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# Alcohol Use During Pregnancy: An Application of the Theory of Planned Behavior[1]

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The objective of this research was to apply the theory of planned behavior (TPB; Ajzen, 1988, 1991) to alcohol use during pregnancy. Of the pregnant women ($N = 130$) who participated in the study, over one third reported consuming alcohol (34.8%), and the greatest proportion were drinking 2 to 4 times per month (16.4%). Binary logistic regression was conducted, and the full TPB model was able to distinguish between drinkers and abstainers, explaining 57.1% to 77.1% of the variance in drinking behavior. The TPB provides insight into reasons behind the behavior and can be usefully applied, both as a screening tool to identify pregnant women drinking during pregnancy and as an avenue for intervention work.

Alcohol use during pregnancy has been associated with negative outcomes, both for the neonate and for the older child. Alcohol use during pregnancy has an impact on birth outcomes, such as birth weight (Mariscal et al., 2006) and gestational age at birth (Lundsberg, Bracken & Saftlas, 1997). Alcohol use during pregnancy is also related to adverse outcomes in older children, including hyperactivity in 4-year-olds (Streissguth, Barr, Sampson, Darby, & Martin, 1989), adverse behavioral outcomes at age 6 (Sood et al., 2001), and poorer performance on phonological processing and arithmetic tasks in 14-year-olds (Streissguth et al., 1994).

Despite these potential adverse outcomes, studies have suggested that significant numbers of pregnant women continue to drink alcohol past pregnancy recognition. Recent prevalence estimates in developed countries vary widely from 4% to almost 60% of pregnant women drinking some alcohol (Colvin, Payne, Parsons, Kurinczuk, & Bower, 2007; Dunnagan, Haynes, Linkenbach, & Summers, 2007). Retrospective reporting of alcohol use during pregnancy suggested that between 25% to 50% of Scottish women and

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54% of UK women drank alcohol to some extent (Anderson et al., 2007; Bolling, Grant, Hamlyn, & Thornton, 2007). Alcohol use prior to recognition of pregnancy is also widespread. According to Floyd, Decoufle, and Hungerford (1999) about half of all pregnant drinkers in their study drank alcohol in the 3 months before finding out that they were pregnant.

Over recent months and years, pregnant women have received mixed messages from the UK government, health agencies and the British media. Department of Health (2007) guidelines stated that

> As a general rule, pregnant women or women trying to conceive should avoid drinking alcohol. If they choose to drink, they should drink no more than one or two units of alcohol once or twice a week and should not get drunk. (p. 14)

This was a change to the recommendations previously given by the Department of Health (2006), which advised pregnant women to drink no more than 2 to 3 units of alcohol once or twice a week. The National Institute of Clinical Excellence's (NICE, 2008) guidelines stated that health professionals should advise "women planning a pregnancy to avoid alcohol in the first 3 months, if possible" (p. 24). In apparent contrast to this advice, a recent study (Kelly et al., 2009), which was covered widely by the media, reported that children who were exposed to light alcohol use during pregnancy were less likely to score above cut-offs for a number of behavioral and cognitive assessments than were children who were born to abstinent mothers.

As a result of the potentially high rates of alcohol use during pregnancy, research has tried to explain alcohol use during pregnancy by looking at characteristics associated with the behavior. A number of risk factors have been identified, including race, marital status, socioeconomic status, parity, age, being a smoker, and previous drinking behavior (Hanna, Faden, & Dufour, 1994; Nilsen, Holmqvist, Hultgren, Bendtsen, & Cedegren, 2008; Palma et al., 2007; Stewart & Streiner, 1994; Yamamoto et al., 2008). Applying a social cognition model could identify risk factors that are potentially more malleable and, therefore, useful for informing intervention work in this area. Applying a social cognition model could also provide a method of identifying women who are in need of extra help to reduce their alcohol use. The theory of planned behavior (TPB; Ajzen, 1988, 1991) is one such model and has been applied successfully to predicting drinking behavior in non-pregnant samples.

The TPB was developed as an extension of the theory of reasoned action (TRA; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The TRA suggests that volitional behavior is determined by a person's intention to engage in the behavior. It proposes that intention, in turn, is determined by individuals'

attitudes toward the behavior, and their beliefs about what others do and what is expected of them (i.e., subjective norm).

The TPB extended the model beyond purely volitional behaviors to include a role for an individual's beliefs about the ease or difficulty of performing the behavior (i.e., perceived behavioral control [PBC]). The TPB predicts that a person's PBC will have a direct influence on his or her intention and actual behavior. Under this framework, the more favorable the individual's attitudes and subjective norm, and the greater the PBC, the greater will be the individual's intention to engage in a specific behavior. Greater intention to engage in a behavior will, subsequently, mean a greater likelihood of the individual adopting the behavior.

