David P. MacKinnon, PhD
Rhonda M. Williams-Avery, MA
Mary Ann Pentz, PhD

Two of the authors are with Arizona State University. Dr. MacKinnon is an Associate Professor in the Psychology Department and a member of the National Institute on Mental Health Prevention Intervention Research Center. Ms. Williams-Avery is a doctoral candidate in clinical psychology. Dr. Pentz is a Professor in the Department of Preventive Medicine and a member of the University of Southern California Institute for Disease Prevention and Health Promotion Research.

Tearsheet requests to David P. MacKinnon, PhD, Department of Psychology, Arizona State University, Tempe, AZ 85287-1104.

Youth Beliefs and Knowledge about the Risks of Drinking While Pregnant

SYNOPSIS

BECAUSE NO PUBLISHED studies of young persons' knowledge and awareness of fetal alcohol syndrome are available, the awareness and beliefs about drinking while pregnant in several large samples of young persons ages 13–20 are examined.

Approximately 81 percent of the entire sample that completed questionnaires in school surveys believe that drinking alcohol while pregnant can definitely harm the fetus, although males and younger persons are less likely to believe in this risk. A substantial proportion of respondents believe that occasional heavy use is not harmful and suggest a safe level of drinking that is higher than the Surgeon General's abstinence recommendations.

Only 72 percent have heard of fetal alcohol syndrome, and more than one-third incorrectly report that it describes a baby born addicted to alcohol, that the syndrome can be inherited, and that it can be cured.

As in prior studies of adults, beliefs about drinking while pregnant are inconsistent with the Surgeon General's recommendations. Implications for increasing the awareness of the risk of drinking while pregnant are discussed.

Heavy maternal drinking during pregnancy has been associated with a pattern of craniofacial defects and abnormalities in growth, limb, and performance known as fetal alcohol syndrome (FAS). When babies with observable anatomic or functional problems less severe than FAS are born to mothers who have used alcohol during pregnancy, the term alcohol-related birth defects (ARBD) may be applied (*1,2*). FAS recently became the most common birth defect, outranking spina bifida and Down syndrome (*3*). The health and other costs of caring for FAS and ARBD babies and children are estimated at billions of dollars annually.

Because FAS and ARBD are entirely preventable by avoiding alcohol during pregnancy and because those afflicted with FAS and ARBD suffer lifelong difficulties (*4*), national efforts to increase awareness of FAS and ARBD have become a high priority (*5*). Despite these efforts, recent surveys suggest that alcohol consumption during pregnancy continues (*6,7*).

Although knowledge of the risks of drinking while pregnant is very high among adults in both national and local surveys such as the National Health

Interview Survey (*8*), a telephone survey of U.S. adults (*9*), adults in Multnomah County, Oregon, (*10*), and recently pregnant women in Los Angeles County (*11,12*), there are considerable misconceptions about fetal alcohol syndrome and the risk of moderate drinking. To the best of our knowledge, no studies have addressed whether these beliefs are also present among young persons.

In this article, our purpose is to describe the beliefs and knowledge about the risks of drinking during pregnancy in several large samples of young persons. Youth are an important population to study because during these years, experimentation with alcohol begins, and many attitudes regarding alcohol are established (*13*). The high prevalence of teenage pregnancy also makes research on awareness of alcohol's effects on the fetus important in this age group. Our questions were patterned after those in other studies (*8,10,11*) to compare between youth and adult beliefs about drinking while pregnant. We also examine beliefs about the risk of drinking while pregnant by sex, ethnicity, alcohol use, and grade in school.

Methods

Our data are from five large studies involving 27,544 people. All the studies included one question regarding beliefs about drinking while pregnant. Two of the five studies included 14 additional questions described subsequently and shown in the box. As shown in table 1, middle and high school students from Marion County, Indiana; Kansas City, Missouri, and Kansas City, Kansas; Arizona (outside of Maricopa County); and Los Angeles, and college students at Arizona State University were sampled between 1989 and 1992. All data were collected after the alcohol warning label was required to appear.

Subjects. Classrooms were randomly selected from all 27 public, parochial, and private schools in Marion County, Indiana, resulting in data for 14,354 students between 1990 and 1992 (*14*). The 1989–90 sample of 1,435 students was 48.9 percent female, 76.2 percent white and included most 12th graders (84.4 percent). The 1990–91 school year sample of 5,780 was 49.7 percent female, 73.5 percent white, and composed primarily of 10th (62.7 percent) and 12th (34.7 percent) graders. The 1991–92 sample of 7,139 was 50.3 percent female, 73.3 percent white, 54 percent in 10th grade, 44.5 percent in 12th grade.

In the 1990–91 and 1991–92 surveys, some students did not receive a form with the birth defects question, so they were not included in this report (1,607 in 1990–91 and 1,804 in 1991–92). These frequencies are not included in the sample size of 10,943 analyzed in this report.

Two of the four forms administered to students in the 1991–92 sample included 14 additional questions about drinking while pregnant. Of the 3,478 students who could have answered the 14 additional questions, 389 did not complete at least one of the questions. Reasons for failure to complete all the questions is likely due to time constraints in questionnaire administration. These 389 respondents with missing data were more likely to be male and to have lower grades but did not differ significantly from students with complete data on beliefs about drinking while pregnant or grade in school. Because being male and having lower grades tended to be oppositely related to many of the questions studied, we expect that the statistics in this report are not substantially biased high or low because these of the missing data.

