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The Prevalence of Fetal Alcohol Spectrum Disorders in An American Indian Community

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Abstract: The prevalence of fetal alcohol spectrum disorders (FASD) differs among populations and is largely unknown among minority populations. Prevalence and characterization of FASD is necessary for prevention efforts and allocation of resources for treatment and support. However, prevalence data are lacking, including among many minority populations. The aim of this study was to obtain an FASD prevalence estimate in a Southern California American Indian community employing active case-ascertainment. In 2016, American Indian children aged 5–7 years and their caregivers were recruited in collaboration with Southern California Tribal Health Clinic. Children were assessed using physical examinations and neurobehavioral testing. Parent or guardian interviews assessed child behavior and prenatal exposures including alcohol. Of 488 children identified as eligible to participate, 119 families consented and 94 completed assessments to allow a classification for FASD. Participating children (n = 94) were an average of 6.61 ± 0.91 years old and half were female. Most interviews were conducted with biological mothers (85.1%). Less than one third (29.8%) of mothers reported consuming any alcohol in pregnancy and 19.1% met study criteria for risky alcohol exposure prior to pregnancy recognition. Overall 20 children met criteria for FASD, resulting in an estimated minimum prevalence of 41.0 per 1000 (4.1%). No cases of fetal alcohol syndrome (FAS) were identified; 14 (70.0%) met criteria for alcohol related neuro- developmental disorder (ARND). Minimum prevalence estimates found in this sample are consistent with those noted in the general population.

Keywords: fetal alcohol spectrum disorder; prevalence; American Indian Alaska Native

1. Introduction

Accurate estimates of the types and overall prevalence of fetal alcohol spectrum disorders (FASD) among minority populations in the U.S. are lacking. This information is crucial to target clinical resources and maximize efficacy of prevention, treatment and support within individual communities.

Estimates of FASD prevalence have recently been reviewed by Roozen et al. (2016) [1] and Lange et al. (2017) [2]. These estimates ranged from a global rate of 7.7 per 1000 to varying specific

population rates, including the particularly high prevalence of 113.2 per 1000 in selected locations in South Africa. A recent U.S. study used active case ascertainment in a cross-sectional sample of general population first-grade children residing in four communities [3]. Prevalence estimates in that study ranged from 11.0 per 1000 to 50.0 per 1000 (1.1–5.0%) using the most conservative method for calculation. Using less conservative, weighted prevalence estimates, this study further suggested that FASD may affect as many as one in ten first-grade school children. However, it is unknown to what extent these estimates are generalizable to other populations.

The heterogeneous American Indian Alaska Native (AIAN) populations of the U.S. differ substantially in patterns of alcohol consumption, use of contraception, as well as preferences, cultural practices and traditions [4–9]. For this reason, it is reasonable to assume that the prevalence of FASD might differ by specific AIAN population as well.

The impetus for the present study lay in the prioritization of FASD as a health issue by a specific AIAN community. This was in part due to previous studies in this community documenting vulnerability to having an alcohol-exposed pregnancy among approximately one third of women of childbearing age [10,11]. In response to this risk of prenatal alcohol exposure, local American Indian (AI) community members expressed an interest in establishing support mechanisms for families dealing with the sequelae of alcohol-exposed pregnancies. However, without access to diagnosis and a baseline prevalence estimate of FASD, efforts to determine the support-related needs and priorities for prevention and treatment in the community would be limited.

The present study was undertaken to estimate the prevalence of FASD among a reservation-based Southern California AI community and to identify families dealing with the effects of FASD to allow determination of how best to support them.

2. Materials and Methods

This study was designed as an ancillary special population study under the umbrella of a larger parent study, the National Institutes of Health (NIH)—National Institute on Alcohol Abuse and Alcoholism (NIAAA)-funded Collaboration on FASD Prevalence (CoFASP) study which estimated the regional prevalence of FASD in the U.S. [3]. The parent study used a cross-sectional design to sample children 5–7 years of age in regular first grade classrooms over two academic years in four regional communities in the U.S. Children were selected for the parent study through active case ascertainment in public and private elementary schools. Participating children and parents/guardians underwent multi-tiered evaluations, in most cases including a screening tier for growth deficiency, followed by a full evaluation for the key domains required for a classification of FASD. These included growth measurements, a dysmorphological evaluation for physical features of FASD, a neurobehavioral testing battery and a maternal or collateral interview regarding alcohol consumption in the index pregnancy. Details regarding the sampling strategies and methods for the parent study are described elsewhere [3].

The ancillary study in the selected AI community employed the same cross-sectional study design and evaluation of the key domains using the same tools with specific attention to cultural considerations. However, eligibility was defined as an AI child registered at the Southern California Tribal Health Clinic in the age-range of 5–7 years and did not utilize school-based ascertainment. Consequently, no teacher assessments of behavior were collected. In addition, for the ancillary study, no screening tier was used to select children for the full evaluation. All eligible consented children were offered assessment for growth, dysmorphology, neurobehavior and prenatal alcohol exposure. Data from the ancillary study were not included in the regional prevalence estimate from the parent study.

2.1. Sample Source

All AI children from 5 to 7 years of age and their caregivers were eligible to participate. Families were recruited in collaboration with a Southern California Tribal Health Clinic from two health clinic sites located in Southern California. Clinic membership rolls as of January 2016 were used to identify the eligible sample.

2.2. Ethics

This study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by University of California, San Diego (UCSD-#111082) and the Southern California Tribal Health Clinic (SCTHC-approved 7/7/2015) Institutional Review Boards (IRBs). All staff members completed human subjects' protections training. All caregivers provided written informed consent and the subset of children who were seven years of age at the time of consent provided written assent through a process whereby the consent/assent forms were read aloud. The purpose of the study was described to children who were under the age of seven. Participants were provided incentives commensurate with time and/or travel required for participation. Caregivers received a summarized report of findings from their child's evaluations as well as referrals for services and support where relevant.

Data from the present study belongs to the tribal entities from which the data were collected. The Tribal IRB reviewed and approved this manuscript for publication (4/30/2019). Cultural considerations affected the manner of recruitment, contact with participants, and structuring of recruitment awareness events. Local AI community members were involved as research staff and contributed to the design of study procedures. Where non-AI staff were involved in the study, they were educated regarding local etiquette and other relevant issues.

2.3. Recruitment

Letters inviting eligible families to participate were sent from the Southern California Tribal Health Clinic. Culturally congruent methods were used to raise awareness and to encourage participation. Flyers were posted in the clinics, local Tribal Halls, and in the community newsletter. Information was provided through table displays at local community events.

