A reduction in reported alcohol use in pregnancy in Australian Aboriginal communities: a prevention campaign showing promise

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Abstract

Objective: Aboriginal leaders in remote Western Australian communities with high rates of prenatal alcohol exposure invited researchers to evaluate the community-led Marulu foetal alcohol spectrum disorder (FASD) Prevention Strategy initiated in 2010.

Methods: The proportion of women reporting alcohol use during pregnancy to midwives was compared between 2008, 2010 and 2015. Initial midwife appointments were calculated by weeks of gestation. The proportions of women reporting alcohol use by age at birth were compared.

Results: Alcohol use reduced significantly from 2010 (61.0%) to 2015 (31.9%) with first-trimester use reducing significantly from 2008 (45.1%) to 2015 (21.6%). Across all years, 40.8% reported alcohol use during pregnancy and 14.8% reported use in both first and third trimesters. Most women attended the midwife in the first trimester. There was a significant relationship between increased maternal age and third-trimester alcohol use.

Conclusions: The reduction in reported prenatal alcohol exposure in an Aboriginal community setting during a period of prevention activities provides initial evidence for a community-led strategy that might be applicable to similar communities.

Implications for public health: The reductions in alcohol use reduce the risk of children being born with FASD in an area with high prevalence, with possible resultant reductions in associated health, economic and societal costs.

Key words: foetal alcohol spectrum disorder, prevention, prenatal alcohol exposure, longitudinal, Aboriginal

Prenatal alcohol exposure (PAE) is a common, preventable cause of intellectual disability.[1] PAE can cause a range of birth defects, structural central nervous system (CNS) anomalies, and pervasive and permanent impairment of CNS function, termed foetal alcohol spectrum disorder (FASD).[2] FASD is associated with high economic,[3] health[4] and societal costs and many secondary disabilities, including contact with the justice system and reduced life-span.[5] High rates of PAE and FASD are associated with risk factors including low socioeconomic status, rural and remote communities and some indigenous populations.[6,7] There are limited data on FASD prevalence in Australian Aboriginal communities. In the Fitzroy Valley, a remote area in the Kimberley region of northwest Australia, community leaders and research partners documented high-risk PAE in 52% of pregnancies (2002–2003), and FASD prevalence of 19.4% in school-aged children.[8,9] This evidence led to the implementation of the multi-faceted Marulu (meaning 'worth nurturing' in local language) FASD Prevention Strategy.

Community-led interventions for the prevention of PAE and FASD in regions with high levels of alcohol use are a priority of the Commonwealth Government of Australia.[10] While many prevention approaches exist for Indigenous communities, few have been evaluated.[11,12] In those that have been evaluated, there was significant heterogeneity in interventions and methodological quality was rated as 'poor' due to the potential for bias introduced by lack of control groups, self-reported alcohol use, and high drop-out rates.[13] Despite these difficulties, it is generally agreed that interventions need to be culturally secure and developed in conjunction with local communities.[14,15]

Reducing the harmful effects of alcohol at the population level is crucial to any health promotion policy. Approaches that include restricting access to alcohol through prohibition of sale, importation or possession of alcohol ('dry' communities or

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households) and reducing trading hours can reduce alcohol-related harm in Indigenous communities.[16] Modifying purchasing behaviour through minimum floor pricing is also effective.[17] Notably, the restriction of the sale of alcohol with more than 2.7% ethanol from takeaway outlets (commencing September 2007 in the Fitzroy Valley) was associated with improvements in multiple outcome measures.[18,19]

Prior to the Marulu FASD Prevention Strategy, there have been no data from Australian FASD prevention interventions published documenting long-term trends in PAE at a population level. The aims of this study were to develop, implement and evaluate a prevention intervention to reduce rates of PAE in the Fitzroy Valley. It was hypothesised that a multi-faceted approach to FASD prevention that combined alcohol policy interventions, health promotion strategies and community capacity building could reduce PAE in the Fitzroy Valley. To test this hypothesis, alcohol-use data collected during pregnancy by community midwives from February 2008 until the end of 2015 were analysed to determine the rates of self-reported alcohol use by pregnant women.

