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Assessing the risk of fetal alcohol syndrome: understanding substance use among pregnant women☆

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Abstract

Fetal alcohol exposure is a common cause of birth defects and developmental disorders. As many as 1 in 100 children in the United States are believed to be affected by fetal alcohol exposure. Characteristics of fetal alcohol syndrome (FAS) include abnormal facial features, growth impairment, problems with learning, memory, attention span, problem solving, speech, and hearing. FAS is 100% preventable. Preliminary data from 1704 pregnant women in Minnesota were assessed: substance use during pregnancy, risk factors related to substance use during pregnancy, and how substance use among pregnant women varies across the state. Of the sample, 19.6% of the women were calculated to have drunk alcohol while pregnant. Nondrinkers were more likely to be married and unemployed than drinkers. The drinkers reported significantly higher levels of depressed mood and greater number of problems with alcohol than their abstaining counterparts. Abstainers reported a greater number of pregnancies and initiated their first prenatal visit earlier than the drinkers. Significant differences in prenatal substance use and related factors also emerged by geographic region in Minnesota. Findings are discussed in relation to prevention and policy efforts.

Keywords: Prenatal alcohol use; Pregnancy; Alcohol use; Four-state FAS consortium

1. Introduction

Fetal alcohol exposure is a common cause of birth defects and developmental disorders. It is estimated that in the United States, 5 per 10,000 to 1 per 100 live births have been affected by fetal alcohol exposure [3]. An estimated 3–22 cases per 10,000 births in the United States are children with fetal alcohol syndrome (FAS)—between 1300 and 8800 children each year [4]. Characteristics of FAS include abnormal facial features, growth impairment, problems with learning, memory, attention span, problem solving, speech, and hearing. FAS is 100% preventable. If women choose not to drink alcohol during their pregnancies, or if drinking women practice effective contraception or abstinence, they will not have children with FAS [5].

The risk of alcohol consumption during pregnancy has varied by a number of factors, such as race, age, and employment and marital status. In the early 1990s, the CDC reported that the incidence of FAS per 10,000 births varied greatly by race. Asians had 0.3 incidents, Hispanics had 0.8, and Whites had 0.9. These figures are a stark contrast to the 6.0 cases per 10,000 for the African American population and 29.9 cases per 10,000 for native Americans [15].

Age is another risk factor associated with the delivery of babies with FAS. Based on national data, women over the age of 30 are more likely to drink while pregnant [16]. Adolescents are also of concern given their high drinking rates [12]. Women under the age of 25 are less likely to reduce their drinking during pregnancy than their older counterparts [11]. One study actually reported an increase in binge drinking among adolescents after pregnancy [7]. Teens recognize their pregnancies after an average of 30 days, whereas their older counterparts make the recognition after about 17 days [7].

Sidhu and Floyd [16] also reported that compared with other pregnant women, pregnant women who reported any

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alcohol use and binge or frequent drinking were more likely to be employed and unmarried. Higher levels of depression have also been associated with greater alcohol use [10].

Across the country, very little statewide data are currently available to determine the risk of prenatal alcohol use and its potential variability by geographic area. Two statewide studies reported no significant geographical differences in the prevalence of substance use. The California study focused on pregnant women [17], and the Alabama study focused on women of child-bearing age [9].

This study uses preliminary statewide data to examine the substance use among pregnant women in Minnesota. We examined the characteristics of pregnant women in Minnesota. Special attention is given to the factors associated with increased risk of substance use. Specifically, differences in characteristics of women who have drank during pregnancy and those who have abstained are explored. In addition, differences in the percentages of pregnant women who drank and risk factors associated with prenatal alcohol use are also considered by region within the state.

2. Method

2.1. Sample and procedures

In 2000, approximately 67,500 births occurred in Minnesota. A stratified geographic sampling strategy was developed based on the number of births in each of 13 planning areas designated by the state of Minnesota, based on location and population. Maternal education and racial background were also considered in the sampling strategy. Following completion of the study in July 2003, 8500 surveys would have been collected.