The model has considerable empirical support (e.g., Armitage & Conner, 2001; Godin & Kok, 1996). Armitage and Conner conducted a meta-analysis of 185 studies applying the TPB to a range of behaviors. TPB variables accounted for 39% of the variance in intention and 27% of the variance in behavior. The model is even more effective when applied to health behaviors. Godin and Kok conducted a review of 56 studies applying the TPB to 87 different health behaviors. The TPB was able to account for about 41% and 34%, respectively, of the variance in intentions and future behavior.

A number of studies have used the TPB to predict and explain alcohol use, mainly in student populations. TPB variables explained 16.7% to 76.0% of the variance in intention to drink alcohol (Marcoux & Shope, 1997; McMillan & Conner, 2003) and 17.0% to 73.4% of the variance in drinking behavior (Armitage, Conner, Loach, & Willets, 1999; Huchting, Lac, & LaBrie, 2008).

Most studies examining the TPB applied to alcohol use have investigated participants' usual drinking patterns. However, pregnant women are likely to have made some changes to drinking patterns and may be attempting to limit their use (Giglia & Binns, 2007). A small number of studies have examined the TPB's utility with regard to limiting or reducing drinking. Murgraff, McDermott, and Walsh (2001) examined females' adherence to low-risk, single-occasion drinking guidelines. Attitude, subjective norm, and PBC explained 17% of the variance in participants' adherence to the guidelines. Cooke, Sniehotta, and Schüz (2007) also examined the model's effectiveness in predicting participants' reduction in binge-drinking behavior. Cooke et al. used an extended TPB that included a measure of anticipated regret and descriptive norms. This accounted for 58% of the variance in participants' intentions to limit their drinking. TPB variables explained 37% of the variance in participants' drinking behavior. When a measure of past behavior was added to the model, this increased to 43%.

Numerous studies have investigated alcohol use during pregnancy. However, the present study includes application of the TPB to alcohol use during pregnancy. Although there is evidence to suggest that the TPB is

effective in predicting alcohol use in nonpregnant populations, a more specific test of the model is required to determine its utility in the context of alcohol use and pregnancy.

Conner and Sparks (2005) argued that in TPB studies, "General attitudes should predict general classes of behaviors, and specific attitudes should predict specific behaviors" (p. 171). Therefore, a questionnaire based solely on alcohol use is unlikely to be appropriate for a pregnant population. Pregnant women are likely to hold specific attitudes regarding alcohol use during pregnancy that may be very different from their general attitudes toward alcohol use.

Given the potentially high rates of alcohol use in pregnancy, the main aims of this study are to apply the TPB to alcohol use during pregnancy in order to explain why some women continue to drink, and to test a TPB questionnaire in identifying pregnant drinkers. Further aims are to obtain an estimate of the numbers of pregnant women in Aberdeenshire who drink alcohol during pregnancy, and to identify potential targets for future intervention work.

## Method

### *Participants*

We gave questionnaires to 205 pregnant women who were attending their 20-week scan in the Aberdeenshire area, of which 130 were returned (return rate = 63.4%). Of the 130 women, 51.6% lived in the city of Aberdeen and 46.6% lived in the surrounding area. The participants were mainly White (54.6%), while 3.1% were Black, 1.5% were Middle Eastern, 1.5% were Asian, and 0.8% were South American. A large proportion of participants (38.5%) gave their nationality, rather than their ethnic origin, and the majority of these participants described themselves as British (76.0%). The participants' mean age was 29.6 years ($SD = 5.11$). Participants had a mean of 15.0 years of education ($SD = 2.6$), and 75.4% were employed. The majority of the sample were married (64.6%) or living with a partner (30.0%), and 63.1% were primigravidas.

Participants who reported that they did not consume alcohol before becoming pregnant ($n = 13$) were removed from analyses so that analysis was carried out only on participants who had the opportunity to change their behavior during their pregnancy. One participant reported that she did not consume any alcohol before becoming pregnant, but had been consuming alcohol since; this participant was also excluded from the analysis. Therefore, analysis was carried out on 116 participants. The research was approved by

the Grampian NHS Research Ethics Committee and was conducted according to the British Psychological Society's code of conduct.

### *Design and Procedure*

The questionnaire was piloted with a small number ($n = 7$) of pregnant or recently pregnant women to identify any items needing revision. Small changes were made to the questionnaire as a result of this pilot testing.

A postal self-report questionnaire design was employed. Questionnaires were distributed at two centres in Aberdeenshire (Aberdeen Maternity Hospital and Kincardine Community Hospital, Stonehaven). Participants were approached while waiting for their antenatal scan. The researcher explained the purpose of the study, participants were asked to sign a consent form, and then they were given a questionnaire pack. The questionnaire packet included demographic questions, questions relating to alcohol use prior to and during pregnancy, and a questionnaire based on TPB variables. A 2-week deadline was set for return of the questionnaires. Participants who had not returned their questionnaires within this time frame were sent a reminder letter.