Data were collected from 6,837 students in grades 8 (45 percent), 10 (46 percent) and 12 (9 percent) in the fall semester of the 1989–90 academic year as part of a large scale drug prevention program in Kansas City. Classrooms were randomly selected from public schools. This sample is 51.8 percent female and 72.7 percent white. A total of 1,494 pupils were not included in this group because their form did not include the birth defects question.

The Arizona school sample includes 7,786 students attending public high schools outside of Maricopa County who participated in a statewide survey during November 1991. The Arizona Criminal Justice Commission conducted the survey as part of a series of annual substance abuse surveys. The statewide sample was selected so that the gender, racial, and regional composition was representative of the Arizona public high school population according to the 1990 Arizona Census. Schools were randomly sampled, but some schools were oversampled by race composition to achieve a representative final sample. A single page addendum containing eight questions about alcohol beliefs and the Arizona Alcohol Warning Poster and the Federal Alcohol Warning Label was added to this general survey. Of the students included, 51.5 pecent were male, 59.7 percent white, and 24.8 percent Hispanic. Of the students in the sample, 28.4 percent were in grade 9, 26.2 percent in grade 10, 22.5 percent in grade 11, and 21.5 percent in grade 12.

The Los Angeles sample was collected as part of the Adolescent Alcohol Prevention Trial (*15*) in schools throughout Los Angeles county. This sample of 2,388 students was composed of students in ninth (44.6 percent) and 10th grades (51.5 percent), was 37.8 percent Hispanic, 36.2 percent white, and 54.4 percent female. The schools represent a sample of those that agreed to participate in the drug prevention study.

The college sample consisted of students in introductory psychology classes at Arizona State University in the spring of 1992, fall of 1992, and spring of 1993 (*16*). Subjects are required to participate in studies such as this for academic credit. Students ages 21 or older were eliminated from the final study to maintain a sample of young persons. The resulting sample of 1,084 was 43.7 percent male and 82.3 percent white.

Although the samples studied in this report were not randomly selected across the United States, several were selected randomly from certain locations. We obtained additional samples to examine the generalizability of the

Complete Checklist of Frequency Items Were Asked Students in Seven Surveys, 1989–92 by Sample

Question	Indianapolis 1989–90 N=1,435	Indianapolis 1990–91 N=5,780	Indianapolis 1991–92 N=7,139	Los Angeles 1990–91 N=2,388	Kansas City 1989–90 N=6,837	Arizona high schools 1991 N=7,786	Arizona State University N=1,084
Can drinking alcohol while pregnant cause birth defects	Yes	6 of 8 forms	3 of 4 forms	Yes	2 of 3 forms	Yes	Yes
How many alcoholic drinks have you had in the last 30 days	Yes	Yes	Yes	No	Yes	No	Yes
How many times have you been drunk in the last 30 days	Yes	Yes	Yes	No	2 of 3 forms	No	No
Have you heard of fetal alcohol syndrome?	No	No	2 of 4 forms	No	No	No	Yes
Where have you heard of fetal alcohol syndrome?	No	No	2 of 4 forms	No	No	No	Yes
Which of the following (3 options) best describes fetal alcohol syndrome?	No	No	2 of 4 forms	No	No	No	Yes
Can fetal alcohol syndrome be prevented?	No	No	2 of 4 forms	No	No	No	Yes
Can fetal alcohol syndrome be cured?	No	No	2 of 4 forms	No	No	No	Yes
Can fetal alcohol syndrome be inherited?	No	No	2 of 4 forms	No	No	No	Yes
Can fetal alcohol syndrome be caused by a women drinnking too much during her pregnancy?	No	No	2 of 4 forms	No	No	No	Yes
Does a mother's occasional use of alcohol while pregnant place her baby at risk for birth defects?	No	No	2 of 4 forms	No	No	No	Yes
Is it okay for a pregnant woman to consume 4 or 5 alcoholic drinks at one time during her pregnancy if it is a special occasion?	No	No	2 of 4 forms	No	No	No	Yes
Are children with severe fetal alcohol syndrome physically and mentally retarded	No	No	2 of 4 forms	No	No	No	Yes
What amount of alcohol use is okay by a pregnant woman?	No	No	2 of 4 forms	No	No	No	Yes
How beneficial is it for a pregnant woman to avoid all alcohol while pregnant?	No	No	2 of 4 forms	No	No	No	Yes
Where have you heard of fetal alcohol syndrome? (11 options)	No	No	2 of 4 forms	No	No	No	Yes

NOTE: This total of 32,449 represents all subjects who completed a questionnaire for these projects. The N=27,544 cited in the text, shown in table 1, and used in analyses reflects the sample that received a form with the "Can drinking alcohol while pregnant cause birth defects?" question (1,494 students deleted from the Kansas City

results across different locations and sampling methods.

The similarity across samples makes us more confident about the results. Nevertheless, the true value of the measures studied may differ from those obtained in this report.

Procedures. With the exception of college students, who completed a questionnaire outside of class time for academic credit, the students completed the forms within scheduled class time.