The research team included local AI trusted community members not just to provide cultural and logistic insights, and prevent cultural mishaps and misunderstandings, but to enable the collection of valid data reflecting the community. Local team members conducted all recruitment. They were also responsible for all scheduling, participant transportation, and the majority of mother and child related interviews. The neurobehavioral testing staff was augmented by training one local AI team member to conduct neurobehavioral exams. Team members were extensively trained and carefully monitored. As much as possible, all aspects of the study involved local research staff. Food was provided at each research event or participant assessment interaction as is culturally expected.

2.4. Assessment

Assessments took place on participating reservations. Study staff representing specific types of expertise from the parent CoFASP study regional site located in San Diego, California traveled to the various reservation sites to perform physical examinations and neurobehavioral testing. The assessments were the same standardized, age-appropriate assessments as used in the CoFASP study and used the same cut-off criteria as described in May and Chambers et al. (2018) [3]. As this study was community based, not school based, no teacher questionnaires were included. The following assessments were performed:

2.4.1. Physical Examination by a Dysmorphologist

- Measurement of the child's height, weight, and head circumference
- Ranking on a Likert scale the smoothness of the child's upper lip and thinness of the vermilion border of the upper lip
- Measurement of the length of the palpebral fissures (eye openings)
- Evaluation for heart murmur using a stethoscope
- 2D and 3D facial photographs

2.4.2. Neurodevelopmental Assessments

- Differential Ability Scales (2nd Edition) (DAS-II) [12]. Cronbach's alpha in our sample was 0.819.
- NEPSY-II (NEuroPSYchological Assessment) Subtests (2nd Edition) including attention/executive functioning, language, and sensorimotor functioning [13–15]. Cronbach's alpha in our sample was 0.788.
- Beery-Buktenica Developmental Test of Visual-Motor Integration (6th Edition) (VMI) for graphomotor skills [16–18]
- Bracken Basic Concept Scale–Revised (BBCS-R) [19] which evaluates academic achievement and basic concept development including letters, colors, numbers, sizes, comparisons, shapes, direction/position, and time/sequence

2.4.3. Parent/Guardian Interview Instruments Regarding the Child

- Vineland Adaptive Behavior Scales (2nd Edition) (VABS) [20]. This well normed and widely used measure of adaptive functioning provides a measure of "real world" functioning of the child. Cronbach's alpha in our sample was 0.720.
- Child Behavior Checklist (CBCL) [21–23] which includes 100 problem behaviors. The CBCL is commonly used in both research and clinical application to obtain standardized rating of various aspects of behavioral, emotional, and social functioning of the child. Cronbach's alpha in our sample was 0.909.

2.4.4. Biological Mother or Collateral Caregiver Structured Interview Regarding the Biological Mother and Pregnancy Including Questions Regarding Prenatal Alcohol Exposure

- Maternal health questions including alcohol use prior to pregnancy recognition and during pregnancy
- Cofactors of maternal risk including demographics, maternal nutrition, tobacco and recreational drug use

2.4.5. Diagnostic Classification

Criteria for physical and neurobehavioral features were identical to those used in the parent CoFASP study and were based on revised Hoyme criteria [24] including the following criteria for Risky Maternal Alcohol Consumption:

- ≥3 drinks per occasion on ≥2 occasions during pregnancy
- ≥6 drinks per week for ≥2 weeks during pregnancy
- Self (or collateral caregiver) report of alcohol-related events during pregnancy

2.5. Classification of FASD

The study diagnostic team met in case conference on four occasions during the course of the study to review the physical examination data, neurobehavioral assessments, 2D facial photographs, and interview data to determine FASD category for children whose data were sufficiently complete to allow for classification. Children were classified as fetal alcohol syndrome (FAS), partial fetal alcohol syndrome (pFAS), alcohol related neurodevelopmental disorder (ARND) or no FASD.

2.6. Statistical Analysis

Prevalence was estimated using the eligible population invited to participate as the denominator and the total number of children classified with an FASD as the numerator.

3. Results

Of 488 eligible children and their mothers or guardians, 119 were recruited, and 94 completed assessments with sufficient data to allow a classification for FASD and inclusion in this analysis (Figure 1). Data from 94 physical exams, 80 maternal interviews and 14 collateral interviews, 94 CBCL, 94 VABS, 94 DASII, 92 NEPSY, 94 VMI, and 90 BBCS assessments are represented. As shown in Table 1, half of all participating children were female and their average age was 6.61 ± 0.91 years. The majority of mothers interviewed were cohabitating (71.3%) and had at least some college education (61.2%). Most interviews were conducted with biological mothers (85.1%). Women ranged from 24–49 years old at the time they were interviewed and were an average of 7.53 ± 5.33 weeks (range 1–39 weeks, median 6.5, mode 8) of gestation when they became aware of their pregnancy. Prior to being aware of their pregnancy but in the first trimester, nearly 30% of women consumed some alcohol and 19.1% of them met the study criteria for an alcohol-exposed pregnancy.

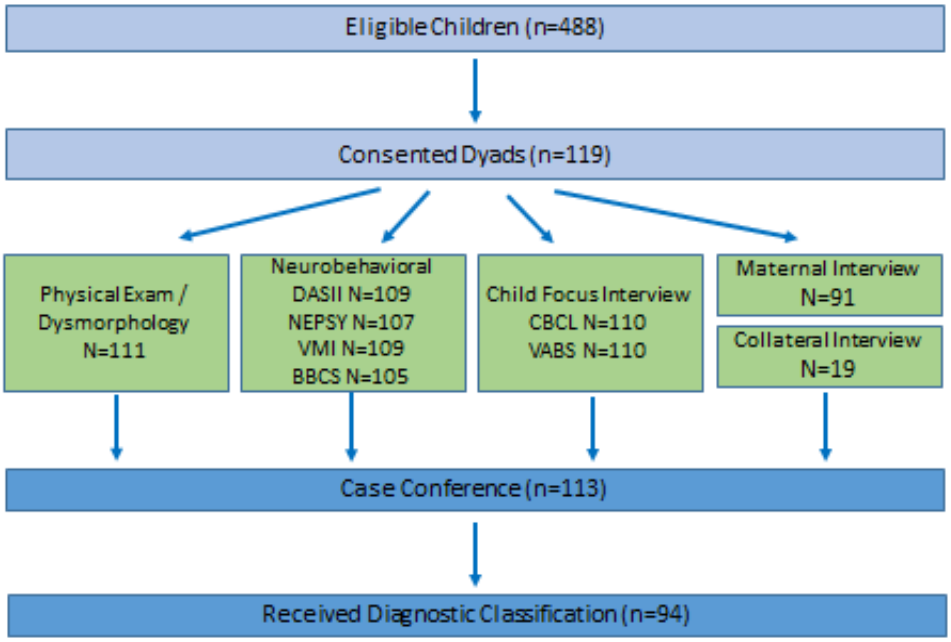

Figure 1. Study Flowchart.