### *Measures*

Demographic questions included items relating to age, relationship status, number of children, level of education, employment status, and ethnic origin. Past and present alcohol use was determined with eight items based on consumption questions[3] from the Alcohol Use Disorders Identification Test (AUDIT), an alcohol screening tool that was developed by a World Health Organization study group (Saunders, Aasland, Babor, de la Fuente & Grant, 1993). The AUDIT is a reliable and valid screening instrument to identify at-risk drinkers within primary care and prenatal and antenatal settings (Scottish Intercollegiate Guidelines Network, 2004).

The TPB variables were measured with a 14-item questionnaire using 5-point response scales based on recommendations established by Francis et al. (2004). The questionnaire contains four subscales investigating participants' intention to engage in the behavior (3 items; i.e., drinking alcohol while pregnant), their attitude toward the behavior (4 items), their beliefs about the subjective norm (3 items; i.e., what they believe other people want them to do), and their PBC (4 items; i.e., the degree to which they can control

[3]For more information or to obtain copies of the questionnaire, please contact the first author.

the behavior). The items consist of statements about alcohol use during pregnancy, and participants are asked to rate how strongly they agree or disagree with each. Items were recoded so that high scores consistently reflected stronger agreement, and mean scores were calculated for each of the four subscales. The TPB questionnaire had acceptable reliability (Cronbach's $\alpha = .74$).

### *Data Analysis*

We used Mann-Whitney U tests to investigate differences between drinkers and abstainers on TPB subscales. Binary logistic regression was conducted to examine the effectiveness of the TPB in explaining drinking behavior and intention to drink during pregnancy. An alpha level of .05 was used for all analyses. Power calculations were conducted using Study Size 2.0, which confirmed that the sample size was sufficient for the analyses.

## Results

### *Frequency of Alcohol Use Reported by Sample*

Most participants (87.9%) reported that they had made changes to their drinking habits during their current pregnancy, and the mean gestation at which the changes were made was 5.18 weeks ($SD = 2.09$; range = 0–10 weeks). Before becoming pregnant, most of the participants who drank alcohol prior to pregnancy were drinking two to four times per month (36.2%) or two or three times per week (35.3%), but the percentages of participants drinking at these frequencies during pregnancy dropped to 16.4% and 2.6%, respectively. Most participants first saw their midwife at an average of 8.75 weeks' gestation ($SD = 1.86$; range = 5–16 weeks). Although the majority of participants reported receiving advice from health professionals about drinking during pregnancy, a proportion of participants (12.9%) reported receiving none.

There were 75 participants (64.7%) who reported abstaining from alcohol completely, 40 (34.5%) reported drinking alcohol to some level, and 1 participant (0.9%) did not answer the question. The drinking group's alcohol consumption is presented in Figure 1.

The largest proportion of participants (47.4%) were drinking one or two units of alcohol around two to four times per month. A small number were drinking more units than the maximum levels recommended for pregnant women (7.8% drinking 3–4 units each time; 5.6% drinking on 2–3 days per week).

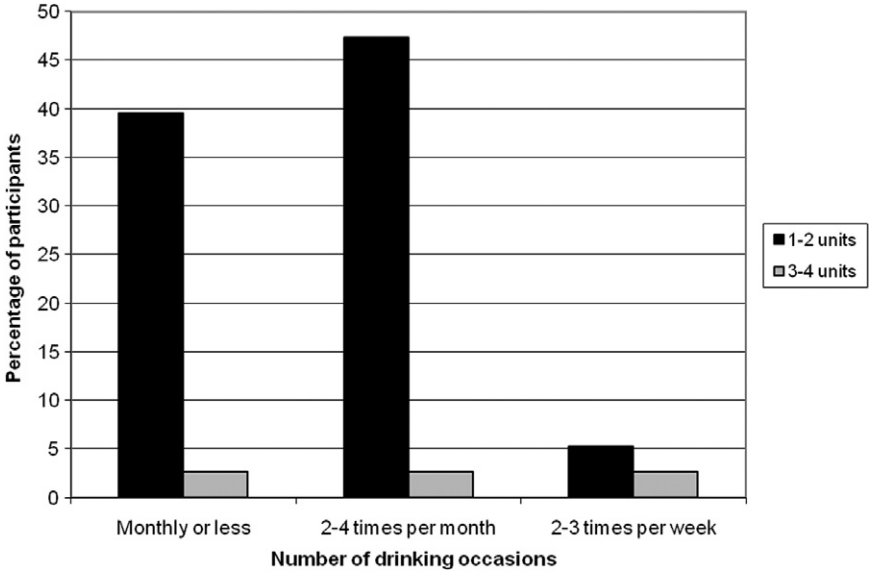


*Figure 1.* Number of drinking occasions and units typically consumed in one occasion.

