UNINTENDED PREGNANCY AND OTHER ASSOCIATED RISK FACTORS FOR PERICONCEPTIONAL BINGE DRINKING: ANALYSIS OF THE 2000 OREGON PRAMS SURVEY

by

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A THESIS

Presented to the Department of Public Health & Preventive Medicine
and the Oregon Health & Sciences University
School of Medicine
in partial fulfillment of
the requirements for the degree of
Masters in Public Health
May 2005

School of Medicine

Oregon Health & Sciences University

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List of Abbreviations

PRAMS	Pregnancy Risk Assessment Monitoring System
CDC	Centers for Disease Control and Prevention
CNS	Central Nervous System
IQ	Intelligence Quotient
SES	Socio-Economic Status
ARND	Alcohol Related Neurodevelopmental Disorders
ARBD	Alcohol Related Birth Defects
FASD	Fetal Alcohol Spectrum Disorder
SIDS	Sudden Infant Death Syndrome
BAL	Blood Alcohol Level
BRFSS	Behavioral Risk Factor Surveillance System
NMIHS	National Maternal and Infant Health Survey
SGA	Small for Gestational Age
NIDA	National Institute on Drug Abuse
NHSDA	National Household Survey on Drug Abuse
CHOICES	Changing High Risk Alcohol Use and Improving Contraceptive Effectiveness Study
NA/AN	Native Americans/Alaskan Natives
DHSHS	Department of Human Services, Health Services
OHSU	Oregon Health and Sciences University
CATI	Computer-Assisted Telephone Interviews

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Acknowledgements

I would very much like to thank my thesis committee for their encouragement and support. Jodi Lapidus, PhD, is an expert teacher of biostatistics, whose enthusiasm and encouragement was invaluable. Sig-Linda Jacobson, MD, MPH, with her incredible insight into the realities of substance abuse in pregnancy, continually enabled me to ground my ideas in reality. And, my mentor and thesis advisor, Kenneth D. Rosenberg, MD, MPH, whose passion for maternal and child health, coupled with his rigorous approach to academics, served to guide my efforts toward achieving my thesis goals.

I would also like to thank everyone in the Department of Public Health and Preventive Medicine at OHSU, especially: Donald Austin, MD, MPH; Thomas M. Becker, MD, PhD; Nichole Carlson, PhD; Dongseok Choi, PhD; Jay D. Kravitz, MD, MPH; Yvonne L. Michael, ScD; William E. Morton, MD, DrPH; Bertha Moseson, MD, MPH; Katherine J. Riley, EdD; John Stull, MD, MPH; and Gail Yamashita. I could not have achieved so much in such a short period of time without all of you.

Finally, I would like to thank my family and my future wife Laura. This thesis would not have been possible were it not for their patience and reassurance.

Abstract

Introduction: Maternal binge drinking early in the first trimester of pregnancy may have a significant effect on fetal development, especially neurological development. Mothers who report binge drinking in the three months prior to pregnancy (the periconceptional period) are at high risk of early first trimester fetal alcohol exposure. Knowledge of modifiable risk factors associated with periconceptional binge drinking may help the development of strategies to prevent fetal alcohol exposure.

Objective: Determine whether maternal pregnancy intention is associated with periconceptional binge drinking in Oregon, and explore other Oregon-specific risk factors for this alcohol consumption pattern during the periconceptional period.

Methods: The Oregon Pregnancy Risk Assessment Monitoring System (PRAMS) surveyed a stratified random sample of postpartum women who delivered a live-born baby in Oregon in 2000 (n = 2100; unweighted response rate = 73.0%). To inquire about periconceptional binge drinking, mothers were asked "During the 3 months before you got pregnant, did you drink 5 or more alcohol drinks at one sitting?" To inquire about pregnancy intention, mothers were asked, "Just before you got pregnant, how did you feel about becoming pregnant?" Pregnancies were classified as unintended if mothers responded "I wanted to be pregnant later" or "I didn't want to be pregnant then or any time in the future." Other potential risk factors, captured by the PRAMS survey or the birth certificate, were analyzed for an association with periconceptional binge drinking. Responses were weighted for oversampling, non-response, and non-coverage.

Results: Of all Oregon PRAMS respondents, 13.6% (weighted) reported binge drinking in the periconceptional period and 39% (weighted) reported unintended pregnancy. Mothers with an unintended pregnancy were more likely to binge drink: crude odds ratio (OR) 2.60, 95% confidence interval (CI) 1.58 - 4.29. Mothers were also more likely to binge drink if they were smokers, nuilliparus, unmarried, educated at least through high school, victims of pre-pregnancy non-partner violence, having difficulty paying their bills, and self-identified as non-Hispanic White or Native American/Alaskan Native. After controlling for these other predictors, women with unintended pregnancy were still more likely to binge drink, adjusted OR 1.93, 95% CI 1.03 - 3.60. Validating

these predictors in the Oregon PRAMS 2001 dataset showed pregnancy intention remained strongly predictive of periconceptional binge drinking (OR 1.71).

Conclusions: The association between unintentional pregnancy and periconceptional binge drinking in 17.5% of new mothers in Oregon is concerning because it indicates a large at-risk group for fetal alcohol exposure. Public health interventions to reduce fetal alcohol exposure need to target women who are not contemplating pregnancy and who are using inadequate contraception. Other strong predictors identified in this study also serve to target prevention efforts in Oregon

Background and Significance

Alcohol Related Birth Defects and Disorders of Infancy and Childhood

Prenatal alcohol exposure is the leading cause of preventable neurodevelopmental disorders and birth defects [1]. Fetal Alcohol Syndrome (FAS) is the most severe alcohol form [2]. The Centers for Disease Control and Prevention (CDC) requires 4 criteria for FAS diagnosis: 1. Three facial malformations: a smooth philtrum, a thin vermillion border, and a small palpebral fissure; 2. Growth deficits of prenatal/postnatal height and/or weight $\leq$ 10 percentile adjusted for mother's age, gestational age, gender, and race/ethnicity; 3. Central nervous system (CNS) or neurobehavioral disorders; and 4. Maternal use of alcohol during pregnancy [3]. Currently, the CDC's National Task force on FAS and Fetal Alcohol Effect is refining the recommendations for diagnosis and referral for FAS [3].

CDC population-based studies have estimated rates of FAS in the United States ranging from 0.3 to 1.5 cases per 1000 live births [1]. Other studies report the occurrence of FAS ranges from 0.6 to 3 births per 1000 in most populations, with some communities having much higher rates [4].

Children exposed to alcohol *in utero* can have significant alcohol related neurodevelopmental disorders (ARND) without the physical effects required for a FAS diagnosis. ARND includes disorders such as: decreased Intelligence Quotient (IQ), increased behavioral difficulties, and poor attention and memory. These disorders may be difficult to link to fetal alcohol exposure because they can manifest late in a child's life.

Other alcohol related birth defects (ARBD) that do not meet diagnostic criteria for FAS, or are separate from FAS, have been described. Specific categories of ARBD include: cardiac, skeletal, renal, ocular, and auditory defects. However, the etiologic specificity of some of these anomalies to alcohol teratogenesis remains uncertain [4].

The term Fetal Alcohol Spectrum Disorder (FASD) encompasses both FAS and the entire range of fetal alcohol effects, including ARND and ARBD. The prevalence of FASD is estimated to be up to 10 times higher than FAS alone [5].

Maternal alcohol during pregnancy has also been associated with other significant outcomes for the course of the pregnancy and the future infant/child. The consequences include: an increased rate of miscarriage, premature delivery, and low birth weight [6-9]. Alcohol exposure during pregnancy also may be linked to an increased rate of SIDS (Sudden Infant Death Syndrome) and child abuse [10, 11].

Timing, Dose, and Pattern of Teratogenic Maternal Alcohol Use

Animal Studies

Animal studies can help to understand how the dose, pattern and timing of alcohol exposure *in utero* relates to human fetal teratogenesis.

Animal studies varying the dose and pattern of alcohol exposure have shown that peak blood alcohol level (BAL) is more relevant to fetal outcome than the dose of alcohol administered. For example, a particular dose administered over 24 hours has significantly fewer fetal effects than the same dose administered in a shorter period of time. In addition, increasing BAL during organogenesis has increasing fetal effects. Exposure to alcohol in the mouse model results in: neural anomalies and low fetal weight at low doses, cardiac and facial anomalies at moderate doses, and embryo-lethality at high doses. This result indicates that binge drinking during pregnancy, which results in high BAL, may be the most damaging to the fetus.

The timing of fetal development can be divided into three periods: the pre-differentiation period, the period of the embryo, and the period of the fetus. The "period of the embryo" occurs after implantation and encompasses most of organogenesis[1]. During this stage the embryo's gross structures are maximally susceptible to teratogens. Malformations in mice embryos exposed to ethanol early in this stage most closely represent the craniofacial and neurological anomalies of human FAS including micrognathia, low-set ears, short philtrum, cleft lip, cleft palate as well as multiple brain defects [13]. Furthermore, exposure to increasing BAL during this stage is dramatically more teratogenic than increasing BAL exposure at later stages [13]. Thus, early

[1] In human fetal development, implantation occurs 6 days after conception and organogenesis occurs up to the eighth week of gestation.

exposure of the human fetus to alcohol, especially binge level alcohol, may also have the most significant affect on development.

In summary, animal studies demonstrate FAS-like malformations occur when the fetus is exposed to high BAL, early after implantation. In addition, animal studies confirm both subtle and overt neurodevelopmental disorders can result from alcohol exposure *in utero* even without dysmorphogenic effects.

Human Epidemiological Studies

Human epidemiological data can also be used to understand how dose pattern and timing of maternal alcohol use during pregnancy relates to alcohol-induced teratogenesis. However, this data is limited by inherent difficulties including: subject recruitment and attrition, accurate reporting of exposure, extensive follow-up requirement, and multiple confounding factors including other potentially teratogenic exposures, and socioeconomic conditions. Nevertheless, certain conclusions can be made from well-conducted studies of FAS, ARBD and ARND.

There is limited data on the dose, pattern and timing of alchol exposure that leads to FAS. Historically mothers of children with FAS were heavy, chronic alcohol users during pregnancy. More recent case study data indicates that mothers of children with FAS consumed 10 drinks or more per day during pregnancy [16]. While this may be the threshold dose for FAS, it does not indicate the pattern, e.g. binge versus non-binge, or timing of alcohol exposure. Indeed, mothers of FAS children may have binge drank throughout pregnancy.

Other epidemiological studies of children with ARND better document the pattern and timing of alcohol exposure. These studies indicate that binge drinking[2] may be the most significant pattern of alcohol use for fetal teratogenesis. In one study maternal binge drinking during pregnancy was linked to children with learning disabilities, deficits in attention and memory, and an inflexible approach to problem solving at age 7.5 years [21]. Other studies indicate that the first trimester is the most critical time for teratogenesis. Studies of children born to women consuming moderate to heavy amounts

[2] Binge drinking is most often defined as having 5 or more drinks at one sitting; however some researchers have used 4 or 3 drinks at one sitting as an alternative definition.

of alcohol during the first trimester document increased spontaneous abortion, decreased height (length) and weight, increased craniofacial abnormalities, and increased neurobehavioral deficits [16]. Thus, binge drinking in the first trimester seems most critical for fetal alcohol related teratogenesis.

One study in Seattle followed the children of mothers who had chronically used alcohol during pregnancy, with or without binging, into childhood. Binge drinking, in the first trimester, was the strongest predictor of poor attention, poor memory skills, increased distractibility, and poor organization at 7.5 years of age [19, 20]. This indicates that any binge drinking events in the first trimester may have a teratogenic effect.

Binge drinking early in the first trimester prior to pregnancy recognition has also been linked to ARND. A recent study from Canada followed a cohort of 51 pregnant women who binge drank during the weeks before pregnancy awareness and 51 women who did not drink. The majority of women who binged did so less than 3 times with only 24% binging more than 6 times. Moreover, 91% of binge drinkers had no binge episodes at 8 weeks gestation, and all women had no binge episodes after 12 weeks gestation. Children were initially evaluated by dysmorphologists and then followed through age 8 by neuropsychologists. None of the children showed characteristic features of FAS. However, children at age 7 whose mothers binge drank were overly friendly, more willing to approach strangers, more easy-going, and overly fixated on tasks; even after controlling for maternal IQ, socio-economic status (SES), parent stress and gestational age. This study identifies subtle but significant neurobehavioral effects from relatively few binge-drinking episodes early in the first trimester, prior to pregnancy recognition [25].

Together, human epidemiological studies indicate that while high, chronic levels of alcohol use during pregnancy are likely required for FAS, alcohol used in a binge pattern in the first trimester is the most predictive of the broad category of fetal alcohol effects including ARND. Thus, public health studies to reduce all fetal alcohol effects should focus reducing binge drinking early in the first trimester, even prior to pregnancy recognition.

Prevalence of Binge Drinking Alcohol Before and During Pregnancy

The Behavioral Risk Factor Surveillance System (BRFSS) surveys women about binge drinking "during pregnancy". The results from this national survey indicate that binge drinking during pregnancy rose dramatically from 1991 to 1995 (0.7 to 2.9%) and has remained constant through 1999 (2.7%) [28, 29]. These figures, however, may no have recorded a significant number of binge drinking events because it does not specifically inquire about binge drinking just at the start of pregnancy.

When asked about the start of pregnancy, some women will think in terms of biology and define their pregnancy as starting at conception, others will define pregnancy as starting at their last menstrual period, and still others will only recall the time when they were aware of their pregnancy [21]. This latter group of women, when asked about binge drinking during pregnancy, would likely not report binge drinking that occurred prior to pregnancy recognition. Furthermore, a significant number of women may continue typical patterns of alcohol use, including binge drinking, until pregnancy recognition [16]. One study suggests the proportion of women who binge drink at 3 weeks gestation is approximately 22% whereas by 7 weeks gestation the rate is less than 3% [21]. This dramatic drop likely occurs with pregnancy recognition. This indicates there are a significant number of women who are not aware they are pregnant and continue their drinking pattern until pregnancy recognition. Therefore, surveys that do not ask about binge drinking prior to pregnancy recognition, like the BRFSS, may significantly under-report the actual proportion of women who binge drink during pregnancy.

Other national surveys specifically inquire about drinking prior to pregnancy recognition. The National Center for Health Statistics administered the National Maternal and Infant Health Survey (NMIHS) from 1998 - 1991. This survey queried women regarding their drinking patterns during the 3 month interval prior to learning they were pregnant. This interval is called the periconceptional period because it includes the weeks immediately proceeding and following conception [16]. The NMIHS survey, however, only asked about average alcohol intake and not binge drinking.

The Pregnancy Risk Assessment Monitoring System (PRAMS) adapted and incorporated the NMIHS binge drinking survey question. The PRAMS survey asks about

binge drinking, "during the 3 months before you [the mother] got pregnant" (appendix 2, PRAMS survey, Q40b). This question does not directly ask about the time prior to pregnancy recognition. However, PRAMS designers state that this question may be a more sensitive measure of binge drinking prior to pregnancy recognition than a question directly asking about this period of time [30]. This statement implies that mothers may not be truthful about reporting binge drinking prior to pregnancy recognition perhaps because it is an admonition of fetal alcohol exposure. Instead, PRAMS asks mothers about binge drinking prior to pregnancy, which does not imply fetal alcohol exposure occurred. Nevertheless, since mothers who binge drink until pregnancy recognition will most likely have also binge drank 3 months prior to pregnancy, asking mothers about binge drinking 3 months prior to pregnancy will capture all women who continue to binge drink until pregnancy recognition. Thus, the PRAMS question on periconceptional binge drinking is a sensitive measure of early fetal alcohol exposure that occurred prior to pregnancy recognition.

The PRAMS periconceptional binge-drinking question does not specifically identify fetal alcohol exposure. Obviously, some mother's who answer yes to periconceptional binge drinking stopped binge drinking before becoming pregnant. Nevertheless, many health authorities[3] recommended abstaining from alcohol well before conception, to eliminate any possibility of fetal alcohol exposure. Thus, periconceptional binge drinking, even without actual fetal alcohol exposure, is considered a risky behavior.

In a multi-state PRAMS study, from 1996 to 1999, 14% of mothers reported periconceptional binge drinking [24]. This frequency is close to the rate of binge drinking in non-pregnant women in their peak childbearing years (18-30 years) in the BRFSS survey (10.8% in 1997, and 12.3% in 1999) [29]. This indicates a high number of mothers at risk for exposing their fetus to binge level alcohol early in the first trimester. Since binge drinking in the first trimester may be the most teratogenic pattern of alcohol exposure for the developing fetus (see previous section), prevention of

[3] The United States Surgeon General, the Secretary of Health and Human Services, the American Academy of Pediatrics, and the American College of Obstetricians and Gynecologists [14-15]

periconceptional binge drinking could significantly reduce the number of alcohol related birth defects and neurodevelopmental disorders.

Targeted Interventions to Prevent Fetal Alcohol Exposure

Understanding risk factors for binge drinking in the periconceptional period may be vital to target prevention efforts in the general public as well as in clinical settings. One example of a targeted intervention is CHOICES (Changing High Risk Alcohol Use and Improving Contraceptive Effectiveness Study), an ongoing CDC project to identify and target interventions in community settings with significant numbers of women at risk for alcohol exposed pregnancies. In this study, risk was defined as inconsistent use of birth control, and/or "frequent drinking (more than 7 drinks per week) or binge drinking once in the last 6 months" [45]. Settings included a jail, an alcohol treatment facility, a hospital based gynecology clinic, an inner city primary care clinic, a suburban primary care clinic, and a media-recruited population of high risk drinkers. Overall, 12.5% of women were at risk (i.e., inconsistent birth control use and/or at-risk drinking).

Results from project CHOICES show that the highest numbers of at-risk women were found in jail (40%) and in an alcohol treatment facility (55%). In univariate analyses, at-risk women were more likely to be older, White non-Hispanic, less educated, unemployed, uninsured, personally perceived to be in poorer health, smokers, early starters of drinking (< 16 years), drinkers (> 2 drinks per week) during their most recent pregnancy, illicit drug users, previously in alcohol treatment, previously in mental health treatment, victims of sexual abuse, victims of physical abuse, sexually non-monogamous, involved in trading sex for money, and homeless in the last 24 hours. In multivariate analyses, at-risk women used drugs in the last 6 months, smoked, had experienced inpatient treatment for alcohol, drugs or mental health disorders, had multiple sex partners, and had been physically abused in last year. Despite these multiple risk factors, the survey study concluded that no single variable sharply distinguished at-risk women [45].