Prenatal exposures are shown in Table 2. Among the 28 women (29.8%) who consumed alcohol while pregnant before they were aware of their pregnancy, 66.7% drank at least once per week and 73.1% engaged in heavy episodic drinking or "binge" drinking (defined as 3 or more standard drinks per occasion in this study). Following pregnancy awareness, 4 (19.0% of the 21 women responding to the question) indicated that they continued to drink, with three of the four reporting alcohol consumption at least once per week. About one-quarter of women (24 or 25.8%) reported using marijuana or hashish prior to pregnancy recognition, with roughly half of these women using daily. After pregnancy recognition, 12 (15.0%) reported continued use at any level. Women reporting tobacco use decreased from 29 (30.9%) prior to pregnancy recognition to 11 (13.9%) following pregnancy recognition. Number of cigarettes smoked per day prior to pregnancy recognition averaged 9.3 ± 7.6, and after pregnancy recognition averaged 5.6 ± 4.8. Exposure to secondhand smoke was reported by 42.6% of women prior to and 27.5% after pregnancy recognition.

Table 1. Characterization of Sample.

	Mean ± SD or Number (%)
Children	
Age, years	6.61 ± 0.91
Sex, female	47 (50.0)
Mothers	
Current Age, years	32.6 ± 5.3
Parity	3.04 ± 1.24
Marital Status	
Married	29 (36.3)
Unmarried, living with partner	28 (35)
Widowed	1 (1.3)
Divorced	5 (6.3)
Separated	4 (5.0)
Single	13 (16.3)
Highest Education Level	
Some High School [1]	6 (7.5)
High School Graduate [2]	25 (31.3)
Some College or Two-year Degree	41 (51.2)
Bachelor's Degree	6 (7.5)
Graduate or Professional School	2 (2.5)
Any alcohol during pregnancy	28 (29.8)
Met CoFASP alcohol exposure criteria	18 (19.1)
Fathers	
Age (at child's birth), years	28.0 ± 6.1
Number drinks typically consumed on drinking day	5.87 ± 12.79
Number days per month consumed alcohol	13.5 ± 10.0
Primary Caregiver	
Mother	80 (85.1)
Father	1 (1.1)
Grandmother	6 (6.4)
Grandfather	1 (1.1)
Aunt	3 (3.2)
Adoptive, Step, or Foster Parent	3 (3.2)

[1] High School is 9th through 12th grade [2] The majority of students are 17–19 years at graduation.

Table 2. Prenatal Exposures.

	Mean (SD) or Number (%)
Alcohol during pregnancy, Prior to pregnancy awareness	28 (29.8)
Women drinking at least once per week	16
Drinks per drinking occasion	5.81 ± 4.71
Women binge drinking when drinking	19
Alcohol during pregnancy, After pregnancy recognition	4 (19.0)
Women drinking at least once per week	3
Marijuana or hashish during pregnancy	
Any, Prior to pregnancy recognition	24 (25.8)
Any, After pregnancy recognition	12 (15.0)
Tobacco	
Any, Prior to pregnancy recognition	29 (30.9)
Amount, Cigarettes per smoking day, Prior to pregnancy recognition	9.25 ± 7.60
Any, After pregnancy recognition	11 (13.9)
Amount, Cigarettes per smoking day, After pregnancy recognition	5.63 ± 4.82
Second-hand tobacco smoke	
Any, Prior to pregnancy recognition	40 (42.6)
Any, After pregnancy recognition	22 (27.5)

A total of 20 children were classified with FASD. Prevalence estimates according to the classification of FASD used in the CoFASP study are shown in Table 3. ARND was identified in 14/20 (70.0%) and pFAS in 6/20 (30.0%). No cases of FAS were identified. The overall minimum FASD prevalence in this sample was 41.0 per 1000 or 4.1%. None of the parents or guardians of the 20 children identified were aware prior to the study that their child had an FASD.

Table 3. FASD Diagnostic Categories.

Diagnostic Category	*N*	Prevalence Estimate Among 488 Eligible Children
ARND	14	28.7 per 1000 (2.9%)
PFAS	6	12.3 per 1000 (1.2%)
FAS	0	0
Total FASD	20	41.0 per 1000 (4.1%)

4. Discussion

The present study used active case ascertainment to establish a minimum FASD prevalence in an AI reservation-based population. The estimated prevalence of 41.0 per 1000 or 4.1% was consistent with the range found in the parent study in four communities in different regions of the United States (11.0–50.0 per 1000 or 1.1–5.0%). In the general population prevalence study, of 222 cases of FASD identified, 27 (12.2%) were classified as FAS, 104 (46.8%) were classified as pFAS and 91 (41.0%) were classified as ARND. However, in the present sample, the highest proportion of FASD cases were classified as ARND (14/20 or 70.0%).

The study was undertaken not only to obtain a prevalence estimate for resource allocation purposes but to identify children affected by FASD and their families for referral for intervention and treatment. Early intervention is crucial to avoid secondary disabilities [25] and to maximize benefit from available treatment and support, yet children with FASD are frequently under-diagnosed or misdiagnosed [26]. At the study venue, expert diagnostic services for FASD had not previously been available. Locally relevant data was needed to harness the power of the community itself to address the issue.

Previous studies have found varying patterns of drinking among AIAN populations, in general higher abstention rates than in the general population, and a higher likelihood of engaging in heavy episodic alcohol consumption when drinking [4–7,27]. In characterizing our sample population, there appeared to be a strong social norm to engage in heavy episodic alcohol consumption when drinking. Average drinks per drinking day were remarkably similar for men and women (5.87 vs. 5.81). Previous studies within the same community have documented similar levels of binge drinking and that most women do not drink at all [10,11].

No cases of FAS were identified in our study which may reflect resilience within the community that should be further explored or potential differential expression of the manifestations of prenatal alcohol exposure in this population. Conversely, it is also possible that sampling bias led to under-ascertainment of children with full blown FAS. By the same token, nearly twice the proportion of cases of ARND were identified in this AI sample (70.0%) compared to the four regions in the parent study (41.0%). This could have been due in part to the fact that there was no screening tier for growth in the AI sample. As growth deficiency is not a criterion for ARND, it is possible that in the parent study, more children who would have met criteria for ARND were screened out on growth.