The data were collected in clinics that offer prenatal care across the state of Minnesota. Clinics were located and contacted by research staff. After the study was explained, clinics self-selected to participate in the study. To date, 82 clinics are participating in the data collection effort across the state. However, each clinic has not submitted data at the time of this analysis. Hence, the data from 79 clinics are included in the analyses.

The following data collection procedure has been followed in each of the clinics. The clinic receptionist or nurse responsible for the intake procedures approaches women in the prenatal clinic about the study. Each woman must self-identify as being (1) interested in the study, (2) a Minnesota resident, and (3) in the process of having her first prenatal visit. The survey requires 5–10 min to complete and is filled out at the first prenatal appointment. After the respondent completes the survey, it is given to the receptionist or nurse in a sealed addressed envelope to be sent immediately to the project. In appreciation of the respondent's time, she receives a five-dollar gift certificate to a local store.

The survey is the Prenatal Questionnaire (PQN), which was designed to screen for prenatal alcohol use and determine risk factors. The core questions of the PQN are taken from the SAQ [1] questionnaire. The SAQ includes questions about other substance use, binge drinking, and respondent knowledge about drinking during pregnancy (for a complete description, see Ref. [1]). This instrument has been tested with the Native American and Caucasian population. The SAQ appears to have acceptable reliability, validity, and performance. Based on the results of 208 prenatal patients, the sensitivity of the SAQ was 76.6%, specificity was 92.8%, and the predictive value positive was 92.4% for detecting drinking during pregnancy [1].

Identification measures are not included in the data, so all information is confidential. To date, the data from 2246 surveys are available for analyses. These surveys in this sample were completed between November 2001 and October 2002. All women who had complete data for each of the measures outlined under the Measures section (see below) were included in the analyses. Thus, the sample was reduced from 2246 to 1704. Given the exclusion of 542 cases, an analysis of sample bias was conducted to better understand how persons with complete data might have varied from a person with incomplete data.

2.2. Analyses of sample bias

The analyses were divided into two parts, depending on whether the variables examined were categorical or continuous. The categorical variables included alcohol use while pregnant/abstinence while pregnant, White/non-White, married/not married, employed/not employed, and abuse history/no abuse history. The continuous variables included age, education, depressed mood, number of pregnancies, months of pregnancy, and alcohol problem.

In examining the categorical set of variables, significant differences were found for each of the measures. The study sample was comprised of a higher percentage of women who did not drink while pregnant [80.4%, $\chi^2(1, n=2189)=104.5$, $P<0.001$], were White [90.5%, $\chi^2(1, n=2129)=54.66$, $P<0.001$], married [74.7%, $\chi^2(1, n=2233)=166.9$, $P<0.001$], employed [75.2%, $\chi^2(1, n=2239)=125.9$, $P<0.001$], and had not experienced abuse [89.4, $\chi^2(1, n=2238)=5.95$, $P<0.05$] compared to the women with incomplete data (57.7% did not drink alcohol while pregnant, 77.4% White, 44.6% married, 49.5% employed, and 85.6% not abused).

Independent t tests were used to examine potential differences in the mean levels of continuous measures by sample. Significant mean differences by study and nonstudy group emerged for age, education, depressed mood, and month of pregnancy. The study sample was significantly older ($M=28.20$, $t=-11.37$, $P<0.001$), had higher levels of education ($M=14.1$, $t=-17.31$, $P<0.001$), lower levels of depressed mood ($M=1.57$, $t=6.57$, $P<0.001$), and had their first prenatal visit earlier ($M=2.78$, $t=6.49$, $P<0.001$) than the nonstudy group ($M_{age}=24.83$, $M_{edu}=11.8$, $M_{depress}=1.95$, $M_{pregmonth}=3.48$). No differences between the groups emerged for number of pregnancies or alcohol problem.

In sum, 9 of the 11 variables of interest differed significantly between the nonstudy and study samples. It appears, with the exception of employment, that persons included in the study sample may have had advantages over the nonstudy sample that might reduce their risk of drinking alcohol while pregnant—the study sample was older and a greater percentage were White, and reported lower levels of depressed mood. The nonstudy sample also had a significantly greater percentage of persons who drank while pregnant than the study sample.