Following the survey, all high risk women were given four motivational interview sessions and an Obstetrics and Gynecology appointment, each targeted to reduce alcohol use and/or increase effective contraception use. At six months after the intervention,

68.2% of at-risk women were not at risk (18.4% reduced drinking, 34% used contraception consistently and 47.6% did both) [46]. Project CHOICES is a clear example of how knowledge of risk factors and targeted interventions can help clinicians and public health officials significantly reduce fetal alcohol exposure.

Unfortunately, clinician-obtained alcohol consumption data is often inaccurate. In one study, twice as many women binge drank as was reported on their medical record [15]. This indicates many clinicians are screening women inadequately or rarely for alcohol use.[4] Clinical tools are available to accurately identify pregnant women consuming alcohol, especially in a binge pattern. One tool is the T-ACE (Box 2), an adaptation of a traditional alcohol screening test, the CAGE questionnaire (Box 1).

Box 1. CAGE Questionnaire [47]

Cut-down:

"Have you ever felt you should cut-down your drinking?"

Annoyed:

"Have people annoyed you by criticizing your drinking?"

Guilty:

"Have you ever felt bad or guilty about your drinking?"

Eye-Opener:

"Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover?"

* Alcohol dependence is likely if the patient gives 2 or more positive answers.

[4] The U.S. Preventive Services Task Force published recent guidelines in 2004 for screening of alcohol use and misuse in all adults (http://www.ahrq.gov/clinic/uspstf/uspsdrin.htm).

Box 2. T-ACE Screening Tool for Pregnancy Risk Drinking [15]

Tolerance:

"How many drinks can you hold?"

Annoyed:

"Have people annoyed you by criticizing your drinking?"

Cut Down:

"Have you ever felt you ought to cut down on your drinking?"

Eye opener:

"Have you ever had a drink first thing in the morning to steady your nerves or to get rid of a hangover?"

* The first question is scored 0 or 2 points, the last 3 questions are scored 1 point if answered affirmatively. A total score of 2 or more is considered positive for risk-drinking.

The T-ACE has a sensitivity of 90% or more of risk-drinkers; false-positives are determined with follow-up questions [15]. Rigorous use of these tools with every women of child-bearing age would aid clinicians in identifying and reducing fetal alcohol exposure [48]. In addition to using these tools, clinicians who serve patients with the most risk factors for fetal alcohol exposure could make the most significant reduction in fetal alcohol exposure. These risk factors are identified though epidemiological surveillance studies.

Previously Identified Risk Factors for Binge Drinking in Non-Pregnant and Pregnant Women

National prevalence studies, like the PRAMS survey, present the most robust epidemiological data for studying risk factors associated with binge drinking. Examples of demographic and risk factor variables used in the surveys are: pregnancy intention, age, race, education, smoking, marriage, and domestic violence. Knowing how these characteristics relate to binge drinking in non-pregnant women, in pregnant women and in women during the periconceptional period may help intervention efforts aimed at reducing fetal alcohol exposure.

Pregnancy Intention

More than one half of all pregnancies in the United States are unintended. Approximately half of these unintended pregnancies end in abortion [32]. In a recent PRAMS study, 45% of women who delivered live born infants reported that their pregnancy was unintended [24]. Pregnancy intention was classified in this PRAMS study by how women responded to the question, "How did you feel about becoming pregnant…just before you got pregnant." Women who responded, "I wanted to be pregnant sooner" or "I wanted to be pregnant then," were classified as having intended pregnancies. Women who responded, "I wanted to be pregnant later" or "I didn't want to be pregnant then or at any time in the future," were classified as having unintentional pregnancies. Women with unintended pregnancies were significantly younger, less educated, more likely to have Medicaid insurance and were less likely to be Caucasion (1996 to 1999 National PRAMS) [24]. Similar findings regarding age, race, and education have been reported from other national surveys, including the 1988 NMIHS and the National Survey of Family Growth, a nationally representative sample of reproductive-aged women [32].

Unintended pregnancy is associated with various behaviors that can affect pregnancy outcomes including sexually transmitted diseases, lack of knowledge about emergency contraception, tobacco and alcohol use during pregnancy, and exposure to domestic violence [24, 32, 33]. Unintended pregnancy also results in a lost opportunity for preconception care as well as delayed pregnancy recognition and delayed access to prenatal care [24]. Unintended pregnancy is also liked with low birth weight and preterm delivery, in some studies [32].

In a study of PRAMS data from 1996 to 1999, Naimi determined a strong univariate association with binge drinking in the periconceptional period and the risk for unintended pregnancy. This result persisted in a multivariate analysis after adjusting for multiple confounders including age, education, marital status, parity, birth control usage at conception, health insurance status, receipt of Medicaid, binge drinking, smoking, and exposure to physical violence. However, the association was only seen in white women. [24].

Age

Age is one characteristic that seems to distinguish drinking patterns among pregnant and non-pregnant women. Binge drinking in non-pregnant women of childbearing age, tends to be more prevalent at younger ages. In the BRFSS survey from 1991-1999, among non-pregnant women (ages 18 – 44) binge drinking and frequent drinking were more likely to occur among women < 30 years [29]. This result parallels other studies on binge drinking. In the 2000 NHSDA, the highest prevalence of binge drinking was for young adults age 18-25, with the peak age at 21 years. Moreover, in the same study more than a third (35%) of full-time female college students were binge drinkers [35]. Thus, younger non-pregnant women are more likely to binge drink than older women.

Among pregnant women, those who are older appear to be more likely to binge drink. In the BRFSS from 1991 to 1999, binge drinking or frequent drinking during pregnancy was more common in women aged 30 to 44 compared to women < 30 years old [29]. The 1994 NIDA survey and the 1988 NMIHS survey found similar results [13, 16]. These findings may explain why FAS is more often found in children whose mothers were >25 years old when pregnant [34].

Binge drinking around the time of conception (periconceptional) has a similar age distribution to binge drinking in pregnant women. An analysis of the PRAMS survey from 1996 – 1999 found that periconceptional binge drinking (3 months prior to pregnancy), was more common in older women [24]. In addition, two studies found that any drinking in the periconceptional period or the early part of pregnancy was more common in women older than 25 years [16, 20]. Interestingly, younger women (< 30 years old) tended to reduce alcohol use more than older women when they became aware of their pregnancy [29]. Thus, a similar age group of women (i.e. older women), continue to binge drinking in the periconceptional period and during pregnancy.

Race/Ethnicity

Many national surveys find that White non-Hispanic women are more likely than women of other races and ethnicities to drink or binge drink during pregnancy and during

the periconceptional period (NMIHS 1988, BRFSS 1988 and PRAMS 1996-1999) [13, 16, 24, 40]. These results parallel the 2000 NHSDA survey that found non-pregnant White non-Hispanic women were the most likely race/ethnicity to report alcohol use [35].

Some national studies contrast these results. The 1988 NMIHS survey found that heavy drinking during pregnancy (more than 14 drinks per week) was more likely in non-White women than in White women. Another study had a similar conclusion: that rates of heavier drinking during pregnancy tended to be highest among pregnant African Americans, Native Americans, and Native Canadians [4]. Heavy drinking throughout pregnancy, however, is rare in all women (0.2%) [13].

Since national surveys tend to underrepresent minority populations, little can be determined from these surveys about minority women's alcohol use during pregnancy. For example, a recent 14 state PRAMS survey had an 80% White female representation with the next highest racial group represented being Hispanic at 8% [24]. General population surveys that over-sample minority groups may better reveal cultural differences between alcohol use patterns during pregnancy in minority racial/ethnic groups.

Education

Educational attainment is another characteristic that may have a different relationship between pregnant women and non-pregnant women who report binge drinking. In the BRFSS, non-pregnant women were more likely to be binge drinkers if they had a high school education or less [41]. However, in a multi-state PRAMS study, as educational attainment increased so does the risk of periconceptional drinking. Those of the highest educational attainment were almost twice as likely to be frequent drinkers in the periconceptional period compared to those with high school education or less [16]. A similar result was obtained in a study of Seattle pregnant women [13]. In contrast, a national PRAMS survey from 1996 to 1999 found pregnant women's educational attainment did not differentially affect periconceptional binge drinking [24]. Thus, further analysis of national data is needed to elucidate the relationship between education and binge drinking.

Smoking

Smoking is significantly related to alcohol consumption in both non-pregnant and pregnant women. In the BRFSS, non-pregnant binge drinkers were more likely to smoke than non-pregnant non-binge drinkers [41]. Similarly, during pregnancy, smoking was one of the strongest risk factors for frequent drinking (7 or more drinks in one week, or 5 or more at one sitting) [18]. During the periconceptional period, smoking has also been reported to be one of the strongest risk factors for binge drinking during pregnancy [16, 24]. Smoking has also been reported as a maternal risk factor for FAS [34]. Thus, smoking is an important risk factor for binge drinking during pregnancy.

Marriage

In one set of studies, unmarried women are more likely than married women to drink frequently, drink heavily, and binge drink before pregnancy, during the periconceptional period and during pregnancy [16, 24, 31]. Thus, marriage may be protective against fetal alcohol exposure.

Domestic Violence

Many studies have found an association between alcohol use and domestic violence in non-pregnant women [13]. However, in studies of married couples, when the husband's drinking, use of drugs, and selected demographic variables are accounted for, the wife's alcohol use is not a significant predictor of husband-to-wife violence. One researcher concluded that there is little evidence that a women's drinking provokes or even occurs before aggression by husbands [34].

Similar to non-pregnant women, studies show a strong association between binge drinking during the periconceptional period and domestic violence [24]. However, none of these studies controlled for the father's alcohol use. Further research needs to elucidate this possible association and potentially continue to decriminalize the woman's

role in domestic violence. Prevention efforts could also be boosted by methods gleaned from further research, such as providing enhanced screening in prenatal care visits. [5]

Oregon Data on Binge Drinking during Pregnancy

In Oregon, the rate of binge drinking in non-pregnant women and in women in the periconceptional period has been consistently higher than the national average. In the 1991 BRFSS, the Oregon rate for binge drinking in non-pregnant women was 7.7% versus 6.5% for the nation, and in 2002 the Oregon rate was 9.0% versus 8.1% for the nation [56]. In the Oregon PRAMS study, 15.8% of women from 1998 to 1999 reported binge drinking during the periconceptional period and in 2000 the figure increased to 16.8%. These were both higher than the national rate of 14% from 1996 to 1999 [57]. This data indicates periconceptional binge drinking is an especially significant public health problem in Oregon.

No studies have looked at Oregon specific risk factors for maternal binge drinking during the periconceptional period. Previous multi-state PRAMS analysis did not include Oregon. While risk factors may be similar, variations may occur. These variations may be especially important for targeted interventions to reduce fetal alcohol exposure in Oregon.

[5] The U.S. Preventive Services Task Force published recent guidelines in 2004 for screening of domestic violence (http://www.ahrq.gov/clinic/uspstf/uspsfamv.htm).

Purpose

The original purpose of this study was to determine risk factors associated with periconceptional binge drinking in the Oregon PRAMS 2000 data.

From this analysis, the association between pregnancy intention and periconceptional binge drinking was identified as an *a posteriori* association of interest. This association was studied further by controlling for other risk factors for periconceptional binge drinking, using a multivariate model. This multivariate model, containing pregnancy intention, was then analyzed to determine if it accurately and reproducible predicted mothers who reported periconceptional binge drinking in PRAMS.

The intent of this study is to identify Oregon-specific risk factors for periconceptional binge drinking that can be used to target public health interventions. Targeting prevention strategies, using local data, may be more effective than global strategies at reducing maternal alcohol use and binge alcohol use during pregnancy. Ultimately, these targeted interventions may help to decrease the incidence of alcohol related birth defects (ARBD), and alcohol related neurodevelopmental disorders (ARND) in Oregon.

Methods

Pregnancy Risk Assessment Monitoring System (PRAMS) Survey

The PRAMS survey was designed by the CDC's National Center for Chronic Disease Prevention and Health Promotion, Division of Reproductive Health. Initiated in 1987, PRAMS is an ongoing, state- and population-based surveillance survey. It is designed to monitor self-reported maternal behaviors and experiences occurring before, during, and after pregnancy. Each participating state uses a standardized data collection methodology to sample women who recently gave birth to live-born babies [32].

Oregon PRAMS

Oregon PRAMS began in November 1998 with some technical support from the CDC and became part of the CDC PRAMS system in 2002. It is currently an ongoing public health surveillance project of the Oregon Department of Human Services, Health Services (DHS-HS), Office of Family Health. The Oregon 2000 and 2001 PRAMS survey's were modeled after the CDC survey but also incorporated unique questions about use of the Oregon Health Plan, and folic acid intake prior to pregnancy.

Oregon PRAMS combines mailed questionnaires with computer-assisted telephone interviews (CATI) of women who have not responded to mail surveys. Beginning two to six months after delivery, women are mailed a questionnaire and an explanation of PRAMS. About three weeks later, a second mailing is sent to non-respondents. About two weeks after that, those still not responding are referred to the CATI contractor for phoning, using a script modeled after the mailed questionnaire. Women are generally first called about six weeks after the initial mailing.

New mothers are sampled each month. All Oregon women who gave birth within the past 60-180 days, as identified by birth certificate records submitted to the Oregon DHS-HS, are eligible for sampling.

Oregon PRAMS employs a stratified random sampling scheme that divides eligible mothers into six strata. Five of the six strata (non-Hispanic African-American, Hispanic, non-Hispanic Asian and Pacific Islanders, non-Hispanic Native Americans and Alaskan Natives (NA/AN), and non-Hispanic White mothers who gave birth to babies weighing less than 2500 grams) are over-sampled to ensure these minority groups are

included. The sixth stratum is non-Hispanic White women with normal birthweight babies.

Oregon PRAMS data uses a 3-tiered weighting scheme to account for oversampling, non-response, and non-coverage. First, each respondent is assigned a weight based on their sampling strata to restore the proper Oregon demographic proportions to the dataset. Next, each respondent is assigned a weight to account for non-responders, based on the following characteristics from the birth certificate: race/ethnicity, marital status, parity, initiation of prenatal care, maternal age, and maternal education. Finally, each respondent is assigned a weight to account for birth certificates lost from the sampling frame.

2000 Oregon PRAMS

Sampling for the PRAMS 2000 survey began in March 2000 and ended March 2001. Respondents numbered 2,157 out of 2,950 women, for a response rate of 73.1%. In April 2000, several questions were removed and a new PRAMS survey made. Of the total 2,950 surveys mailed, only 2,877 received the new PRAMS survey. Respondents to the new survey numbered 2,100, for a new response rate of 73.0%. Only respondents to the new survey were used in this analysis.

The 3-tiered weighting scheme in 2000 included: 1) a weight, ranging from 1.95 for American Indian/Alaskan Native women to 61.75 for Non-Hispanic White women with babies weighing ≥ 2500 grams at birth; 2) a weight, ranging from 1.19 to 2.74 to account for non-responders; and 3) a weight of 0.9998 to each women to account for the few birth certificates lost from the sampling frame.

For this study, the 2000 Oregon PRAMS dataset was linked with the birth certificate, removed of all patient identifiers and converted to a SPSS format [58]. Oregon Health and Sciences University (OHSU) Institutional Review Board exemption was obtained (Appendix 2). The data was transferred from the DHSHS to a secure computer at OHSU. The data was imported into SAS 8 [59]. All analyses for this study were conducted using SAS-callable SUDAAN 8 or SAS-callable SUDAAN 9 [60]. The SUDAAN program was chosen because it appropriately accounts for the PRAMS weighting scheme.

Variable Selection and Coding

Periconceptional Binge Drinking

The PRAMS survey asked about periconceptional binge drinking in a two part skip pattern question. First, women were asked about any alcohol use in the past 2 years (question 39) (Appendix 1, PRAMS survey, Q39). If the woman answered "no," she was instructed to skip the next 4 questions asking about specific patterns of drinking. If the woman answered "yes," she was prompted to answer question 40b: "During the 3 months prior to pregnancy, did you drink 5 or more alcoholic drinks at one sitting?" (Appendix 1, Q40b). Based on the combination of responses to these two questions, the 2,100 mothers in the PRAMS dataset were recoded as responding "yes" or "no" to periconceptional binge drinking or having "missing" information on periconceptional binge drinking (Table 1). Mothers with missing information were not included in analyses.

Table 1. Classification of periconceptional binge drinking from PRAMS survey

Answer to Q39	Answer to Q40b	Followed skip correctly	Periconceptional binge drinking
Yes	Yes	Yes	Yes
No	-	Yes	No
Yes	No	Yes	No
Yes	I don't know	Yes	Missing
-	Yes	No	Yes
No	No	No	No
-	No	No	No
No	I don't know	No	No
-	-	No	Missing
Yes	-	No	Missing

Pregnancy Intention

Pregnancy intention was determined from PRAMS survey question 5 (Appendix 1, Q5). The question asked new mothers, "Thinking back to just before you were pregnant, how did you feel about becoming pregnant?" Mothers who responded they wanted to be pregnant "Sooner" or "Then" were designated as having intended pregnancies. Those who responded they wanted to be pregnant "Later" were designated as mistimed births. Those who responded they didn't want to be pregnant "... now or any time in the future" were designated as unwanted births. Those mothers whose pregnancies were classified as mistimed or unwanted were classified as unintended.

Other Potential Risk Factor Variables for Periconceptional Binge Drinking

Potential risk factors for periconceptional binge drinking were identified from both a literature review and from variables relevant to the preconceptional or periconceptional period in the PRAMS survey and birth certificate data. Twenty-eight total variables were selected (Tables 2 and 3). Literature-identified variables included: age, race/ethnicity, education, smoking, marriage, parity, pre-pregnancy domestic abuse (see Previously Identified Risk Factors for Binge Drinking in Non-pregnant and Pregnant Women, page 9), and pre-pregnancy insurance status.