Table 1. Characteristics and alcohol use of five samples surveyed, 1989–92

Characteristics	Indianapolis[28] (N=10,943) Number	Percent	Los Angeles[15] (N=2,388) Number	Percent	Kansas City[28] (N=5,343) Number	Percent	Arizona[27] (N=7,786) Number	Percent	Arizona State University[16] (N=1,084) Number	Percent
Grade:										
6th	N/A		N/A		N/A		28	0.4	N/A	
7th	N/A		N/A		1	0.0	27	0.3	N/A	
8th	N/A		4	0.2	2,880	53.9	37	0.5	N/A	
9th	31	0.3	1,064	44.6	2	0.0	2,209	28.5	N/A	
10th	5,640	51.5	1,229	51.5	2,048	38.3	2,035	26.2	N/A	
11th	190	1.7	90	3.8	9	0.2	1,755	22.6	N/A	
12th	5,082	46.4	1	0.0	403	7.5	1,673	21.5	N/A	
College	N/A		N/A		N/A		N/A		1,084	100
Sex:										
Female	5,408	49.4	1,292	54.4	2,786	52.3	3,751	48.2	604	56.3
Male	5,535	50.6	1,084	45.6	2,537	47.7	4,007	51.5	468	43.7
Ethnicity:										
White	8,104	74.1	573	36.2	3,858	72.2	4,648	59.7	884	82.3
Black	2,602	23.8	48	3.0	1,245	23.3	276	3.5	23	2.1
Hispanic	52	.5	599	37.8	137	2.6	1,933	24.8	76	7.1
Native American	N/A		111	7.0	N/A		437	5.6	20	1.9
Asian	97	0.9	212	13.4	65	1.2	154	2.0	47	4.4
Other	76	0.7	40	2.5	37	0.7	172	2.2	24	2.2
Socioeconomic status:										
Low	3,951	41.6	N/A		1,772	33.2	N/A		N/A	
High	5,535	58.4	N/A		1,934	36.2	N/A		N/A	
Number of times drunk in last month:										
Never	7,680	75.9	N/A		3,230	82.8	N/A		N/A	
More than once	2,442	24.1	N/A		670	17.2	N/A		N/A	
Number of alcoholic drinks in last month:										
None	5,174	51.2	1,441	60.5	2,941	55.0	N/A		258	23.8
1–10	3,696	36.6	825	34.6	2,017	37.8	N/A		362	33.4
11 or more	1,227	12.2	116	4.9	385	7.2	N/A		463	42.8
Sampling	Random sample of classrooms in schools		Sample of available schools		Random sample of classrooms in available schools		Random sample of schools		Sample of available students	
Dates of data collection	1989–1992 School years		1990–1991 School year		Fall 1989		Fall 1991		Spring 1992 Fall 1992 Spring 1993	

NOTES: Percent values represent percent of the total sample that completed the question. Missing data account for percentages that do not add exactly to 100. Socioeconomic status was based on a fill-in-the-blank response to the question "What is your father's job?" which was then coded from 0 to 9 and dichotomized. Missing data for this question may reflect student difficulties in stating their father's job, blank responses, or responses impossible to code. Missing data for "How many times were you drunk in the last month?" also reflect students who did not complete this question.

N/A=not available in the data (not asked on that particular questionnaire form).

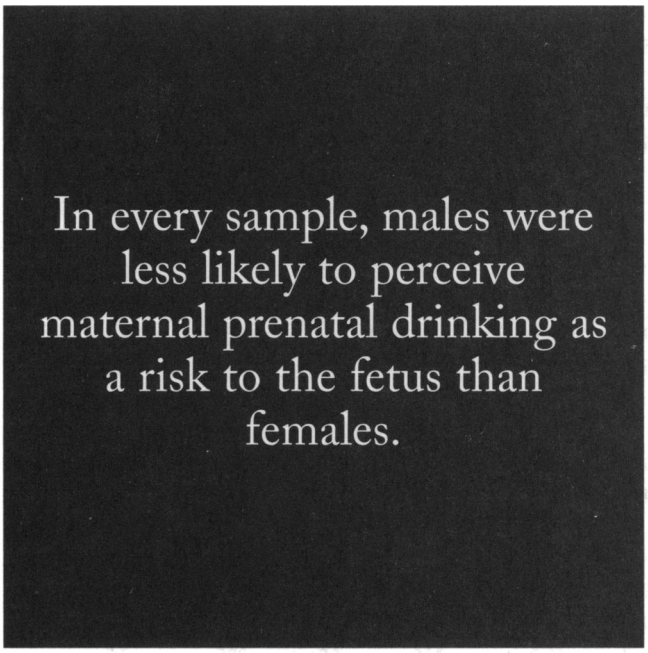
Forms varied somewhat both within and across the samples. All students in the samples responded to more than 100 items. The forms differed by content; all asked some general questions about drug use, the college students answered questions pertaining to the alcohol warning label and poster, and the majority of high school students were surveyed about their relationships with family and friends, academic behaviors, as well as their beliefs about alcohol and drugs. In the Kansas City and Indianapolis 1990–91 and 1991–92 data collections, different forms were used to

maximize the number of items asked.

Measures. This paper concentrates on the question, "Can drinking alcohol while pregnant cause birth defects," asked of those in the five samples. In all the samples except the Arizona middle and high school students, this question had four response options: "Yes, definitely," "Probably," "I don't think so," and "No." In Arizona schools, the options for the same question were slightly different; the second option was "Yes, probably" and the third option was "No, I don't think so."