2.3. Measures

The descriptive statistics associated with each of the measures are found in Table 1.

2.3.1. Months pregnant

Months pregnant was calculated as the difference in months between the survey administration and the woman's last menstrual cycle dates. Twenty-three cases were deleted as months pregnant exceeded 9.5 months. Of the sample, 75.2% had their first prenatal visit in their first trimester, 19.2% during their second trimester, and 5.6% in their third trimester ($M = 1.30$). In 1999, 84.6% of births had prenatal care in the first trimester [14]. Based on our calculations, the women in the sample had their first prenatal visit a bit later than the general population in Minnesota.

Table 1
Description of measures

Variable name values	Number (%)	Mean (S.D.)
Alcohol use while pregnant		
Drank	334 (19.6)	
Abstained	1370 (80.1)	
White		
White	1542 (90.5)	
Non-White	162 (9.5)	
Married		
Married	1273 (74.7)	
Not married	431 (25.3)	
Employed		
Employed	1273 (74.7)	
Unemployed	422 (25.3)	
Abuse		
Abused	180 (10.6)	
Not abused	1524 (89.4)	
Income (US$)		
0–10,000	149 (8.7)	
10,001–20,000	170 (10.0)	
20,001–30,000	181 (10.6)	
30,001–50,000	406 (23.8)	
over 50,001	798 (46.8)	
Months pregnant		2.8 (1.5)
Age		28.2 (2.6)
Education		14.1 (2.6)
Depressed mood		1.6 (0.9)
Number of pregnancies		2.5 (1.3)
Alcohol problem		0.2 (0.7)

2.3.2. Alcohol use while pregnant

This measure was based on the number of months pregnant and the woman's response to "When was your last drink of alcohol [0.25 = *within the last week*; 1 = *within the last month*; 12 = *within the last year* (number of months ago, range = 1–12); 13 = *more than a year ago*; 88 = *I have never drank*]?" If the respondent provided the number of months ago, this figure was used. Otherwise, 0.25, 1, 12, 13, or 88 was used as appropriate. For the final measure, 1 = *drank during pregnancy* (pregnancy date is earlier than date of last drink) and 0 = *stopped drinking prior to pregnancy*. This calculation was found to be more sensitive compared to the women's self-report of drinking before and during their pregnancy [1].

2.3.3. White

A value of 1 indicates that the respondent selected White as her only race/ethnicity, and a value of 0 indicates that a different race was selected or that more than one race was selected.

2.3.4. Married

This is a dichotomous measure: 1 indicates *currently married* and 0 indicates *single*, *living together*, *separated*, *divorced*, or *widowed*.

2.3.5. Employed

This is also a dichotomous measure: 1 means *currently employed* and 0 means *not currently employed*.

2.3.6. Age

Respondents shared their age in years.

2.3.7. Education

Education is based on the response to "How many years of school have you completed (e.g., high school graduate = 12)?" A value of 14 would indicate 2 years of education beyond high school.

2.3.8. Income

Income is a categorical measure (1 = *US$40–10,000* to 5 = *over US* 50,001*). Most women (43.6%) reported a family income of over US$50,001.

2.3.9. Depressed mood

Depressed mood was a one-item measure that depends on the answer to "In the last month, have you felt so sad, discouraged, hopeless, or had so many problems that you have wondered if everything was worthwhile (1 = *not at all* to 6 = *extremely so—to the point that I have just about given up*)."

2.3.10. Number of pregnancies

The women responded to "How many times have you been pregnant before?" A value of one was added to their response (past pregnancies) to include the current pregnancy.