Selected variables were either continuous, or categorical. The six continuous variables were age, education, parity, terminations, and pre-pregnancy income. Continuous variables were recoded into the smallest numbers of categories to enable ease of interpretation and to increase individual variable cell sizes. Recoding followed three steps: 1. the direction of the association between the continuous variable and periconceptional binge drinking was determined[6]; 2. the continuous variable was broken into logical strata and the weighted frequencies of periconceptional binge drinking in each stratum were compared graphically; and 3. cut points were made to collapse the data and maximize the strength of the association[5] in the same direction as that for the continuous variable. All continuous variables were recoded into two categories accept for BMI (body mass index) which was recoded into 4 categories: Underweight (BMI < 18.5), Normal (BMI 18.5 ≤ to < 25.0), Overweight (BMI 25.0 ≤ to < 30.0), and Obese (BMI ≥ 30.0). Table 2 shows the chosen cut points for the other 5 variables.

Table 2. Final coding of continuous variables

Independent Variables	Recoded to 1	Recoded to 2 (Referent)	Source
Age	< 26	≥ 26	Birth Certificate
Education	At least a high school education	Less than a complete high school education	Birth Certificate
Parity	Nulliparus	One or more live births	Birth Certificate
Terminations	> 0	0	Birth Certificate
Pre-pregnancy Income	< 30,000	≥ 30,000	Q81a and Q82a*

* PRAMS questions in appendix 1

[6] Associations calculated with bivariate logistic regression using SUDAAN 'crosstab' and 'proc logistic' function. Wald p-values used for calculation of significance.

Twenty-two categorical variables were selected for analysis (Table 3). Categories were collapsed into dichotomous variables if significant data was not compromised. The only variable not recoded into a dichotomous variable was race/ethnicity.

Table 3. Final coding of categorical varaibles

Independent Variables	Recoded to 1	Recoded to 2 (Referent)	Source
Marital status	Unmarried	Married	Birth Certificate
Father's name on birth certificate	No	Yes	Birth Certificate
Pre-pregnancy insurance status	None	Any	Q6*
Pre-pregnancy Oregon Health Plan (OHP)	Yes	No	Q7*
Birth control prior to pregnancy	Yes	No	Q9*
Smoking in the 3 months prior to pregnancy (periconceptional smoking)	Yes	No	Q30 and Q31*
A close family member was very sick before and/or during pregnancy	Yes	No	Q42a*
Separated or divorced from partner before and/or during pregnancy	Yes	No	Q42b*
Moved to a new address before and/or during pregnancy	Yes	No	Q42c*
Homeless before and/or during pregnancy	Yes	No	Q42d*
Mom fired from job before and/or during pregnancy	Yes	No	Q42e*
Partner lost a job before and/or during pregnancy	Yes	No	Q42e*
More frequent partner arguments before and/or during pregnancy	Yes	No	Q42g*
Had a lot of bills you couldn't pay before and/or during pregnancy	Yes	No	Q42i*
Mom in physical fight before and/or during pregnancy	Yes	No	Q42j*
Partner went to jail before and/or during pregnancy	Yes	No	Q42k*
Partner or close relation had drug or alcohol problem before and/or during pregnancy	Yes	No	Q42l*
Close relation died before and/or during pregnancy	Yes	No	Q42m*
Pre-pregnancy domestic abuse	Yes	No	Q42n*
Pre-pregnancy non-partner violence	Yes	No	Q42o*
Unwanted pregnancy by partner	Yes	No	Q42h*

* PRAMS questions in appendix 1

Bivariate Logistic Regression

The crude strength of the association between potential independent risk factor variables and periconceptional binge drinking was calculated using bivariate logistic regression. The dependent variable was periconceptional binge drinking, classified as a dichotomous variable (i.e., Yes or No response). Mothers who did not binge drink in the periconceptional period were the referent group. Pregnancy intention was coded as intended or unintended, with intended pregnancy as the referent group. Referent groups for other risk factors are listed in Tables 2 and 3. Associations were calculated with bivaraite logistic regression using SUDAAN "crosstab" and "proc logistic" function. Wald p-values were used for calculation of significance.

Multivariate Logistic Regression Model Building

The goal of logistic regression model building was to study the *a posteriori* association between unintended pregnancy and periconceptional binge drinking by controlling for other risk factors associated with periconceptional binge drinking. Other risk factors are controlled for because they could confound the association of interest. Controlling for confounders could determine the true strength and significance of the association between pregnancy intention and periconceptional binge drinking.

Selection Criteria for Candidate Variables

Risk factors for periconceptional binge drinking were selected as candidates for model building, based on recommended parameters [49]. Variables were selected if they were significantly related ($p < 0.10$) to periconceptional binge drinking based on bivariate analysis. A p-value greater than the traditional 0.05 was used because previous model building studies show that the traditional level often fails to identify critical candidate variables [49]. However, a lower p-value than that recommended by Hosmer and Lemeshow (p-value < 0.25) is used to minimize the number of candidate variables.

Variables were also included in the pool if they were previously shown in the literature to be associated with periconceptional binge drinking, regardless of their significance in the bivaraite analysis. These risk factors were age, race, education, smoking, marriage, parity, pre-pregnancy domestic abuse, and pre-pregnancy insurance.

Variables were excluded from the pool if they were proxies for other candidate variables already in the pool, especially if they were highly correlated with other potential candidate variables. Correlations were calculated using the chi-squared (χ^2) statistic with one degree of freedom[7] between each candidate variable. Variables that had a χ^2 greater than 35.00 (p-value < 0.000001) were considered highly correlated.

Highly correlated variables not considered proxies for each other were included in the pool of candidate variables. A model containing 2 or more highly correlated variables can cause unstable estimates of the coefficients. Therefore, if two or more of these variables were included in the final multivariate model, the directions of the odds ratios were scrutinized. The direction of the odds ratios had to match those identified in the univariate analysis.

Forward Stepwise Procedure

The same dependent variable for bivariate regression (periconceptional binge drinking) was also used for multivariate logistic regression. Unintended pregnancy was included as the first independent risk factor for model building and was kept in the model regardless of statistical significance. The remaining independent risk factors were selected from the candidate pool using a forward selection procedure.

Forward selection was a manual process using multivariate logistic regression with weighted data in SUDAAN. Stringent entry and exit criteria were used to minimize the number of final variables in the model. In previous studies, minimizing the number of variables produced more numerically stable and more generalizable results [49]. The criterion for entry was a Wald p-value ≤ 0.10 and for exit was a Wald p-value > 0.10. The SUDAAN design STWOR was used, which calculates point and standard error estimates using the Taylor series linearization method. This method is appropriate for single-stage sampling without clustering, for stratified random sampling without replacement, and sampling with equal probabilities of selection within one stratum [50].

Variables in the model previously identified to be highly correlated ($\chi^2 > 35.00$) were scrutinized to determine whether the direction of the odds ratios differed from that

[7] All χ^2 were calculated with one degree of freedom.

in the univariate analysis. The last variable added to the model that changed directions once added to the model was removed. This process continued until no correlated variables in the model changed direction relative to the univariate analysis. The resulting model was labeled the "Preliminary Main Effects Model."

Interactions among the variables in the Preliminary Main Effects model were subsequently considered. Interaction variables were created between the pregnancy intention variable and other model variables to determine if the association between pregnancy intention and periconceptional binge drinking varied between different levels of other risk factors in the model. Interaction terms were created in SAS by multiplying two variables together to make a tri-variate interaction variable. Forward stepwise selection, using the same entry and exit criteria in the initial model building, was used to select interactions. Interaction terms that became significant in the model were said to have modified the effect between pregnancy intention and periconceptional binge drinking. The model containing interactions was scrutinized to ensure no main effects coefficients changed markedly in magnitude. Interactions that drastically changed main effects coefficient estimates were analyzed for small cell sizes that would result in unstable coefficient estimates. Interaction variables that created small cell sizes in the model were removed. The resulting model, containing those selected interactions, was then labeled the "Final Model."

Goodness of Fit Test

The Hosmer and Lemeshow "Goodness of Fit" test was used to determine how well the preliminary final model fit its analyzed data [49]. The test compares observed data to model-predicted data. The Goodness of Fit test first divides the observed sample into 10 risk categories (desciles of risk) based upon the probabilities estimated from the preliminary final model. In this case, the deciles of risk are based upon who is at risk for periconceptional binge drinking. Estimated numbers of women in each category of risk are then calculated based upon the weighted average of each variable in the model. Numbers of women in the observed deciles of risk are compared to those expected from the model. The null hypothesis is that the observed and expected are equal. Thus, if the null hypothesis cannot be rejected, at $p > 0.05$, then the model fits the data well.

Multivariate Model Validation on Oregon PRAMS 2001 Dataset

Validation was used to determine whether the variables in the final model accurately predicted maternal periconceptional binge drinking in Oregon in 2001. First, variables in the final model were located in the Oregon PRAMS 2001 dataset and recoded using the same coding schemes in the Final Model. Then, new estimates for these variables were calculated for a multivariate logistic regression using 2001 data. The odds ratios were then compared between the 2000 and 2001 model. Variables with similar odds ratios were considered reproducible risk factors of periconceptional binge drinking. Those with dramatically lower odds ratios were considered poorly reproducible risk factors. Confidence intervals are affected mostly by sample size [24], so non-significant confidence intervals were not considered indicative of poor reproducibility.

Variables that became insignificant, but retained similar odds ratios and confidence intervals were still considered reproducible risk factors. Confidence intervals were assumed to be affected by sample size, and thus deviations of confidence intervals causing insignificant results were not considered an indicator of reproducibility.

The Goodness of Fit test was also calculated for the new model created on 2001 data to determine how well the preliminary final model fit its analyzed data.

Associations between Periconceptional Binge Drinking and Pregnancy Outcomes and Occurrences

In addition to model building, a second analysis was performed to determine whether periconceptional binge drinking was related to pregnancy outcomes and occurrences. Continuous and categorical variables were selected, recoded, and analyzed in a bivariate analysis with periconceptional binge drinking. Variables analyzed included: alcohol use in final 3 months of pregnancy, binge drinking in the final 3 months of pregnancy, mother smoking in the 1st, 2nd or 3rd trimester of pregnancy, mother smoking after pregnancy, prenatal care initiation, OHP for prenatal care, inadequate prenatal care, insurance at delivery, birthweight, gestational age at birth estimate, intrauterine growth restriction (IUGR), breastfeeding, number of months on Women, Infants, Children (WIC), baby's sleep location, baby's sleep position, and mother's birth control after pregnancy.

Results

Analysis of Periconceptional Binge Drinking

Out of 2,100 women, 1,994 followed the PRAMS skip pattern about periconceptional binge drinking. This included 181 women who answered "yes" to both Q39 and Q40b, 983 women who answered "yes" to Q39 but "no" to Q40b, 804 women who answered "no" to Q39 and appropriately skipped Q40b, and 26 women who answered "yes" to Q39 and "I don't know" to Q40b (Table 4). The remaining 106 women did not obey the skip pattern correctly (Table 4).

Table 4. Initial categorization of periconceptional binge drinking

Q39+ answer	Q40b++ answer	Followed skip +++	Periconceptional binge drinking	n* - unweighted	Weighted percent**
Yes	Yes	Yes	Yes	181	10.96
No	-	Yes	No	804	31.71
Yes	No	Yes	No	983	53.24
Yes	I don't know	Yes	Missing	26	1.27
			Total =	1994	97.18
-	Yes	No	Yes	1	2.66
No	No	No	No	58	1.28
-	No	No	No	9	0.23
No	I don't know	No	No	1	0.01
-	-	No	Missing	30	1.21
Yes	-	No	Missing	7	0.10
			Total =	106	5.49
			Grand Total =	2100	100.00

\+ PRAMS Q39 "Have you had an alcoholic drink in the past 2 years?" (Appendix 2, PRAMS survey)
++ PRAMS Q40b "During the 3 months before you got pregnant, did you drink 5 or more alcoholic drinks at one sitting?" (Appendix 1, PRAMS survey)
+++ Skip pattern: If response to Q39 is "No" then Q40b should be skipped.
* Unweighted number of respondents
** Percent of total weighted responses.
\- No information recorded on survey

Overall, 182 women (13.6% of weighted responses) were classified as having binge drank in the periconceptional period and 1,855 women (83. 9% of weighted responses) were classified as not having binge drank prior to pregnancy (Table 5). Periconceptional binge drinking could not be assessed in 63 women (2.5% of weighted responses), these were treated as "missing." Data classified as "missing" was not used in any further analysis.

Table 5. Final categorization of periconceptional binge drinking

Periconceptional binge drinking	n* - unweighted	Weighted percent**
Yes	182	13.6
No	1855	83.9
Missing***	63	2.5
	Total = 2100	Total = 100.0

* Unweighted number of respondents
** Percent of total weighted responses.
*** Missing answers were not used in analysis

Analysis of Pregnancy Intention

Responses to the PRAMS pregnancy intention question (Q5) are listed in Table 6. Thirty six women did not respond to the question and 18 answered "I don't know;" these data were excluded from any further analysis. Of the other 2,026 responses, 893 mothers (38.5 weighted percent) reported an unintended pregnancy ("I wanted to be pregnant later," or "I didn't want to be pregnant then or any time in the future"). The balance, 1,153 mothers (59.4 weighted percent), reported an intended pregnancy ("I wanted to be pregnant sooner" or "I wanted to be pregnant then").

Table 6. Frequency of pregnancy intention responses

Pregnancy intention	n* - unweighted	Weighted percent**
I wanted to be pregnant sooner	344	16.4
I wanted to be pregnant then	809	43.0
I wanted to be pregnant later	676	30.5
I didn't want to be pregnant then or at any time in the future	217	8.0
I don't know	18	0.5
No response	36	1.6
	Total = 2100	Total = 100.0

* Unweighted number of respondents
** Percent of total weighted responses.

Association between Periconceptional Binge Drinking and Pregnancy Intention

Combined, 99 mothers had missing responses to the periconceptional binge drinking question and/or the pregnancy intention question. This left 868 mothers with an unintended pregnancy and 1,133 with intended pregnancies (Table 7). Of those who had

an unintended pregnancy the weighted frequency of periconceptional binge drinking was 17.5% whereas, of those who had intended pregnancies the weighted frequency of periconceptional binge drinking was only 7.5% Thus, the odds of periconceptional binge drinking was 2.60 (95% CI 1.58 – 4.29) times higher for women with unintended pregnancies than in women with intended pregnancies (p = 0.0002).

Table 7. Bivariate logistic association between pregnancy intention and periconceptional binge drinking

	n* - unweighted	Weighted Percent – Periconceptional Binge Drinking	Odds Ratio	Lower 95% CI	Upper 95% CI	p-value
Pregnancy intention						
Unintended	868	17.46	2.60	1.58	4.29	0.0002
Intended	1133	7.52	1.00	-	-	.

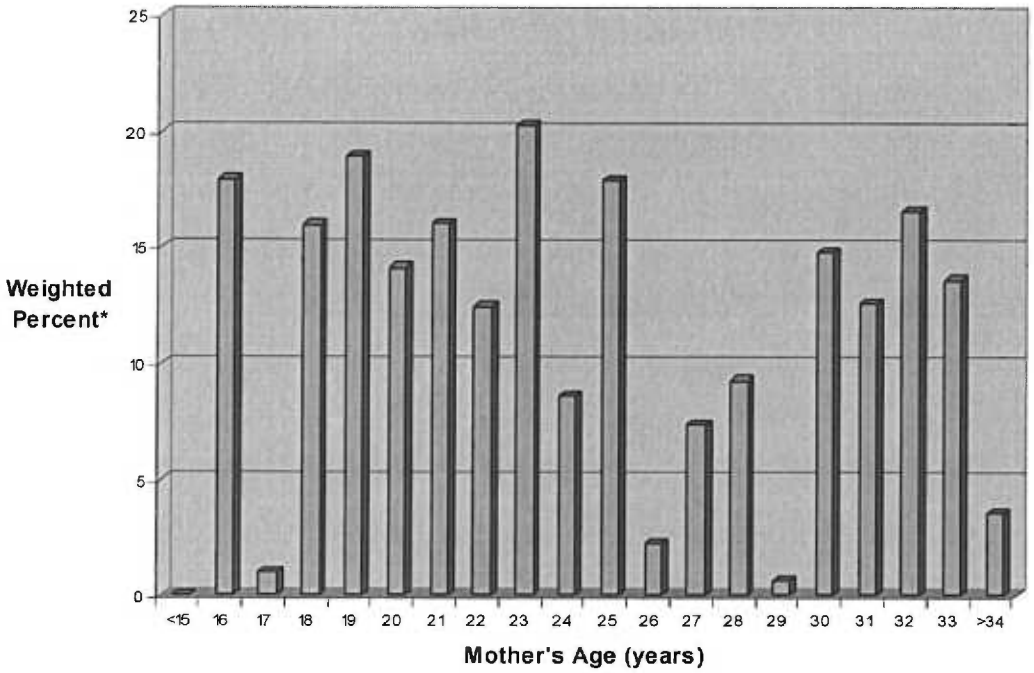
* Unweighted number of respondents

Recoding and Analysis of Continuous Variables

Age

Mother's age was obtained from the birth certificate with no missing data. The age range in the Oregon 2000 PRAMS survey was 12 to 45 years old. No women younger than 16 or older than 41 answered "yes" to binge drinking in the periconceptional period. The odds for periconceptional binge drinking were 0.95 (95% CI 0.92 – 0.99) for every one year increase in age. Thus, as age increased, the odds of periconceptional binge drinking decreased. Graphic analysis of the weighted data (Graph 1) shows two peaks of periconceptional binge drinkers at ages 16 – 25 and then ages 30 – 33. To create a dichotomous variable, different cut points in age were made and the odds ratio calculated. The strongest and most significant odds ratio was found between mothers younger than age 26 who were 1.94 (95% CI 1.18 - 3.21) times more likely to binge drink in the periconceptional period than were women 26 years or older (Table 8, page 33).