4.1. Limitations and Strengths

This study had a number of limitations. Less than a quarter of eligible children participated, and participants were self-selected. The small number of child-caregiver dyads recruited and the small number of cases in each category of FASD naturally involve more uncertainty compared to larger studies. Prenatal exposures, including alcohol, were self-reported or, in the case of a collateral interview, reported by the current caregiver. It was not possible to validate maternally reported exposure data by

biomarkers or laboratory measures. The study was limited to single assessments at a narrow age-range and it cannot be discounted that deficits may develop at a later time. Some children could not be classified with or without an FASD due to incomplete data collection. It is possible that these data were not missing at random.

The study was conducted in an AI community. There are substantial barriers to conducting research in AIAN communities that may influence findings. Among many AIAN communities there is a lack of trust in research and particularly in **non**-CBPR (community based participatory research) studies where methods are imposed from the outside. This may be due to the legacy of colonialism, the Mission system in our area, historical trauma, and continuing discrimination as well as negative experiences with research [28–31]. Optimal studies are developed within a community using locally-relevant, culturally congruent motivations and methods. While our study was not "optimal", it responded to a community prioritized concern, modified the protocol where possible and proceeded with respect. Flexibility was built into the assessments employed, and some were minimally modified.

There are 573 federally recognized AIAN tribes in the United States with remarkably diverse histories, traditions, living conditions, disease burdens, and cultures. These characteristics may influence the reliability of assessment tools [32]. Importantly, not all standardized measures used in this study had been validated among AIAN populations much less this AI population. In particular, the neurobehavioral testing battery had not been specifically validated for AI communities and may be vulnerable to cultural differences. There is an unknown contribution of culture to our findings. Investment is needed in development of valid, culturally congruent measures.

Our study also had strengths. There was community support for the study and recruitment was conducted by respected, trusted community members. The study was broadly publicized using culturally congruent methods. Transportation and refreshments were provided. We sought to minimize reporting bias by assuring participants of confidentiality, explaining Tribal IRB approval, and by carefully training staff. Furthermore, the expertise and experience of the investigators and examiners from the parent study were strengths. Active case-ascertainment was also a strength, and the use of the standardized protocol and measures developed for the parent study allows for comparison with other communities.

4.2. Local Relevance

As a result of the present study, we identified a need within the community for FASD-related prevention, services, treatment, and support. We further identified families affected by FASD allowing us to facilitate the goals of an ongoing access to interventions project to link families and children to needed services. The study helped raise awareness of FASD and currently available services. It provided opportunities to decrease stigma and increased the capacity of the local clinic and the community to address FASD.

4.3. Implications for Public Health

Our findings contribute to the understanding of FASD among minority populations, specifically AIAN populations. In addition to providing information helpful for clinical resource allocation, this study raises questions about community resilience and the effect of culture. Future research into community-specific risk and protective factors is warranted.

5. Conclusions

The estimated minimum prevalence of FASD among a sample of reservation-based American Indians in Southern California was 41.0 per 1000 or 4.1%. This estimate is consistent with the range of estimates from four regional general population samples in the CoFASP study. Of the 20 cases classified in this sample, no cases of FASD had been previously identified. These findings may not be generalizable to all AIAN populations given the heterogeneity of American Indian communities.

Author Contributions: A.C.M. and C.D.C. had full access to all study data and take responsibility for the integrity of the data and the accuracy of the data analysis. Conceptualization, A.C.M., D.C. and C.D.C.; Methodology, CoFASP collaboration, C.D.C., A.C.M.; Validation, J.A.Z., and A.C.M.; Formal Analysis, A.C.M.; Investigation, A.C.M., R.R., T.J., A.G., A.A., C.W., N.A., M.S., M.Z., M.d.C., and K.L.J.; Resources, A.C.M., D.C., N.A., J.A.Z., M.d.C., K.L.J., and C.D.C.; Data Curation, J.A.Z.; Writing—Original Draft Preparation, A.C.M.; Writing—Review & Editing, C.D.C., J.A.Z., A.G., C.W.; Supervision, A.C.M. and J.A.Z.; Project Administration, A.C.M., N.A., J.A.Z., and C.D.C.; Funding Acquisition, C.D.C.

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Community-Specific Risk and Protective Factors for Risky Alcohol Consumption in American Indian Women of Reproductive Potential: Informing Interventions

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Community-Specific Risk and Protective Factors for Risky Alcohol Consumption in American Indian Women of Reproductive Potential: Informing Interventions

Abstract

Objective: To explore the effect of community-specific risk and protective factors on risky alcohol consumption and vulnerability to having an alcohol-exposed pregnancy in women within a Southern California American Indian community. Methods: A sample of 343 American Indian women of childbearing age was enrolled in a study of risky drinking. All participants completed a questionnaire including alcohol consumption, other health behaviors, the T-ACE risky alcohol consumption screen and the PHQ-9 to measure depression and functionality. A subset of 80 women additionally answered focus group-derived questions about why they choose or do not choose to drink. Results: Risk and protective factors varied among sample subgroups. Broadly, factors affecting risk and protection included: depression, perception of other women's drinking, children/family, perception of risk to the unborn child, and feeling pressured to drink. Women's drinking was highly influenced by female friends and relatives. Women were most likely to drink with a girlfriend. Nearly 40% of all participants asked felt pressured to drink. Depression was associated with riskier alcohol consumption, less effective contraception, and testing positive for risky drinking using the T-ACE screen. Depressed women were more likely to binge drink because of stress, trauma, and "to escape my problems", and more likely to have been exposed to trauma including sexual assault. Conclusions: Interventions should incorporate community-specific factors. In the present sample, two separate strategies are indicated by the data: an information campaign to increase women's awareness of true social norms and the risks of prenatal alcohol-exposure; and screening for and treating depression.

Keywords

Alcohol, women, AIAN, prevention research, fetal alcohol spectrum disorders

Introduction

Alcohol exposed pregnancies result in a range of persistent cognitive, behavioral and adaptive function deficits termed Fetal Alcohol Spectrum Disorders (FASD) (Jones & Smith, 1973; Riley et al., 2011; Secretary of Health and Human Services, 2000; Streissguth, 2007). Interventions to prevent risky alcohol consumption and FASD may be more effective when specifically targeted (Caldwell, 2005; Fisher et al., 2007; Griner & Smith, 2006; Kreuter et al., 2000; Montag et al., 2012; Skinner et al., 1999). For this reason, a good understanding of both risk and protective factors for risky alcohol consumption among women of reproductive potential is of high importance.