Methods

Study setting

Details of the demographic and geographical context of the study have been detailed previously.[20] The Fitzroy Valley comprises ~3,500 predominantly Aboriginal people living in more than 40 remote communities in north-western Australia within a 200km radius of the main town of Fitzroy Crossing (population ~1,500).[21] There were approximately 80 pregnancies per year with women generally travelling 200–400km to regional hospitals to give birth. Antenatal care was primarily provided by government-funded community midwives, regional general practitioners and visiting obstetricians.

Prevention activities across the study period

Establishment of a locally led Marulu FASD Prevention Strategy

Community leaders partnered with local service providers and researchers,[20] and between 2010 and 2016 a range of community-led FASD prevention activities were implemented based on the Canadian Four Part Model of FASD prevention.[22]

Level One activities included mass media advertisements delivered over six weeks (September 2015) including an evidence-based television advertisement developed for Aboriginal communities[23] and radio messaging that provided information about the harmful effects of PAE and FASD.[24]

Level Two activities comprised targeted health promotion messaging coordinated and delivered through local Aboriginal organisations from 2010 to 2015. The 'trickle-surge' approach included a constant baseline level of health promotion with intensive surges of messaging each September around International FASD Day (9 September), before the wet season – when it was anecdotally reported that alcohol use increases, and in March when communities were accessible again after the wet season, and also to help educate new staff in the region after typically high staff turnover during that period. This innovative approach was guided by community needs and ideas and included: FASD prevention messages on water cups at the local bar; FASD Awareness Day community activities; development of local posters promoting healthy pregnancy and providing information about FASD; and distributing pamphlets to community members and local organisations. The Lililwan FASD prevalence study (2010–2012) also included FASD education messaging.

Level Three activities: Community midwives screened all pregnant women for alcohol use in pregnancy (AUP) and referred and encouraged women with any alcohol use to access local mental health, alcohol and drug services, and the local Nindilingarri Cultural Health Services. Concomitantly, FASD training and awareness opportunities were provided between 2010 and 2015, with local health, mental health, alcohol and drug, and antenatal services becoming more FASD-informed. This increased referrals between services (personal communication, KN) and specialised support for pregnant women using alcohol during pregnancy.

Level Four activities included an increased focus of child health services on multidisciplinary developmental screening, complex diagnosis including FASD, and therapy intervention.[25] From 2013 to 2015, regular FASD diagnostic clinics were established 4–6 times per year and families were increasingly linked to an Aboriginal Therapist and early intervention disability funding.

Supportive Alcohol policy is a key component of the four-part model. In 2007, lobbying by Aboriginal community leaders resulted in the Western Australian Director of Liquor Licensing introducing restrictions on the sale of full-strength alcohol from take-away outlets in Fitzroy Crossing such that: "The sale of packaged liquor, exceeding a concentration of ethanol in liquor of 2.7 per cent, is prohibited to any person, other than a lodger".[26] This restriction reduced supply and use of alcohol and was extended indefinitely following evaluation of improved education, hospital, and policing outcomes in the two-year period following restrictions.[18,19]

Participants

Participants were all pregnant women living in the Fitzroy Valley from February 2008 until the end of 2015 who had a pregnancy outcome recorded in medical notes by midwives or in the electronic medical records database.

Data collection

Pregnant women were routinely asked about their AUP during midwife appointments in Fitzroy Crossing or the smaller outlying communities of Noonkanbah, Bayulu, Wangkatjungka, Yakanarra and Djugerari. The two local midwives asked about AUP in a confidential, sensitive and respectful manner, which can increase the accuracy of responses.[27]

Pregnancy data were collected using three methods over different time periods (Table 1). Antenatal data were recorded in the Communicare database more widely across the Kimberley from January 2013.