Graph 1. Binge drinking in the periconceptional period by maternal age

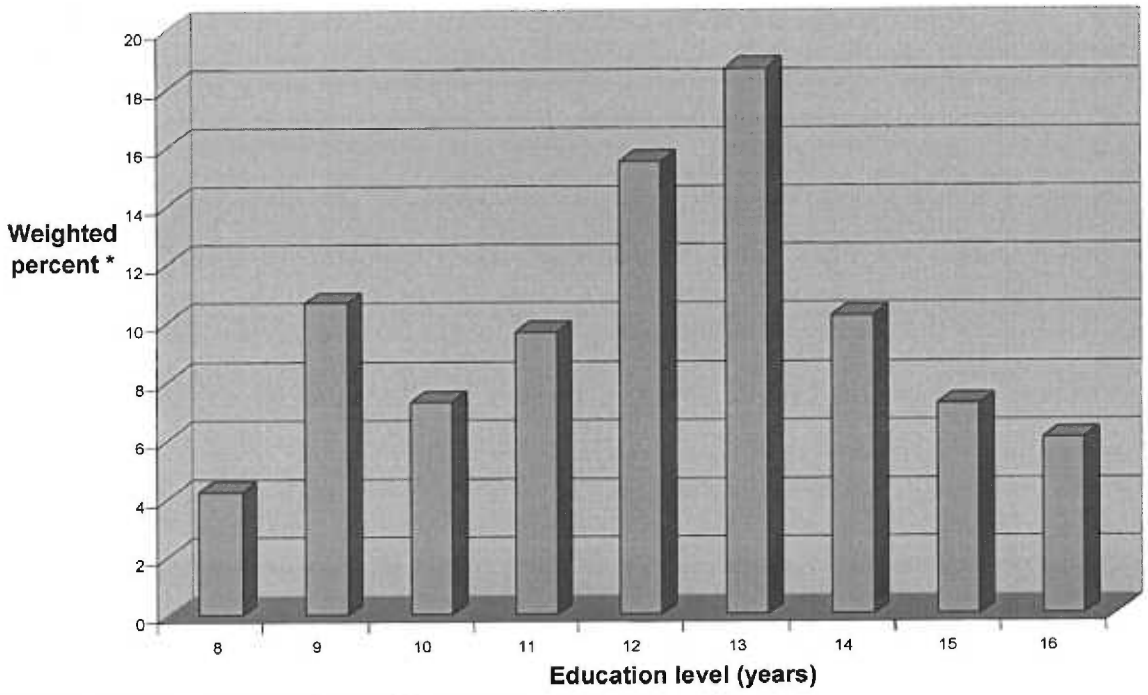


* Weighted percent of mothers in each age group who reported periconceptional binge drinking

Education

Mother's education was obtained from the birth certificate. Forty-nine women were missing information about their education. The education range for all women in the Oregon 2000 PRAMS was 0 to 17 years of education. Twelve years of education was considered a high school education. The odds for periconceptional binge drinking was 0.98 (95% CI 0.92 – 1.04) for every one year increase in education. Thus, as a continuous variable, education was not significantly related to the odds of periconceptional binge drinking. Graphic analysis of the weighted data (Graph 2) shows the highest frequency of periconceptional binge drinking among those mothers who completed high school or among mothers who completed 1 year of college. Splitting education into a dichotomous variable shows that mothers with 12 or more years of education are 1.85 (95% CI 0.94 – 3.65) times more likely to binge drink in the periconceptional period than are women with less than 12 years of education (p-value = 0.0739) (Table 8, page 33).

Graph 2. Binge drinking in the periconceptional period by maternal education

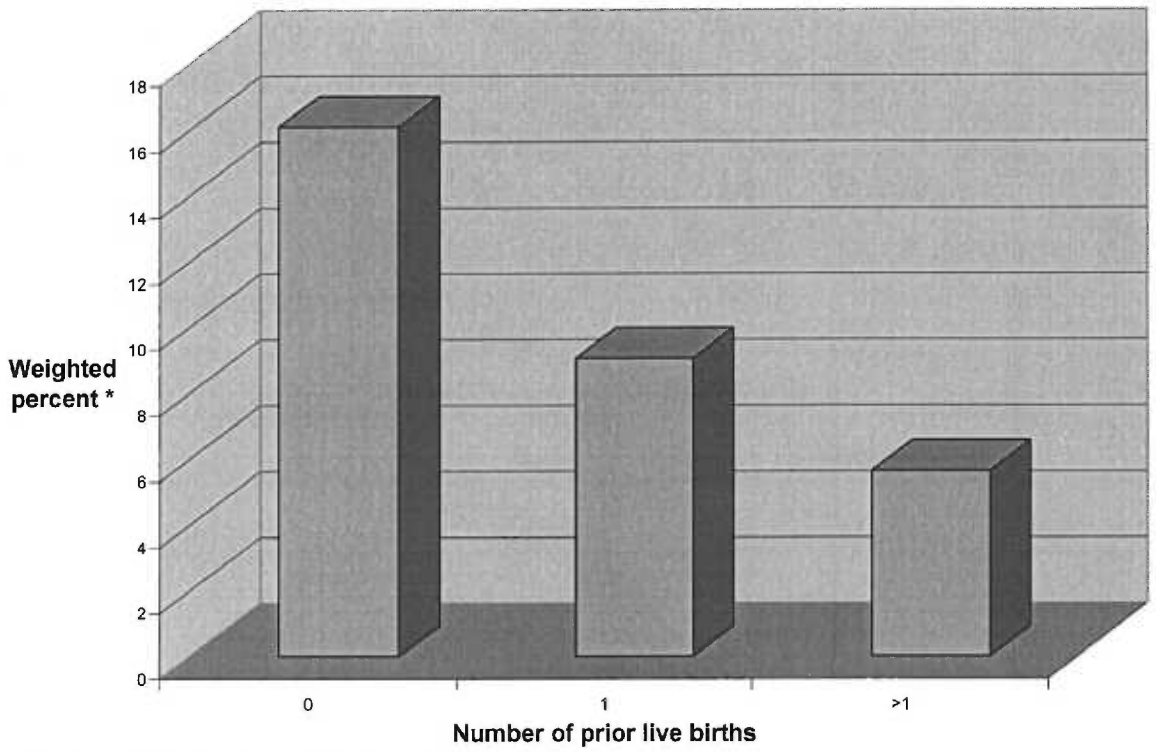


* Weighted percent of mothers who reported periconceptional binge drinking

Parity

Parity was obtained from the birth certificate. One mother was missing information about parity and her information was not included in the analysis. The range of parity for all women in the Oregon 2000 PRAMS was 0 to 9 previous live born children. No women who had 5 or more children prior to pregnancy reported periconceptional binge drinking. Parity was not assessed as a continuous variable. Graphic analysis of the weighted data (Graph 3) shows decreasing frequency of periconceptional binge drinking with increasing numbers of children. Splitting parity into a dichotomous variable shows that primagravid mothers are 2.34 (95% CI 1.41 – 3.86) times more likely to binge drink prior to pregnancy than those mothers who had one or more prior live births (p = 0.0009) (Table 8).

Graph 3. Binge drinking in the periconceptional period by parity

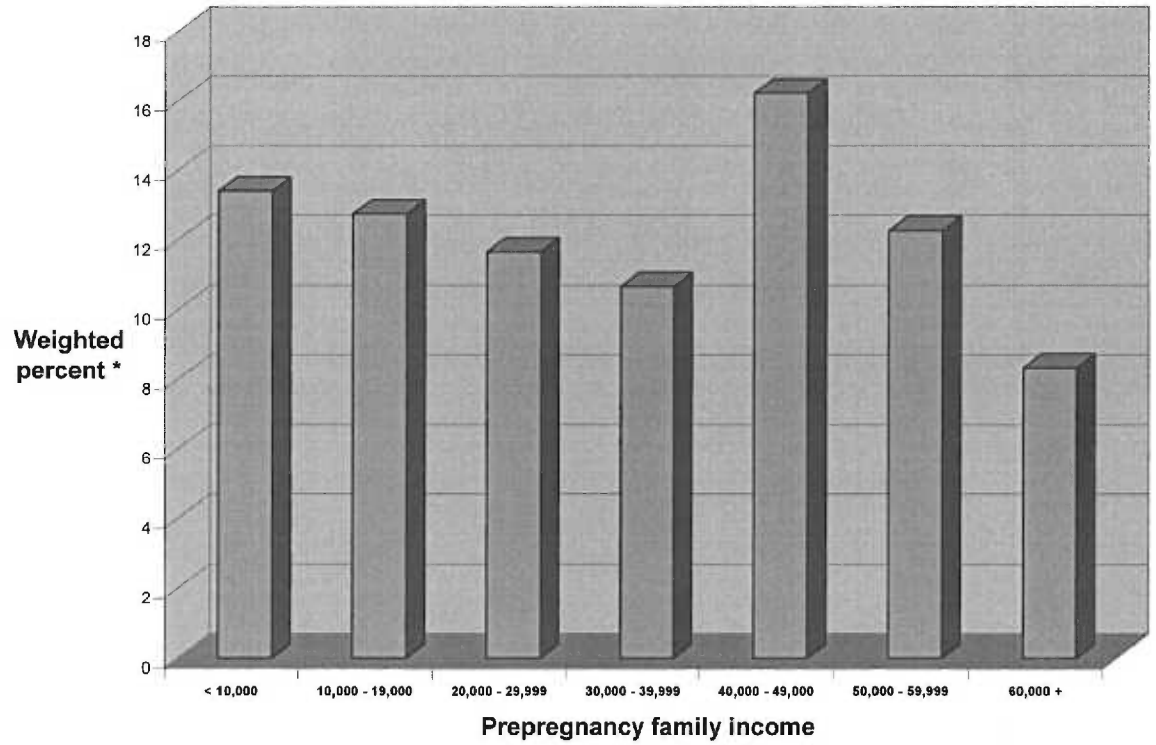


* Weighted percent of mothers who reported periconceptional binge drinking

Income

Family income prior to pregnancy was obtained from the PRAMS question number 81a (Appendix 1). Two hundred fifty-two mothers did not report information about income, and their data was not included in the analysis. The maximum family income was 400,000 U.S. dollars per year. Graphic analysis of the weighted data (Graph 4) shows no significant relationship between family income and periconceptional binge drinking. The highest odds ratio was obtained when income was split at 30,000 dollars, OR 2.6 (95% CI 1.58 – 4.29). However, the confidence internal indicates it was still not significantly related to periconceptional binge drinking (p-value 0.5960) (Table 8, page 33).

Graph 4. Binge drinking in the periconceptional period by prepregnancy family income



* Weighted percent of mothers who reported periconceptional binge drinking

Abortions

Number of prior pregnancy terminations was obtained from the birth certificate. Two women were missing information about terminations and their data was not included in this analysis. The range of abortions for all women in the Oregon 2000 PRAMS was 0 to 7. Splitting terminations into a dichotomous variable (one or more versus no abortions) shows that mothers with one or more terminations are not significantly more likely to report periconceptional binge drinking than those who have had not prior abortions, OR 1.48 (95% CI 0.88 – 2.49) (Table 8).

BMI

Mother's BMI prior to pregnancy was obtained from PRAMS questions 15 and 16 (Appendix 1). The formula for calculating BMI was weight (kilogram) divided by height (meters), squared (i.e., kg/m^2). Two hundred twelve mothers were missing information about BMI and were not included in the analysis. No statistically significant association was found between BMI and binge drinking prior to pregnancy (Table 8, page 33).

Table 8. Association between recoded continuous variables and periconceptional binge drinking

	n* - unweighted	Weighted Percent – Periconceptional Binge Drinking	Odds Ratio	Lower 95% CI	Upper 95% CI	p-value
Age**						
< 26 years	990	14.78	1.94	1.18	3.21	0.0092
≥ 26 years	1047	8.19	1.00	-	-	.
Education**						
At least a high school education (≥ 12 years)	1452	12.26	1.85	0.94	3.65	0.0739
Less than a full high school education (< 12 years)	536	7.01	1.00	-	-	.
Parity**						
Nulliparous	897	16.08	2.34	1.41	3.86	0.0009
One or more live births	1139	7.58	1.00	-	-	.
Pre-pregnancy income						
< 30,000/yr	1107	12.55	1.15	0.69	1.89	0.5960
≥ 30,000/yr	703	11.13	1.00	-	-	.
Abortions						
> 0	1488	10.12	1.48	0.88	2.49	0.1427
0	547	14.28	1.00	-	-	.
BMI						
Underweight (BMI < 18.5)	118	4.88	0.34	0.08	1.53	0.1613
Normal (BMI 18.5 ≤ to < 25.0)	1016	12.94	1.00	-	-	.
Overweight (BMI 25.0 ≤ to < 30.0)	400	10.69	0.81	0.42	1.55	0.5175
Obese (BMI ≥ 30.0)	291	11.12	0.84	0.42	1.67	0.6221

* Unweighted number of respondents

** Candidate variables for multivariate model (previously identified in literature as a risk factor for periconceptional binge drinking)

Recoding and Analysis of Categorical Variables

Race/Ethnicity

Mother's race and ethnicity were obtained from two questions on the birth certificate. Possible answers for race included: White (including Mexican, Puerto Rican and Caucasian), Black, African American, Indian (North, Central, South American, Eskimo and Aleut), Chinese, Japanese, Hawaiian, Philipino, Other Asian or Pacific Islander, Other, Unknown or Not Classifiable. Possible answers for ethnicity were Non-Hispanic, Mexican, Puerto Rican, Cuban, Central or South American, Other or Unknown Hispanic, Not Classifiable or Unknown. All mothers identified as Hispanic were classified as "Hispanic" for the race/ethnicity variable irrespective of race or Hispanic category; this included 558 identified as White, 6 as Indian (all Mexican), 2 as non-classifiable Asian or Pacific Islanders (one Puerto Rican and one Central or South American), one as Black (Mexican), and 1 as Philipino. Table 9 (page 37) shows all categories of mother's race/ethnicity, their weighted frequency of answering "yes" to periconceptional binge drinking and the odds ratio of periconceptional binge drinking compared to White non-Hispanic mothers. Race/ethnicity was not made into a dichotomous variable because doing so would mask the significant differences in periconceptional binge drinking between specific race/ethnicities (Table 9, page 37).

Periconceptional Smoking

Smoking 3 months prior to pregnancy was obtained from the PRAMS questions 30 and 31 (Appendix 1, PRAMS survey). Q30 contained a skip pattern such that if the answer to Q30 was "no," the next 8 questions about smoking should have been skipped. Approximately 5% of mothers did not follow the skip pattern correctly; their data was treated as missing. Based on the combination of answers provided in Q30 and Q31, the responses to periconceptional smoking were classified into 3 categories: "yes," "no," or "missing." Missing data was not used in further analyses. The odds of binge drinking in the periconceptional period in those who smoked in the periconceptional period was 4.94 (95% CI 2.96 – 8.25) times more than those who did not smoke during that period (Table 9, page 37).

Marital Status and No Father's Name on the Birth Certificate

Marital status was obtained from the birth certificate. Those who answered "unmarried," "divorced," "annulled," and "not reported" were considered unmarried. Those who answered "married" or "separated" were considered married. The odds of binge drinking in the periconceptional period in unmarried mothers was 2.48 (95% CI 1.52 – 4.06) times those who were married (Table 9, page 37).

No father's name on the birth certificate was obtained from the birth certificate. Those whose birth certificates had both first and last father's name were classified as having the father's name on the birth certificate. Those whose birth certificates did not have both the father's first and last name were classified as no father's name on the birth certificate. The odds of binge drinking in the periconceptional period in women who did not have their baby's father's name on the birth certificate was 2.77 (95% CI 1.4 – 5.49) times those whose partners were named on the birth certificate (Table 9, page 37).

Stressful Life Events

Question 42 on the Oregon 2000 PRAMS survey asked about 15 stressful life events (Appendix 1, Q42a through Q42o.) Three of these questions (Q42h, Q42k and Q42l,), asked about characteristics of the father and were not included in the analysis. Eight out of the remaining 12 stressful life events were significantly related to periconceptional binge drinking (Table 9). These included: prepregnancy domestic violence (Q42n), prepregnancy non-partner violence (Q42o), separated or divorced from partner before and/or during pregnancy (Q42b), homelessness before and/or during pregnancy (Q42d), mom fired from job before and/or during pregnancy (Q42f), more partner arguments before and/or during pregnancy (Q42g), and had a lot of bills that couldn't be paid before and/or during pregnancy (Q42i).

Insurance Prior to Pregnancy

The PRAMS survey contains two questions about pre-pregnancy insurance status. Question 6 (Appendix 1) asks about insurance prior to pregnancy and whether this insurance covers prenatal care. Question 7 (Appendix 1) asks about having Oregon Health Plan (OHP) insurance just prior to pregnancy. The odds of periconceptional binge

drinking was not significantly greater in women who did not have health insurance prior to pregnancy compared to those who did, OR 1.26 (95% CI 0.75 - 2.13). The odds of periconceptional binge drinking was also not significantly greater in women who had OHP insurance prior to pregnancy compared to those who did not, 1.10 (95% CI 0.56 – 2.15), (Table 9, page 37).

Table 9. Association between categorical variables and periconceptional binge drinking

	n* - unweighted	Weighted Percent – Periconceptional Binge Drinking	Odds Ratio	Lower 95% CI	Upper 95% CI	p-value
Marital status**						
Unmarried	776	18.52	2.48	1.52	4.06	0.0003
Married	1261	8.38	1.00	-	-	.
Father on the birth certificate**						
No	242	23.89	2.77	1.40	5.49	0.0064
Yes	1795	10.18	1.00	-	-	.
Race/ethnicity**						
Black non-Hispanic	247	4.88	0.34	0.19	0.61	0.0002
American Indian or Alaskan Native	227	22.03	1.88	1.29	2.74	0.0011
Asian and/or Pacific Islander	322	3.71	0.26	0.14	0.47	<0.0001
Hispanic	568	5.08	0.36	0.23	0.56	<0.0001
White non-Hispanic	673	13.06	1.00	-	-	.
Periconceptional smoking**						
Yes	453	25.72	4.94	2.95	8.25	<0.0001
No	1546	6.54	1.00	-	-	.
Pre-pregnancy domestic abuse**						
Yes	77	28.28	3.43	1.22	9.61	0.0191
No	1669	10.31	1.00	-	-	.
Pre-pregnancy non-partner violence**						
Yes	40	49.27	8.46	2.57	27.85	0.0006
No	1707	10.3	1.00	-	-	.
Had a lot of bills couldn't pay before and/or during pregnancy**						
Yes	613	18.00	2.27	1.38	3.73	0.0013
No	1387	8.82	1.00	-	-	.
Homeless before and/or during pregnancy **						
Yes	101	26.07	2.86	1.10	7.45	0.0312
No	1899	10.97	1.00	-	-	.
Insurance prior to pregnancy**						
None	681	13.03	1.26	0.75	2.13	0.3794
Any	1341	10.60	1.00	-	-	.
Oregon Health Plan just prior to pregnancy						
Yes	372	12.23	1.10	0.56	2.15	0.7836
No	1641	11.26	1.00	-	-	.
Mom fired from job before and/or during pregnancy						
Yes	297	19.21	2.05	1.09	3.83	0.0251
No	1692	10.41	1.00	-	-	.

