1.6%)	2 (0.8%)		
		Weekly	3	0 (0%)	1 (0.4%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
4	How often during the last year have you found you were not able to stop drinking once you had started? (n = 494)	Never	0	250 (100%)	243 (99.6%)	1.027	0.311
		Less than monthly	1	0 (0.0%)	1 (0.4%)		
		Monthly	2	0 (0.0%)	0 (0.0%)		
		Weekly	3	0 (0.0%)	0 (0.0%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
5	How often during the last year have you failed to do what was normally expected of you, because of drinking? (n = 494)	Never	0	250 (100%)	244 (100%)	-	-
		Less than monthly	1	0 (0.0%)	0 (0.0%)		
		Monthly	2	0 (0.0%)	0 (0.0%)		
		Weekly	3	0 (0.0%)	0 (0.0%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
6	How often during the last year have you needed a drink first thing in the morning to get yourself going after a heavy drinking session? (n = 494)	Never	0	250 (100%)	244 (100%)	-	-
		Less than monthly	1	0 (0.0%)	0 (0.0%)		
		Monthly	2	0 (0.0%)	0 (0.0%)		
		Weekly	3	0 (0.0%)	0 (0.0%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		

Table 7: (*Continued*)

Questions		Response	Score	Brief intervention group	Non-brief intervention group	χ^2	*p*-value
7	How often during the last year have you had a feeling of guilt or remorse after drinking? (n = 494)	Never	0	247 (98.8%)	244 (100%)	2.946	0.086
		Less than monthly	1	3 (1.2%)	0 (0.0%)		
		Monthly	2	0 (0.0%)	0 (0.0%)		
		Weekly	3	0 (0.0%)	0 (0.0%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
8	How often during the last year have you been unable to remember what happened the night before you had been drinking? (n = 494)	Never	0	250 (100%)	244 (100%)	-	-
		Less than monthly	1	0 (0.0%)	0 (0.0%)		
		Monthly	2	0 (0.0%)	0 (0.0%)		
		Weekly	3	0 (0.0%)	0 (0.0%)		
		Daily or almost daily	4	0 (0.0%)	0 (0.0%)		
9	Have you or someone else been injured as a result of your drinking? (n = 494)	No	0	250 (100%)	244 (100%)	-	-
		Yes, but not in the last year	1	0 (0.0%)	0 (0.0%)		
		Yes, during last year	2	0 (0.0%)	0 (0.0%)		
10	Has a relative, friend, doctor or health worker been concerned about your drinking/suggested you cut down? (n = 494)	No	0	249 (99.6%)	244 (100%)	0.978	0.323
		Yes, but not in last year	1	1 (0.4%)	0 (0.0%)		
		Yes, during last year	2	0 (0.0%)	0 (0.0%)		
Mean total score (S.D.)				0.78 (1.324)	0.70 (1.277)	$t = -0.643$	0.520

AUDIT, Alcohol Use Disorders Identification Test.

Table 8. *Multi-variable analysis of AUDIT score following intervention*

Variables	β	S.E.	t	p-value
Age	0.029	0.009	3.226	0.001
Non-Irish nationality	−0.256	0.120	−2.138	0.033
Education	−0.022	0.038	−0.591	0.555
Employment	0.005	0.104	0.050	0.960
Gestation	−0.018	0.014	−1.302	0.194
AUDIT score (time 2)	0.420	0.034	12.227	<0.001
Group	0.098	0.104	0.941	0.347
Constant	0.055	0.457	0.122	0.903

AUDIT, Alcohol Use Disorders Identification Test.
This is a multi-variable linear regression analysis with AUDIT score at time 3 as the dependent variable. Adjusted $R^2 = 0.264$.

Table 9. *Multi-variable analysis of change in AUDIT score following intervention*

Variables	β	S.D.	t	p-value
Age	−0.029	0.009	−3.226	0.001
Non-Irish nationality	0.256	0.120	2.138	0.033
Education	0.022	0.038	0.591	0.555
Employment	−0.005	0.104	−0.050	0.960
Gestation	0.018	0.014	1.302	0.194
AUDIT score (time 2)	0.580	0.034	16.874	<0.001
Group	−0.098	0.104	−0.941	0.347
Constant	−0.055	0.457	−0.122	0.903

AUDIT, Alcohol Use Disorders Identification Test.
This is a multi-variable linear regression analysis with change in AUDIT score between time 2 and time 3 as the dependent variable. Adjusted $R^2 = 0.380$.

engaged in binge drinking. The brief intervention was delivered immediately following AUDIT assessment at time 2.