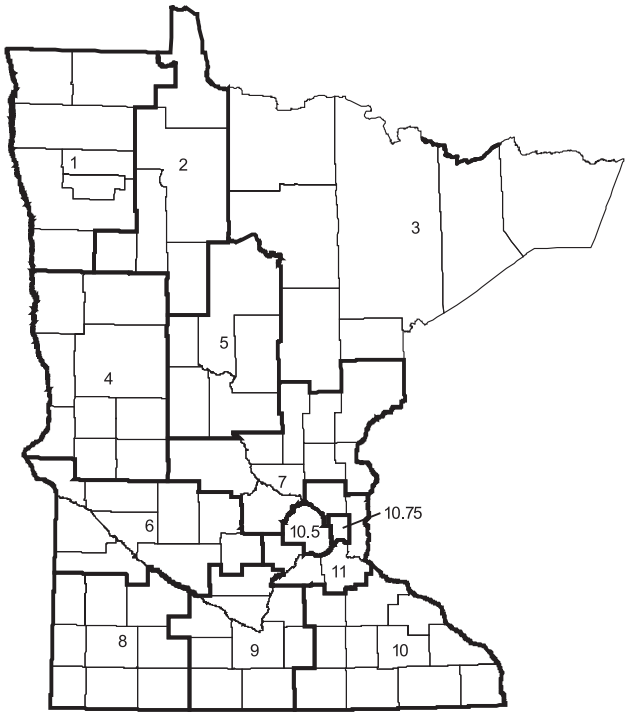

Fig. 1. Minnesota by regional development commission districts (Regions).

2.3.11. Abuse

Abuse is based on three dichotomous items: (1) "Has anyone physically abused (hit, kicked, slapped, etc. . .) you during the last year?"; (2) "Has anyone physically abused (hit, kicked, slapped, etc. . .) you during this pregnancy?"; and (3) "Have you ever had sex without giving your consent?" A score of 1 indicates that *the respondent has experienced at least one of the three abuses* and 0 indicates *no abuse experiences related to these three questions*.

2.3.12. Alcohol problem

Alcohol problem was based on the women's responses to five questions. Each of the questions was answered with 1 = *yes* and 0 = *no*. These included: (1) "Do you ever feel that you have an alcohol problem?"; (2) "Do you ever feel that you should cut down on your drinking?"; (3) "Has a friend or family member ever told you about things you said or did while you were drinking that you could not remember?"; (4) "Has a friend or family member ever asked you to drink less?"; and (5) "Do you ever have a drink in the morning as an eye opener or prevent yourself from getting sick (hangovers)?" The alcohol problem scale is the sum of these measures and ranges from 0 to 5.

2.3.13. Region

Region is based on the geographic unit created by the Minnesota Department of Planning, typically known as regional development commission districts. These regions are based on geographic size and not population base. Region 10, the Twin Cities metropolitan area, is further subdivided in Regions 10.75 (Ramsey county, home of St. Paul) and 10.5 (Hennepin county, home of Minneapolis). These regions are depicted in Fig. 1.

2.4. Analyses

Several types of analyses were used to address the research questions. Distributions of categorical measures were tested with chi-squared analyses. Mean differences between two groups were tested with independent *t* tests. And comparisons of means between three or more groups were conducted using analysis of variance (ANOVA).

3. Results

3.1. Characteristics of pregnant women in Minnesota

Analyses of categorical and continuous measures were conducted to better understand the characteristics of pregnant women in Minnesota and differences in these characteristics by pregnant women who abstained (80.4%) and those who did not (19.6%, see Table 2). The majority (90.5%) of the women included in the sample were White compared to 85.5% reported in the statewide birth record data. Nearly 75% of the sample were married compared to 74.3% reported by the Minnesota Department of Health (MDH) ([13]). Almost three quarters of the women were employed (74.7%). Over 10% of the women reported physical or sexual abuse.

The mean age of the women at the time of their first prenatal visit was just over 28 years (see Table 3). The average first prenatal visit occurred during the first trimester with the average number of months being 2.76. Typically, this prenatal visit was in regards to the woman's second or third pregnancy. On average, women in the sample had 14

Table 2
Characteristics of pregnant women in Minnesota by group

	Complete sample ($n = 1704$)	Drinkers ($n = 334$, 19.6%)	Abstainers ($n = 1370$, 80.4%)	χ^2	*P* value
White	1542 (90.5)	331 (93.1)	1231 (89.9)	3.32	0.07
Married	1273 (74.7)	234 (70.1)	1039 (75.8)	1.75	0.03
Employed	1282 (75.2)	271 (81.1)	1011 (73.8)	7.77	0.01
Abused	180 (10.6)	41 (12.3)	139 (10.1)	1.29	0.28

The table shows the number of complete sample, drinkers, and nondrinkers; numbers inside parentheses show percentages.