Table 9. continued

Unwanted pregnancy by partner						
Yes	193	21.23	2.27	1.09	4.72	0.0278
No	1807	10.60	1.00	-	-	.
More partner arguments before and/or during pregnancy						
Yes	508	19.41	2.49	1.50	4.14	0.0004
No	1482	8.82	1.00	-	-	.
Partner had drug or alcohol problem before and/or during pregnancy						
Yes	335	19.24	2.11	1.18	3.80	0.0122
No	1665	10.13	1.00	-	-	.
Separated or divorced from partner before and/or during pregnancy						
Yes	235	18.49	1.90	0.98	3.71	0.0593
No	1768	10.65	1.00	-	-	.
Partner went to jail before and/or during pregnancy						
Yes	119	21.93	2.26	0.88	5.81	0.0909
No	1881	11.06	1.00	-	-	.
Mom in physical fight before and/or during pregnancy						
Yes	99	23.79	2.50	0.84	7.46	0.1001
No	1904	11.09	1.00	-	-	.
Moved to a new address before and/or during pregnancy						
Yes	871	13.15	1.36	0.83	2.22	0.2169
No	1144	10.01	1.00	-	-	.
Birth Control Prior to Pregnancy						
No	1530	10.51	0.73	0.42	1.26	0.258
Yes	499	13.85	1.00	-	-	.
A close family member was very sick before and/or during pregnancy						
Yes	466	13.13	1.25	0.73	2.15	0.4076
No	1537	10.75	1.00	-	-	.
Close relation died before and/or during pregnancy						
Yes	372	12.58	1.15	0.61	2.16	0.6708
No	1626	11.15	1.00	-	-	.
Partner lost a job before and/or during pregnancy						
Yes	338	11.73	1.04	0.56	1.93	0.9034
No	1659	11.34	1.00	-	-	.

* Unweighted number of respondents

** Candidate variables for multivariate model.

Multivariate Model Building

Variable Selection

Of all the variables analyzed by univariate analysis, 13 were selected for multivariate model building using selection criteria. Three were continuous variables, recoded into categorical variables (Table 8) and 10 were categorical variables (Table 9). All candidate variables were significantly related to periconceptional binge drinking ($p < 0.10$) except for insurance prior to pregnancy (Table 9). This variable was included because it was significantly related to periconceptional binge drinking in a previous study [24].

Model Building

From the pool of 13 candidate variables, forward stepwise logistic regression was used to select those variables for the model. Model 1 contained 9 variables: Pregnancy intention, Periconceptional smoking, Parity, Education, Race/ethnicity, Had a lot of bills that couldn't be paid before and/or during pregnancy, Marital status, Pre-pregnancy non-partner violence, and Insurance prior to pregnancy (Model 1).

Model 1. Initial model of risk factors

$$g(x) = -4.25 + 0.72x_1 + 1.23x_2 + 1.03x_3 + 1.05x_4 - 1.64x_5 + 0.24x_6 - 1.27x_7 - 0.58x_8 + 0.65x_9 + 0.83x_{10} + 2.18x_{11} - 0.66x_{12}$$

$g(x)$ = log odds of periconceptional binge drinking = ln (p / 1-p) where p equals the probability of **Periconceptional binge drinking**
x_1 = **Pregnancy intention** (non-intended as referent)
x_2 = **Periconceptional smoking** (not smoking as referent)
x_3 = **Parity** (one or more live births as referent)
x_4 = **Education** (less than a high school education as referent)
x_5 = **Race/ethnicity** Black non-Hispanic (White non-Hispanic as referent)
x_6 = **Race/ethnicity** American Indian or Alaskan Native (White non-Hispanic as referent)
x_7 = **Race/ethnicity** Asian and/or Pacific Islander (White non-Hispanic as referent)
x_8 = **Race/ethnicity** Hispanic (White non-Hispanic as referent)
x_9 = **Had a lot of bills that couldn't be paid before and/or during pregnancy** (answering "no" as referent)
x_{10} = **Marital status** (married as referent)
x_{11} = **Pre-pregnancy non-partner violence** (no violence as referent)
x_{12} = **Insurance prior to pregnancy** (not having insurance as referent)

Some variables in Model 1 were highly correlated. Education was highly correlated with marital status ($\chi^2 = 56.83$) and insurance prior to pregnancy ($\chi^2 = 72.89$). Marital status was also highly correlated with education ($\chi^2 = 56.83$), pregnancy intention ($\chi^2 = 52.11$), smoking ($\chi^2 = 52.79$) and insurance prior to pregnancy ($\chi^2 = 47.28$).

The multivariate odds ratios for each variable in Model 1 were compared to their bivariate odds ratios (Table 9). The odds ratio for insurance status differed in the direction of association. In the bivariate analyses, women without pre-pregnancy insurance were more likely to binge drink in the periconceptional period. However, in Model 1, women with insurance were more likely to binge drink during this period (Table 11). Previously published studies found the same result as the bivariate analysis [24]. The change in direction was attributed to an unstable estimate secondary to this variable's high correlation with Education ($\chi^2 = 72.89$) and Marital status ($\chi^2 = 47.28$). Therefore, Insurance Prior to Pregnancy was removed from the model and the model refit using only 8 variables (Model 2).

Table 11. Pre-pregnancy insurance status changes direction of association in multivariate model.

Pre-pregnancy insurance	Bivariate OR	L. 95% CI	U. 95% CI	Multivariate OR	L. 95% CI	U.95% CI
No	1.26	0.75	2.13	0.52	0.25	1.05
Yes	1	-	-	1	-	-

The multivariate odds ratios for each variable in Model 2 were compared to their bivariate odds ratios (Table 12). Because the direction of association for all variables was consistent with the univariate analysis, Model 2 was labeled the "preliminary main effects" model.

Interactions between unintentional pregnancy and other variables in the preliminary main effects model were calculated using SAS. When interactions were included in the model, SUDAAN reported an over-parameterized model, indicating that including interactions destabilizes the model. Therefore, no interactions were included. The "preliminary main effects model" was therefore labeled the "final model" (Model 2).

Model 2. Main effects and final model of risk factors

$g(x) = -4.25 + 0.72x_1 + 1.23x_2 + 1.03x_3 + 1.05x_4 - 1.64x_5 + 0.24x_6 - 1.27x_7 - 0.58x_8 + 0.65x_9 + 0.83x_{10} + 2.18x_{11} - 0.66x_{12}$

$g(x)$ = log odds of periconceptional binge drinking = ln (p / 1-p) where p equals the probability of **Periconceptional binge drinking**
x_1 = **Pregnancy intention** (non-intended as referent)
x_2 = **Periconceptional smoking** (not smoking at referent)
x_3 = **Parity** (one or more live births as referent)
x_4 = **Education** (less than a high school education as referent)
x_5 = **Race/ethnicity** Black non-Hispanic (White non-Hispanic as referent)
x_6 = **Race/ethnicity** American Indian or Alaskan Native (White non-Hispanic as referent)
x_7 = **Race/ethnicity** Asian and/or Pacific Islander (White non-Hispanic as referent)
x_8 = **Race/ethnicity** Hispanic (White non-Hispanic as referent)
x_9 = **Had a lot of bills that couldn't be paid before and/or during pregnancy** ("no" as referent)
x_{10} = **Marital status** (married as referent)
x_{11} = **Pre-pregnancy non-partner violence** (no violence as referent)
x_{12} = **Insurance prior to pregnancy** (not having insurance as referent)

Table 12. Comparison between bivaraite and multivariate odds ratios of risk factors for periconceptional binge drinking

	Univariate odds ratio	Lower 95% CI	Upper 95% CI	Multivariate* odds ratios	Lower 95% CI	Upper 95% CI
Pregnancy intention						
Unintended	2.60	1.58	4.29	1.93	1.03	3.60
Intended	1.00	-	-	1.00	-	-
Periconceptional smoking						
Yes	4.94	2.95	8.25	3.12	1.69	5.73
No	1.00	-	-	1.00	-	-
Parity						
Nulliparus	2.34	1.41	3.86	2.68	1.46	4.49
One or more live births	1.00	-	-	1.00	-	-
Education						
At least a high school education	1.85	0.94	3.65	2.84	1.16	6.96
Less than a full high school education	1.00	-	-	1.00	-	-
Race/ethnicity						
Black non-Hispanic	0.34	0.19	0.61	0.22	0.10	0.49
American Indian and/or Alaskan Native	1.88	1.29	2.74	1.33	0.78	2.28
Asian and/or Pacific Islander	0.26	0.14	0.47	0.27	0.12	0.63
Hispanic	0.36	0.23	0.56	0.49	0.25	0.98
White non-Hispanic	1.00	-	-	1.00	-	-
Had a lot of bills you couldn't pay before and/or during pregnancy						
Yes	2.27	1.38	3.73	1.77	0.94	3.33
No	1.00	-	-	1.00	-	-
Marital status						
Unmarried	2.48	1.52	4.06	2.09	1.08	4.06
Married	1.00	-	-	1.00	-	-
Pre-pregnancy non-partner violence						
Yes	8.46	2.57	27.85	6.65	1.34	33.16
No	1.00	-	-	1.00	-	-

* Multivariate odds ratios estimated from model 2.

Variable Exclusion

Prior to model building, certain variables were excluded as potential candidate variables for the model. Pre-pregnancy income was not a candidate variable for multivariate model building because of the high number of missing responses in this category. About 10% of women did not answer Q81 or Q82 (Appendix 1). If included in a multivariate model, the 10% missing data would be excluded from all analyses and may have had a significant and unpredictable effect on the estimates of the coefficients for other variables in the model. Moreover, income was not significantly related to periconceptional binge drinking in the bivariate analysis (p-value 0.596).

The variable "mom fired from job before and/or during pregnancy" (Appendix 1, Q42f) was excluded from the pool of candidate variables because it was considered an indication of a stressful financial situation which was already accounted for by "having lots of bills that couldn't be paid." The responses to these 2 questions were also highly correlated with each other (Chi-square (χ^2) = 39.19). Having lots of bills to pay was selected over mom being fired because the association with periconceptional binge drinking was stronger in bivariate analysis with having lots of bills to pay (Table 9).

Three variables were proxies for other candidate variables and were not used as candidate variables, even though they were not highly correlated. Two variables: "mom in a physical fight before and/or during pregnancy" (Appendix 1, Q42j) and "more partner augments before and/or during pregnancy" (Appendix 1, Q42g), were excluded because questions about pre-pregnancy domestic abuse (Appendix 1, Q42n) and pre-pregnancy non-partner violence (Appendix 1, Q42o) were already candidate variables. The correlation between responses to Q42j and Q42n was $\chi^2 = 6.91$, to Q42j and Q42o was $\chi^2 = 4.93$, to Q42g and Q42n was $\chi^2 = 13.47$, and to Q42g and Q42o was $\chi^2 = 3.63$.

The variable, "separated or divorced from partner before and/or during pregnancy" (Appendix 1, Q42b) was excluded because it was a proxy for marital status. The correlation between responses to Q42b and marital status was $\chi^2 = 28.14$.

Goodness of Fit Test

Analysis of Model 2 showed a Hosmer and Lemeshow Goodness of Fit statistic using an F-distribution of 0.4376 (p value 0.9152) using 9 degrees of freedom. This high

p-value indicates that the model had little error (i.e. distance between observed and predicted values) in predicting those women at higher risk of binge drinking prior to pregnancy. This indicates Model 2 fit the data in the PRAMS 2000 dataset well.

Validation on Oregon PRAMS 2001 Dataset

In 2001, the Oregon PRAMS respondents numbered 1,795 out of 2,490 women sampled for a response rate of 72.1%. Of these women, 1,305 responded to the first or second mailing and 490 were interviewed by phone. This response rate is similar to the rate in 2000 (73.0%). For those variables in Model 2, the questions on the PRAMS survey and the birth certificate were identical from 2000 to 2001. The weighting process was the same between the two years but weights were different because of a yearly change in the Oregon census.

Table 13 (page 46) compares the estimates between the Model 2 fit to PRAMS 2000 data and to PRAMS 2001 data. The odds ratios for pregnancy intention are essentially unchanged from 2000, 1.93 (95% CI 1.03 – 3.60) to 2001, 1.71 (95% CI 0.92 – 3.19), indicating that pregnancy intention is a reproducible risk factor for periconceptional binge drinking. Since confidence intervals are dramatically affected by sample size [24], the non-significant confidence interval for pregnancy intention in 2001 is not indicative of poor reproducibility.

Other risk factors with similar odds ratios from 2000 to 2001 were periconceptional smoking, parity, and having lots of bills to pay (Table 13, page 46). Thus, these were also reproducible risk factors for periconceptional binge drinking.

Individual race categories had mostly similar odds ratios from 2000 to 2001 (Table 13, page 46). However, in 2001 AI/AN mothers were even less likely than White non-Hispanic women to report periconceptional binge drinking. All other race categories had reproducible results from 2000 to 2001.

Pre-pregnancy non-partner violence and Marital status had large drops in odds ratios from 2000 to 2001 (Table 13, page 46). The strength of these risk factors to predict periconceptional binge drinking was not reproducible.

Education was no longer associated with periconceptional binge drinking in 2001 and thus is not a reproducible risk factor.

The Hosmer and Lemeshow Goodness of Fit test was calculated for Model 2 using Oregon PRAMS 2001 data. The Hosmer and Lemeshow Goodness of Fit statistic using an F-distribution is 0.5723 (p value 0.8207) using 9 degrees of freedom. The large p-value indicates the null hypothesis cannot be rejected and thus the model, built on the PRAMS 2000 data, still has a good fit to the 2001 PRAMS data on periconceptional binge drinking.

Table 13. External validation of final model with Oregon PRAMS 2001 data

	Multivariate odds ratios built on Oregon PRAMS 2000	Lower 95% CI	Upper 95% CI	Multivariate odds ratios validated on Oregon PRAMS 2001	Lower 95% CI	Upper 95% CI
Pregnancy intention						
Unintended	1.93	1.03	3.60	1.71	0.92	3.19
Intended	1.00	-	-	1.00	-	-
Periconceptional smoking						
Yes	3.12	1.69	5.73	4.11	2.05	8.23
No	1.00	-	-	1.00	-	-
Parity						
Nulliparus	2.68	1.46	4.49	2.64	1.38	5.07
One or more live births	1.00	-	-	1.00	-	-
Education						
At least a high school education	2.84	1.16	6.96	0.76	0.32	1.77
Less than a full high school education	1.00	-	-	1.00	-	-
Race/ethnicity						
Black non-Hispanic	0.22	0.10	0.49	0.55	0.27	1.12
American Indian and/or Alaskan Native	1.33	0.78	2.28	0.81	0.44	1.47
Asian and/or Pacific Islander	0.27	0.12	0.63	0.52	0.26	1.03
Hispanic	0.49	0.25	0.98	0.46	0.22	0.95
White non-Hispanic	1.00	-	-	1.00	-	-
Had a lot of bills you couldn't pay before and/or during pregnancy						
Yes	1.77	0.94	3.33	2.28	1.16	4.47
No	1.00	-	-	1.00	-	-
Marital status						
Unmarried	2.09	1.08	4.06	1.13	0.57	2.27
Married	1.00	-	-	1.00	-	-
Pre-pregnancy violence						
Yes	6.65	1.34	33.16	1.29	0.33	5.02
No	1.00	-	-	1.00	-	-

Associations between Periconceptional Binge Drinking and Pregnancy Outcomes and Occurrences

Bivariate analysis was used to explore associations between periconceptional binge drinking and newborn outcomes (Table 14), pre-pregnancy indicators (Table 15), prenatal exposures and prenatal care (Table 16), and post-delivery healthcare (Table 17). Continuous and categorical variables were recoded to maximize odds ratios or according to published values. Variables that required extensive recoding were: timing of prenatal care initiation, birthweight, gestational age at birth, and intrauterine growth restriction (IUGR). IUGR was classified based upon standard fetal growth charts [55].