AUDIT scores at follow-up (time 3, post-intervention)

One hundred and fifty-nine women (24.2%) did not participate post-intervention (time 3) as they were not identified at an antenatal clinic after 32 weeks gestation. Since their first antenatal visit, the majority of women for whom information was available ($n = 499$) had not attended any agency for help because of their alcohol consumption (97.8%), and small proportions had attended their general practitioner (0.4%), an alcohol counsellor (0.2%) or some other agency (1.6%). These proportions did not differ between the brief intervention and control groups (overall χ^2 1.5, $p = 0.672$).

Of those who did participate ($n = 497$) at time 3 (at ~32 weeks gestation), 296 women (59.6%) had ceased consuming alcohol since becoming pregnant; 43 women (8.6%) had reduced consumption; 77 (15.5%) had not changed their level of consumption; and 81 (16.3%) had increased consumption. These proportions did not differ between the brief intervention and control groups (overall χ^2 1.9, $p = 0.601$). Participants in the two groups did not differ in terms of AUDIT score regarding their alcohol consumption post-intervention (time 3); mean score in those who had received the brief intervention was 0.8 (standard deviation 1.3) and mean score in the control group was 0.7 (standard deviation 1.3) ($t = -0.6$, $p = 0.520$) (Table 7).

Multi-variable analyses

Higher AUDIT scores at time 3 (i.e. post-intervention, towards the end of pregnancy) were significantly associated with increasing age, Irish nationality and higher AUDIT scores at time 2, but were not associated with whether or not the woman had received the brief intervention (Table 8). This model accounted for 26.4% of the variance in time 3 AUDIT score between participants

Larger changes in AUDIT score between time 2 and time 3 were significantly associated with younger age, non-Irish nationality and higher AUDIT scores at time 2, but were not associated with whether or not the woman had received the brief intervention (Table 9). This model accounted for 38.0% of the variance in change in AUDIT score between times 2 and 3.

Discussion

Summary

Before pregnancy, 57% of women consumed five or more units of alcohol per drinking occasion (i.e. binge drinking); during pregnancy, the rate of binge drinking fell to 4.8%. Sixty per cent of women who drank before pregnancy ceased drinking when pregnant, and a further 9% reduced their intake substantially. The brief intervention examined in this study did not produce any significant reduction in alcohol consumption above that attributable to pregnancy and screening in antenatal care. Larger reductions in alcohol intake during pregnancy were associated with younger age and non-Irish nationality. The more alcohol a woman drank before her first antenatal clinic visit, the greater the reduction when pregnant but, notwithstanding this reduction, the greater her level of drinking while pregnant also.

Strengths

The strengths of this study include the large sample size ($n = 656$); the setting in a large, academic teaching

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hospital in Dublin's inner-city; the use of a reliable, well-validated instrument (AUDIT) (Saunders *et al.* 1993) that is increasingly used to assess alcohol consumption in pregnancy (Nilsen 2009); the use of a single rater (A.G.) for all participants at all time-points, thus eliminating inter-rater variability; the high follow-up rate between times 2 and 3 (75.8%); and the naturalistic sampling technique which optimises the study's applicability to 'real-life' ante-natal clinic populations.

Limitations

Limitations of this study include the fact that allocation to brief intervention or control groups was arbitrary rather than random. Allocation was, however, influenced by a range of unpredictable factors at each antenatal clinic including the number and throughput of patients, the absence of individual appointment times and random interruptions (e.g. women being called from the waiting room for investigations, women failing to attend, etc.); these unpredictable factors contributed to allocation bias and probably account for the difference in numbers between the treatment and control groups as well as the difference in age and stage of gestation.

In such a hectic environment, the brief intervention used could have been fortified by the addition of written material for those women who continued to drink in pregnancy. Furthermore, those women who continued to binge drink could benefit from a specific follow-up appointment to explore their alcohol use further and devise ways of addressing it.

Data on alcohol consumption were based on retrospective, self-reporting, rather than objective measures (e.g. blood alcohol level) or collateral reports, raising the possibility of information bias; this is, however, a recurring issue in the literature on alcohol consumption, especially in pregnancy (Sommers *et al.* 2002; Chang *et al.* 2005). This limitation is also, to a certain extent, inevitable: the assessment of alcohol intake before pregnancy requires the woman to be pregnant and is highly likely, therefore, to be retrospective. Nonetheless, alcohol intake in pregnancy is often an emotive issue and recall bias may affect self-reported consumption; our study addresses this issue, at least in part, by comparing self-reported consumption at three time-points, so that even if recall bias is present it may be equally present at all three time-points and should have minimal effect on *comparisons* over time.