In the general population, the strongest known risk factor for an alcohol-exposed pregnancy (AEP) is drinking prior to pregnancy (Ethen et al., 2009; Palma et al., 2007). Other risk factors often cited but not always significantly associated include higher maternal age, gravidity and parity; being unmarried or unemployed; heavy alcohol consumption by spouse or partner; psychological stress; being less religious or spiritual; smoking; and illegal drug use (Bakhireva et al., 2011; Cannon et al., 2015; Flynn & Chermack, 2008; Green PP, 2016; McLeod, 1993; Naimi et al., 2003; Palma, et al., 2007; Tsai et al., 2009; Waterson et al., 1990). Depression has also been associated with problem alcohol consumption in women (Helzer & Pryzbeck, 1988; Kessler et al., 1997; KUO et al., 2006; Parker et al., 2010; Slade et al., 2013; Tsai, et al., 2009).

In addition, cultural norms influence the consumption of alcohol leading to varying vulnerabilities to an AEP (Balachova et al., 2012; Green PP, 2016; Nilsen et al., 2008; O'Keeffe et al., 2015; Roozen et al., 2016). Variations in these norms are of high relevance in the various distinct American Indian/Alaskan Native (AIAN) populations across the U.S. (Beals et al., 2003; May & Gossage, 2001; O'Connell et al., 2005; Spicer et al., 2003; Yuan et al., 2010). However, risk factors for an AEP have not been well characterized for these communities. Similar to the general population, depression in AIAN communities may play a role (Beals et al., 2005; Dillard et al., 2012; Duran et al., 2004; Gone & Trimble, 2012); and among several AIAN population samples, problem drinking and depression have been linked (Dillard, et al., 2012; Kunitz, 2006; Montag et al., 2015; O'Connell et al., 2006). As in other communities, healthcare provider advice may be largely ignored (O'Connor & Whaley, 2006a) and women may not understand the extent to which they are at risk (Kaskutas, 2000), nor appreciate the true amount of alcohol they consume (Branco & Kaskutas, 2001).

In addition to risk factors shared by the general population, there may be other risk and resiliency factors specific to AIAN communities (Allen et al., 2006; Hawkins et al., 2004; Whitbeck et al., 2004). Historical loss, trauma, and discrimination resonate throughout AIAN life today, and mistrust of research and externally imposed interventions may be important factors (Caldwell, 2005; Davis, 2002; Szlemko et al., 2006; Whitbeck, et al., 2004). Conversely, enculturation may be a source of resilience (Gray et al., 2010; Torres Stone et al., 2006; Whitbeck, et al., 2004), and family and community may exert protective influences for an AEP (LaFromboise et al., 2006).

In this manuscript we describe the risk and protective factors in a specific AIAN community for risky drinking and an AEP using data from a study of AIAN women of reproductive age. This community-based study can inform prevention strategies specifically targeted to the risk and protective factors for that community. Given the known variability in AIAN communities' characteristics, an intervention's potential to succeed may depend upon the degree to which it is grounded in community-specific factors.

Methods

Ethics

This study was approved by University of California at San Diego (UCSD), San Diego State University (SDSU), and Southern California Tribal Health Clinic (SCTHC) Institutional Review Boards. A Certificate of Confidentiality (CoC), obtained from the National Institutes of Health (NIH), further protected the confidentiality of participants' data. All participants provided informed consent through a process where the consent form was read aloud and all staff members completed human subjects' protections training.

Sample Source

American Indian Alaska Native (AIAN) women from 18 to 45 years of age, of childbearing potential, were recruited from one of three AIAN health clinics located in Southern California between April 2011 and April 2014.

Recruitment and Study Protocol

Potential participants were approached by project staff, local AIAN community members, in waiting areas of health clinics and screened for eligibility. Interested and eligible participants were brought to a private room where they were taken through the consenting procedure, assigned a unique identifier, and completed a self-administered paper and pencil survey. The majority of women who completed the paper-based survey then completed a web-based survey, while a randomly selected subset was instead asked to complete an additional paper-based survey. Participants had the opportunity to be referred for professional substance problem use treatment following completion of each survey. Participants were provided incentives in the form of a $10 gift card and a choice of a project fan or t-shirt emblazoned with the project logo at baseline.

Data Collection

Data was collected by project staff members who were trusted local AIAN community members.

Entire sample

Paper and pencil questionnaire. The self-administered, paper-based questionnaire included questions regarding current relationship situation (an eight response option question reduced to "cohabitating" or not), employment, religiosity, gravidity, parity, birth control use and frequency of correct usage, current use of prescription and non-prescription medications, smoking, illegal drug use, awareness of FASD, and alcohol consumption including number of standard drinks consumed per week and per occasion, and number of binge episodes in the past two weeks (binge defined in this setting as consuming ≥ 3 standard drinks/occasion). They were asked to complete a T-ACE and a PHQ-9 questionnaire.

Sample subgroups

Web-based questionnaire. Participants selected for the web-based survey self-reported additional information by computer regarding alcohol consumption over the past two weeks, pregnancy status, family history of alcohol problems, the age they began drinking alcohol, and contraceptive use. Illustrations of various alcoholic beverage containers were used to prompt recall.

Paper and pencil questionnaire. These questions were the result of feedback from the community obtained through a focus group and interview process described in detail elsewhere (Montag et al., 2017). Topics included whether and, if yes, when women felt pressured to drink; why they drank when they binge drank and why they chose not to when they did not drink; who they drank with when they were binge drinking and questions about this person's drinking; and whether they had experienced trauma or abuse. At each point of contact, participants were offered referrals for professional treatment.

Measures

The nine item Patient Health Questionnaire (PHQ-9) measured depression and functionality. In a variety of studies it has been found to have a sensitivity of 73% and specificity of 94% for major depression (Kroenke & Spitzer, 2002; Kroenke et al., 2001; Spitzer et al., 1999). In 2016, the PHQ-9 was adopted as a HEDIS (Healthcare Effectiveness Data and Information Set) measure of depression and incorporated into the majority of healthcare plans in the US. Despite extensive validation among other groups and use within AIAN communities, the PHQ-9 has not been specifically validated among AIAN women of childbearing age. However, using NHANES data, the PHQ-9 was found to be invariant across race/ethnicity and education level groups (Patel, 2017). Depression variables derived from this measure included "depression" (depressed or not depressed), and "functionality" (impaired or not impaired) and were calculated as follows: Depression: a participant scoring >5 was identified as "depressed"; Functionality: a participant scoring 2 or 3 was identified as having their "functionality impaired".