Original midwife paper-based records

Alcohol use and birth outcomes were extracted from paper records collected by midwives from February 2008 until December 2013. Relevant variables recorded per pregnancy included: mother's and baby's dates of birth; birth weight; gestation (weeks); mother's ethnicity; and first antenatal visit (weeks of gestation). AUP was recorded separately for the first and third trimesters by midwives after asking about alcohol use as part of clinical practice, not using a standardised questionnaire.

Communicare data overview

In 2005, the Communicare medical database was installed in the Fitzroy Valley Hospital with antenatal data routinely

and reliably recorded from October 2008. In Communicare, each pregnancy was recorded as a pregnancy outcome record with associated demographic and pregnancy variables. From January 2012, data were additionally collected for every antenatal check-up record with the midwife. Records were made available by the Kimberley Population Health Unit (KPHU) for pregnancy outcomes, first antenatal check-up and subsequent antenatal check-ups.

Communicare pregnancy outcome records

Individual pregnancy outcome records included mother's patient ID number, pregnancy outcome (miscarriage, normal delivery, etc), and midwife attendance for the first and third trimesters. AUP was recorded using three levels: no alcohol use, low-risk use or high-risk use (Supporting Information, Table A1) with the question "At any time since you confirmed your pregnancy have you consumed alcohol? If yes how frequently? (Note: if antenatal check is during third trimester ask, 'During the third trimester of your pregnancy what has your alcohol use been?')".

Communicare antenatal check-up records

Antenatal check-ups were recorded per midwife appointment and were collected using two Western Australia Country Health Service forms: a longer first visit form followed by shorter check-ups for subsequent visits. AUP was recorded at each visit in addition to mother's patient ID number, appointment location and date, mother's age and gestation (weeks).

Choice of exposure measure

Although different measures were available, the binary presence or absence of reported AUP was chosen as the exposure measure for two reasons. Firstly, it was used to standardise data reporting across the period under investigation, as the volume of use was not recorded in the midwife paper records. Secondly, it maintained consistency with the Australian National Health and Medical Research Council advice that: "No alcohol during pregnancy is the safest choice".[28]

Data linkage

To determine a single birth outcome and AUP for each pregnancy the three data sources were linked. When combining data alcohol use was considered present if there was any record of AUP from any data source. Each antenatal check-up was associated with the appropriate pregnancy outcome based on patient ID numbers and dates. AUP was calculated for the first, second and third trimesters by combining pregnancy outcome records with antenatal check-ups in the relevant trimesters. Secondly, Communicare pregnancy outcomes were matched to midwife paper records where possible. As paper records had no ID numbers, probabilistic matching software and expert supervision were provided by the Centre for Data Linkage at Curtin University. Records were matched on estimated gestation at birth, date of birth and birthweight of the child. After matching, unmatched pregnancy outcomes for women living in Fitzroy Valley were added to the paper record data set. Finally, the paper records matched with the Communicare pregnancy outcomes were used where they overlapped in time. After paper record collection ceased, matched pregnancy outcome records and antenatal check-ups were used.

Table 1: Timeline of data collection methods and prevention activities in the Fitzroy Valley.

Data Source	2008	2009	2010	2011	2012	2013	2014	2015
Midwife Paper Records	Feb					Dec		
Communicare Pregnancy Outcomes	Oct							
Communicare Antenatal Check-ups					Jan			
Prevention Activity								
Alcohol Restrictions								
Marulu FASD Prevention Strategy								
Lililwan FASD Prevalence Study								

Control locations

Communicare pregnancy outcome records and antenatal check-up data for other areas of the Kimberley with comparable demographic and socio-cultural characteristics including Broome, Derby, Halls Creek, Kununurra, and Looma were collected and processed using the same methods.

Statistical analysis

Descriptive statistics were calculated for demographic variables and AUP during the first and third trimesters separately and for any time during pregnancy. Due to the small numbers of pregnancies per month and high variability in AUP, all data were reported by year.