Alcohol consumption before pregnancy

We found that, before pregnancy, 57% of women consumed five or more units of alcohol per drinking occasion; this represents binge drinking, according to WHO criteria (WHO 2004). Existing data relating to Ireland indicate that 21% of adult females consume more than the recommended weekly limits for sensible alcohol consumption (Department of Health & Children 2000; Ramstedt and Hope 2005). Ireland has, however, notably high rates of binge drinking compared with other European countries: existing data indicate that 58% of drinking occasions among men and 30% among women end up in binge drinking (Department of Health & Children 2004). Our study indicates that rates of binge drinking among women may now match those among men, as we found that 57% of women consumed five or more units of alcohol per drinking occasion, before becoming pregnant.

Alcohol consumption during pregnancy

We found that 60% of women who drink alcohol before becoming pregnant cease drinking alcohol when pregnant, and a further 9% reduce their intake substantially. This is consistent with the international literature, which associates confirmation of pregnancy with significant reductions in alcohol consumption (Zammit *et al.* 2008). More specifically, Mehta *et al.* (2009) reported that 79% of women who drank alcohol before pregnancy ceased drinking when pregnant. In the Irish context, Barry *et al.* (2007), in a study based on case-records, suggested that 81% of women stopped or decreased alcohol intake as a consequence of becoming pregnant.

The present study adds to this literature by confirming, in an Irish context, that pregnancy is associated with a dramatic decrease in alcohol intake. In addition, we followed up participants in person throughout their pregnancy and performed a final assessment of alcohol intake towards the end of pregnancy (at ~32 weeks of gestation). Our findings confirm that the positive changes associated with pregnancy are maintained throughout the pregnancy.

The present study also demonstrates that the positive effects of pregnancy are not limited to light or moderate drinkers: we found that, in the 12 months before pregnancy, 57% of women engaged in binge drinking, but after becoming pregnant only 4.8% of women engaged in binge drinking. In light of Ireland's particular problem with binge drinking (Department of Health & Children 2004), this finding suggests that pregnancy is an especially valuable opportunity to intervene with this group of women.

Brief intervention

We found that the brief intervention provided in this study did not produce any significant reduction in alcohol consumption above that attributable to pregnancy and comprehensive assessment in antenatal care. This is consistent with the majority of studies of brief

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interventions in pregnancy, which demonstrate no statistically significant effect (Handmaker *et al.* 1999; Chang *et al.* 1999, 2005). With regard to potential reasons for the lack of difference between the two groups, the main reason seems to be that women had already changed their alcohol use before the brief intervention. Of the 57% who reported binge drinking before pregnancy, just 4.8% continued to binge drink when assessed at their first antenatal visit and 53% of the entire sample had become abstinent. Had these results followed the brief intervention, then the findings would have been quite phenomenal as only small to medium effect sizes are most often associated with studies of brief interventions. Furthermore, the finding that there was no significant difference between AUDIT scores at time 2 and time 3 suggests that an assessment reactivity effect did not take place.

O'Connor and Whaley (2007), by contrast, found that a brief intervention did produce a reduction in drinking over and above that attributable to pregnancy alone, but their brief intervention, in contrast to ours, was delivered repeatedly at repeated clinic visits, possibly producing a cumulative effect absent in other studies. Given the diversity of settings, samples and specific interventions it is difficult to compare studies directly. Notwithstanding these methodological pluralities, however, our study demonstrates that a single, brief intervention aimed at reducing alcohol consumption in pregnancy does not produce additional benefit over and above that produced by pregnancy and comprehensive antenatal assessment.

Predictors of reductions in alcohol intake during pregnancy

We found that larger reductions in alcohol intake during pregnancy are associated with (a) younger age; (b) non-Irish nationality, and (c) higher levels of drinking before first antenatal clinic visit.

(a) Regarding the relationship between alcohol consumption in pregnancy and age, the Centres for Disease Control and Prevention (CDC), in a study of alcohol use among women of child-bearing age in the United States, found that drinking during pregnancy was associated with older age (CDC 2002). This was confirmed by Zammit *et al.* (2008) in an Australian population and is again confirmed by the present study in an Irish setting: we found that older age is associated with higher levels of drinking during pregnancy. Drinking habits possibly become more entrenched with age and hence are less amenable to change. Furthermore, older women are more likely to be multiparous and may have drunk alcohol on a previous pregnancy without any clear adverse effect. In contrast, younger age was associated with greater reduction in alcohol consumption. The relationship between younger age and greater reductions in alcohol intake highlights the particular usefulness of intervening in this age group, which appears especially amenable to positive change during pregnancy.