Participants were asked to report the highest number of units consumed in one occasion both before and after being aware of the pregnancy. Over half of participants (55.5%) had drunk at levels that exceed the guidelines for nonpregnant women; that is, two to three units in one occasion (Department of Health, 2008) during their current pregnancy.

### *Theory of Planned Behavior Constructs*

Three constructs of the TPB were found to be non-normally distributed. Therefore, we performed Mann-Whitney U tests to investigate differences between drinkers and abstainers. Means, standard deviations, and $z$ scores for each TPB construct are displayed in Table 1.

Statistically significantly differences were found. Abstainers had higher scores ($Mdn = 5.00$) on the intention scale than did drinkers ($Mdn = 3.00$; $Z = -7.18$, $p < .05$; $r = .71$). Abstainers also had higher scores ($Mdn = 5.00$) on the subjective norm scale than did the drinkers ($Mdn = 4.00$; $Z = -4.53$, $p < .05$; $r = .45$). Higher scores on the intention scale suggest greater intention to quit drinking during pregnancy, while higher scores on the subjective norm scale indicate greater perceived pressure from significant others to quit drinking.

Table 1

*Means for TPB Constructs for Drinking Behavior*

| | Abstainers | | Drinkers | | |
|---|---|---|---|---|---|
| TPB construct | *M* | *SD* | *M* | *SD* | *Z* score |
| Intention | 4.65 | 0.72 | 3.07 | 0.93 | −7.18 * |
| Attitude | 1.62 | 0.80 | 3.07 | 0.65 | −6.82 * |
| Subjective norm | 4.44 | 0.93 | 3.72 | 0.81 | −4.53* |
| PBC | 4.57 | 0.55 | 4.45 | 0.51 | −1.50 |

*Note.* TPB = theory of planned behavior; PBC = perceived behavioral control.
*$p < .05$.

A statistically significant difference was also found on the attitude scale ($Z = -6.82$, $p < .05$; $r = .73$), with abstainers ($Mdn = 1.00$) scoring lower than drinkers ($Mdn = 3.00$). Lower scores on the attitude scale indicate a less positive attitude toward drinking during pregnancy. The PBC scale did not show any significant differences between drinkers and abstainers ($Z = -1.50$, $p > .05$). The PBC scale measures strength of participants' perceived self-efficacy for stopping drinking, with higher scores indicating greater sense of control over drinking.

We conducted correlation analyses to examine the relationship between TPB variables and intention (to drink alcohol during pregnancy). Attitude ($r_s = -.76$) and subjective norm ($r_s = .51$) variables were strongly correlated with intention ($p < .01$), and a small positive correlation existed between PBC and intention ($r_s = .23$, $p < .05$).

Binary logistic regression analysis was conducted to examine the utility of the TPB in predicting intention to drink alcohol during pregnancy. The TPB as a whole was able to explain 59.3% of the variance in intention to drink during pregnancy (adjusted $R^2$), with attitude and subjective norm variables providing statistically significant contributions to the model.

Binary logistic regression was performed to assess the effectiveness of the TPB in predicting and explaining behavior (alcohol use during pregnancy). The full model containing all TPB constructs was statistically significant, $\chi^2(4, N = 86) = 71.84$, $p < .001$, indicating that the TPB can distinguish between drinkers and abstainers. The TPB as a whole explained between 57.1% (Cox & Snell's $R^2$) and 77.1% (Nagelkerke's $R^2$) of the variance in drinking status, and correctly classified 91.8% of cases.

Table 2

*Binary Logistic Regression Analysis Predicting Intention and Behavior*

| Predictor | $R^2$ | $\Delta R^2$ | Cox & Snell's $R^2$ | Nagelkerke's $R^2$ | *B* | *SE B* | β |
|---|---|---|---|---|---|---|---|
| Prediction of intention | .61*** | .59*** | | | | | |
| Attitude | | | | | –0.70 | 0.09 | –0.66** |
| Subjective norm | | | | | 0.25 | 0.09 | 0.21** |
| PBC | | | | | 0.05 | 0.15 | 0.02 |
| Prediction of behavior | | | .57*** | .77*** | | | |
| Intention | | | | | –2.60 | 0.79 | 0.07** |
| Attitude | | | | | 1.16 | 0.54 | 3.19* |
| Subjective norm | | | | | 0.75 | 0.84 | 2.12 |
| PBC | | | | | –0.60 | 0.87 | 0.55 |

*Note.* PBC = perceived behavioral control.
*$p < .05$. **$p < .01$. ***$p < .001$.