In addition, most students were asked the following questions about their drug use: (*a*) "How many alcoholic drinks have you had in the last 30 days?" and (*b*) "How many times have you been drunk in the last 30 days?"

Some students from the Marion County, Indiana, sample (*14*) and all of those in the college sample (*16*) were asked several specific questions regarding FAS that were used by Fox and coworkers (*8*) and Minor and Van Dort (*11*). Specifically, they were asked "Have you heard of FAS?" and "Where have you heard of FAS?" Eleven options were presented for the latter question. The options were the same for both samples with the exception of "warning poster," which was an option for Indiana students only and "never," which was an option only for the college sample. Both samples were also asked "Which of the following (3 options) best describes FAS?" Answer responses included "a baby born drunk," "a baby born addicted to alcohol," and "a baby born with certain birth defects."



The following seven FAS knowledge items, five of which were taken from Fox and colleagues (*8*), were completed by some of the students in the Indianapolis 1991 sample:

1. Can fetal alcohol syndrome be prevented?
2. Can FAS be cured?
3. Can FAS be inherited?
4. Can FAS be caused by a woman drinking too much alcohol during her pregnancy?
5. Does a mother's occasional use of alcohol while pregnant place her baby at risk for birth defects?
6. Is it okay for a pregnant woman to consume four or five alcoholic drinks one time during her pregnancy if it is a special occasion? and
7. Are children with severe fetal alcohol syndrome physically and mentally retarded?

The four answer options for these questions were: "Yes, definitely"; "Probably"; "I don't think so"; and "No." At Arizona State University, five of these seven items were instead phrased as statements—FAS can be prevented (inherited, cured, caused by a woman drinking too much during her pregnancy) and Children with severe fetal alcohol syndrome are physically and mentally retarded. Students responded true or false.

In this study, we combined all of the data by recoding the Indiana data so that "Yes, definitely" and "Probably" were coded as a "Yes" and "I don't think so" and "No" were coded as "No." Arizona students' true and false answers were recoded as yes or no. Items were revised so that all were in question (as opposed to statement) form for the summary tables.

Part of the 1991 Marion County, Indiana, sample and all the college students were asked "what amount of alcohol use is okay by a pregnant woman?"—a question similar to the open-ended question presented by Little and colleagues (*10*). Answer options included three-four glasses per day, three-four glasses per week, three-four glasses per month, one or two glasses during the pregnancy, and none.

Statistical analysis. Descriptive statistics and adjusted and unadjusted logistic regression odds ratios are used to present overall associations between demographic and drug use measures and youth beliefs and knowledge of drinking while pregnant. Pearson correlations between composite FAS knowledge and beliefs about abstinence scores, and demographic and drug use measures were also computed.

Results

The demographics of each sample are shown in table 1. Of approximately 27,544 students who were asked, "Can drinking alcohol while pregnant cause birth defects?" 81 percent responded "Yes, definitely" (table 2). When both the "Yes, Definitely" and "Yes, Probably" response options are combined, 97 percent responded affirmatively to this question. The odds of answering this question affirmatively by grade, sex, race, and drug use are shown in table 3. In every sample, males were less likely to perceive maternal prenatal

Table 2. Frequency and percentage of students who responded "yes, definitely" to the question, "can drinking alcohol while pregnant cause birth defects?" Five-site survey, 1989–92

	Indianapolis		*Los Angeles*		*Kansas City*		*Arizona state high school*		*Arizona State University*	
Dependent variable	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Grade:										
8th	N/A		4	100.0	1,934	68.7	23	62.2	N/A	
9th	23	74.2	944	89.1	2	100.0	1,560	71.3	N/A	
10th	4,815	85.8	1,125	91.9	1,487	73.8	1,516	74.9	N/A	
11th	160	85.6	84	93.3	7	77.8	1,417	81.1	N/A	
12th	4,463	88.2	1	100.0	319	80.2	1,307	78.5	N/A	
College	N/A		N/A		N/A		N/A		912	84.4
Sex:										
Male	4,596	83.5	956	88.5	1,636	66.5	2,842	71.4	363	78.1
Female	4,865	90.3	1,194	92.3	2,102	76.2	3,006	80.6	538	89.2
Ethnicity:										
White	7,027	87.0	520	91.1	2,757	72.3	3,534	76.4	743	84.2
Black	2,237	86.7	42	87.5	828	69.2	204	75.0	22	95.7
Hispanic	46	88.5	539	90.6	97	72.4	1,430	74.6	65	86.7
Native American	N/A		N/A		N/A		347	79.6	18	90.0
Asian	76	78.4	99	89.2	43	69.4	98	64.5	34	73.9
Other	66	86.8	222	88.4	24	68.6	125	72.7	21	87.6
Socioeconomic status:										
Low	3,433	87.3	N/A		1,245	71.2	N/A		N/A	
High	3,964	87.5	N/A		1,431	74.6	N/A		N/A	
Number of times drunk in last 30 days:										
None	6,721	87.9	N/A		2,266	71.3	N/A		N/A	
1 or more	2,055	84.5	N/A		484	73.2	N/A		N/A	
Number of alcoholic drinks in last 30 days:										
None	4,532	88.0	1,308	91.0	2,057	71.5	N/A		215	83.3
1–10	3,182	86.5	742	90.5	1,407	70.7	N/A		313	86.9
11 or more	1,029	84.3	104	90.4	285	76.0	N/A		383	83.2