(b) The relationship we detected between nationality and drinking pattern is consistent with the broader literature, which demonstrates that overall patterns of alcohol consumption differ between cultures and countries (Crome 1997), and that patterns of alcohol consumption in pregnancy also differ between cultures and countries (Crome 1997; Nilsen 2009). Our study confirms this finding in an Irish setting, by highlighting the significance of nationality in higher AUDIT scores at time 3 – associated with Irish nationality – and in assessing the likelihood of reductions in alcohol consumption during pregnancy – associated with non-Irish nationality.

The linkage of high AUDIT score at time 3 is consistent with the findings of Carew *et al.* (2009) who reported that Ireland has one of the highest levels of alcohol consumption in Europe.

The finding in relation to non-Irish nationality is important given the increased rates of inward migration into Ireland in the recent past: while Ireland has traditionally had a strong history of outward migration, between 1995 and 2000, 250 000 persons migrated *into* Ireland, and as a result the aggregate figure for immigrants over this 5-year period represented 7% of the entire population (MacÉinrí 2001). Today, Ireland's population includes individuals from 188 different countries, constituting 10% of the overall population (Donnelly *et al.* 2008). Our study highlights one of the relatively neglected public health dimensions of this change: the significance of nationality in determining likely reductions in alcohol consumption during pregnancy. Our results highlight the greater likelihood that women of non-Irish nationality who drink alcohol before pregnancy will demonstrate a larger reduction in alcohol consumption during pregnancy.

(c) We found that pre-pregnancy drinking is a significant predictor of both reduction in alcohol intake during pregnancy and level of alcohol intake towards the end of pregnancy; that is the more alcohol a woman drank before her first antenatal clinic visit, the greater the reduction when pregnant but, notwithstanding this reduction, the greater her level of drinking while pregnant also. This is consistent with the international literature, which demonstrates that pre-pregnancy drinking is a strong predictor of drinking during pregnancy (Gladstone *et al.* 1997; Goransson *et al.* 2003; Naimi *et al.* 2003; Chang *et al.* 2006; Central Statistics Office 2009; Harrison and Sidebottom 2009; Skagerstrom *et al.* 2011). Our study, however, adds to this literature by demonstrating that, notwithstanding relatively high

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levels of drinking before and towards the end of pregnancy, this group is not entirely resistant to change: we found that the higher the level of drinking before pregnancy, the greater the reduction during pregnancy. This suggests that this population is not utterly resistant to change. Indeed, pregnancy may represent a unique opportunity to develop strategies to help this group of relatively heavy drinkers reduce consumption and, hopefully, maintain safer levels of alcohol intake following pregnancy.

Conclusions

More than one in two women who consume alcohol before pregnancy engages in binge drinking. Pregnancy, however, produces large reductions in alcohol consumption, even among women who drink relatively heavily. Future interventions could usefully take account of the factors associated with the greatest decreases in alcohol consumption during pregnancy identified in this study; that is younger age, non-Irish nationality and level of drinking before first antenatal clinic visit.

Overall, the literature to date, including the present study, suggests that brief interventions aimed at reducing alcohol consumption in pregnancy do not reduce alcohol intake over and above the reductions attributable to pregnancy and comprehensive screening in antenatal care. This highlights the usefulness of comprehensive screening in antenatal care and emphasises the importance of doctors and midwives discussing alcohol with pregnant women. However, screening followed by a brief intervention would not be indicated if applied universally.

Future initiatives in this area might usefully shift the focus from brief interventions during pregnancy and increase the focus on the period following pregnancy; that is focus on maintaining the reductions in alcohol intake attributable to pregnancy itself after the birth of the baby. Our study emphasises the importance of this strategy by demonstrating an especially dramatic reduction in binge drinking among women as a result of pregnancy: in our study, the rate of binge drinking fell from 57% before pregnancy to 4.8% during pregnancy. Future research could usefully focus on interventions among those who continue to binge drink during pregnancy. Given Ireland's particular problem with binge drinking, if this reduction in binge drinking among women was maintained after pregnancy, the public health benefits for Ireland would be substantial.

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