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Narrowing the Gap? Describing women's outcomes in Midwifery Group Practice in remote Australia

ABSTRACT

Background

In Australia, Aboriginal women and babies experience higher maternal and perinatal morbidity and mortality rates than their non-Aboriginal counterparts. Whilst midwifery led continuity of care has been shown to be safe for women and their babies, with benefits including reducing the preterm birth rate, access to this model of care in remote areas remains limited. A midwifery group practice was established in 2009 in a remote city of the Northern Territory, Australia, with the aim of improving outcomes and access to midwifery continuity of care.

Aim

The aim of this paper is to describe the maternal and newborn outcomes for women accessing midwifery continuity of care in a remote context in Australia.

Methods

A retrospective descriptive design using data from two existing electronic databases was undertaken and analysed descriptively.

Findings

In total, 763 women (40% of whom were Aboriginal) gave birth to 769 babies over a four year period. There were no maternal deaths and the rate of perinatal mortality was lower than that across the Northern Territory. Lower rates of preterm birth (6%) and low birth weight babies (5%) were found in comparison to population based data.

Conclusion

Midwifery continuity of care can be achieved in a remote context in Australia. It may also assist in improving maternal and infant outcomes for women residing in remote areas and could assist in 'Closing the Gap' in health between Aboriginal and non-Aboriginal people.

SUMMARY OF RELEVANCE

Issue: Aboriginal women and babies experience higher mortality and morbidity rates in Australia than their non-Aboriginal counterparts. Women who reside in remote areas, in particular Aboriginal women from remote Aboriginal communities, are often unable to access midwifery continuity of care.

What is already known: Midwifery continuity of care has been shown to be safe for women and their babies with benefits including lower preterm birth rates and fetal loss before 24 weeks gestation.

What this paper adds: Continuity of Midwifery Care can be effectively provided to remote dwelling Aboriginal women and appears to improve outcomes for women and their infants.

INTRODUCTION

In Australia, there are considerable health inequities experienced by people living in rural and remote areas, many of whom are Aboriginal and Torres Strait Islander peoples (hereafter referred to as Aboriginal in recognition that the study was conducted in Central Australia where the traditional custodians are Aboriginal peoples). Inadequate access to appropriate health care is a major contributing factor to the health inequities experienced by people who reside in these areas.[1] One particular area of concern is maternal and infant health. The Australian Government has acknowledged that whilst Australian maternity care rates are among the safest in the world, poor maternal and infant health outcomes are still experienced by Aboriginal peoples and people residing in rural and remote areas.[2,3]

In a targeted effort to reduce health inequalities for Aboriginal people, a national campaign aimed at 'Closing the Gap' was launched by the then Social Justice Commissioner in 2006 and soon after adopted by the Australian Government.[4] Within a generation the campaign aims to close the health and life expectancy gap between Aboriginal and non-Aboriginal Australians.[5] The Australian government developed and adopted a 'Closing the Gap' framework with six targets. One of these targets was to halve the gap in mortality rates for Aboriginal children, under five years of age, by 2018.[6] Over 80% of deaths of Aboriginal children occur in the first year of life[1] with the majority of these being neonatal deaths (occurring in the first 28 days of life).[7]

Access to health care services is identified as a critical factor in 'Closing the Gap'.[5] Improved access to culturally appropriate primary health care services is likely, over time, to translate into improved outcomes for Aboriginal people.[5] Increasing access and changing the way maternity care is delivered in rural and remote areas has been suggested as a way of substantially improving outcomes for Aboriginal women and their babies.[8] Kildea et al[8] also recommend establishing rural and remote-based Midwifery Group Practices that provide midwifery continuity of care in order to contribute to 'Closing the Gap' and assist in reducing poor maternal and infant health outcomes for Aboriginal and Torres Strait Islander women.