NOTES: Frequencies shown represent frequency of students within a given category level (for example, within 10th grade) who responded "yes, definitely" to the beliefs about drinking while pregnant question. Missing data for this question were: for Indiana, N=53 missing, for Kansas City, N=102 missing, for Arizona state schools, N=51 missing, for Arizona State University, N=4 missing, and for Los Angeles, N=9 missing for a total of 219 students missing this question. An additional 54 sixth and seventh students from the Arizona school sample were excluded from this table. Additional missing data reflect incomplete data for some of the demographic variables.N/A = Not available in the data.

drinking as a risk to the fetus than females. Older students were more likely to respond that drinking during pregnancy was a risk to the fetus. Ethnicity and socioeconomic status were not associated substantially with the perception of risk of maternal drinking during pregnancy so they are not shown in the table.

Awareness of FAS and knowledge about FAS and appropriate alcohol use were measured for 3,478 students in the Indianapolis 1991–92 sample and all 1,084 in the college sample and are presented in table 4. Seventy-two percent of the 4,173 students in the college and Indianapolis samples asked whether or not they had heard of FAS responded yes. The main sources of this awareness were school magazines and television (36 percent). Of the high school students, 47.8 percent thought that FAS was a baby born addicted to alcohol, 5.3 percent thought that it was a baby born drunk, while 46.9 percent correctly thought that FAS described a baby born with certain birth defects. Ninety-five percent of the sample correctly believed that FAS could be prevented. However, 50.3 percent of the sample also incorrectly believed that FAS could be cured, and 48.5 percent believed it could be inherited.

More than 96 percent of the total sample that answered FAS knowledge questions believed that FAS was caused by a woman drinking too much during her pregnancy. Knowledge about the definition of too much was inconsistent, however. Approximately 78.8 percent of the high school sample and 62.1 percent of the college sample thought that all alcohol during pregnancy should be avoided, and 3.4 percent of the high school sample and 1.9 percent of the col-

Table 3. Ordinal logistic regression adjusted odds ratios and 95 percent confidence intervals (CI) for the affirmative response to the question, "can drinking alcohol while pregnant cause birth defects?" Five-site survey, 1989–92

	Indianapolis		*Los Angeles*		*Kansas City*		*Arizona school*		*Arizona college*	
Variable	*Adjusted odds ratio*	*95 percent CI*	*Adjusted odds ratio*	*95 percent CI*	*Adjusted odds ratio*	*95 percent CI*	*Adjusted odds ratio*	*95 percent CI*	*Adjusted odds ratio*	*95 percent CI*
Grade	1.09	1.03,1.16	1.30	.90,1.85	1.20	1.12,1.28	1.18	1.13,1.24	N/A	N/A
Sex (F=0,M=1)	.50	.45, .56	.52	.36, .73	.67	.58, .77	.59	.53, .66	.44	.31, .61
Ethnicity:										
White (=1)	1.56	1.02,2.37	1.26	.79,2.03	1.32	.80,2.17	1.28	.89,1.9	1.32	.75,2.33
Black (=1)	1.31	.85,2.02	.71	.29,1.76	.97	.58,1.62	1.15	.75,1.78	N/A	N/A
Hispanic (= 1)	1.84	.72,4.70	1.08	.92,1.26	1.45	.74,2.84	1.14	.80,1.62	1.51	.64,3.55
Native American (=1)	N/A	N/A	N/A	N/A	N/A	N/A	1.52	1.01,2.30	N/A	N/A
Asian (=1)	N/A	N/A	N/A	N/A	N/A	N/A	.65	.41,1.04	N/A	N/A
Times drunk last month	.88	.83, 94	N/A	N/A	.96	.88,1.06	N/A	N/A	N/A	N/A
Number of drinks last month	.99	.93,1.04	.93	.69,1.25	1.0	.91,1.09	N/A	N/A	N/A	N/A

NOTE: N/A is not available in the data or for a category with fewer than 50 cases. The odds is the average odds of moving one unit on the four-unit scale, for example, the average of: the odds of moving from the "Probably" to the "Yes, definitely" response, moving from the "I don't think so" to the "Probably" response, and moving from the "No" to the "I don't think so" response. Ethnicity odds are compared to the other categories.

lege sample reported that a pregnant woman could have at least three-four glasses of alcohol per week.

Twenty-five percent of the high school students and 13.7 percent of the college students felt that it was acceptable for a pregnant woman to consume four-five alcoholic drinks on one occasion during the pregnancy. Eighty-six percent of the students felt that it was extremely beneficial for a woman to avoid all alcohol during pregnancy. Those students least likely to believe in total abstinence during pregnancy were younger males and those who had been drunk in the last 30 days.

A composite of FAS knowledge, consisting of the number of correct responses to the following questions: "Have you heard of FAS?" (yes was treated as a correct response), "Which best describes FAS?" "Can FAS be prevented?" "Can FAS be cured?" "Can FAS be inherited?" "Is FAS caused by a woman drinking too much during her pregnancy?" and "Are children with severe FAS physically and mentally retarded?" was correlated with five demographic and alcohol use variables separately in the Indiana and Arizona college student samples (table 5). Among high school students, FAS knowledge was significantly related to sex, grade, and the number of times the subject was drunk in the last month. Only white ethnicity was related to knowledge in the college sample and only when adjusted for the other predictors.