As shown in Table 2, only the intention and attitude subscales made a unique statistically significant contribution to the regression model. The strongest predictor of drinking during pregnancy was intention to abstain, with an inverted-odds ratio of 13.51 (95% confidence interval = 2.84–62.5, $p < .01$). This indicates that for each 1 point drop in the intention to abstain score, the odds of drinking during pregnancy increases by a factor of 13.51. The model had a positive predictive value of 93.6%.

## Discussion

The main aim of the study was to investigate the utility of the TPB in identifying women who drink alcohol during pregnancy. Significant differences were found between abstainers and alcohol drinkers for the intention, subjective norm, and attitude subscales of the TPB. Women who drank alcohol during pregnancy had lower scores on the intention subscale, indicating a weaker intention to quit drinking during pregnancy. They also

scored lower on the subjective norm scale, suggesting that they were less likely to rate significant others as wanting them to abstain from drinking during pregnancy. Drinkers also scored higher on the attitude scale, suggesting that they had more positive attitudes toward drinking during pregnancy than did the abstainers. The effect sizes for the differences between alcohol drinkers and abstainers on the intention and attitude subscales are considered large, and the differences found for the subjective norm subscale are considered medium (Cohen, 1988). Interestingly, the PBC component of the TPB was not statistically different for the abstainers group and the alcohol drinking group.

The logistic regression analyses also provide support for the application of the TPB to alcohol drinking during pregnancy. The overall model explained 59.3% of the variance in intention to drink and between 57.1% and 77.1% of the variance in drinking behavior during pregnancy. These results are in line with previous research using the TPB to predict alcohol intentions and behavior in nonpregnant samples. Studies have suggested that TPB variables predict 58% to 66% of the variance in binge-drinking intentions and 22% of the variance in binge-drinking behavior at 1-week follow-up (Norman, Armitage, & Quigley, 2007; Norman & Conner, 2006). Moreover, Conner, Warren, Close, and Sparks (1999) reported that the TPB explained between 28% and 40% of the variance in students' intentions to drink and between 12% and 50% of the variability in behavior.

In the current study, the attitude and subjective norm variables added a unique contribution to the prediction of intentions, while intention and attitude variables contributed significantly to the prediction of behavior. The attitude component added the greatest statistically significant contribution to predicting intention and also contributed significantly to predicting behavior, suggesting that this could be an appropriate target for intervention. The PBC did not contribute significantly to the regression model for predicting either intention or behavior. These results are in contrast to other studies examining the TPB applied to alcohol behavior. Other studies (e.g., Conner et al., 1999; Norman et al., 2007; Norman & Conner, 2006) found the PBC component of the TPB to contribute significantly to the prediction of intention to drink alcohol.

Our results suggest that the TPB without the PBC component (i.e., the TRA) is a more appropriate model to use for alcohol during pregnancy. Schlegel, D'Avernas, Zanna, DeCourville, and Manske (1992) compared the explanatory power of the TRA and the TPB in their 12-year longitudinal study of alcohol use. They suggested that the same behavior could vary in terms of actual volitional control; for example, lower level drinking may be more volitional than problem drinking.

Examining our participants' reports of drinking prior to becoming pregnant, it is likely that the majority of participants in our sample do not have a drinking problem. Therefore, it is possible that the participants in our study will have greater PBC than will individuals who have a drinking problem. Schlegel et al. (1992) found that the TRA was progressively less predictive of intentions and behavior as drinking status changed from non-problem drinking to problem drinking. Perhaps for the majority of pregnant women (i.e., non-alcohol dependent), perceptions of control over drinking may be higher than in the general population, possibly because of a greater motivation to limit drinking, and the TRA may prove to be more valuable than the TPB. According to Ajzen and Fishbein (2004), "The relative importance of attitudes, subjective norms, and perceived behavioral control for the prediction of intentions is expected to vary from behavior to behavior and population to population" (p. 431). Perhaps for this specific application to alcohol use during pregnancy, the TRA is a more useful model.

A further aim of the present study was to obtain an estimate of the numbers of pregnant women who drink alcohol during pregnancy. The pattern of alcohol use in pregnant women in Aberdeenshire appears to be relatively high. At 20 weeks, just over one third of our participants (34.5%) reported currently drinking alcohol. This is much higher than the worldwide prevalence figures of reported drinking during pregnancy (15% of American women: Drews, Coles, Floyd, & Falek, 2003; 23% of Norwegian women: Alvik, Heyerdahl, Haldorsen, & Lindemann, 2006; 23% of French women: Kaminski, Lelong, Bean, Chwalow, & Subtil, 1995). The overall figures for alcohol consumption in this study appear to be similar to those found in Sweden by Goransson, Magnusson, Bergman, Rydberg, and Heilig (2003), who reported that 30% of pregnant women continued regular drinking. However, Goransson et al. reported that only 6% of their participants were drinking two to four times per month.