In 2011, the Australian 'National Maternity Services Plan' set out a number of short, medium and long term recommendations for improvements in maternity service provision.[3] The recommendations included increasing access to appropriate maternity services for all women, in particular, for women who live in rural and remote Australia and for Aboriginal women. There was a focus on promoting access to models of care that provide continuity of care. One example of such a model of care is the Alice Springs Midwifery Group Practice (MGP) in the Northern Territory (NT) of Australia.

In 2009, the Alice Springs MGP was established with the aim of improving maternal and infant health outcomes by increasing access to maternity services, including midwifery continuity of care, for women living in this remote part of Australia. The aim of this paper is to describe a model of midwifery care in Central Australia and report on outcomes over a four year period.

Setting

Alice Springs is located in the geographic centre of Australia approximately 1532km north of Adelaide, South Australia's capital city and 1499km south of Darwin, the NT's capital city. The region that surrounds Alice Springs is known as the Alice Springs region or 'Central Australia' [9]. It is classified as very remote and the majority of the townships in this arid region are Aboriginal communities.[10]

Aboriginal communities are defined as geographic locations with either a physical or legal boundary where housing and infrastructure are provided and managed by the government (Commonwealth or NT governments) where Aboriginal people reside[11]. Essential services such as power and sewerage supply, water and community and health infrastructure are limited and often difficult to access. In communities with a population of 50 people or more, essential services such as a school and primary health care centre are provided. Additional facilities such as a general store and sports grounds may also be found in larger communities[11].

The Alice Springs Hospital is a 189-bed specialist teaching public hospital and the only major secondary referral hospital in Central Australia. Its catchment area covers approximately 1.6

million square kilometres and supports up to 60 000 people residing in Alice Springs and the Central Australian region and also in remote Aboriginal communities in northern South Australia and in the south west of Western Australia.[12]

The NT has the highest proportion of women who give birth and live in either remote or very remote regions, than any other state or territory in Australia. Just under half (47.8%) of all women who give birth in the NT live in either a remote or very remote area compared with 1.1% across the country.[13] Prior to 2009, women living in and around Alice Springs, accessed standard maternity care through the local hospital, general practitioners, remote primary health care centres and/or Congress-Alukura (a women's health and maternal and child health care centre for Aboriginal women in Central Australia). A critical gap existed in these services as they lacked continuity of both care and carer. Services for people living in remote communities were particularly critical as women are required to travel to regional centres at approximately 38 weeks gestation to await the birth.[14]

The MGP was established in Alice Springs to provide continuity of midwifery care to women residing in Alice Springs and the surrounding very remote communities. On average, there are 850 births per annum at the Alice Springs Hospital. Of these births, 60% (approximately 510 women per year) are Aboriginal women who reside either in Alice Springs or very remote surrounding communities. The Alice Springs MGP provides care for approximately 30% of all women (255 women) who give birth at the Alice Springs Hospital each year. Of all Aboriginal women who give birth at Alice Springs Hospital, approximately 22% (112 women per year) of them are cared for by the MGP.

The Alice Springs Midwifery Group Practice

The Alice Springs MGP is based on national and international evidence that demonstrates midwifery continuity of care is not only safe but also beneficial to the woman, her family and the health care system.[15-17] The Alice Springs MGP consists of eight midwives who work in pairs or teams of three midwives, dependant on skill level and work hours. Each woman is assigned a primary midwife by the MGP manager. Her secondary midwife or midwives are her primary midwife's colleagues in either a pair or team of three. The woman meets the other midwives during the pregnancy.

Two models of care are provided within the MGP depending on where the woman resides. Women who live in Alice Springs typically self-refer to the MGP however some women are referred by their general practitioner. These women have their antenatal, labour, birth and postnatal care provided at home, the MGP centre or the Alice Springs hospital. The location is determined by the choice of the woman and the level of care she requires. The woman's primary MGP midwife provides and coordinates the woman's maternity care from her first visit at around 8 weeks of pregnancy until her 6 week postnatal visit when she is discharged from the MGP.