Chi-square analysis was used to compare AUP in the Fitzroy Valley from the start of data collection (2008) to the start of the Marulu FASD Prevention Strategy in 2010, and then between both years and the final study year (2015). AUP in the Fitzroy Valley was compared with control locations. Logistic regression was used to explore the relationship between mother's age at birth and reported alcohol use.

Results

Data completeness

Initial data and data matching

In total, 386 midwife paper records (average 5.5/month), 630 pregnancy outcome records (average 7.2/month) and 2,101 antenatal check-ups (43.8/month) were available. During matching, 12 records had a disagreement in recorded AUP between outcome records and check-ups and 55 disagreements in 310 overlapping paper records and pregnancy outcomes. All disagreements were resolved by recording positive AUP. A total of 188 pregnancy outcome records with no matching midwife paper record were added to the final data set. The matched data set had 752 births of which 98 (13.0%) had no record of midwife attendance during pregnancy.

Final data set and missing data

The final data set of 654 records with recorded midwife attendance had 50 (7.6%) records with no AUP data at any time during pregnancy. Similarly, 567 and 576 records were available for the first and third trimesters, respectively, with 85 and 41 (15.0%/7.1%) missing AUP data. Integrating different data sources and a restriction to those who attended a midwife improved data quality and reduced missing data. The proportion of missing AUP data per year in the final data set varied widely. The first trimester had the most missing data (mean 14.7%, range 0%–40.3%). The third trimester (mean 6.7%, range 0%–18.4%) and whole pregnancy (mean 7.0%, range 0%–16.3%) had fewer missing data.

Characteristics of pregnancy outcomes and birth outcomes

The mean age at pregnancy outcome for women who attended a midwife appointment (n=648, range=13–43, mean=25.37, sd=6.15, missing=6) was similar to those who didn't have a recorded attendance in the Kimberley region (n=97, range=13–41, mean=25.57, sd=5.63, missing=1). A total of 563 (87.6%, missing=11) of midwife-attending mothers identified as Aboriginal compared with 87 (88.8%) of non-attenders. Mean gestation at birth outcome was 35.5 weeks. Mean birth weight was similar for those who attended (mean=3092.05, sd=722.73) and did not attend a midwife (mean=3098.86, sd=563.79). On average, the first midwife visit was at 12.8 weeks of gestation with a median of 10 weeks and mode of 6 weeks (n=627, missing=29). The proportion of live births was higher for those who attended the midwife (84.5%, n=426) than non-attenders (46.0%, n=58). The proportions of abortions and miscarriages/stillbirths were lower for midwife attenders (6.2% n=31, 9.3% n=47, respectively) than non-attenders (27.8%, n=35, 26.2%, n=33, respectively).

The count of women's first midwife visit recorded by week of gestation is presented in Figure 1.

Alcohol use in pregnancy trends over time

Changes in alcohol use from first to third trimesters

The pattern of AUP in the first and third trimesters is shown in Table 2. Further counts and proportions for missing data and midwife attendance are available in Supporting Information, Table A2.

For women with midwife attendance and AUP recorded for both first and third trimesters, 186 (43.2%) of 431 women reported first trimester AUP. Of these 186 women, 87 (46.8%) continued alcohol use in the third trimester. Only 14 (5.7%) of the 245 women who reported no first-trimester AUP reported third-trimester use. Assuming all 35 women missing third-trimester data started using alcohol, this would be 20%. Overall, 239 (40.8%) of 586 women who provided data reported AUP and 87 (14.8%) reported use in both first and third trimesters.

Reported alcohol use for the whole pregnancy

The proportion of Fitzroy Valley women reporting AUP by year is shown in Figure 2 with the total number below each year. In 2010, 61% of women reported AUP after an increase from 45% in 2008. From 2010 onwards there was a steady decline to 26% in 2014 before increasing back up to 32% in 2015.