Table 14. Associations between newborn outcomes and periconceptional binge drinking

Newborn Outcomes	n* - unweighted	Weighted Percent – Periconceptional Binge Drinking	Odds Ratio	Lower 95% CI	Upper 95% CI
Estimate Gestation Age at Birth					
< or = 37 weeks	507	13.29	1.25	0.67	2.31
> 37 weeks	1530	10.95	1.00	-	-
Birthweight					
< 2500	393	8.92	0.76	0.49	1.18
≥ 2500	1644	11.39	1.00	-	-
IUGR					
IUGR	190	5.78	0.47	0.13	1.69
no IUGR	1847	11.54	1.00	-	-

* Unweighted number of respondents

Table 15. Association between pre-pregnancy indicators and periconceptional binge drinking

Pre-pregnancy	n* - unweighted	Weighted Percent – Periconceptional Binge Drinking	Odds Ratio	Lower 95% CI	Upper 95% CI
Folic acid use.					
No	1164	13.69	1.64	0.99	2.72
Yes	859	8.81	1.00	-	-
Knowledge of Emergency Contraception					
No	1211	12.94	1.93	1.04	3.56
Yes	787	7.16	1.00	-	-

* Unweighted number of respondents

Table 16. Associations between prenatal exposures or prenatal care and periconceptional binge drinking

Prenatal Occurrences	n* - unweighted	Weighted Percent – Periconceptional Binge Drinking	Odds Ratio	Lower 95% CI	Upper 95% CI
Binge drinking during the last 3 months of pregnancy					
Yes	7	91.52	88.54	14.66	534.79
No	2028	10.86	1.00	-	-
Alcohol use during the last 3 months of pregnancy					
Drink	87	25.69	2.99	1.40	6.41
No drink	1947	10.35	1.00	-	-
Smoking in the first trimester					
Yes	303	24.23	3.3	1.90	5.74
No	1705	8.83	1.00	-	-
Smoking in the 2nd trimester					
Yes	211	23.62	2.89	1.56	5.34
No	1807	9.68	1.00	-	-
Smoking in the 3rd trimester					
Yes	189	25.27	3.18	1.70	5.95
No	1830	9.62	1.00	-	-
Smoking now, after pregnancy					
Yes	316	20.67	2.47	1.41	4.33
No	1709	9.54	1.00	-	-
Domestic abuse during pregnancy					
Yes	59	31.49	3.94	1.27	12.22
No	1686	10.45	1.00	-	-
Physical violence during pregnancy					
Yes	24	34.08	4.28	0.64	28.8
No	1721	10.78	1.00	-	-
Women, Infants, Children care (WIC) during pregnancy					
Yes	938	12.04	1.13	0.69	1.85
No	1099	10.79	1.00	-	-
Prenatal care at first pregnancy test					
Yes	1321	10.44	1.00	-	-
No	614	13.22	1.31	0.77	2.22
OHP for any portion of prenatal care					
Yes	821	16.65	2.13	1.29	3.49
No	1085	8.59	1.00	-	-
Prenatal care as early as wanted by mother					
Yes	1581	11.07	1.00	-	-
No	436	12.45	1.05	0.69	1.6

* Unweighted number of respondents

Table 17. Associations between post-delivery healthcare and periconceptional binge drinking

Post-Delivery Occurrences	n* - unweighted	Weighted Percent – Periconceptional Binge Drinking	Odds Ratio	Lower 95% CI	Upper 95% CI
Breast feeding new baby					
Yes	1756	11.13	0.94	0.41	2.15
No	207	11.79	1.00	-	-
Baby with mom					
Baby living not with mom	15	31.81	3.72	0.47	29.14
Baby living with mom	1996	11.14	1.00	-	-
Exposure of new baby to smoke					
Yes	53	13.29	1.23	0.31	4.87
No	1905	11.12	1.00	-	-
Others besides mom who expose child to smoking					
Yes	525	20.13	2.82	1.70	4.68
No	1449	8.2	1.00	-	-
How is the baby put to sleep?					
On side	513	10.36	0.87	0.46	1.64
On stomach	162	9.11	0.75	0.30	1.87
On back	1295	11.73	1.00	-	-
How often does the baby sleep in bed with you?					
Always	539	13.13	1.50	0.72	3.14
Almost Always	294	9.29	1.02	0.42	2.5
Sometimes	741	12.42	1.41	0.75	2.65
Never	391	9.13	1.00	-	-
Firearms in or around home					
I don't know	28	1.01	0.08	0.01	0.45
Yes	437	12	1.10	0.64	1.89
No	1506	10.99	1.00	-	-
Using birth control after birth					
No	426	13.03	1.24	0.68	2.26
Yes	1605	10.81	1.00	-	-

* Unweighted number of respondents

Discussion

Unintentional Pregnancy and Periconceptional Binge Drinking in Oregon

In 2000, Oregon mothers with unintended pregnancies who delivered a live born child were 2.60 (95% CI 1.58 – 4.29) times higher risk of periconceptional binge drinking than women who had intended pregnancies. After adjusting for other significant risk factors (periconceptional smoking, parity, education, race/ethnicity, lots of bills that can't be paid, marital status, and pre-pregnancy non-partner violence) these same mothers with unintended pregnancies were still 1.93 (95% CI 1.03 – 3.6) times higher risk of periconceptional binge drinking than those with intended pregnancies. In 2001, after adjusting for these same risk factors, Oregon mothers with unintended pregnancies were 1.71 (95% CI 0.92 – 3.19) times higher risk of periconceptional binge drinking than those with intended pregnancies. Thus, unintended pregnancy is a strong, independent and reproducible risk factor for periconceptional binge drinking.

Mothers whose pregnancies are unintentional, that also report binge drinking in the periconceptional period, may actually have binge drank after conception but before pregnancy recognition. This is because a woman who is not expecting to become pregnant is unlikely to stop her typical drinking pattern before getting pregnant [16]. In addition, many women continue their drinking patterns into pregnancy until pregnancy recognition [16]. Thus, women who report periconceptional binge drinking may have not stopped binge drinking until pregnancy recognition.

Since the median time of pregnancy recognition is 5 weeks gestation [24], mothers who report periconceptional binge drinking may have continued their pattern of drinking up to or beyond this period of time. Both animal and human studies confirm that high maternal alcohol exposure early in gestation, even without baseline alcohol use, is strongly associated with fetal alcohol effects. This type of exposure can produce a range of subtle neurobehavioral deficits that may only be recognized late in childhood [3, 20, 25].

Significance of Results for Oregon Public Health

In this study 17.46% of mothers who had unintended pregnancies also binge drank in the periconceptional period (Table 7). Since there are on average about 45,500 annual births in Oregon per year [52], and a previous study found that 39% of women who deliver in Oregon have unintended pregnancies [33], about 18,200 (39% of 45,500) births in Oregon are unintended. Given the relationship between unintended pregnancy and periconceptional binge drinking in this study, approximately 3,094 (17% of 18,200) babies are at risk every year in Oregon for binge level fetal alcohol exposure early in the first trimester. This alarming level indicates a significant clinical and public health need to decrease unintended pregnancies and/or risky drinking patterns such as binge drinking in Oregon.

Recently, Oregon was selected by the Centers for Disease Control and Prevention (CDC) to be one of 7 states to implement a comprehensive, state-based fetal alcohol syndrome (FAS) prevention program [61]. The purpose of this program is to: (1) develop, implement, and evaluate population-based and targeted programs for FAS prevention, including the identification of high-prevalence geographic areas or selected subpopulations of childbearing-aged women at high risk for an alcohol-exposed pregnancy; (2) establish or enhance prenatal and preconceptional intervention programs to serve these populations; and (3) establish or use existing systems for monitoring the impact of prevention programs. The present study argues that this prevention strategy requires a focus on women who are at risk for unintended pregnancies in Oregon.

Recent clinical and public health strategies to prevent fetal alcohol exposure recognize that women with unintentional pregnancies are at higher risk for fetal alcohol exposure. Project CHOICES (Changing High Risk Alcohol Use and Improving Contraceptive Effectiveness Study) was a clinically targeted intervention by the CDC to reduce the likelihood of fetal alcohol exposure in those women who were at high risk for unintended pregnancies. The goal of Project CHOICES was to increase effective, consistent use of contraception and/or reduce at-risk drinking (defined as more than 7 drinks per week or binge drinking once in the last 6 months) [45]. At six months post intervention, 68.2% of at-risk women were not at risk (18.4% reduced drinking, 34% used effective contraception and 47.6 percent did both) [46].

Public health educational materials to prevent fetal alcohol exposure also recognize that women with unintentional pregnancies are at higher risk for fetal alcohol exposure. The CDC recently released a flier entitled, "I never thought I'd get pregnant… let alone have a child with Fetal Alcohol Syndrome" (Appendix 3). This flier states, "Unprotected sex + Alcohol = Alcohol Affected Babies" and that, "If you drink and are sexually active, use birth control *all the time*."

Increasing knowledge and availability of emergency contraception (EC) is another example of a strategy to help reduce fetal alcohol exposure. Previous studies link unintended pregnancies with lack of EC knowledge [33]. In this study, the crude odds ratio of not knowing about EC was 1.93 (95% CI 1.04 – 3.56) times greater in women who binge drank in the periconceptional period (Table 15). Controlling for unintended pregnancies strengthens this relationship (data not shown). Thus, women who are at high risk for fetal alcohol exposure, i.e., those that binge drink and have inconsistent contraceptive use may need particular emphasis on EC education. In addition to education, EC must be easily accessible. Only though education and access will EC help to prevent unwanted pregnancies, and potentially alcohol exposed unwanted pregnancies. Using these strategies, Oregon could be the first state to utilize EC as part of an FAS prevention effort.

Other Risk Factors for Periconceptional Binge Drinking in Oregon

This study identified other significant risk factors, besides pregnancy intention, for periconceptional binge drinking (Model 2). These associations were assessed for independence, i.e., significance in a multivariate model (Table 12), and for reproducibility, i.e., similarity in the odds ratio with validation (Table 13). Four risk factors (periconceptional smoking, nulliparity, being White non-Hispanic, and having lots of bills to pay) were independently and reproducibly associated with periconceptional binge drinking. Four others (being unmarried, having experienced pre-pregnancy non-partner violence, being of higher education, and being NA/AN) were independent but not reproducible risk factors.

Periconceptional Smoking

This study found an association between smoking 3 months before pregnancy and periconceptional binge drinking: crude odds ratio 4.94 (95% CI 2.95 – 8.25) and adjusted odds ratio 3.12 (95% CI 1.69 – 5.73). This result parallels previous studies that showed smoking was significantly related to alcohol consumption in non-pregnant women [41], in pregnant women [16,18], and in women during the periconceptional period [24].

Cigarette smoking during pregnancy contributes to multiple adverse outcomes, including spontaneous abortion, ectopic pregnancy, stillbirth, fetal death, low birth weight, preterm delivery, intrauterine growth restriction, *placenta previa, abruptio placenta,* and preterm premature rupture of the membranes [32]. A combination of alcohol and cigarette exposure *in utero* is likely to cause additive, if not multiplicative effects on the fetus. In this study, 25% of women who smoked during the periconceptional period also binge drank during this time.

Because of similar risk factors, identification of non-pregnant as well as pregnant smokers provides an opportunity to reduce smoking rates during pregnancy. Since effective interventions exist and many women (in particular, those who are pregnant) have regular contact with health-care providers, physicians should obtain a smoking history from all patients and provide smokers with counseling and/or referrals to smoking cessation programs [32]. Furthermore, with the strong association between smoking and alcohol use during pregnancy, identification of smoking in any woman of childbearing age, and especially in pregnant women, should prompt screening for alcohol use. Early intervention may reduce alcohol exposure to the fetus during pregnancy.

Smoking may also be a confounder in the relationship between binge drinking during the periconceptional period and other predictor variables. Previous studies have shown that maternal smoking is correlated with having a high school education or less, being White, and being unmarried [42]. In this study, periconceptional binge drinking was similarly correlated with race/ethnicity and marital status, however, oppositely with education, i.e., with having at least a high school education (Table 12, page 42). Nevertheless, these similarities indicate that maternal smoking in some way may be confounding the relationship between these predictors and binge drinking. Incorporating smoking into a multivariate model with marital status adjusts for this type of confounding

relationship. Thus, future epidemiological studies of periconceptional binge drinking need to control for smoking.

Parity

Having no previous live births was a significant risk factor for periconceptional binge drinking in both the crude and adjusted analysis (odds ratios: 2.34 (95% CI 1.41 – 3.86) and 2.38 (95% CI 1.46 – 4.49), respectively). This same relationship persisted in the 2001 validated data (Table 13, page 46). These results parallel previous studies indicating that women having their first child are more likely to drink and binge drink during the periconceptional period (BRFSS 1991 – 1995 and PRAMS 1996 – 1999) [16, 24].

Women having their first child (nulliparous) are less likely to report frequent alcohol use after pregnancy recognition, than multiparous women [16]. This indicates nulliparous women may be less likely to be dependent on alcohol, because they can stop drinking at pregnancy recognition. This fits with the epidemiology of FAS, which demonstrates that more multiparous women have children diagnosed with FAS [34]. Thus, in this study, binge drinking in nulliparous women may be more likely to be sporadic and not part of a pattern of alcoholism.

While sporadic binge drinking during pregnancy is potentially less damaging to the fetus than chronic alcoholism [13], the prevalence of sporadic binge drinking is likely to be much higher in women than chronic alcoholism. Thus, the potential correlation between parity and patterns of binge drinking indicates two separate targets for prevention of fetal alcohol effects: 1. women who sporadically binge drink, and 2. women who chronically abuse alcohol. Future studies need to elucidate to what extent these patterns correlate with parity.

Race/Ethnicity

Racial differences between periconceptional binge drinkers differed between crude and adjusted associations. Unadjusted analysis found Native American and/or Alaskan Native (NA/AN) women had significantly higher rates of periconceptional binge

drinking than other races or ethnicities (Table 9, page 37). However, after adjusting for other risk factors (pregnancy intention, periconceptional smoking, parity, education, race/ethnicity, lots of bills that can't be paid, marital status, and pre-pregnancy non-partner violence) the rate of periconceptional binge drinking in NA/AN was not significantly different than that of White non-Hispanic women (Table 12). Thus, after adjustment, both White non-Hispanic women and NA/AN were equally likely to report periconceptional binge drinking (Table 12). Further analysis needs to be conducted to determine which combination of these risk factors most greatly affected the association between periconceptional binge drinking and NA/AN race/ethnicity.

The reason for the significance of the crude, and not adjusted, odds ratios of NA/AN may be because there is a subset of NA/AN with a high proportion of binge drinking in the periconceptional period. This subset of women likely has other risk factors for periconceptional binge drinking that were controlled for the multivariate model (Table 12, page 42). In some Native American tribes, drinking patterns are bimodal: a high proportion of the tribe does not drink at all, but among those who do drink there is a high proportion of heavy and abuse drinkers [13]. Moreover, urban populations of NA/AN are thought to have higher rates of alcoholism than those that live in rural reservations [62]. These are just two examples of subsets of AI/AN women with higher rates of alcohol use and likely higher rates of periconceptional binge drinking.

Bills that Couldn't be Paid

Financial problems (i.e., having lots of bills that couldn't be paid) remained in the multivariate analysis with an adjusted odds ratio of 1.77 (95% CI 0.94 – 3.33). In contrast, income had no significant relationship with periconceptional binge drinking (Graph 4, page 31 and Table 8, page 33). Other studies suggest that the stress of debt problems is more significant than the dollar amount of income [51]. Thus, indebtedness may be a likely stressor triggering women to binge drink alcohol even around the time of conception.

Other studies have shown that not having medical insurance is a risk factor for periconceptional binge drinking [24] and is a potential proxy for poverty. However, in

this analysis neither insurance status nor being on the Oregon Health Plan (Medicaid) was associated with binge drinking prior to pregnancy (Table 9, page 37).

Homelessness was significantly associated in the univariate analysis (crude odds ratio 2.86 (95% odds ratio 1.1 – 7.45)) (Table 9, page 37), but it did not remain significant in the multivariate analysis (Table 12). Interestingly, no variable in the multivariate model, including having too many bills to pay, was significantly correlated with homelessness (data not shown). Thus, homelessness may be an independent socio-economic status risk factor for maternal periconceptional binge drinking.

Marital Status

From previous studies, having the father's name on the birth certificate was predicted to be a better proxy for a supportive relationship than marital status [43]. In the univariate analysis, not having the father's name on the birth certificate was, in fact, a stronger predictor of periconceptional binge drinking (crude odds ratio 2.77 (95% CI 1.4 – 5.49)) than being unmarried (crude odds ratio 2.48 (95% CI 1.52 – 4.06)). This likely indicates that having a supportive relationship is preventative for maternal alcohol use, for periconceptional binge drinking, and especially for an unplanned pregnancy.

In the multivariate model, marital status and not father's name on the birth certificate remained significantly related to periconceptional binge drinking, adjusted OR 2.09 (95% CI: 1.08 – 4.06) (Table 12, page 42). In the validation study, the odds ratio changed significantly (adjusted OR 1.13 (95% CI 0.57 – 2.27)). Thus, marital status does not seem a consistent predictor of periconceptional binge drinking. Future studies should investigate whether father's name on the birth certificate is a more stable predictor of periconceptional binge drinking and/or fetal alcohol exposure.

Pre-Pregnancy Non-Partner Violence

Of the 2100 women surveyed in the 2000 PRAMS, only 40 reported pre-pregnancy non-partner violence. Weighted data showed 49.27% of these women reported periconceptional binge drinking. Thus, non-partner violence was a very strong risk factor

for periconceptional binge drinking, crude odds ratio 8.46 (95% CI 2.57 – 27.85). However, having a variable with such a small number of responses in one category may have caused instability in the estimates of the multivariate model. This may explain why pre-pregnancy violence did not remain significant in the validated model (Table 13). Nevertheless, if the variable was taken out of the model, the Hosmer and Lemeshow Goodness of Fit statistics dropped significantly (data not shown). Thus, those women predicted to binge drink because of pre-pregnancy violence may not have been adequately predicted by the other variables in the model. Future analysis needs to be conducted to determine the reason for the discrepancy between different year's data.

Education

Mothers of higher educational attainment were more likely to report periconceptional binge drinking, crude odds ratio 1.85 (95% CI: 0.94 - 3.68) and adjusted odds ratio 2.84 (95% CI 1.16, 6.96). This is similar to results from one previous study [16]. The relationship however, was not reproducible in the 2001 data, adjusted odds ratio 0.76 (95% CI 0.32 – 1.77). This is similar to results from a different study that showed no relationship between education and periconceptional binge drinking [24]. The reason for this discrepancy is unclear. Future research needs to investigate these conflicting results.

Age Not Associated with Periconceptional Binge Drinking

In the crude analysis younger age was significantly related to periconceptional conceptional binge drinking, crude OR 1.94 (95% CI 1.18 – 3.21) (Table 8, page 33). However, age was not significantly related after adjusting for other variables in the model. A previous multi-state PRAMS study on periconceptional binge drinking found younger age was associated with periconceptional binge drinking even when controlling for pregnancy intention, race, marital status, pre-pregnancy violence, and parity [24]. However, controlling for these variables in the 2000 Oregon PRAMS data, does not demonstrate a significant relationship between age and periconceptional binge drinking (data not shown).

The lack of association between age and periconceptional binge drinking in this study may be because the periconceptional period overlaps two demographic groups, non-pregnant and pregnant women. Multiple studies have shown that among non-pregnant women those who are younger are more likely to binge drink [29, 35]. However, studies of pregnant women show that alcohol use is more common in older women. Interestingly, younger women (aged < 30 years) tend to reduce alcohol use when they became aware they are pregnant, but women aged > 30 years are less likely to reduce alcohol use after learning they are pregnant [13, 16, 29]. Thus, the demographics of periconceptional binge drinking may be mixed with respect to age.