For women who live in a remote Aboriginal community, the majority of antenatal and postnatal care is provided in a government-funded primary health care centre located in her community and the care is the responsibility of the centre. Midwives work in some of these centres however most are staffed by nurses without midwifery qualifications.[7] Remote outreach midwives are based in Alice Springs and employed by the NT government. They travel to and liaise with many different Aboriginal communities each week to support primary health care centre clinical staff in providing antenatal and postnatal care. They provide midwifery care, education, management and referral as required for women especially in health centres without resident midwifery staff.[18] Women who live in a remote Aboriginal Community can self-refer to the MGP however they are typically referred by the remote outreach midwives and the health care staff who work in their community's primary health care centre.

Once a woman is accepted onto the MGP program (based on availability) the woman's assigned MGP primary midwife will make contact with the community's primary health care centre staff and remote outreach midwives, via phone or email, to notify them. This communication continues between the MGP midwife, remote outreach midwives and the primary health care centre staff throughout the woman's antenatal and postnatal periods. Whilst a woman resides in her community her care is the responsibility of the health care staff. Whilst she is in Alice Springs, her care is the responsibility of her primary MGP midwife.

Women from remote communities are required to travel to Alice Springs for ultrasound examinations, obstetric review (if clinically indicated) and to await birth. It is Northern Territory Government policy that all pregnant women who reside in a remote community are transported to a regional town with a maternity hospital prior to birth.[8] This travel typically occurs at 36 to 38 weeks gestation, however it may be earlier if clinically indicated.[8] Staff at the woman's primary health care centre either ring or email the woman's primary MGP midwife to inform her of when the woman will be travelling to Alice Springs for care. Once the woman arrives in Alice Springs her primary MGP midwife coordinates and provides her maternity care.

Initially, the MGP only provided care for women without medical complexities. After six months of operation, an informal internal evaluation was conducted with key stakeholders. The evaluation recommendations resulted in an expansion of eligibility criteria in order to provide care for all women regardless of their pre-existing or pregnancy related morbidities and to include the option of publicly funded home birth for low-risk women who primarily reside in Alice Springs.

METHODS

Design and ethical approval

A retrospective descriptive study was undertaken to describe maternal and newborn outcomes for women accessing the Alice Springs MGP. Approval to conduct the study was received from the Central Australian Human Research Ethics Committee (CAHREC) (reference number HREC-12-112).

Sample

The study included women and their babies who received care through the Alice Springs MGP from March 2009 to March 2013. During this 4 year period, 763 births occurred with 769 babies born. All of these have been included in the analysis.

Data collection

Data were extracted from a maternity computer software system (CareSys). Throughout a woman's pregnancy, the MGP midwives and other health professionals involved in her care,

record the woman's maternity history and pregnancy care in the woman's hospital or community clinic file. Details of every woman's labour, birth and early postnatal period are entered into CareSys by the MGP midwives after the woman's birth. Additional data in relation to continuity of carer is recorded by the MGP manager on an Excel database as CareSys does not currently allow for this. Smoking and alcohol usage data were not able to be extracted from the database due to an IT problem.

Data analysis

Chi-square tests were used to determine if statistically significant differences existed between the Aboriginal and non-Aboriginal groups. Statistical tests were undertaken using http://www.socscistatistics.com. Only a small number of statistical tests were undertaken as the sample size was not large and there was a risk of Type 1 errors (finding a difference due to chance). Where numbers were small (<10), statistical tests were not undertaken. The level of statistical significance was set at an alpha of <0.05.

FINDINGS

Characteristics of the women

Of the 763 women who accessed the MGP during the four year period, 40% identified as Aboriginal and 60% as non-Aboriginal. Similar proportions of Aboriginal (46%) and of non-Aboriginal women (47%) were primiparous. Aboriginal women were younger than the non-Aboriginal women – 74% were less than 26 years of age compared with 17% of non-Aboriginal women (Table 1).