Table 3
Characteristics of pregnant women in Minnesota

	Complete sample ($n=1704$)	Drinkers ($n=334$; 19.6%)	Abstainers ($n=1370$; 80.4%)	t test	P value
Age	28.20 (5.56)	28.63 (5.49)	28.1 (5.57)	− 1.55	0.12
Education	14.08 (2.55)	14.15 (2.50)	14.06 (2.57)	− .61	0.54
Depressed mood	1.57 (0.92)	1.70 (1.05)	1.53 (0.88)	− 2.7	0.01
Number of pregnancies	2.46 (1.34)	2.22 (1.31)	2.52 (1.34)	3.62	0.00
Month of pregnancy	2.76 (1.53)	2.99 (1.55)	2.70 (1.52)	− 3.01	0.00
Alcohol problems	0.24 (0.67)	0.46 (0.88)	0.18 (0.60)	− 5.43	0.00

The table shows the mean of complete sample, drinkers, and nondrinkers; numbers inside parentheses show standard deviation.

years of education, or an equivalent of 2 years of college. The mean level of depressed mood was 1.6 with a value of 2 on the scale, indicating "feeling sad, discouraged, hopeless. . .*a little bit*" in the last month. The mean alcohol score (range: 0–5) was 0.24.

3.2. Characteristics of pregnant women in Minnesota by alcohol consumption

We calculated that nearly 20% ($n=334$) of the 1704 women consumed alcohol while pregnant. Significant differences between the drinkers compared to the abstainers emerged when tested with chi-squared and t test analyses. Chi-squared analyses were used to examine the categorical measures (see Table 1). A slightly greater proportion of drinkers were White compared to abstainers. This trend was not significant. Nondrinkers were more likely to be married than drinkers ($P<0.05$). Drinkers were more likely to be employed than abstainers ($P<0.01$). No significant difference between the groups was detected for abuse.

To explore mean differences between the two groups, t tests were used (see Table 3). The drinkers reported significantly higher levels of depressed mood ($M=1.70$) compared to the abstainers ($M=1.53$, $P<0.01$). Abstainers reported a greater number of pregnancies ($M=2.52$) and initiated their first prenatal visit earlier ($M=2.70$) than the drinkers ($M_{\text{number}}=2.22$, $P<0.001$ and $M_{\text{pregmonths}}=2.99$, $P<0.01$, respectively). Finally, drinkers reported a significantly greater number of problems with alcohol ($M=0.46$) than their abstaining counterparts ($M=0.18$). No significant differences emerged for age or education.

3.3. Sample characteristics by geographic region

The following analyses are preliminary and not meant to be representative of the state or a given region. Data are still being collected; thus, efforts to weight the sample to more accurately reflect the various regions were not conducted at this time. Region 9 was excluded from these analyses due to the small sample size ($n=2$). Chi-squared analysis was used to examine the distribution of the categorical measures by region. In examining the categorical set of variables, significant differences in the distribution of the measures by region emerged for drinking alcohol while pregnant [$\chi^2(11, n=1702)=24.1$, $P<0.05$)], White [$\chi^2(11, n=1702)=106.5$, $P<0.001$)], married [$\chi^2(11, n=1702)=100.0$, $P<0.001$)], and abused [$\chi^2(11, n=1702)=31.6$, $P<0.01$]. No significant differences in distribution emerged for education (see Table 4).