In our study, 16.4% of participants reported drinking two to four times per month, which is over twice the number found drinking at these levels in the Swedish study (Goransson et al., 2003). The prevalence of alcohol use in our sample is similar to that of two surveys in Scotland (Anderson et al., 2007; Bolling et al., 2007). However, it is possible that these numbers are an underestimation of the actual numbers who drink during pregnancy.

Kesmodel and Olsen (2001) compared different methods of data collection and found that self-report questionnaires generated lower levels of alcohol use in pregnant women than did diaries. Therefore, the frequency of alcohol use in our sample may be even higher than that reported by participants. The mean number of the most units consumed by participants on one occasion before realizing they were pregnant was 4.08 units. This exceeds the NHS guidelines (NHS Choices, 2008) for single-occasion drinking for

*nonpregnant* women of two to three units per day. Even after pregnancy recognition, 50.4% of our participants reported having drunk 3.5 units or more in one occasion since becoming pregnant. This means that half of the participants were drinking at levels that are risky for nonpregnant women in the first few weeks of pregnancy. This behavior indicates the wider problem of unhealthy drinking that is apparent in Britain. McMillan and Conner (2003) found that 40.7% of nonpregnant women were exceeding healthy drinking limits (i.e., 1–14 units per week). Furthermore, Murgraff et al. (2001) reported that 73.6% of their sample exceeded low-risk, single-occasion drinking guidelines (i.e., 2 units per day) at least occasionally.

There are a number of potential limitations in the present study that should be noted. First, alcohol use was assessed using self-report measures, which may have influenced the results. Armitage and Conner (2001) found that the TPB was more predictive of self-reported, rather than observable behaviors. Perhaps future studies could obtain estimates of alcohol use from women's partners or from alcohol-use diaries.

The generalizability of this study may also be affected by the sample being taken from only one geographic area. However, the rates of alcohol use reported in this sample are similar to previous studies with a wider geographical spread (Anderson et al., 2007; Bolling et al., 2007). Furthermore, the TPB was used to predict concurrent behavior, which may have produced greater estimates of predictive validity than studies predicting future behavior. However, the focus of the present study was in examining what pregnant women were drinking at one time point, not predicting what they would drink in the future.

One aim of the present study was to assess the appropriateness of the TPB model with a view to its potential clinical use as a questionnaire to distinguish between drinkers and abstainers. Future research to replicate these results could further assess the utility of this questionnaire as a screening tool for use by antenatal care professionals. For this purpose, it is relevant to assess the utility of the TPB in predicting concurrent behavior.

Despite these potential limitations, the results of this study have important implications for antenatal care and health promotion. This study provides an estimate of the numbers of pregnant women who continue to drink during pregnancy in Aberdeenshire. It also suggests that the TPB is a useful tool for exploring the reasons behind this behavior and could be of benefit to antenatal healthcare professionals.

Targeting pregnant women's attitudes toward alcohol use during pregnancy, as well as their perceptions of what other pregnant women drink and what is expected of them, may be an effective avenue for health professionals supporting behavior change. Abraham and Michie (2008) identified three such behavior-change techniques based on TPB/TRA constructs that may be

useful for application to drinking during pregnancy. The first of these—*provide information on consequences*—is defined as giving information about the benefits and costs of action or inaction and focusing on what the outcomes will be for the person. The second behavior-change technique—*provide information about others' approval*—relates to providing information about what other people think about the person's behavior and whether others will approve or disapprove of that behavior. Further research could examine the most important influences on a pregnant woman's behavior.

The final TPB/TRA-related behavior-change technique identified by Abraham and Michie is *prompt intention formation*. This technique encourages the person to decide, act, or make a goal related to the behavior they are attempting to change. Future research is needed to determine whether complex interventions based on these TPB/TRA-related techniques are effective in reducing alcohol consumption and encouraging abstention. This research would also have to address the acceptability of these types of interventions for pregnant drinkers, as any intervention would need to be framed sensitively and framed appropriately for the woman's stage of pregnancy and levels of drinking. Individually tailored, sensitive approaches would be necessary to ensure that potentially harmful guilt or worry was not caused to pregnant women. Developments in TRA/TPB research indicate that perceptions of anticipated regret are an important moderator of the intention–behavior relationship (Conner & Sparks, 2005). It could prove to be an interesting avenue for future research to investigate if the inclusion of such variables would improve the overall predictive power of the model for alcohol use during pregnancy.

## References

Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology*, *27*, 379–387.

Ajzen, I. (1988). *Attitudes, personality, and behavior*. Milton Keynes, UK: Open University Press.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179–211.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice Hall.

Ajzen, I., & Fishbein, M. (2004). Questions raised by a reasoned action approach: Comment on Ogden (2003). *Health Psychology*, *23*, 431–434.