<Insert Table 1 here>

Pregnancy-related events

Aboriginal women accessed their first antenatal visit later than non-Aboriginal women (χ^2 =117.2, df=2, $p < 0.05$) and had less appointments (χ^2 =12.2, df=1, $p < 0.05$). This finding includes all appointments a woman attended regardless of whether it was with the MGP or the Aboriginal community primary health care centre. Nearly 10% of Aboriginal women

attended one to four antenatal appointments compared with less than 1% of non-Aboriginal women.

More Aboriginal women experienced complications during their pregnancy than non-Aboriginal women. Nearly half (47%) of Aboriginal women experienced one complication compared with 32% of non-Aboriginal women. Multiple complications were experienced by 8% of Aboriginal women and 3% of non-Aboriginal women. These were statistically different between the groups (χ^2 =31.6, df=2, $p < 0.05$).

<Insert Table 2 here>

Labour and birth outcomes

Overall, most women gave birth at the Alice Springs Hospital (93%). More than two thirds (67%) of women had a spontaneous onset of labour and just over one quarter (27%) had their labour induced. The spontaneous vaginal birth rate was 74% with an overall caesarean section rate of 20%. Proportionally more Aboriginal women were induced (32%) compared with non-Aboriginal women (24%) (χ^2 = 4.8, df=1, $p < 0.05$).

Five women, both Aboriginal and non-Aboriginal women, were transferred to a tertiary hospital for further care. The nearest referral hospitals are approximately 1500km north in Darwin, Northern Territory and 1500km south in Adelaide, South Australia.

<Insert Table 3 and 4 here>

There were no maternal deaths during the four year period.

Neonatal outcomes

Of the 769 babies born, more babies were identified as non-Aboriginal (55%) than Aboriginal (43%). Higher rates of prematurity (born at less than 37 weeks gestation) existed for Aboriginal babies compared with non-Aboriginal babies (9% vs 3%) (χ^2 =4.9, df=1, p <

0.05). The overall perinatal mortality rate was 11.8 per 1000 births. The numbers were too low to give specific perinatal mortality based on Aboriginality.

Statistically more Aboriginal babies (7%) were of low birth weight (<2500gm) (χ^2 =15.7, df=2, $p < 0.05$) and admitted to the special care nursery from birth to three days of age (15%) (χ^2 =10.8, df=1, $p < 0.05$) than their non-Aboriginal counterparts (3% and 8% respectively).

<Insert Table 4 here>

Continuity of carer

The woman's primary midwife was present at 51% of all births and the woman's secondary midwife was present at 28% of all births. A further 16% of births were attended by another MGP midwife who was neither the primary nor secondary midwife.

DISCUSSION

The Alice Springs Hospital MGP is a unique service that provides midwifery continuity of care to women of all risk who reside in either very remote Aboriginal communities or in the remote city of Alice Springs. The service utilises the role of midwives to provide a sustainable maternity service that is based on the ten principles of the National Maternity Service Plan.

Gao et al[19] have shown that in the 'Top End' of Australia, this model of care is a cost effective and well utilised service for women of all risk who relocate for birth from their remote Aboriginal communities. Through the MGP, the women also received better care and their birth outcomes were equivalent to standard maternity hospital care.[19] Despite this and other research on the benefits of midwifery continuity of care,[16,20] not all women in rural and remote areas receive maternity care from a skilled care provider and access to continuity of midwifery care is limited.[8] This is suggested as one of many contributing reasons why maternal and infant health worsens with increasing remoteness.[3,21] In an attempt to improve these outcomes, the Australian Government committed to a number of actions specific to rural and remote maternity services.[3] The Alice Springs MGP is an

example of how local services, funded by the government, are beginning to meet the challenges of providing safe, woman-centred midwifery continuity of care in remote locations.