A second composite variable measuring beliefs about abstinence during pregnancy was based on four questions: "How beneficial is it for pregnant women to avoid all alcohol?" "Does a mother's occasional use of alcohol while pregnant place her baby at risk for birth defects?" "Is it ok for a pregnant woman to have four-five alcoholic drinks at one time during her pregnancy?" and "How many drinks is it ok for a pregnant woman to have?" Males, younger respondents, and persons who consumed alcohol were less likely to endorse abstinence during pregnancy.

Discussion

Most of the respondents surveyed believe that drinking while pregnant is potentially harmful to the fetus, that avoiding all alcohol during pregnancy is extremely beneficial, and that FAS can be prevented. Younger persons and males are less likely to believe that drinking alcohol while pregnant is harmful and that pregnant women should abstain completely. Although many young people are aware of the risks of drinking while pregnant, many endorse a safe level of drinking that is higher than the Surgeon General's abstinence recommendation.

There are also misconceptions about the exact meaning of fetal alcohol syndrome, as found among adults studied by others (*8,10*). More than a quarter of students at both the high school and college level have not heard of fetal alcohol syndrome. Of those who have heard of FAS, less than half know what FAS is; almost half incorrectly believe that FAS describes a baby born addicted to alcohol or a drunk baby. Moreover, 50.3 percent of the high school students and 39.1 percent of the college students believe that FAS can be cured.

Prior studies of adults differ in age and sample selection, making direct comparisons with the present sample difficult. Despite these differences, the conclusions from this sample of young persons are similar to earlier studies of adults. Most respondents believe that pregnant women should abstain from using alcohol. Although this general belief among youth (81 percent for our beliefs question) is similar to adult samples, for example, 84 percent for ages 18–44 (*8*), the youth sample had more accurate knowledge of specific consequences of alcohol use. The 1985 National

Table 4. Data on awareness of and knowledge about fetal alcohol syndrome (FAS) and appropriate alcohol use, available for students completing two of four forms in the Indianapolis 1991 sample and all of the college sample.

Question	High school Number	High school Percent	College Number	College Percent
Have you heard of FAS?				
No	827	26.8	324	29.9
Yes	2,262	73.2	759	70.1
Where did you hear of FAS?				
Doctor, nurse	680	19.6	173	16.0
Family	533	15.3	206	19.0
Friends	537	15.4	226	20.9
Brochure	629	18.1	257	23.7
Magazine	1,070	30.8	479	44.2
Newspaper	625	18.0	287	26.5
Poster	422	12.1	n/a	n/a
Radio	355	10.2	120	11.1
School	1,371	39.4	484	44.7
Book	885	25.4	286	26.4
Television	1,047	30.1	454	41.9
Never	n/a	n/a	264	24.4
Which best describes FAS?				
A baby born drunk	154	5.3	19	1.8
A baby born addicted to alcohol	1,398	47.8	554	53.6
A baby born with certain birth defects	1,371	46.9	460	44.5
Can FAS be prevented?				
Yes	2,861	94.8	1,058	99.1
No	156	5.2	10	.9
Can FAS be cured?				
Yes	1,486	50.3	405	39.1
No	1,466	49.7	631	60.9
Can FAS be inherited?				
Yes	1,459	48.5	414	39.4
No	1,549	51.5	636	60.6
FAS is caused by a woman drinking too much during pregnancy.				
True	2,490	96.3	1,018	96.7
False	96	3.7	35	3.3
Children with severe FAS are physically and mentally retarded.				
True	2,543	86.0	791	75.5
False	415	14.0	257	24.5
How beneficial is it for pregnant women to avoid all alcohol?				
Extremely	2,197	83.8	1,003	93.0
Less than extremely	426	16.2	76	7.0
Does a mother's occasional use of alcohol while pregnant place her baby at risk for birth defects?				
Yes	2,603	87.3	903	83.6
No	379	12.7	177	16.4
Is it ok for a pregnant woman to have 4–5 alcoholic drinks at one time once during her pregnancy?				
Yes	751	25.2	148	13.7
No	2,225	74.8	930	86.3
How many drinks is it OK for a pregnant woman to have?				
None	2,260	78.8	667	62.1
1–2 during entire pregnancy	445	15.5	324	30.1
3–4 glasses per month	65	2.3	73	6.8
3–4 glasses per week	35	1.2	9	.9
3–4 glasses per day	64	2.2	1	.1

NOTES: Questions adapted from previous studies (*8,11*). Questions administered to entire college sample (Arizona State University, N=1,084) and to part of the Indiana 1991–92 sample (N=3,478). Within the Indiana sample, the FAS knowledge and knowledge of appropriate drinking questions were administered on two out of four forms. A total of 389 high school students were missing at least one of the measures. See discussion of missing data analyses in text.

Health Interview Survey by Fox and coworkers (*8*) sampled nearly 20,000 adult respondents, ages 18–44. Only 55 percent of that sample had ever heard of FAS, and of those who had, only 24 percent correctly identified FAS. In our study, 73 percent of high school students and 70 percent of college students had heard of FAS, and approximately 47 percent of the high school students and 45 percent of the college students correctly identified FAS as a baby born with certain birth defects.