T-ACE (Tolerance, Annoyed, Cut down, Eye-opener) is a validated screening instrument of four questions structured to identify risky drinking (Sokol et al., 1989) shown to be valid in an AIAN population (Gale et al., 1998). The T-ACE questions and scoring were as follows: How many drinks does it take to make you feel tipsy/high? (≤2 = 0 points, >2 = 2 points); Have people annoyed you by criticizing your drinking? (No = 0 points, Yes = 1 point); Have you felt you ought to cut down on your drinking? (No = 0 points, Yes = 1 point); Have you ever had a drink first thing in the morning to steady your nerves or to get rid of a hangover? (No = 0 points, Yes = 1 point). A score of ≥2 was considered positive for risky drinking ("T-ACE positive" variable). Sensitivity of the instrument has been estimated at 80-90% and specificity at 40-70% (Chang, 2001; Chang et al., 1998; Chiodo et al., 2010; Russell et al., 1994; Russell et al., 1996).

Contraceptive effectiveness defined as by WHO (see http://www.fphandbook.org/). *Using Birth Control Correctly* was defined as responding that birth control was used correctly every time or most of the time, as opposed to some of the time or none of the time.

The "Vulnerability to Alcohol-Exposed Pregnancy" variable was defined in four categories: "not at risk", "at risk", "not at high risk", and "at high risk". Being "at risk" for an AEP was defined as 1) currently using alcohol and 2) using a less than highly effective contraceptive method. The NIAAA defines "risky drinking" for women as more than 3 drinks at one time or more than 7 drinks per week (NIAAA, 2011). For the purposes of this study, we defined "binge" or "risky" drinking as 3 or more standard drinks per occasion and/or 8 or more drinks per week as this level of consumption has been predictive of risk of adverse pregnancy outcomes in other studies (May et al., 2013; May et al., 2007; May et al., 2008; May et al., 2004; May & Phillip Gossage, 2011). Being "at high risk" for an AEP was defined as "at risk" coupled with either consuming ≥3 drinks per occasion or consuming ≥8 drinks per week. The categories of vulnerability to AEP were not mutually exclusive, i.e., all "at high risk" women were also included in the "at risk" category.

"Regret" was measured by asking "Imagine you drank alcohol while you were pregnant and your child was born with fetal alcohol syndrome. How much would you regret drinking during your pregnancy?"

Statistical Analyses

Comparison of continuous, dichotomous, or categorical variables in tables of demographics, alcohol consumption, birth control use, knowledge questions (Appendix C), and depression were conducted using t-tests (continuous), $\chi 2$ (dichotomous), Fisher's exact test (dichotomous with small cell sizes), ANOVA, or nonparametric analyses (for data not normally distributed and not log-transformed). Normality in continuous variables was investigated by looking at skewness and kurtosis. ANOVA was used to examine associations among population characteristics. Regression was used to test for predictors of depression / impaired functionality and for vulnerability to AEP. First, each predictor was

tested to determine whether there were significant independent associations with that factor and depression/ functionality/ vulnerability to AEP. Then multiple logistic regression analysis was used to examine all variables previously found to be significant. All two-way interactions among significant variables were tested. Statistical significance was defined as 2-sided, p-value of <0.05. Statistical analyses were carried out using SPSS (PASW 18, SPSS Inc., Chicago, IL).

Results

Total Sample

A total of 343 women were recruited into the study, 33 of whom were pregnant. All women were included in analysis and tables indicate number responding to each question. Half of participants reported not currently consuming alcohol. As shown in Table 1 (see Appendix A), those reporting that they currently consumed alcohol were more likely to be employed, to have had more pregnancies, to use effective birth control and use it correctly, to smoke tobacco and to take illegal drugs. Drinkers and non-drinkers did not differ in the proportion who wanted more children, who were religious, or who were cohabitating. Furthermore, they did not differ in proportion identified as depressed or functionally impaired, or in FASD awareness.

Participants who did drink tended to drink in a heavy episodic pattern (binge drinking). Of 113 women responding to T-ACE questions, 73.5% (a quarter of the total sample) were T-ACE positive, identified as a risky drinker. A quarter of participants used no form of contraception (including abstinence) and less than a quarter used highly effective birth control. Applying the definitions specified in the methods section, we found 42.3% of participants to be “at risk” of having an alcohol-exposed pregnancy and more than a third, 35.2%, “at high risk” of AEP.

The level of awareness of FASD (nearly ¾ of participants had heard of FAS or FASD) and familiarity with community members affected by prenatal alcohol exposure (more than a third of participants knew someone affected) did not different across the study subgroups (Tables 1 and 2, see Appendix B).

The level of knowledge regarding the risks of alcohol to pregnancies was relatively high. Risky drinkers were slightly less likely to answer questions correctly (Table 3). The level of knowledge regarding the risks of alcohol to women and prevalence of local alcohol consumption was relatively low and not different across the study subgroups.

Table 3.
Knowledge Questions (percent answering correctly)

Type Questions	Comparator Group	n	Selected Subgroup	n	p-value
	Not current drinker		Current drinker		
Relating to Pregnancy	95.9	62	92.0	58	.040
Relating to Women's Health	34.4	61	31.0	58	.542
Total	84.6	62	80.9	58	.043
	Not risky drinker		Risky drinker		
Relating to Pregnancy	95.8	69	91.5	51	.025
Relating to Women's Health	36.0	68	28.4	51	.175
Total	84.8	69	80.0	51	.009
	Not depressed		Depressed		
Relating to Pregnancy	94.7	78	92.8	40	.339
Relating to Women's Health	33.3	78	30.8	39	.668
Total	83.5	78	81.3	40	.263

More than a third of our sample (115 women) was identified as depressed. The proportion of participants categorized as depressed did not differ among current drinkers and abstainers. Nearly 14% of these women reported that their functionality was impaired. Women identified as depressed were more likely to consume alcohol in a risky fashion and to perceive a higher social norm regarding how many drinks are consumed by women of childbearing age in their community than women not identified as depressed (Table 2). In addition, they were less likely to use birth control (trend) and less likely to use it effectively; more likely to take prescription and illegal drugs; and more likely to test positive for risky drinking using the T-ACE screen. In this study, depression was associated with risk factors for having an alcohol-exposed pregnancy.

Subset Sample

Among the 80 women in our subset sample, 39% reported feeling pressured to drink. The times women reported feeling most pressured to drink were "Girl's Night Out" (22.4% of total and 56.7% of those feeling pressured), "Holidays/occasions" (22.4%), and "when I'm at the casino" (7.9%).