Reported alcohol use in the first trimester

AUP during the first trimester reached a peak of more than 60% in 2010 after increasing from 45% in 2008 (Figure 2). From 2010, it decreased each year down to a low of 22% in 2015.

Reported alcohol use in the third trimester

Fewer women reported third trimester AUP with the proportion generally between 20% and 30% across the whole period (Figure 2) with a low of 15% in 2013 before increasing to 25% in 2015.

Comparisons of proportion of women reporting alcohol use over time: chi-square tests

The proportion of women reporting AUP did not significantly change for any period (any time, first trimester, third trimester) of pregnancy between 2008 and 2010 (Table 3). The proportion reporting AUP at any time during pregnancy, and in the first trimester, was significantly higher in 2010 when compared with 2015. The proportion reporting first trimester AUP was significantly higher in 2008 than in 2015. There were no significant changes in the proportion reporting third-trimester AUP in 2008, 2010 and 2015.

Control data comparison

The introduction of consistent AUP data into Communicare started later outside Fitzroy Valley. The proportions of missing data were higher for Broome (78%) and Kununurra (90%) compared with Fitzroy Valley (7.6 %). Data were available for two locations since 2013, although first-trimester data were often missing (Derby 43%, Halls Creek 33%). Across the whole pregnancy, the proportion of women using alcohol in 2013, 2014 and 2015, respectively, was similar for Fitzroy Valley (33%, 26%, 32%) and Derby (33%, 23%, 25%), which were both lower than Halls Creek (35%, 36%, 34%). Given there were only three years of consistently recorded data, statistical testing was not performed.

Figure 1: Count of women attending the midwife for the first time by weeks of gestation.

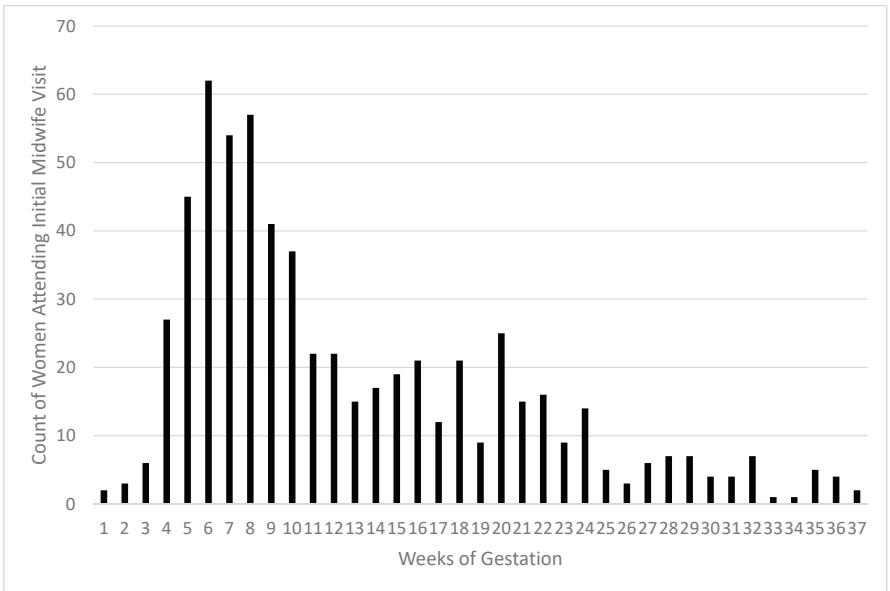


Table 2: Patterns of alcohol use over trimesters for all pregnancies with attendance in final matched data for Fitzroy Valley.

1st Trimester Alcohol Use	3rd Trimester Alcohol Use			
	No	Yes	Missing	Grand Total
No	231	14	35	280
Yes	99	87	16	202
Missing	81	23	68	172
Grand Total	411	124	119	654

Proportion of women consuming alcohol by age

The proportion using alcohol by mother's age at birth showed differences across ages between the patterns of use for the third trimester only (Figure 3). A smaller proportion of younger women used alcohol during the third trimester compared with older women. There were fewer than 10 pregnancies for each year group ≤15 and ≥37, so these data were less reliable.