Baseline Alcohol Use in Periconceptional Binge Drinkers

In this study, there was a spectrum of baseline alcohol use in mothers who reported binge drinking in the periconceptional period. Some women were likely chronic alcohol abusers whereas others may have had isolated binge drinking events. Among the women who report binge drinking in the periconceptional period, 58% reported drinking less than 3 drinks per week in the periconceptional period, and 14% reported drinking 7 or more drinks during this period (Table 18).

Table 18. Weekly drinking habits of mothers who reported binge drinking in the periconceptional period

Weekly Drinking Patterns in the Periconceptional Period	Weighted Percentage of Total Periconceptional Binge Drinkers
Less than 1 drink a week	28.71
1 to 3 drinks a week	28.99
4 to 6 drinks a week	21.84
7 to 13 drinks a week	10.85
14 or more drinks a week	2.68
I didn't drink then	2.56
I don't know	4.38
Total	100.00%

Drinking 7 or more drinks per week plus binge drinking may be an indicator of chronic alcohol abuse. Chronic alcohol abusers are at risk for continuing their pre-pregnancy drinking patterns into pregnancy [29]. These mothers also have the highest

risk of having a baby with FAS [18]. Even women who report moderate to heavy alcohol use with binge drinking just in the periconceptional period, are more likely to have low birth weight babies [22]. These women are important targets for clinical and public health prevention efforts to reduce FAS and FASD. Finding these women may help them get treatment prior to conception or even during pregnancy to prevent fetal alcohol exposure.

Women who reported less than 3 drinks per week plus binge drinking probably binge drank sporadically. Unfortunately, many women did not report the frequency of binge drinking, even though this question is part of the PRAMS survey. Nevertheless, even a few isolated episodes of binge drinking after conception but before pregnancy recognition has been shown to cause measurable neurodevelopment deficits in children [25]. Thus, prevention of sporadic binge drinking in the periconceptional period, especially in unplanned pregnancies, should be an important public health concern.

Chronic alcohol abusers and isolated alcohol bingers of are two distinct groups. Indeed, these two groups may have different socio-environmental demographics. However, in this study these groups were collapsed into one. This study therefore, captures the intersection of these two groups. Thus, the risk factors in this study likely identify common characteristics between these two groups of women. These risk factors cast a broad net capturing both groups, both of whom are at high risk of exposing their pregnancies to binge level alcohol.

Limitations

The results of this study may not be generalizable to all pregnant women. PRAMS only surveys mothers with live born infants. About 20% of pregnancies in the U.S. end in elective abortions [53]. Another 15 – 20% of pregnancies end in spontaneous abortion. Little is known about fetal alcohol exposure or periconceptional alcohol use in women who choose elective termination or whose pregnancies spontaneously abort. This is an important topic for future study.

Disclosure of prenatal alcohol consumption in this study may be underreported because of increasing awareness of the dangers of alcohol consumption during pregnancy

[54]. However, since PRAMS asks about binge drinking, "in the 3 months before you knew you were pregnant," women may not associate this with fetal alcohol exposure, and thus may answer this question honestly. This indicates that women who reported periconceptional binge drinking in PRAMS may not have binge drank after conception but before pregnancy recognition. Risk factors identified for periconceptional binge drinking may not be the same as risk factors for those who binge drank after conception but before pregnancy recognition. Future studies are needed to determine if the two sets of risk factors are similar.

Some but not all of the mothers who binge drank in the periconceptional period actually binge drank early in the first trimester. Unfortunately, PRAMS does not contain any questions on binge drinking in the first trimester. Future studies are needed to determine what percentage of mothers who reported periconceptional binge drinking actually binge drank in the first trimester.

Since PRAMS is a cross-sectional survey, causal relationships cannot be inferred. Thus, variables associated with periconceptional binge drinking cannot be identified as causing periconceptional binge drinking. In general, these variables (Table 12) indicate lifestyle differences relating to norms about alcohol use and misuse, the value of alcohol use, the accompanying social network that may provide pressure to use, or triggers that may lead to problematic drinking behavior [34]. Thus, cross-sectional surveys asking about alcohol use allow inferences about social and cultural norms among persons with similar characteristics. This was the basis for calling variables in this study "risk factors for periconceptional binge drinking."

Because of the sampling method used by PRAMS these results may have underrepresented certain subsets of women. Those women who were institutionalized, were homeless, or who had recently moved, may not have received the paper survey; and women without a phone would not have received the phone survey. Furthermore, women who could not read or speak English or Spanish were not able to answer the survey. Finally, women were excluded if their baby was not living with them. All of these exclusions may have introduced bias into the study.

Conclusions:

This study identifies individual risk factors for periconceptional binge drinking among Oregon women. Women who drink in the periconceptional period are at high risk for binge drinking in the first trimester, especially prior to pregnancy recognition. This model, and the individual variables identified in the model may help to better understand where to target programs to prevent periconceptional binge drinking and prenatal alcohol exposure.

Unintended pregnancy is a particularly concerning risk factor for periconceptional binge drinking. Women with unintended pregnancy may have delayed pregnancy recognition and thus may be at very high risk of fetal alcohol exposure before pregnancy recognition. While this study did not show a relationship between periconceptional binge drinking and fetal outcomes (Table 14, page 47), other studies have shown that binge drinking early in pregnancy is the most teratogenic pattern of alcohol consumption during pregnancy; leading to potentially significant developmental and neurobehavioral effects in the fetus [25].

Many authors have concluded that a preconceptional approach to preventing alcohol exposure during pregnancy is needed [18]. A preconceptional approach would target women who are most at risk of getting pregnant unintentionally and who are currently binge drinking. Since this study analyzed risk factors associated with periconceptional binge drinking and unintended pregnancy, the study results are ideally suited to help target such a preconceptional approach.

Oregon was recently selected by the CDC to be one of 7 states to implement a comprehensive, state-based FAS prevention program. Strategies suggested by this study would likely assist the development of this program.

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Appendix 1. 2000 Oregon PRAMS Survey

First, please tell us:

1. What is today's date? _____/_____/_____ month day year

2. What is ***YOUR*** date of birth? _____/_____/_____ month day year

Next, we would like to ask you some questions about the time just before and during your pregnancy with your new baby. It may help to look at the calendar when you answer these questions.

3. Where did you have a pregnancy test? **Check all that apply.**
   - Home
   - Private doctor's office or HMO clinic
   - Planned Parenthood
   - Health department clinic
   - Community health clinic
   - "Crisis pregnancy center"
   - Didn't take a pregnancy test
   - Other • Please tell us: _____

4. How many weeks or months pregnant were you when you were ***sure*** you were pregnant?
   - ___Weeks or ___Months
   - I don't remember

5. Thinking back to ***just before*** you got pregnant, how did you feel about becoming pregnant? **Check the best answer. (Feel free to note any reason why the answer you checked doesn't quite fit -- but *please* check the best answer.)**
   - I wanted to be pregnant sooner
   - I wanted to be pregnant later
   - I wanted to be pregnant then
   - I didn't want to be pregnant then or at any time in the future

6. ***Just before*** you got pregnant, did you have health insurance?
   - No
   - Yes, but it did not cover prenatal care
   - Yes, it covered prenatal care

7. ***Just before*** you got pregnant, did you have health insurance through the Oregon Health Plan?
   - No
   - Yes

8. In the month before you got pregnant with your new baby, how many times a week did you take a multivitamin (a pill that contains many different vitamins and minerals)?

- I did not take a multivitamin at all
- 1 to 3 times a week
- 4 to 6 times a week
- Every day of the week

9. ***When you got pregnant*** with your new baby, were you or your husband or partner using any kind of birth control?
Birth control means the pill, condoms, diaphragm, foam, rhythm, Norplant®, shots (Depo-Provera®), or ANY other way to keep from getting pregnant.

- No
- Yes • **Go to Question 11**

10. Why were you or your husband or partner not using any birth control?
Check <u>all</u> that apply.

- I wanted to get pregnant
- I didn't think I could get pregnant
- I had been having side effects from the birth control I used
- I didn't want to use birth control
- I didn't think I was going to have sex
- My husband or partner didn't want to use birth control
- Other • Please tell us:

_____

If you were not using birth control when you got pregnant, go to Question 13.

11. ***When you got pregnant***, what kinds of birth control were you or your partner using?
Check <u>all</u> that apply.

- Pill
- Condoms
- Foam, jelly, cream
- Diaphragm
- Norplant®
- Shots (Depo-Provera®)
- Withdrawal
- IUD (Intra-Uterine Device)
- Natural Family Planning (Rhythm)
- Other • Please tell us:

_____

12. Where were you or your partner getting your birth control method(s)? **Check <u>all</u> that apply.**

- A family planning clinic (for example, Planned Parenthood)
- A health department clinic
- A community health center
- A private gynecologist
- A general or family physician
- A drug store or other store
- Other • Please tell us:

_____

- No place

13. These questions ask about things you knew about birth control ***before you got pregnant.*** **For each item, please circle N (No) or Y (Yes).**

	No	**Yes**
a. Did you know there was free or low cost birth control at health departments and Planned Parenthood clinics?	N	Y
b. Had you ever read or heard about emergency birth control (the "morning-after" pill)? **This special combination of regular birth control pills is used to prevent pregnancy up to three days after unprotected sex.**	N	Y

14. ***Before you got pregnant***, did your health insurance cover the cost of birth control? **Check the <u>best</u> answer.**

- Yes, it covered all or part of the cost of my birth control method
- Yes, it covered birth control, but ***not the method I wanted***
- Yes, it covered birth control, but ***I didn't use a method***
- No, it did not cover birth control
- I didn't have any health insurance
- Don't know/Not sure

15. ***Just before*** you got pregnant, how much did you weigh?

_____ Pounds

16. How tall are you without shoes?

___ Feet ___ Inches

The next questions are about the prenatal care you got during your most recent pregnancy. Prenatal care includes visits to a doctor, nurse, or other health care worker before your baby was born to get check-ups and advice about pregnancy. It may help to look at a calendar when you answer these questions.

17. ***At the time of your first pregnancy test*** were you insured for prenatal care?
- No
- Yes
- Don't know/Not sure

18. If you had insurance for prenatal care, was it an employee benefit?
- No
- Yes
- Don't know/Not sure

19. Did the Oregon Health Plan pay for any portion of your prenatal care?
- No
- Yes
- Don't know/Not sure

20. About how many weeks or months pregnant were you when you had your ***first*** visit for prenatal care? **Don't count a visit that was only for a pregnancy test or only for WIC (Women, Infants, and Children's Nutrition Program).**
___Weeks or ___Months
- I did not go for prenatal care

21a. Did you get prenatal care as early in your pregnancy as you wanted?
- No
- Yes
- I did not want prenatal care

21b. Did any of these things keep you from getting prenatal care as early in your pregnancy as you wanted? **Check <u>all</u> that apply.**
- I couldn't get an appointment earlier in my pregnancy
- I didn't have enough money to pay for my visits
- I didn't have insurance to pay for my visits
- I didn't know that I was pregnant
- I had no way to get to the clinic or doctor's office
- The doctor or my health plan would not start care earlier
- I couldn't find a doctor or a nurse who would take me as a patient
- I had no one to take care of my children
- I had too many other things going on
- Other • Please tell us:

_____

- No, I got prenatal care as early as I wanted
- No, I did not want prenatal care

If you did not go for prenatal care, go to Question 24.

22. Where did you go ***most of the time*** for your prenatal visits? **Don't include visits for WIC. Check <u>one</u> answer.**

- Hospital clinic
- Health department clinic
- Private doctor's office or HMO clinic
- Other • Please tell us:

_____

23. During any of your prenatal care visits, did a doctor, nurse, or other health care worker talk with you about any of the things listed below? Please count only discussions, not literature or videos. **For each item, please circle N (No) or Y (Yes).**

	No	Yes
a. What you should eat during your pregnancy	N	Y
b. How smoking during pregnancy could affect your baby	N	Y
c. How secondhand smoke could affect your baby after birth	N	Y
d. Breast-feeding your baby	N	Y
e. How drinking alcohol during pregnancy could affect your baby	N	Y
f. Using a seat belt during your pregnancy	N	Y
g. Birth control methods to use after your pregnancy	N	Y
h. How using illegal drugs could affect your baby	N	Y
i. How to keep from getting HIV (the virus that causes AIDS)	N	Y
j. Getting your blood tested for HIV (the virus that causes AIDS)	N	Y
k. Physical abuse to women by their husbands or partners	N	Y
l. The importance of seeing a dentist during your pregnancy N	Y	
m. Doing tests to screen for birth defects or diseases that run in your family	N	Y

24. This question is about care of your teeth during your most recent pregnancy. **For each item, circle N (No) or Y (Yes).**

	No	Yes
a. I needed to see a dentist for a problem	N	Y
b. I went to a dentist or dental clinic	N	Y
c. A dental or health care worker talked with me about how to care for my teeth and gums	N	Y

25. How long has it been since you had your teeth cleaned by a dentist or dental hygienist?

- Within the past year (less than 12 months)
- 1 to 2 years ago (12-23 months)
- 2 to 5 years ago (24-59 months)
- 5 or more years ago (more than 60 months)
- Never

26. If you were on WIC (Women, Infants and Children Nutrition Program) during this pregnancy, how many weeks or months pregnant were you when you had your first visit for WIC?

___Weeks or ___Months
- I was not on WIC

27. At any time during your most recent pregnancy did a doctor or midwife suggest that you get a blood test for HIV (the virus that causes AIDS)?

- No
- Yes
- I don't know

28. At any time during your most recent pregnancy, did you have a blood test for HIV (the virus that causes AIDS)?

- No
- Yes
- I don't know

29. Have you ever heard or read that taking the vitamin folic acid can help prevent some birth defects?

- No
- Yes

The next questions are about smoking cigarettes.

30. Have you smoked at least 100 cigarettes in your entire life?

- No • **Go to Question 39**
- Yes

31. In the ***3 months before*** you got pregnant, how many cigarettes or packs of cigarettes did you smoke on an average day? (A pack has 20 cigarettes.)

___ Cigarettes or ___ Packs
- Less than 1 cigarette a day
- I didn't smoke
- I don't know

32. In the ***first 3 months*** of your pregnancy, how many cigarettes or packs of cigarettes did you smoke on an average day?

___ Cigarettes or ___ Packs
- Less than 1 cigarette a day
- I didn't smoke
- I don't know

33. In the ***second 3 months*** of your pregnancy, how many cigarettes or packs of cigarettes did you smoke on an average day?

___ Cigarettes or ___ Packs
- Less than 1 cigarette a day
- I didn't smoke
- I don't know

34. In the ***last 3 months*** of your pregnancy, how many cigarettes or packs of cigarettes did you smoke on an average day?

___ Cigarettes or ___ Packs
- Less than 1 cigarette a day
- I didn't smoke
- I don't know

35. How many cigarettes or packs of cigarettes do you smoke on an average day ***now***?

___ Cigarettes or ___ Packs
- Less than 1 cigarette a day
- I don't smoke
- I don't know

36. During your visits to your doctor or midwife for prenatal care or after the baby was born, did someone ask if you smoked, either by questionnaire or in person?

- Yes, before my baby was born
- Yes, after my baby was born
- Yes, both times
- No

37. During your visits for prenatal care or after the baby was born, did your doctor or midwife ever advise you to quit smoking?

- Yes, before my baby was born
- Yes, after my baby was born
- Yes, both times
- No
- No, I didn't smoke at that time

38. During your visits for prenatal care or after the baby was born, did your doctor or midwife offer advice or help on how to quit smoking?

- Yes, before my baby was born
- Yes, after my baby was born
- Yes, both times
- No
- No, I didn't smoke at that time

The next questions are about drinking alcohol.

39. Have you had any alcoholic drinks in the past 2 years? **(A drink is: One glass of wine. One wine cooler. One can or bottle of beer. One shot of liquor. One mixed drink.)**

- No • **Go to Question 42 on Page 8**
- Yes

40a. During the ***3 months before*** you got pregnant, how many alcoholic drinks did you have in an average week?

- I didn't drink then
- Less than 1 drink a week
- 1 to 3 drinks a week
- 4 to 6 drinks a week
- 7 to 13 drinks a week
- 14 or more drinks a week
- I don't know

40b. During the ***3 months before*** you got pregnant, did you drink 5 or more alcoholic drinks at one sitting?

- No
- Yes • How many times? ____
- I don't know

41a. During the ***last 3 months*** of your pregnancy, how many alcoholic drinks did you have in an average week?

- I didn't drink then
- Less than 1 drink a week
- 1 to 3 drinks a week
- 4 to 6 drinks a week
- 7 to 13 drinks a week
- 14 or more drinks a week
- I don't know

41b. During the ***last 3 months*** of your pregnancy, did you drink 5 or more alcoholic drinks at one sitting?

- No
- Yes • How many times? ____
- I don't know

Pregnancy can be a difficult time for some women. These questions are about things that may have happened before and during your most recent pregnancy.

42. This question is about things that may have happened during the ***12 months before*** your new baby was born. This includes the months before you got pregnant. **For each item, circle N (No) or Y (Yes). It may be helpful to use your calendar.**

		No	Yes
a.	A close family member was very sick and had to go into the hospital	N	Y
b.	You got separated or divorced from your husband or partner	N	Y
c.	You moved to a new address	N	Y
d.	You were homeless	N	Y
e.	Your husband or partner lost a job	N	Y
f.	You lost your job even though you wanted to go on working	N	Y
g.	You and your husband or partner argued more than usual	N	Y
h.	Your husband or partner said he did not want you to be pregnant	N	Y
i.	You had a lot of bills you couldn't pay	N	Y
j.	You were involved in a physical fight	N	Y
k.	You or your husband or partner went to jail	N	Y
l.	Someone very close to you had a bad problem with drinking or drugs	N	Y
m.	Someone very close to you died	N	Y

42n. During the ***12 months before you got pregnant***, did your husband or partner push, hit, slap, kick, choke, or physically hurt you in any other way?
- No
- Yes

42o. During the ***12 months before you got pregnant***, did anyone else physically hurt you in any way?
- No
- Yes

42p. ***During your most recent pregnancy,*** did your husband or partner push, hit, slap, kick, choke, or physically hurt you in any other way?
- No
- Yes

42q. ***During your most recent pregnancy,*** did anyone else physically hurt you in any way?
- No
- Yes

43. Do you feel that you were ever treated differently by health care providers during your prenatal care, labor or delivery because of your:
For each item, circle N (No) or Y (Yes).