Perinatal mortality is an important measure of 'Closing the Gap' between non-Aboriginal and Aboriginal peoples. In 2011, the perinatal mortality rate of babies born to women who usually reside in the Northern Territory was 14.6 per 1000 births.[22] This was the highest perinatal mortality rate amongst all Australian states and territories with the overall national rate being 9.8 per 1000 births. Nationally, the perinatal mortality rate of babies born to Aboriginal women is double the rate of babies born to non-Aboriginal women (19.2 per 1000 births compared with 9.5 per 1000 births respectively).[22] Within the NT specifically, there are 23.4 deaths per 1000 Aboriginal births and 8.5 deaths per 1000 non-Aboriginal births.[23]

The perinatal mortality rate of the Alice Springs MGP over the four years was t 11.8 per 1000 births. When interpreting this rate it is important to consider the remote location of the MGP, the proportion of babies born to Aboriginal women during this time (40%) and the small numbers of women.

The World Health Organization (WHO)[24] recommends that a woman should attend a minium of four antenatal care appointments as a strong relationship exists between positive child health outcomes and regular antenatal care. For Aboriginal women the proportion of preterm births, low birth weight babies and perinatal deaths increases as antenatal visits decrease.[25] Nearly 10% of Aboriginal women accessing care through the Alice Springs MGP had one to four appointments compared with less than 1% of non-Aboriginal women (numbers were too small to give exact percentages in table). This included appointments provided in the woman's primary health care centre and with the MGP in Alice Springs. Even though a statistically significant difference existed between the two groups, it is important to note that just over 90% of Aboriginal women accessed five or more antenatal appointments. This is equivalent to NT data where 90.2% of women accessed more than five appointments.[14] This NT data combines both Aboriginal and non-Aboriginal women. Therefore, whilst there is a difference, the majority of Aboriginal women in our study

accessed antenatal care within the range recommended by the WHO.[24] This finding was similar to a recent study that evaluated a MGP in Darwin that provides care to Aboriginal women in two remote NT communities.[26]

Early access to antenatal care (<13 weeks) is important as it can reduce the risk of health complications for the mother and the baby.[27] Nationally, 65.7% of women accessed antenatal care in the first trimester (recorded as < 14 weeks gestation). Whilst in the NT 71.6% of women accessed early antenatal care.[6] A similar proportion of women (74%) accessed early antenatal care through the Alice Springs MGP.

Low birthweight is associated with an increased risk of developing chronic disease later in life and is therefore a key indicator of health status.[1] In Australia, 6.3% of all live born babies had a low birthweight. Whilst in the NT, 9.6% of all live born babies had a low birthweight.[13] Nationally, live born babies born to Aboriginal women (12.6%) were more than twice as likely to have a low birthweight as babies born to non-Aboriginal women (6%).[13] This same trend existed in the NT with babies born to Aboriginal women (16%) nearly three times as likely to have a low birthweight as babies born to non-Aboriginal women (6%).[23] In comparison to this national and NT data, the number of babies born with a low birthweight through the Alice Springs MGP was small. Overall 5% of all babies born had a low birthweight. Whilst the number of low birthweight babies born to Aboriginal women (7%) was still over twice the amount of those born to non-Aboriginal women (3%), the individual percentages were considerably lower than the NT and national rates.

Timing of the first antenatal care appointment and birthweight are 'Key Performance Indicators' used to monitor services impact on health outcomes.[27] The above comparisons between the Alice Springs MGP with NT and national data demonstrates the MGP's commitment to improving maternity care for all women in remote areas and 'Closing the Gap' between Aboriginal and non-Aboriginal health.

Preterm birth is the leading cause of neonatal death worldwide and the leading cause of child (under five) mortality in almost all high and middle income countries.[28,29] Decreasing preterm birth is therefore a priority in achieving the 'Closing the Gap' child mortality target.

In Australia, 8.3% of all babies are born preterm, with the NT having the highest rate of preterm birth in Australia (11.1% of all births).[13] In comparison, the Alice Springs MGP has an overall low preterm birth rate (6%).