No significant relationship was found between age and drinking at any time during pregnancy $\chi^2(1, n=598)=1.55$, $p=0.21$ or for the first trimester $\chi^2(1, n=476)=0.01$, $p=0.94$. However, a significant relationship between age and AUP was found in the third trimester $\chi^2(1, n=529)=13.42$, $p<0.001$. The Hosmer and Lemeshow test ($\chi^2(8)=18.13$, $p=0.01$) suggests the null hypothesis that observed and expected proportions were equal across ages was rejected. The Nagelkerke R^2 (0.038) indicates approximately 4% of the variance in AUP in the third trimester was accounted for by age. Women under 18 (12.5%) and from 18–21 (9.6%) reported AUP less often than women 22 and older (29.6%).

Discussion

The proportion of Fitzroy Valley women reporting AUP decreased significantly from 61% in 2010 to 32% in 2015 over a period where community-led prevention efforts took place. This decrease consisted of a significant decrease in first-trimester use to 22% in 2015, from 45% in 2008 and 61% in 2010. AUP in the third trimester did not change significantly across the study period. Most women accessed antenatal services during the first trimester, although there were women who didn't access services until the third trimester and 13% of women had no antenatal data recorded in the Kimberley region during pregnancy. Younger mothers reported less AUP, particularly in the third trimester. There was an apparent increase in reported AUP from 2008 to 2010. Speculatively, reporting may have increased as knowledge of the risks of PAE increased, and/or as screening and recording of AUP by midwives increased across this period in the context of the community-led FASD prevention strategy.

Strengths of this study were that it was community-driven and built upon locally

Figure 2: Proportion of pregnant women who both attended the midwife and reported alcohol use during pregnancy by year in the Fitzroy Valley from 2008–2015 with numbers for whole pregnancy.

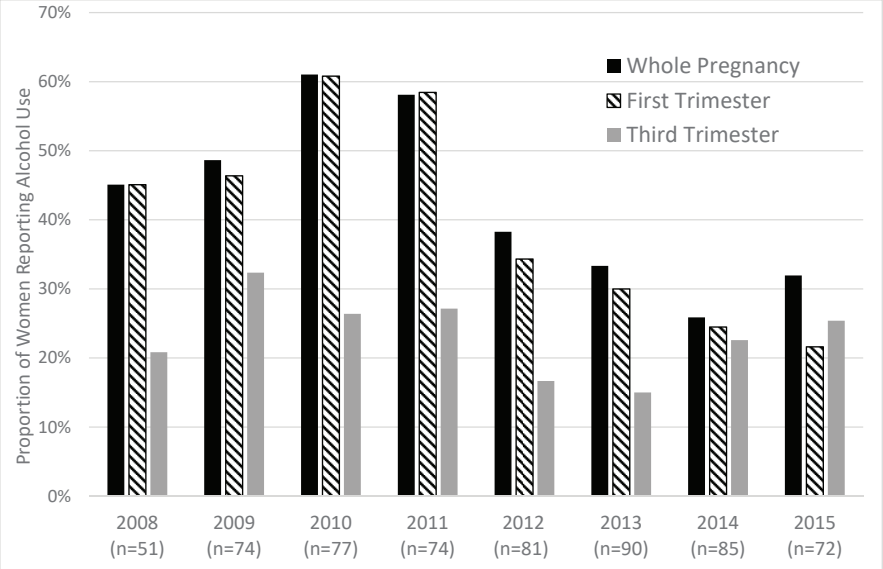
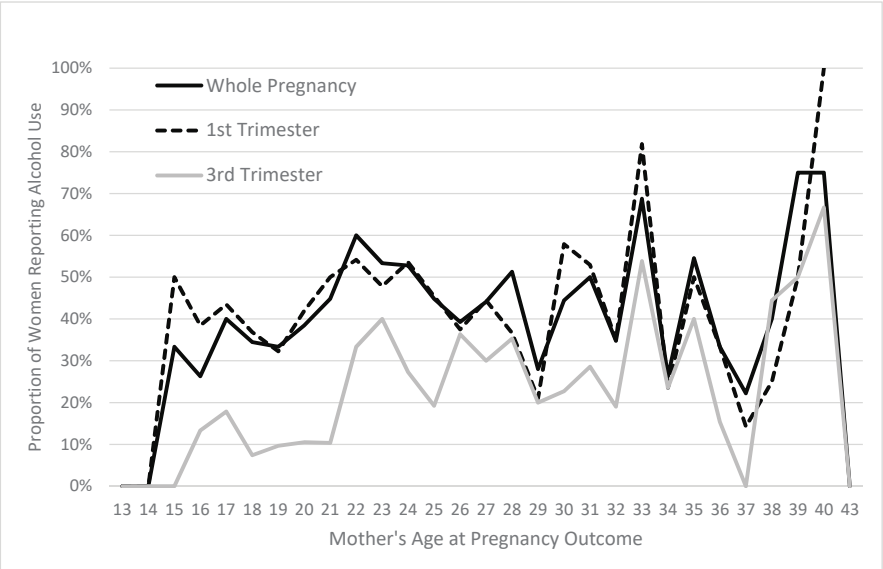