ANOVA was then applied to consider differences in the continuous measures (age, education, depressed mood, number of pregnancies, months of pregnancy, and alcohol

Table 4
Chi-squared analyses of pregnant women characteristics by region

Region	White	Non-White	Married	Not married	Employed	Not employed	Abused	Not abused
1	11 (100.0)	9 (0.0)	7 (63.6)	4 (36.4)	8 (72.7)	3 (27.3)	1 (9.1)	10 (90.9)
2	12 (92.3)	1 (7.7)	8 (61.5)	5 (38.5)	9 (69.2)	4 (30.8)	1 (7.7)	12 (92.3)
3	103 (85.8)	17 (14.2)	63 (52.5)	57 (47.5)	85 (70.8)	35 (29.2)	18 (15.0)	102 (85.0)
4	143 (95.3)	7 (4.7)	111 (74.0)	39 (26.0)	111 (74.0)	39 (26.0)	11 (7.3)	139 (92.7)
5	50 (92.6)	4 (7.4)	38 (70.4)	16 (29.6)	37 (68.5)	17 (31.5)	9 (16.7)	45 (83.3)
6	49 (98.0)	1 (2.0)	35 (70.0)	15 (30.0)	34 (68.0)	16 (32.0)	9 (18.0)	41 (82.0)
7	266 (97.8)	6 (2.2)	224 (82.4)	48 (17.6)	211 (77.6)	61 (22.4)	28 (10.3)	244 (89.7)
8	41 (97.6)	1 (2.4)	30 (71.4)	12 (28.60)	31 (77.6)	11 (26.2)	5 (11.9)	37 (88.1)
10	117 (97.5)	3 (2.5)	43 (35.8)	77 (64.2)	99 (82.5)	21 (17.5)	16 (13.3)	104 (86.7)
10.5	202 (75.9)	64 (24.1)	98 (36.8)	168 (63.2)	195 (73.3)	71 (26.7)	43 (16.2)	223 (83.8)
10.75	209 (87.8)	29 (7.9)	32 (13.4)	206 (86.6)	169 (71.0)	69 (29.0)	20 (8.4)	218 (91.6)
11	337 (92.1)	29 (7.9)	62 (16.9)	304 (83.1)	291 (79.5)	75 (20.5)	19 (5.2)	347 (94.8)
χ^2 value								
	106.47		100.0		15.0		31.6	
P value								
	0.00		0.00		0.18		0.00	

Numbers inside parentheses show percentages.

Table 5
ANOVA: Characteristics of pregnant women in Minnesota by region; mean (S.D.)

	Region											F value	P value
	1	2	3	4	5	6	7	8	10	10.5	10.75	11		
Age	25.0 (6.4)	24.3 (5.0)	25.3 (6.1)	26.3 (5.5)	25.7 (5.9)	26.1 (5.8)	27.6 (5.5)	26.5 (6.6)	26.3 (5.8)	27.7 (6.1)	28.8 (5.8)	28.5 (5.4)	8.34	0.00
Education	13 (2.2)	13 (2.1)	12.6 (2.2)	13.5 (2.3)	12.3 (2.9)	12.7 (2.3)	13.6 (2.4)	12.4 (3.1)	12.8 (2.5)	13.5 (3.3)	14.2 (3.3)	14.3 (2.5)	10.82	0.00
Depressed mood	1.7 (1.2)	2.1 (1.5)	1.8 (1.0)	1.5 (0.8)	1.8 (1.1)	1.6 (0.9)	1.6 (0.9)	1.5 (0.9)	1.7 (1.0)	1.9 (1.3)	1.7 (1.1)	1.5 (0.8)	4.54	0.00
Number of pregnancies	2.3 (1.4)	1.9 (1.1)	2.4 (1.3)	2.6 (1.4)	2.6 (1.4)	2.7 (1.4)	2.6 (1.3)	2.9 (1.5)	2.4 (1.4)	2.5 (1.4)	2.4 (1.3)	2.3 (1.3)	2.39	0.09
Length of pregnancy	4.8 (3.0)	2.2 (0.7)	3.1 (1.6)	2.7 (1.2)	3.5 (2.0)	3.9 (2.5)	2.7 (1.6)	2.7 (1.3)	3.1 (1.8)	2.9 (1.7)	2.9 (1.7)	2.5 (1.4)	9.21	0.00
Alcohol problems	0.2 (0.5)	0.1 (0.3)	0.3 (0.9)	0.1 (0.4)	0.4 (0.9)	0.2 (0.5)	0.3 (0.8)	0.3 (0.7)	0.3 (0.8)	0.3 (0.8)	0.2 (0.6)	0.2 (0.6)	1.38	0.33