Minor and Van Dort also found in 1982 that awareness of FAS was low (*11*). Of their sample of recently pregnant women, only 55 percent had heard of FAS. However, of this subsample, 80–97 percent were in agreement with current expert knowledge about FAS on four questions (Can FAS be inherited, prevented, caused by a woman drinking too much during pregnancy, and characterized by mental and physical retardation?), with the exception being that 50 percent thought that FAS could be cured. Although more students in our samples had heard of FAS, slightly fewer were accurate in their beliefs about the syndrome: 54

Table 5. A composite of FAS knowledge and abstinence beliefs, consisting of the number of correct responses to 10 questions, correlated with five demographic and alcohol use variables separately in the Indiana and Arizona State University student samples

	Beliefs about abstinence				*FAS Knowledge*			
	Indiana		*Arizona State*		*Indiana*		*Arizona State*	
Predictor variables	*Unadjusted*	*Adjusted*	*Unadjusted*	*Adjusted*	*Unadjusted*	*Adjusted*	*Unadjusted*	*Adjusted*
Sex (F=0,M=1)	[1]-.194	[1]-.182	[1]-.123	[1]-.101	[1]-.111	[1]-.125	-.020	-.019
Grade	[1].112	[1].142	N/A	N/A	[2].043	[3].058	N/A	N/A
White	[1].099	[1].071	[3]-.077	-.031	[1].104	.012	-.045	[3]-.118
Number of alcoholic drinks in last month	[1]-.135	-.002	[1]-.209	[1]-.186	-.017	.018	.007	.020
Number of times drunk in last month	[1]-.187	[1]-.212	N/A	N/A	[2]-.041	[2]-.069	N/A	N/A

[1]Significant at $\alpha < .001$.

[2]Significant at $\alpha < .05$.

[3]Significant at $\alpha < .01$.

NOTE: Adjusted correlations are partialled for the other demographic and alcohol use variables listed. N/A means that this question was not asked in this sample. Indiana refers to the subsample of 3,478 students from Indiana who received forms with these questions in the 1991–92 school year.

percent, 97 percent, 86 percent, and 82 percent answered the aforementioned questions correctly, and 48 percent thought that FAS could be cured.

Given the association between alcohol use and FAS and ARBD, the lack of conclusive research describing the risky level of moderate drinking (*2,12,17–20*) and the difficulty of diagnosing FAS and ARBD at birth, abstinence from alcohol during pregnancy remains the most prudent message for prevention strategies among adolescents (*5*). Specific knowledge deficits and inaccurate beliefs may lead to uncertainty about the safety of alcohol consumption and the severity of FAS. Of particular concern are those adolescents who use alcohol and get drunk regularly, whose beliefs about abstinence during pregnancy are the least conservative. Knowledge of FAS and beliefs about abstinence are positively correlated ($r = .24$, $P < .0001$ for Indiana sample, $r = .10$, $P < .01$ for college sample), suggesting that increasing FAS knowledge may be associated with increased beliefs about abstaining from alcohol during pregnancy.

Education to increase knowledge of FAS among young persons might be best delivered jointly through schools and mass media. When asked where they had heard about FAS, both college and high school students most commonly reported "school," followed by "magazines" and "television." Warnings on alcohol beverages, posters in establishments that sell alcohol, and warnings on alcohol advertisements may increase awareness (*14,16*), but existing warning posters and labels do not specifically mention FAS and ARBD. Strategies to increase awareness in schools should be delivered in a way so that the preventive effects on other alcohol-related problems such as drinking and driving and violence are not reduced.

On the other hand, the consensus about the harm of alcohol consumption while pregnant may enhance social norm manipulations. Increased knowledge and awareness of the risk of drinking while pregnant may ultimately alter societal norms regarding maternal alcohol use.

Mothers of FAS and ARBD babies have been characterized by more chronic and severe alcohol-related problems than women who discontinue alcohol use during pregnancy. More intensive and focused prevention efforts are likely required with this group (*21*). The effects of treatment programs for such pregnant addicted women (*22–24*) and programs to increase knowledge and awareness of FAS and ARBD among health providers (*10,25*) might be enhanced if programs were implemented in conjunction with more widely disseminated prevention efforts targeting the general public's awareness of the risks of a pregnant woman's alcohol consumption (*26*).

Youth appears to be an important group to target because of teenage pregnancy and the incomplete knowledge about the risk of drinking while pregnant. A rationale for this approach is that increasing knowledge of FAS among youth should occur before pregnancy because alcohol consumption can be problematic even in the earliest stages of pregnancy, and FAS information delivered to the general public may disseminate to persons at high risk for FAS. Care should be taken so that new strategies to prevent FAS do not reduce or dilute campaigns to prevent other alcohol-related problems such as drinking and driving.

John Graham and William Hansen supplied the Los Angeles data, supported by PHS grant number AA06201; Rex Holgerson and Scott Huebach of the Arizona Criminal Justice System provided the Arizona school data; and Project STAR in Kansas City and Project I-STAR staff in

Indianapolis, and grant AA8547 from the National Institute on Alcoholism and Alcohol Abuse and PHS grant DA0396.