Table 3: Chi-square test comparisons of the proportion of women reporting alcohol use by year and stage of pregnancy.

Period of Use	2008 vs 2010		2010 vs 2015		2008 vs 2015	
	χ^2	*p*	χ^2	*p*	χ^2	*p*
Any time	3.146	0.076	12.645	<0.001*	2.206	0.137
1st Trimester	3.005	0.083	15.184	<0.001*	5.179	0.023*
3rd Trimester	0.485	0.486	0.017	0.896	0.316	0.574

Note:
** p<0.05*

Figure 3: Proportion of women reporting alcohol use at different stages of pregnancy by mother's age at pregnancy outcome.



identified priorities of preventing PAE and building community capacity to respond to high rates of FASD documented in the Lililwan study.[9] This study included population-based data across a long timeframe relative to other Australian studies. Multiple administrative data sources using different questions and formats were accessed for a known number of pregnancies in the region. Rigorous data matching processes were used to improve the reliability of data. To account for differences between records a conservative approach was used with AUP recorded at any time during pregnancy in any format was considered as PAE. Missing data were present in all datasets and 13% of women had no record of attending a Kimberley midwife. Due to the high mobility of the population,[21] they may have received midwife care elsewhere, but a proportion of women may not have accessed midwife care and their AUP status was unknown. This study relied on self-reported AUP. Anxiety, fear of judgment surrounding the social stigma of AUP and recall accuracy could reduce report reliability.[27] An additional potential barrier for this community is the fear of potential child removal by government authorities. Stigma around reporting may have increased with increased knowledge of FASD due to prevention activities. This may have accounted for a proportion of the reduction in AUP. However, data were collected by respected midwives in a manner likely to increase accurate reporting.[27]

The selected control groups did not have enough reliable data that had been collected over a long enough time period to make robust statistical comparisons. However, the decrease in AUP occurred within the same timeframe as a broad range of community-led FASD prevention efforts. Given the number and scope of the prevention activities, it wasn't possible to pinpoint which interventions were most highly associated with the apparent reduction in use. The reduction in AUP in this study was greater than available national trends reported in Australia over a similar time period. A recent meta-analysis reported AUP in 35.6% of Australian women from 1981 to 2010[29] with a general decrease in reported AUP in Australia from between 52.8% and 60% in 2007, ranging from 34.8% to 58.7% in 2011–12, and more recently 44.4% in the 2016 National Drug Strategy Household Survey.[30-32] However, AUP in this study was higher than reported in the National Aboriginal and Torres Strait Islander Social Survey (2014–15), which estimated PAE dropped from 19.6% in 2008 to 9.8% in 2014–15.[33] In the Fitzroy Valley, rates of PAE were previously known to be higher than those in the Aboriginal population nationally, given the Lililwan study found 55% of participants retrospectively reported AUP from 2002 to 2003.[34]