Alvik, A., Heyerdahl, S., Haldorsen, T., & Lindemann, R. (2006). Alcohol use before and after pregnancy: A population-based study. *Acta Obstetricia et Gynecologica Scandinavica*, *85*, 1292–1298.

Anderson, S., Bradshaw, P., Cunningham-Burley, S., Hayes, F., Jamieson, L., MacGregor, A., et al. (2007). *Growing up in Scotland: A study following the lives of Scotland's children*. Edinburgh, Scotland: Scottish Executive.

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behavior: A meta-analytic review. *British Journal of Social Psychology*, *40*, 471–499.

Armitage, C. J., Conner, M., Loach, J., & Willets, D. (1999). Different perceptions of control: Applying an extended theory of planned behavior to legal and illegal drug use. *Basic and Applied Social Psychology*, *21*, 301–316.

Bolling, K., Grant, C., Hamlyn, B., & Thornton, A. (2007). *Infant Feeding Survey, 2005*. Leeds, UK: The Information Centre.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Colvin, L., Payne, J., Parsons, D., Kurinczuk, J. J., & Bower, C. (2007). Alcohol consumption during pregnancy in nonindigenous West Australian women. *Alcoholism: Clinical and Experimental Research*, *31*, 276–284.

Conner, M., & Sparks, P. (2005). Theory of planned behavior and health behavior. In M. Conner & P. Norman (Eds.), *Predicting health behavior* (2nd ed., pp. 170–222). Maidenhead, UK: Open University Press.

Conner, M., Warren, R., Close, S., & Sparks, P. (1999). Alcohol consumption and the theory of planned behavior: An examination of the cognitive mediation of past behavior. *Journal of Applied Social Psychology*, *29*, 1676–1704.

Cooke, R., Sniehotta, F. F., & Schüz, B. (2007). Predicting binge-drinking behavior using an extended TPB: Examining the impact of anticipated regret and descriptive norms. *Alcohol and Alcoholism*, *42*(2), 84–91.

Department of Health. (2006). *The pregnancy book*. London: HMSO.

Department of Health. (2007). *The pregnancy book*. London: HMSO.

Department of Health. (2008). *Alcohol advice*. Retrieved February 23, 2009, from www.dh.gov.uk/en/Publichealth/Healthimprovement/Alcoholmisuse/DH_085385

Drews, C. D., Coles, C. D., Floyd, R. L., & Falek, A. (2003). Prevalence of prenatal drinking assessed at an urban public hospital and a suburban private hospital. *Journal of Maternal and Fetal Neonatal Medicine*, *13*, 85–93.

Dunnagan, T., Haynes, G., Linkenbach, J., & Summers, H. (2007). Support for social norms programming to reduce alcohol consumption in pregnant women. *Addiction Research and Theory*, *15*, 383–396.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior*. New York: Wiley.

Floyd, R. L., Decoufle, P., & Hungerford, D. W. (1999). Alcohol use prior to pregnancy recognition. *American Journal of Preventive Medicine*, *17*, 101–107.

Francis, J. J., Eccles, M. P., Johnstone, M., Walker, A., Grimshaw, J., Foy, R., et al. (2004). *Constructing questionnaires based on the theory of planned behavior: A manual for health services researchers*. Newcastle Upon Tyne, UK: Centre for Health Services Research.

Giglia, R. C., & Binns, C. W. (2007). Patterns of alcohol intake of pregnant and lactating women in Perth, Australia. *Drug and Alcohol Review*, *26*, 493–500.

Godin, G., & Kok, G. (1996). The theory of planned behavior: A review of its applications to health-related behaviors. *American Journal of Health Promotion*, *11*, 87–98.

Goransson, M., Magnusson, Å., Bergman, H., Rydberg, U., & Heilig, M. (2003). Fetus at risk: Prevalence of alcohol consumption during pregnancy estimated with a simple screening method in Swedish antenatal clinics. *Addiction*, *98*, 1513–1520.

Hanna, E. Z., Faden, V. B., & Dufour, M. C. (1994). The motivational correlates of drinking, smoking, and illicit drug use during pregnancy. *Journal of Substance Abuse*, *6*, 155–167.

Huchting, K., Lac, A., & La Brie, J. W. (2008). An application of the theory of planned behavior to sorority alcohol consumption. *Addictive Behaviors*, *33*, 538–551.

Kaminski, M., Lelong, N., Bean, K., Chwalow, J., & Subtil, D. (1995). Change in alcohol, tobacco, and coffee consumption in pregnant women: Evolution between 1988 and 1992 in an area of high consumption. *European Journal of Obstetrics and Gynecology and Reproductive Biology*, *60*, 121–128.