When binge drinking, women were by far most likely to drink with a girlfriend, followed by partner/spouse, sister, and cousin (Table 4). This is true among the sample of all women responding to the question "On occasions when you drink 3 or more drinks in one sitting, who are you most often drinking with?" (n=69) and among the more limited sample of current drinkers responding (n=51). The

proportion choosing to binge drink with a girlfriend increased as the level of risk for an alcohol-exposed pregnancy increased. More risky drinkers and women at high risk for an AEP responded that they drank with a girlfriend than those not identified as risky drinkers or at high risk for AEP. While depressed participants reported binge drinking with a girlfriend more than with anyone else, they were statistically less likely to drink with a girlfriend than non-depressed participants (p=.038).

Table 4.
The Person Participants Reported Drinking with when Binge Drinking. (Percent among indicated sub-sample of 69 persons responding.)

Person drinking with	Total Sample N=69	Current drinkers n=51	Risky drinkers n=39	At high risk for AEP N=29	Depressed N=22
Partner/spouse	30.4	31.4	33.3	27.6	22.7
Mom	13	13.7	10.3	10.3	4.5
Dad	8.7	7.8	7.7	6.9	4.5
Sister	25.1	27.5	30.8	24.1	18.2
Brother	8.7	7.8	10.3	6.9	9.1
Myself; I drink alone	17.4	21.6	25.6	20.7	22.7
Grandparent	2.9	2	2.6	3.4	0
Cousin	24.6	27.5	25.6	37.9*	31.8
Uncle	4.3	2	2.6	3.4	4.5
Aunt	7.2	2	2.6	3.4	13.6
Friend (girlfriend)	58	66.7	71.8*	79.3*	40.9*
Coworker	11.6	11.8	15.4	13.8	4.5
Other	7.2	7.8	10.3	6.9	0

The most common reasons, in order, that non-drinkers cited for not drinking were children, health, and family. Other reasons included “don’t like alcohol”, “I’m a recovering alcoholic”, and “lost loved ones to alcohol related incidents”. Current drinkers, when choosing not to drink, reported doing so because of children, having to drive or having to work or go to school. Risky drinkers cited “no money” significantly more often than non-risky drinkers. Women at high risk for an AEP were significantly more likely to credit having to work or drive. Women identified as depressed were significantly more likely to say they choose not drink because they “don’t like alcohol”.

The top reasons cited for why participants binge drink were “to relax”, “to help me enjoy time with friends or partner”, “because of stress”, and “to get buzzed”. Subgroups differed slightly with risky drinkers significantly more likely to drink to relax (p<0.001) or escape their problems (p=0.007) than non-risky drinkers. Depressed women were more likely than non-depressed women to drink to escape

their problems (p=0.010), or because of stress (p=0.004) or trauma (p=0.013). They were more likely to have been exposed to sexual assault (p=0.032).

Depressed women were slightly less likely (p=.024) than non-depressed women to regret drinking during pregnancy when imagining that they had given birth to a child with FASD, and slightly less likely (p=.008) to worry about their baby being harmed if they were to consume alcohol while pregnant (data not shown).

Of the 80 women in the paper-and-pencil subgroup sample, 17 declined to answer the abuse/trauma questions. Among the participants responding, 44.4% had been exposed to physical abuse, 50.8% to emotional abuse, and 61.9% to verbal abuse. Thirty-seven percent (36.5%) had been exposed to trauma and 36.5% had witnessed a traumatic event. Of the entire responding sample, 27% had been exposed to sexual assault. This did not differ by current drinker status, which was true for all abuse/trauma questions, but women identified as depressed were significantly more likely to have experienced sexual assault.

Regression analysis reveals that approximately 40% of variation in the amount alcohol women consumed per week could be explained by their perception of risk to a potential pregnancy, their perception of the drinking patterns of other women, how much their drinking partner drinks, whether they smoke, and whether they feel pressured to drink or not.

Limitations

Data in this study were self-reported and may have been biased by social acceptability. In view of this possibility, we strove to ensure and convey confidentiality by a variety of means including a Certificate of Confidentiality from the NIH. Approval and support was obtained from the Tribal IRB. Preparation of materials (detailed elsewhere, Montag, et al., 2017), recruitment, and interactions with participants were carried out by trusted community members trained as research staff. Participants were self-selected volunteers and may not represent all women of child-bearing age within the community. However, recruitment occurred at locations throughout the community to allow equal access for all. Validity may have been threatened by our use of 2-week increments when assessing alcohol consumption. A longer period of time may have provided more precise data.

Discussion

High risk drinking is increasing among women in the US including AIAN women (Grant et al., 2017). To maximize the benefit of interventions to reduce risky drinking and prevent FASD, it may be prudent to target efforts to address specific risk and protective factors among differing subgroups.

In the present study, the relevance of specific risk and protective factors varied depending upon alcohol consumption and depression status. Some factors found to affect drinking in general population

samples did not do so in the present sample including age, employment, religiosity, and being married or cohabitating. Other factors identified elsewhere as important were also found to be important in our study such as depression, smoking, and trauma. The strength of our finding that women's drinking is influenced by female friends and family members is interesting. As Table 4 shows, the influence of female friends grows with increased risk of harmful alcohol consumption. We did not specify "cousin" as male or female but, consistent with our other findings, many women verbally reported drinking with female cousins.

How do women make choices regarding alcohol consumption? As in previous literature, healthcare provider advice was not cited as a reason to abstain in the present study and appears to be largely ignored (O'Connor & Whaley, 2006b). Decision making strategies of drinkers and non-drinkers may differ. Reasons cited by non-drinkers for not drinking tended to reflect a more well thought-out or long-term strategy than those cited by current drinkers.

Among study participants, 115 women (34.2%) were identified as depressed (36.7% non-drinkers, 31.4% current drinkers, NS). This rate is high; comparable studies using the same depression instrument found a national prevalence of 14% (Farr et al., 2010) and an Alaska Native sample prevalence of 20% (Dillard, et al., 2012). Depression is an independent risk factor for risky drinking and was found to be meaningful in this study. The good news is that there are effective treatments for moderate and severe depression, and that depressed women may be identified using brief, culturally acceptable, inexpensive screening. Present results are being used to inform community response.

Implications for Prevention

- Differences in risk and protective factors exist among communities and community subgroups necessitating modification and targeting of interventions to maximize impact
- Two strategies are recommended for the present community based on study results:

  1a) Community wide ("girl power") intervention campaign, geared to all women, seeking to shift cultural norms by empowering women to protect friends/female relatives. This would include broad information dissemination regarding the reality of lower community alcohol consumption and risks of drinking to women and pregnancies (FASD), as well as encouraging friend-networks focused on support. Self-assessment of drinking may be encouraged by the campaign and required at each clinic interaction;

  2a) Screening for depression to help identify women at increased risk for AEP; and 2b) treating depression to prevent alcohol-exposed pregnancies.