In addition to not having a good comparative control group, there were limitations in measuring alcohol use common to studies in this area. A validated measure of alcohol use was not used in this study, which may have biased results towards under-reporting. Use of a standardised and validated measure of alcohol use such as the AUDIT-C is recommended, including asking about use before and after pregnancy recognition.[35] This would also provide a validated indication of the likely prevalence of alcohol dependence and the number of children who may be at higher risk of being born with FASD due to exposure to higher volumes of alcohol. The use of instruments specifically designed for use with Australian Aboriginal people have been shown to more accurately capture their patterns, and volume of alcohol use should also be considered.[36] Objective measures of alcohol use are ideal for addressing possible bias introduced by self-report.[37] However, currently available biomarkers are not yet accurate enough in practice for research use.[38]

Alcohol use in the first trimester and an average first midwife visit at nearly 13 weeks suggests PAE is still occurring during this critical period of early development. Further prevention targeted to reduce use in women who may become pregnant and/or to increase their use of reliable contraception might be appropriate, and strategies to facilitate access to antenatal services should be considered. The higher proportion of older women who used alcohol in the third trimester may represent greater difficulties in ceasing use among those who have longer lifetime use habits. Further supporting this argument, the proportion of women who used alcohol across the entire pregnancy (14.8%) may indicate a core group who are either alcohol dependent or have trouble reducing their use. Alternatively, older women may have previously used alcohol in pregnancy and had children not visibly affected by FASD, which may leave them less open to public health messaging in this area. Again, this may indicate a need for population-specific prevention activities.

The approach to FASD prevention in the Fitzroy Valley may have relevance to other similar communities working to address this issue. The evidence-driven approach to FASD prevention incorporates many features recommended in the International Charter on FASD Prevention[39] including policy settings to reduce population-level alcohol use, community education and workforce development, and capacity building for communities and government agencies. Screening for AUP should continue at all midwife check-ups alongside the provision of brief interventions and appropriate referrals to support services.

Conclusions

This is the first Australian study to document self-reported AUP over multiple years in an entire population of Australian Aboriginal women in remote communities during a period when a community-led FASD prevention strategy was conducted. Further evidence linking these changes to increased knowledge of the risks or intention to abstain during pregnancy could be beneficial. The results of this study can be used to acknowledge the courage of the communities to address FASD, which is a sensitive and potentially stigmatising issue.[40] Ascertaining whether this reduction has led to a concurrent reduction in the prevalence of FASD would be the ultimate measure of success. If the incidence of FASD was reduced in this area, which previously had a high prevalence, there would be significant reductions in associated health, economic and societal costs.

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Ethics committee approval and consent to participate

Ethics approval for this study was granted by the following Committees: The University of Western Australia Human Research Ethics Committee (Reference Number RA/4/1/6947), Western Australian Aboriginal Health Ethics Committee (Reference Number 575), Western Australia Country Health Services Board Research Ethics Committee (Reference Number 2014:13), and the Kimberley Aboriginal Health Planning Forum Research Ethics Sub-Committee (Approval number 2014-012). As this study used previously collected de-identified administrative data consent for participation was not sought from individual participants but permission was granted to access and use the data by Western Australia Country Health Services.

Availability of data and materials

The dataset supporting the conclusions of this article is not publicly available due to them being provided by a government agency.

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Supporting Information

Additional supporting information may be found in the online version of this article:

Supplementary Table A1: Risk scoring systems used by different record keeping systems for level of alcohol consumption.

Supplementary Table A2: Further counts and proportions of missing data and midwife attendance by trimester and data collection method.