Kelly, Y., Sacker, A., Gary, R., Kelly, J., Wolke, D., & Quigley, M. A. (2009). Light drinking in pregnancy, a risk for behavioral problems and cognitive deficits at 3 years of age? *International Journal of Epidemiology*, *38*, 129–140.

Kesmodel, U., & Olsen, S. F. (2001). Self-reported alcohol intake in pregnancy: Comparison between four methods. *Journal of Epidemiology and Community Health*, *55*, 738–745.

Lundsberg, L. S., Bracken, M. B., & Saftlas, A. F. (1997). Low-to-moderate gestational alcohol use and intrauterine growth retardation, low birthweight, and preterm delivery. *Alcohol Education Policy*, *7*, 498–508.

Marcoux, B. C., & Shope, J. T. (1997). Application of the theory of planned behavior to adolescent use and misuse of alcohol. *Health Education Research*, *12*, 323–331.

Mariscal, M., Palma, S., Llorca, J., Pérez-Iglesias, R., Pardo-Crespo, R., & Delgado-Rodríguez, M. (2006). Pattern of alcohol consumption during pregnancy and risk for low birth weight. *Annals of Epidemiology*, *16*, 432–438.

McMillan, B., & Conner, M. (2003). Using the theory of planned behavior to understand alcohol and tobacco use in students. *Psychology, Health, and Medicine*, *8*, 317–328.

Murgraff, V., McDermott, M. R., & Walsh, J. (2001). Exploring attitude and belief correlates of adhering to the new guidelines for low-risk single occasion drinking: An application of the theory of planned behavior. *Alcohol and Alcoholism*, *36*, 135–140.

National Institute of Clinical Excellence. (2008). *Antenatal care: Routine care for the healthy pregnant woman*. London: Author.

NHS Choices. (2008). *How many units in your drink* (NHS). Retrieved March 5, 2009, from http://units.nhs.uk/howMany.html

Nilsen, P., Holmqvist, M., Hultgren, E., Bendtsen, P., & Cedegren, M. (2008). Alcohol use before and during pregnancy and factors influencing change among Swedish women. *Acta Obstetricia et Gynecologica Scandinavia*, *87*, 768–774.

Norman, P., Armitage, C., & Quigley, C. (2007). The theory of planned behavior and binge drinking: Assessing the impact of binge drinker prototypes. *Addictive Behaviors*, *32*, 1753–1768.

Norman, P., & Conner, M. (2006). The theory of planned behavior and binge drinking: Assessing the moderating role of past behavior within the theory of planned behavior. *British Journal of Health Psychology*, *11*, 55–70.

Palma, S., Pardo-Crespo, R., Mariscal, M., Perez-Iglesias, R., Llorca, J., & Delgado-Rodriguez, M. (2007). Weekday but not weekend alcohol consumption before pregnancy influences alcohol cessation during pregnancy. *European Journal of Public Health*, *17*, 394–399.

Saunders, J. B., Aasland, O. G., Babor, T. F., de la Fuente, J. R., & Grant, M. (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption. *Addiction*, *88*, 791–804.

Schlegel, R. P., D'Avernas, J. R., Zanna, M. P., DeCourville, N. H., & Manske, S. R. (1992). Problem drinking: A problem for the theory of reasoned action? *Journal of Applied Social Psychology*, *22*, 358–385.

Scottish Intercollegiate Guidelines Network. (2004). *The management of harmful drinking and alcohol dependence in primary care: A national clinical guideline* (updated). Edinburgh, Scotland: Author.

Sood, B., Delaney-Black, V., Covington, C., Nordstrom-Klee, B., Ager, J., Templin, T., et al. (2001). Prenatal alcohol exposure and childhood

behavior at age 6 to 7 years: I. Dose-response effect. *Paediatrics*, *108*(2), 34–43.

Stewart, D. E., & Streiner, D. (1994). Alcohol drinking in pregnancy. *General Hospital Psychiatry*, *16*, 406–412.

Streissguth, A. P., Barr, H. M., Carmichael Olsen, H. C., Sampson, P. D., Bookstien, F. L., & Burgess, D. M. (1994). Drinking during pregnancy decreases word attack and arithmetic scores on standardized tests: Adolescent data from a population-based prospective study. *Alcoholism: Clinical and Experimental Research*, *18*, 248–254.

Streissguth, A. P., Barr, H. M., Sampson, P. D., Darby, B. L., & Martin, D. C. (1989). IQ at age four in relation to maternal alcohol use and smoking during pregnancy. *Developmental Psychology*, *25*, 3–11.

Yamamoto, Y., Kanieta, Y., Yokoyama, E., Sone, T., Takemura, S., Suzuki, K., et al. (2008). Alcohol consumption and abstention among pregnant Japanese women. *Journal of Epidemiology*, *18*, 173–182.