Table 6
Tukey contrasts: characteristics of pregnant women in Minnesota by region

	Significant contrasts
Age	10.75>3, 4, 5, 6, 10 10.5>3 11>3, 4, 5, 10
Education	–
Depressed mood	10.5>4, 7
Number of pregnancies	7, 8>11
Length of pregnancy	1>2, 3, 4, 7, 8, 9, 10, 10.5, 10.75, 11 6>2, 3, 4, 7, 8, 9, 10, 10.5, 10.75, 11 5>4, 7, 11 10.5>7 10, 10.5, 10.75>11

problems) by geographic region (see Table 5). Based on the results of Tukey tests, significant differences emerged for all measures, except problems with alcohol. Regarding age ($F = 8.34$; $P < 0.001$), Regions 10.75 and 11 were significantly older than Regions 3, 4, 5, and 10. Region 10.75 was also significantly older than Region 6 (see Table 6).

Although the ANOVA model for education was significant ($F < 10.82$; $P < 0.001$), no significant contrasts emerged. For depressed mood, Region 10.5 had significantly higher levels of depressed mood than Regions 4 and 7. Regarding number of pregnancies, Region 11 had significantly fewer pregnancies than Regions 7 and 8.

Substantial regional variation also emerged for month of pregnancy or timing of prenatal visit. Regions 1 and 6 had significantly later first prenatal visits than all other regions, with the exception of Regions 5 and 6. Region 6 also had first prenatal visits significantly later than Regions 2 and 3. Region 5 reported later first prenatal visits than Regions 4, 7, and 11. Regions 10, 10.5, and 10.75 had significantly later first prenatal visits than Region 11. In addition, Region 10.5 also had significantly later first prenatal visits than Region 7.

4. Discussion

This study examined the characteristics of pregnant women in the state of Minnesota, including a number of measures previously unavailable through the birth record data collected by the state. In particular, the results summarize alcohol use among these women and the factors associated with alcohol use during pregnancy. To better understand the relation between drinking during pregnancy and its risk factors, comparative statistics were performed by drinking status (i.e., drinkers vs. abstainers). A number of significant differences emerged, including marital status, employment, depressed mood, number of pregnancies, timing of first prenatal visit, and alcohol problems.

Almost one of every five Minnesota women in this study had used alcohol during their pregnancy. This is somewhat higher than the percentages reported in a literature review by Corse and Smith [8]. Figures included in

their review were as low as 11.35% in a California study of nearly 30,000 women to 24.5% in a multisite inner city study. In this study, the calculation of this figure relied on an accurate recording of month and year of last menstruation and the timing of the respondent's last alcoholic drink. Given the nature of the study and the anonymity of the data, collecting data on the birth of the child and their prenatal exposure to alcohol is not possible to confirm the instrument's sensitivity or specificity.

The CDC reports that 53.3% of nonpregnant women of child-bearing age drank alcohol [16]. Based on national 1994 data, 49% of all pregnancies, excluding miscarriages, were unintended [11]. Minnesota is also noted for its high levels of alcohol use among women of child-bearing age—ranking above the national median (11.5%) in the rate of alcohol use. Just over 18% of women, ages 18–44 in Minnesota, report frequent drinking and/or binge drinking [2]. These data support that alcohol consumption during pregnancy could range from 0% to 50%; hence, 20% may not be a high estimate.

As expected based on previous studies, women who were married and unemployed were more likely to report abstinence from alcohol during pregnancy. The relation between being White and prenatal alcohol use was unexpected. In diagnosing FAS, populations of color, particularly African and Native Americans, have had higher rates than Caucasian Americans; yet in this study, White women were more likely to drink during pregnancy. This finding might be related to the dichotomous measure of race—White and non-White. The ongoing collection of data will allow more detailed analyses of race to be examined in the future, as the sample of populations of color is expanded.