Portions of this paper were presented at the 1991 meeting of the American Public Health Association and at the 1993 meeting of the Western Psychological Association.

References

1. Sokol, R. J., and Clarren, S. K.: Guidelines for use of terminology describing the impact of prenatal alcohol on the offspring. Alcohol Clin Exp Res 13: 597–598 (1989).
2. Baumeister, A. A., and Hamlett, C. L.: A national survey of state-sponsored programs to prevent fetal alcohol syndrome. Ment Retard 24: 169–173 (1986).
3. Warren, K. R., and Bast, R. J.: Alcohol-related birth defects: an update. Public Health Rep 103: 638–642 (1988).
4. Streissguth, A. P., et al.: Fetal alcohol syndrome in adolescents and adults. JAMA 265: 1961–1967 (1991).
5. Surgeon General's advisory on alcohol and pregnancy. FDA Drug Bul 2: 10–16 (1981).
6. Chasnoff, I. J., Landress, H. J., and Barrett, M. E.: The prevalence of illicit-drug or alcohol use during pregnancy and discrepancies in mandatory reporting in Pinellas County, Florida. N Engl J Med 322: 1202–1206 (1990).
7. Vega, W. A., Kolody, B., Hwang, J., and Nobel, A.: Prevalence and magnitude of perinatal substance exposures in California. N Engl J Med 329: 850–854 (1993).
8. Fox, S. H., Brown, C., Koontz, A. M., and Kessel, S. S.: Perceptions of risks of smoking and heavy drinking during pregnancy: 1985 NHIS findings. Public Health Rep 102: 73–79 January–February 1987.
9. Graves, K. L.: An evaluation of the Alcohol Warning Label: a comparison of the United States and Ontario, Canada in 1990 and 1991. J Public Policy Marketing 12: 19–29 (1993).
10. Little, R. E., Grathwohl, H. L., Streissguth, A. P., and McIntyre, C.: Public awareness and knowledge about the risks of drinking during pregnancy in Multnomah County, Oregon. Am J Public Health 71: 312–314 (1981).
11. Minor, M. J., and Van Dort, B.: Prevention research on the teratogenic effects of alcohol. Prev Med 11: 346–359 (1982).
12. Waterson, E. J., and Murray-Lyon, I. M.: Preventing alcohol related birth damage: a review. Soc Sci Med 30: 349–364 (1990).
13. Newcomb, M. D., Maddahian, E., and Bentler, P. M.: Risk factors for drug use among adolescents: concurrent and longitudinal analyses. Am J Public Health 76: 525–531 (1986).
14. MacKinnon, D. P., Pentz, M. A., and Stacy, A. W.: The alcohol warning label and adolescents: the first year. Am J Public Health 83: 585–587 (1993).
15. Hansen, W. B., and Graham, J. G.: Preventing adolescent alcohol, marijuana, and cigarette use among adolescents: peer pressure resistance training versus establishing conservative norms. Prev Med 20: 414–430 (1991).
16. Fenaughty, A. M., and MacKinnon, D. P.: Immediate effects of the Arizona warning poster. J Public Policy Marketing 12: 69–77 (1993).
17. Mills, J. L., et al.: Maternal alcohol consumption and birth weight: how much drinking during pregnancy is safe? JAMA 252: 1875–1879 (1984).
18. Jacobson, J. L., et al.: Prenatal alcohol exposure and neurobehavioral function in infancy: evidence for threshold and differential vulnerability. Am J Obstet Gynecol 166: 346 (1992).
19. Barr, H. M., Streissguth, A. P., Darby, B. L., and Sampson, P. D.: Prenatal exposure to alcohol, caffeine, tobacco, and aspirin: effects on fine and gross motor performance in 4-year-old children. Develop Psych 26: 339–348 (1990).
20. Ernhart, C. B., Morrow-Tlucak, M., Sokol, R. J., and Martier, S. S.: Under-reporting of alcohol use in pregnancy. Alcohol Clin Exp Res 12: 506–511 (1988).
21. Smith, I. E., et al.: Identifying high risk pregnant drinkers: biological and behavioral correlates of continuous heavy drinking during pregnancy. J Stud Alc 48: 304–309 (1987).
22. Halmesmaki, E.: Alcohol counselling of 85 pregnant problem drinkers: effect on drinking and fetal outcome. Br J Obstet Gynaecol 95: 243–247 (1988).
23. Rosett, H. L., Weiner, L., and Edelin, K. C.: Treatment experience with pregnant problem drinkers. JAMA 249: 2029–2033 (1983).
24. Weiner, L., Morse, B. A., and Garrido, P.: FAS/FAE: Focusing prevention on women at risk. Int J Addictions 24: 385–395 (1989).
25. Russell, M., Kang, G. E., and Uhteg, L.: Evaluation of an educational program on the fetal alcohol syndrome for health professionals. J Alchol Drug Educ 29: 48–61 (1983).
26. May, P.A., and Hymbaugh, K. J.: A macro-level fetal alcohol syndrome prevention program for Native Americans and Alaska natives: description and evaluation. J Stud Alcohol 50: 508–518 (1989).
27. Substance abuse in Arizona, 1991. Arizona Criminal Justice Commission, Phoenix.
28. Pentz, M. A., et al.: A multicommunity trial for primary prevention of adolescent drug abuse. JAMA 261: 3259–3266 (1989).