Conclusion

Risk and protective factors varied among community subgroups. In our sample, girlfriends and female relatives played an important role in influencing the level of risk associated with alcohol consumption. Their impact could be harmful or protective. Perception of community drinking norms was skewed in that participants at greater risk believed the amount of drinking by their peers to be greater. Protective factors, beyond the perception of a lower social norm of drinking, included knowledge of the risks of alcohol consumption, drinking with people who consume less alcohol, and certain decision-making strategies. Consistent with previous literature, children were the top factor inducing AIAN women to stop or reduce drinking (Bezdek et al., 2004).

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Appendix A

Table 1.
Characterization of Sample by Alcohol Consumption Status

Variable	Not Current Drinker	n	Current Drinker	n	P value
Age (years)	28.0 ± 0.62	161	28.9 ± 0.57	179	.282
Has had a child	67.7	161	64.0	178	.479
Pregnancies (number)	2.44 ± 0.20	154	1.86 ± 0.15	176	.018
Children (number)	1.63 ± 0.14	161	1.44 ± 0.11	178	.269
Wants more children	59.5	148	59.8	174	.955
Employed	35.0	160	50.3	173	.005
Religious	84.8	151	87.3	166	.507
Cohabitating	43.8	160	42.4	177	.799
Birth Control Effectiveness		145		161	<.001
High	9.0		17.4		
Medium High	22.1		35.4		
Medium Low	25.5		20.5		
Low	0		1.2		
No birth control	43.4		25.4		
Using Birth Control Correctly	72.2	133	83.9	155	.016
Smoker	26.3	160	38.2	178	.019
Taking illegal drugs	8.1	161	15.1	172	.046
Taking prescription drugs	41.3	160	35.2	175	.273
Depression medication	9.2	131	6.5	123	.432
Depressed	36.7	158	31.4	175	.310
Functionality impaired	7.5	134	5.2	154	.428
Heard of FASD/FAS	75.8	153	72.1	172	.446
Know someone affected by FASD/FAS	36.4	154	35.7	154	.906
Alcohol consumption variables					
Total Sample					
Age at first drink	15.4 ± 0.3	143	15.0 ± 0.3	178	.423
Perception of Other Women's Drinking					
Drinks per week	7.13 ± 0.81	139	9.03 ± 0.72	165	.080
Drinks per occasion	3.23 ± 0.31	140	4.43 ± 0.28	168	.004
Depressed Subset					
Age at first drink	15.6 ± 0.6	55	13.9 ± 0.4	55	.023
Perception of Other Women's Drinking					
Drinks per week	7.38 ± 1.26	49	13.4 ± 1.9	47	.008
Drinks per occasion	2.87 ± 0.34	50	4.98 ± 0.53	51	.001

Appendix B

Table 2.
Characterization of Sample by Depression Status

Variable	Not Depressed	n	Depressed	n	P value
Age (years)	28.2 ± 0.5	221	29.1 ± 0.8	115	.332
Has had a child	63.2	220	73.0	115	.070
Pregnancies (number)	2.08 ± 0.15	213	2.28 ± 0.21	114	.436
Children (number)	1.45 ± 0.10	220	1.74 ± 0.15	115	.111
Wants more children	58.6	210	62.2	111	.642
Employed	45.4	218	38.4	112	.223
Religious	87.3	205	84.4	109	.475
Cohabitating	46.6	219	36.8	114	.089
Birth Control Effectiveness		201		104	.038
High	14.9		11.5		
Medium High	29.4		28.8		
Medium Low	24.9		16.3		
Low	0		1.9		
No birth control	30.9		41.4		
Using Birth Control Correctly	83.2	196	67.8	90	.003
Smoker	29.4	221	37.7	114	.123
Taking illegal drugs	8.2	219	18.0	111	.015
Taking prescription drugs	31.4	220	53.6	112	<.001
Depression medication	4.8	165	14.9	87	.006
Functionality impaired	1.2	169	13.9	115	<.001
Heard of FASD/FAS	75.7	210	70.8	113	.337
Know someone affected by FASD/FAS	36.1	202	35.6	104	.923
Alcohol consumption variables					
Total Sample					
Drinks per week	2.88 ± 0.35	203	6.10 ± 1.18	108	.001
Drinks per occasion	2.31 ± 0.27	206	2.29 ± 0.37	110	.972
Binge episodes / 2 weeks	0.95 ± 0.12	202	2.04 ± 0.45	108	.004
Age at first drink	15.5 ± 0.3	204	14.7 ± 0.4	110	.069
Perception of Other Women's Drinking					
Drinks per week	7.04 ± 0.58	203	10.2 ± 1.1	98	.006
Drinks per occasion	3.78 ± 0.29	203	3.89 ± 0.33	103	.805
Current Drinkers					
Drinks per week	5.15 ± 0.53	114	12.4 ± 2.1	53	<.001
Drinks per occasion	4.06 ± 0.40	117	4.67 ± 0.60	54	.400
Binge episodes / 2 weeks	1.64 ± 0.19	117	4.15 ± 0.83	53	<.001
Age at first drink	15.6 ± 0.3	119	13.9 ± 0.4	55	.002
Perception of Other Women's Drinking					
Drinks per week	7.07 ± 0.61	115	13.4 ± 1.9	47	<.001
Drinks per occasion	4.07 ± 0.33	114	4.98 ± 0.53	51	.137

Appendix C.

Knowledge Questions

Knowledge Questions (Percent Answering Correctly)
Questions Relating to Pregnancy
When a woman drinks alcohol when she is pregnant, the alcohol enters the baby's bloodstream. (T)
Just having a FEW drinks (1-3) during pregnancy is safe for the baby. (F)
Babies of women who drink alcohol during pregnancy are at risk for developing physical, mental and behavioral problems. (T)
Drinking alcohol is OK during the last 3 months of pregnancy. (F)
If a woman is already pregnant but does not know it yet and she is drinking alcohol, she can have a child with an Alcohol Related Birth Defect. (T)
During pregnancy, it is OK to drink during the morning. (F)
If you are breastfeeding and you drink alcohol, the alcohol can be passed to the baby through the milk. (T)
It is OK to drink wine during pregnancy. (F)
If you are nauseous or feel sick to your stomach during pregnancy, you should drink a beer. (F)
Questions Relating to Women's Health
Women are at a greater risk for developing alcohol-related problems than men. (T)
Most women aged 18-44 who are members of Southwestern Tribes currently drink alcohol. (F)