		No	**Yes**
a.	Race	N	Y
b.	Culture	N	Y
c.	Ability to speak or understand English	N	Y
d.	Age	N	Y
e.	Insurance status	N	Y
f.	Neighborhood you lived in	N	Y
g.	Religious beliefs	N	Y
h.	Sexual orientation or lifestyle	N	Y
i.	Marital status	N	Y
j.	Desire to have out-of-hospital birth	N	Y

Comments:_____

_____

_____

The next questions are about your labor and delivery.

44. When was your new baby born?

_____/_____/_____
month day year

45. What type of insurance paid for your delivery? **Check <u>all</u> that apply.**

- Insurance through my employer
- Insurance through someone else's employer
- Oregon Health Plan or Medicaid
- Tri-Care (Military, formerly CHAMPUS)
- Indian Health Care Program
- Other • please tell us:

_____

- I didn't have insurance for my delivery
- I don't know

46. Is your baby alive now?

- Yes • **Go to Question 48**
- No • **We are truly sorry about your loss and extend our sympathy to you and your family. Your answers are especially important and could help us learn about ways to improve the health of babies in the future.**

47. When did your baby die?

_____/_____/_____
month day year

• **Go to Question 74 on Page 14**

48. Is your baby living ***with*** you now?

- No • **Go to Question 74 on Page 14**
- Yes

49. Did you ever breastfeed or pump breast milk to feed your new baby after delivery?

- No • **Go to Question 53**
- Yes

50. Are you still breastfeeding or feeding pumped milk to your new baby?

- No
- Yes • **Go to Question 52**

51. How many weeks or months did you breastfeed or pump milk to feed your new baby?

___Weeks or ___Months
- Less than 1 week

52. How old was your baby the first time you fed him or her anything besides breast milk? **Include formula, baby food, juice, cow's milk, water, sugar water, or anything else.**

___Weeks or ___Months
- My baby was less than one week old
- I have not fed my baby anything besides breast milk

53. This question asks about things that may have happened at the hospital or birthing center where your new baby was born. **For each item, circle N (No) or Y (Yes).**

	No	Yes
a. Staff gave you information about breast-feeding	N	Y
b. Your baby stayed in the same room with you	N	Y
c. You breast-fed your baby	N	Y
d. Staff helped you learn how to breast-feed	N	Y
e. Your baby was fed only breast milk	N	Y
f. Staff told you to breast-feed whenever your baby wanted	N	Y
g. The staff gave you a gift pack with formula	N	Y
h. The staff gave you a telephone number to call for help about breast-feeding	N	Y

54. ***During your most recent pregnancy***, what did you think about breast-feeding your new baby? **Check <u>one</u> answer.**

- I knew I would breast-feed
- I thought I might breast-feed
- I knew I would ***not*** breast-feed
- I didn't know what to do about breast-feeding

55. Did any of these things prevent you from breast-feeding or stop you after you had started? **Check <u>all</u> that apply.**

- I am still breast-feeding
- I didn't want to breast-feed
- I was planning to go to work or school
- I tried but my baby didn't breast-feed very well
- My baby was not with me
- I think it's better for my baby to be bottle fed
- I was taking medicine
- I felt it was the right time to stop
- My doctor told me to not to breast-feed
  Reason: _____
- Other • Please tell us:

_____

56. ***After your new baby was born***, did a doctor, nurse, or other health care worker talk with you about using birth control?
- No
- Yes

57. ***After your new baby was born***, did a doctor, nurse, or other health care worker talk with you about how to prevent your baby from getting tooth decay?
- No
- Yes

58. ***After your new baby was born***, did a doctor, nurse, or other health care worker talk with you about how secondhand smoke could affect your baby?
- No
- Yes

59. In the hospital or birthing center ***after your new baby was born***, did a doctor, nurse, or other health care worker talk with you about your baby's sleep position?
- No
- Yes

60. ***After you took your baby home***, did your baby's doctor or staff talk with you about your baby's sleep position?
- No
- Yes

61. About how many hours a day, on average, is your new baby in the same room with someone who is smoking?
_____ Hours
- My baby is never in the same room with someone who is smoking

62. Which of the following statements best represents your opinion on children's exposure to secondhand smoke?
- Second hand smoke is ***not harmful*** to children
- Secondhand smoke is ***not very harmful*** to children
- Secondhand smoke is ***somewhat harmful*** to children
- Secondhand smoke is ***very harmful*** to children
- Don't know

63. Is there anyone (else) in your household who smokes cigarettes, cigars, or pipes?

- No
- Yes

64. Which of the following statements best describes the rules about smoking inside your home:

- No one is allowed to smoke anywhere inside my home
- Smoking is permitted anywhere inside my home
- Smoking is not allowed in the baby's room but is allowed in other places in the house
- Don't know

65. How do you ***most often*** lay your baby down to sleep now?
Check <u>one</u> answer.

- On his or her side
- On his or her back
- On his or her stomach

66. How often does your new baby sleep in the same bed with you?
Check <u>one</u> answer.

- Always
- Almost always
- Sometimes
- Never

67. How many times has your baby been to a doctor or nurse for ***routine*** well baby care? Don't count the times you took your baby for care when he or she was sick.
It may help to use the calendar.

_____ Times

- My baby hasn't been for routine well baby care
  - **Go to Question 69 on Page 14**

68. When your baby goes for routine well baby care, where do you take him or her?
Check <u>all</u> the places that you use.

- Hospital clinic
- Health department clinic
- Private doctor's office
- Other • Please tell us: _____

69. Listed below are some things about child safety. **For each item, circle N (No) or Y (Yes).**

	No	Yes
a. Your infant was brought home from the hospital in an infant car seat	N	Y
b. Your baby always rides in an infant car seat	N	Y
c. Your home has a working smoke alarm that has been tested in the last year	N	Y
d. Your hot water heater has been turned down or set to 120• F or below	N	Y

70. Are any firearms now kept in or around your home? Include those kept in your home, in a garage, outdoor storage area, car, truck or other motor vehicle?
- No • **Go to Question 74**
- Yes
- I don't know

71. Are any of those firearms kept loaded?
- No
- Yes
- I don't know

72. Are all of the firearms in your home stored in a locked place?
- No
- Yes
- I don't know

73. Is all of the ammunition stored separately from the firearms?
- No
- Yes
- I don't know

Here are some questions about you after your baby was born.

74. What is ***your*** (not your baby's) health insurance coverage ***now***? **Check <u>all</u> that apply.**
- Insurance through my employer
- Insurance through someone else's employer
- Oregon Health Plan
- Tri-Care (Military, formerly CHAMPUS)
- Indian Health Care Program
- Other • Please tell us:

_____

- I don't have any health insurance

75. Are you or your husband or partner using any kind of birth control ***now***?
Birth control means having your tubes tied, vasectomy, the pill, condoms, diaphragm, foam, rhythm, Norplant®, shots (Depo-Provera®), or ANY other way to keep from getting pregnant.

- No
- Yes • **Go to Question 77**

76. What are your reasons for not using any birth control ***now***?
Check <u>all</u> that apply.

- I am not having sex
- I want to get pregnant
- I don't want to use birth control
- My husband or partner doesn't want to use birth control
- I don't think I can get pregnant
- I can't pay for birth control
- I am pregnant now
- Other • Please tell us:

_____

If you are not using any birth control now, go to Question 79 on Page 16.

77. What kinds of birth control are you or your partner using ***now***?
Check <u>all</u> that apply.

- Tubes tied (sterilization)
- Vasectomy (sterilization)
- Pill
- Condoms
- Foam, jelly, cream
- Diaphragm
- Norplant®
- Shots (Depo-Provera®)
- Withdrawal
- IUD (Intra-Uterine Device)
- Natural Family Planning (Rhythm)
- Other • Please tell us:

_____

78. Where are you or your partner getting your birth control method(s) ***now***?
Check <u>all</u> that apply.

- A family planning clinic (for example, Planned Parenthood)
- A health department clinic
- A community health center
- A private gynecologist
- A general or family physician
- A drug store or other store
- Other • Please tell us:

_____

- No place

79. Does your health insurance cover the cost of birth control ***now***?
Check the <u>best</u> answer.

- Yes, it covers all or a part of the cost of my birth control method
- Yes, it covers birth control, but ***not the method I want***
- Yes, it covers birth control, but ***I don't use a method***
- No, it does not cover birth control
- I don't have any health insurance
- Don't know/Not sure

Please answer the next questions about family income. It will help us see how income affects the health of mothers, babies and families. All information will be kept private.

80. What were the sources of your household income ***during the past 12 months***?
Check <u>all</u> that apply.

- Paycheck or money from a job
- Aid such as Temporary Assistance for Needy Families (formerly AFDC), welfare, public assistance, general assistance, food stamps, or Supplemental Security Income
- Unemployment benefits
- Child support or alimony
- Social Security, Worker's Compensation, veteran benefits, or pensions
- Money from a business, fees, dividends or rental income
- Money from family or friends
- Other • Please tell us:

_____

81. What is your family income, before deductions and taxes? **Include ANY income or money you can use (for example, job, TANF [formerly AFDC], child support, etc.). Please give us your best guesses. All information will be kept private.**

a. Family income
before you got pregnant: $ _____ • • Weekly or • Monthly or • Yearly

b. Family income ***now***: $ _____ • • Weekly or • Monthly or • Yearly

Thank you for giving us your best guesses in Question 81. Now we are going to ask the *same* questions, but about *monthly* income. Your answers will help us judge health programs that are based on *monthly* income.

82. What is your ***monthly*** family income, before deductions and taxes? **Include ANY income or money you can use. All information will be kept private.**

a. Monthly family income
before you got pregnant

- 699 or below
- 700 - 939
- 940 - 1,179
- 1,180 - 1,289
- 1,290 - 1,729
- 1,730 - 2,179
- 2,180 - 2,629
- 2,630 - 3,079
- 3,080 - 3,519
- 3,520 - 3,969
- 3,970 or above

b. Monthly family income ***now***

- 699 or below
- 700 - 939
- 940 - 1,179
- 1,180 - 1,289
- 1,290 - 1,729
- 1,730 - 2,179
- 2,180 - 2,629
- 2,630 - 3,079
- 3,080 - 3,519
- 3,520 - 3,969
- 3,970 or above

83. How many people does this income support? **Count yourself.**

a. Number of people ***before you got pregnant*** _____

b. Number of people ***now*** _____

Your answers to these questions are very helpful to us. If you would be willing to answer additional questions, please fill out the information below:

84. May we contact you by phone?
- No
- Yes

What is your name? _____

What is your telephone number? _____

When is the best time to call you? _____

Thanks for answering our questions! Your answers will help us work to make mothers, babies and families healthier.

Please use the space below and on the next page for any comments you would like to make about the survey.

OREGON HEALTH & SCIENCE UNIVERSITY
Research Integrity Office, L106-RI (503) 494-7887

Appendix 2. OHSU Institutional Review Board exemption

MEMO

Date: March 10, 2004

To: *Kenneth Rosenberg MD L341*

Scott Spencer L341

From: Gary T. Chiodo, DMD, Chair, Institutional Review Board, L106-RI
Susan Hansen, MD, MPH, Co-Chair, Institutional Review Board, L106-RI
Charlotte L. Shupert, PhD, Manager, Research Integrity Office, L106-RI
Bradley T. Noren, MA, CIP, Assistant Manager, Research Integrity Office, L106-RI

Subject: ***8163 EXMPT***

Predictors of binge drinking prior to pregnancy.

Special Communication

This protocol meets the requirements for Exemption from IRB review and approval in accordance with 45CFR46.101(b)(4); data collected and recorded in such a manner that participants can not be identified, directly or through identifiers linked to the participants.

You are required to submit any future revisions to this research activity for prospective IRB review via PRAF. The IRB will determine whether or not the revision affects the study's Exempt status.

Additionally, the requirement to obtain informed consent has been waived or its elements altered in accordance with 45CFR46.116(d)(1-4) as:

(1) the research involved no more than minimal risk to subjects;
(2) the waiver or alteration will not adversely affect the rights and welfare of the subjects;
(3) the research could not practicably be carried out without the waiver or alteration; and
(4) whenever appropriate, the subjects will be provided with additional pertinent information after participation.

Analyst: Stacie Fujisaki/1

WAIVER OF AUTHORIZATION

Certification for Use and Disclosure of Protected Health Information for Research Requesting A Waiver of Authorization

1. Name(s) of Investigator(s):

Name(s) of Investigator(s):	Department(s) of Investigator(s):
Kenneth D. Rosenberg (Principal Investigator)	School of Public Health and Preventative Medicine
Scott Simner Spencer (Contact Person)	School of Public Health and Preventative Medicine

2. Location and Brief Description of the Protected Health Information

- ☐ OHSU Clinical Records
- ☐ OHSU Research Records
- ☐ OHSU Other Records (specify):
- ☐ Oregon Health Division (specify):
- ☐ Emergency Medical Svs (specify):
- ☒ Other (specify): No personal health information will be used. Data already de-identified from the Pregnancy Risk Assesment Monitoring Survey (PRAMS) data set from the Oregon Department Human Services (ODHS).

3. The investigator(s) seeks the use or disclosure of Protected Health Information (PHI) located at the sites indicated in #2, (check one):

- ☐ Solely for Research on PHI of Decedents
  (The investigator will be prepared to provide documentation of the individuals' death.)
- ☐ Solely to Review PHI to prepare a research protocol or for similar purposes preparatory to research
  (The investigator will not remove any PHI from OHSU in the course of the review.)
- ☐ To use or disclose existing PHI for other research purposes and is requesting a waiver of consent and authorization

4. How many individual patient records will you access for this protocol: 3952

5. State how you will identify protected health information in your research records? *(i.e.: name of subjects, coded identifier…)*
The dataset does not contain protected health information because it is de-identified.

6. Will you be sharing PHI with anyone outside of OHSU? ☐ Yes ☒ No
If yes, what PHI will be shared and how will it be identified? *(i.e. name of subjects, coded identifiers...)*

[Note: If the identifiable health information above is shared outside of OHSU, additional documentation may be necessary to account for the disclosure(s). Furthermore, the sharing of protected health information outside of OHSU may require the outside party to comply with federal requirements (HIPAA).]

7. Will the protected health information you access and record include any of the following elements (check all that apply)?

- ☐ Patient/Subject Names
- ☐ Postal address information, other than town or city, State and zip code
- ☐ Telephone numbers
- ☐ Fax numbers
- ☐ Electronic mail addresses
- ☐ Social Security Numbers
- ☐ Medical record numbers
- ☐ Health plan beneficiary numbers
- ☐ Account numbers
- ☐ Certificate/license numbers
- ☐ Vehicle identifiers and serial numbers, including license plate numbers
- ☐ Device identifiers and serial numbers
- ☐ Web Universal Resource Locators (URLs)
- ☐ Internet Protocol (IP) address numbers
- ☐ Biometric identifiers, including finger and voice prints
- ☐ Full face photographic images and any comparable images
- ☒ None of the above

8. State how the PHI will be protected from improper use and disclosure:
N/A

9. When will you destroy the protected health information? *(Be specific, state a date or event, such as following data analysis, following publication.)*
There will be no protected health information. Data will be returned to Oregon Department of Human Services following analysis.

In signing this form, the investigator warrants that he/she will protect the protected health information accessed as described, cannot practicably conduct the research without a waiver of consent and authorization, and cannot practicably conduct the research without access to and use of the PHI.

Printed Name: Kenneth D. Rosenberg

Signature: Kenneth D. Rosenberg

Date: 2/4/04

Office Use:
LDS s DUA
LDS c DUA
>50/not LDS
<50/not LDS

MAR 1 2 2004

Appendix 3. CDC FAS prevention flier

WHAT IS FETAL ALCOHOL SYNDROME?

Fetal alcohol syndrome (FAS) is the name given to a group of physical and mental birth defects caused by a woman drinking heavily during pregnancy.

Babies born with FAS have abnormal facial features and can be mentally retarded. They have problems with learning, memory, attention span, problem solving, speech, and hearing. They can also have problems in school and problems relating to others. FAS cannot be cured. But it is 100% preventable—if a woman does not drink while she is pregnant.

I use birth control most of the time. So I didn't think I would get pregnant. And I don't drink that often— just when I go out with my friends. I never dreamed that could be harmful— until I found out I was pregnant.

Unprotected Sex + Alcohol = Alcohol-Affected Babies

EVEN IF YOU'RE NOT A HEAVY DRINKER

You don't have to be a heavy drinker to have a baby affected by alcohol. Even if you only drink socially, when you go out with friends, if you're having unprotected sex, you can still be at risk for getting pregnant and having a baby with alcohol-related effects. Children with alcohol-related effects don't have the full symptoms of FAS, but they may have learning disabilities and behavior problems. You may be able to handle the alcohol—but the baby that you may be carrying can't.

EVEN BEFORE YOU KNOW YOU'RE PREGNANT

Of course, most women don't drink when they're pregnant. But that's not always enough. Research shows that the baby is most likely to be hurt by alcohol in the first month or two of pregnancy. And most women don't know they're pregnant until the second month...and sometimes even later.

So they drink. And by the time they find out they're pregnant, it might be too late.

Unprotected Sex + Alcohol = Alcohol-Affected Babies

IF YOU'RE HAVING UNPROTECTED SEX, CUT IT OUT.

Here's the good news: FAS and other alcohol-related effects can be stopped completely if a woman doesn't drink while she is pregnant. So what can you do? If you drink and are sexually active, use birth control *all the time*.

And if you are trying to get pregnant or think you might be pregnant —even if there's just a chance—stop drinking *right away*. Don't wait until you know for sure, because by the time you know you're pregnant, your baby could already be harmed by the alcohol—*for life*.

ASK AN EXPERT

If you'd like to learn more about fetal alcohol syndrome and other alcohol-related effects, speak to your own doctor or nurse or family planning clinic.

ALCOHOL AND UNPROTECTED SEX

don't mix