Depressed mood was related to higher likelihood of prenatal alcohol use as predicted. This finding is in the direction of previous research [10]. Interestingly, age and education did not emerge as significant factors of alcohol use during pregnancy. Given that the sample is not yet representative, these factors will continue to be tracked to see if the significance of these relations emerges with an increasing number of respondents.

Unlike the previous statewide prenatal substance use studies, significant differences did emerge by region. The percentage of women drinking some alcohol during pregnancy ranged from 11.7 to 28.0. This finding may have relevance in targeting regions for prevention activities. Given that complete data are not yet available and the data do not accurately represent the regions, speculations regarding the differences will not be explored at this time. However, these trends will continue to be monitored as subsequent data is collected.

4.1. Limitations

The following results are preliminary and should not be used to generalize to the state of Minnesota or its planning regions. Although the sample included over 1700 pregnant women, the rather homogeneous racial composition of Minnesota does not yet allow for a complete understanding of the relation between race and the alcohol use of pregnant women. The number of respondents by planning region in Minnesota did not allow all regions to be included in the geographic analyses (exclusion of Region 9), as related to confidentiality.

The sample composition might be skewing the results. Women with incomplete data were excluded from this study and they had significantly greater risk of substance use during pregnancy than the study sample. This difference between study and nonstudy sample implies that the results may be underestimating alcohol use among pregnant women. The excluded sample also had a greater percentage of women from populations of color. Hence, the generalizability of these findings must be made with caution, even to the state of Minnesota.

The brevity of the instrument lends itself to a higher response rate than might otherwise be achieved with a longer instrument. However, this instrument does not include a number of other factors that are likely to be related to substance use during pregnancy, including self-medication related to mental health or chronic pain issues, poverty, legal complications, and access to substance abuse treatment centers. However, once the data collection efforts are complete, it is anticipated that some of these measures might be included from other data sets to compliment more thorough regional analyses.

The sample used in this study is also quite select in comparison to the general population of pregnant women in Minnesota. The women in this study were having a prenatal visit prior to delivery. Based on 1998–2000 data, approximately 85% of pregnant women in Minnesota reported having prenatal care in their first trimester [6]. In addition, the study sample was required to have complete data for the measures included in this study. Hence, the sample size decreased from 2246 to 1704. Again, these factors may contribute to an underestimation of prenatal alcohol use.

Finally, no identifiers are associated with these data. Hence, there is no opportunity for longitudinal data collection or follow-up of the women who reported alcohol use during pregnancy.

4.2. Application of the findings

These preliminary findings on the alcohol consumption of pregnant women begin to shed light on the risk of FAS among Minnesota infants. Although previous statewide analyses have revealed no geographic differences in risk of prenatal alcohol use, our preliminary results showed that these differences emerged not only for the use of alcohol during pregnancy, but also for the risk factors related to prenatal substance use. Although these findings are preliminary, they assist in considering geographic strategies for prevention efforts and how funding might be allocated more effectively to prevent prenatal alcohol use.

The risk factors that emerged in this study also have the potential to be helpful in the prevention of prenatal substance use. For example, one of the reasons that clinics have shared, regarding their lack of interest in study participation, is that prenatal substance use is not an issue in their geographic area. These data should serve to convince physicians that prenatal substance is an issue in their community and that a 10-min screening instrument may assist them in determining which women may require assistance beyond a brief office discussion.

Finally, these data will assist in directing the next wave of research. By determining which populations face greater risk of prenatal alcohol exposure (age, race, education, etc.), future studies could focus exclusively on the high-risk groups to better understand the processes related to substance use during pregnancy and which issues should be addressed to increase the efficacy of treatment programs.

Prenatal alcohol use is a common cause of birth defects in America—and these consequences are 100% preventable. These preliminary results illustrate the necessity to encourage further efforts in research and intervention. With time, the data and their story should be even more beneficial to women who wish to provide their children with a happy and healthy future.

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