Importantly, the preterm birth rate in Aboriginal women in this study was 9% which is lower than in Aboriginal women across Australia (13.8%)[13] and the NT generally (16%).[23] This finding is consistent with level one international evidence that shows that women cared for in a midwifery continuity of care model experience a 24% reduction in preterm birth.[15]

A worldwide action report on preterm birth mentions that in high income countries, some elective (induction or caesarean) preterm births unintentionally occur due to errors in gestational age assessment.[29] In the Alice Springs MGP, fewer Aboriginal women seek early antenatal care which can lead to inaccurate gestational age assessment [30]. Considering this, it is likely that this may be one causal factor as to why Aboriginal women give birth to more preterm babies than non-Aboriginal women. The report also discussed that in high income countries some preterm births result from early induction of labour that is not always medically indicated.[29] One United States study found that more than half of preterm births at 34 to 36 weeks gestation, that were a result of induction or caesarean, were not medically indicated.[31] Our study could not show the induction of labour rate of women who had preterm babies due to the small numbers. However, more Aboriginal (32%) women experienced an induction of labour than non-Aboriginal women (24%) and this may be related to the higher number of babies born preterm to Aboriginal women.

In 2011, 26% of women nationally[13] and 24% of women in the NT[23] had their labour induced. These rates were slightly lower than the overall induction rate of the Alice Springs MGP (27%). This finding is consistent with an evaluation of the Darwin MGP that showed higher induction rates for women accessing MGP from remote communities compared with women accessing non-MGP care.[19]

During the four year period, only five women (0.7%) and six babies (0.8%) were transferred to another hospital for further care. It is unknown if all eleven transfers occurred because the individual needed further care, or if something occurred to prevent separation of the

mother and baby. These rates are lower than 2011 national data that reports in the NT the neonatal transfer to another hospital was 2.7% whilst maternal transfer was 2.1%.[13]

Four out of five women had their birth attended by either their primary or secondary midwife. This level of continuity of carer is similar to other midwifery models in Australia.[16] This study therefore suggests that a high level of midwifery continuity of care can be provided to women of all risk[15], even in a very remote context. Sandall et al.[15] showed that midwifery continuity of care reduced premature birth rates and fetal loss before 24 weeks and it is encouraging to see potentially this positive association being seen in this study.

Considering the international evidence on the benefits of midwifery continuity of care[15], along with studies on the benefits of this model for remote-dwelling Aboriginal women in Australia,[19,32] our study provides additional evidence of the need for this model of maternity care to be accessible by all women residing in remote and very remote areas, especially for women who must relocate for birth.

There are limitations in this study to be considered. The study was retrospective and routinely collected data were used, which meant there were some missing data although, for the most part, these were few. Disappointingly, data on smoking and alcohol usage was not able to be extracted from the database. There may also be a selection bias as women self-selected or were referred into the MGP and some women who ultimately had poorer outcomes may not have been included. Equally, as this is a small descriptive study, cause and effect cannot be attributed however, the associations between midwifery continuity of care and improved outcomes are important to explore. The outcomes of women who did not receive MGP care were not included in this analysis as it was focusing on the MGP model and outcomes but this would be important to examine in the future. In addition, we may be diluting the potential benefit of midwifery continuity of care as women in remote communities only received continuity of care when they are transferred to Alice Springs at around 38 weeks gestation. If they had access to continuity much earlier in pregnancy, the benefits may be greater.

Alice Springs is a highly contextual environment and these findings may not be generalised to other remote settings. However, this study provides a unique opportunity to explore the impact of midwifery continuity on a particularly vulnerable population. Further research to test the outcomes examined in this study in other settings would be useful and ongoing evaluation of the Alice Springs service will also ensure that mothers and babies in Central Australia receive the best possible midwifery care and support.

CONCLUSION

The establishment of the Alice Springs MGP increased the number of maternity care options available to women in and around the remote city of Alice Springs. It enabled access to midwifery continuity of care for women of all risk residing in Alice Springs and also for women required to relocate from very remote Aboriginal communities to Alice Springs for birth. It also provided the option of publicly funded homebirth for low risk women in Alice Springs.

Women who accessed care through the Alice Springs MGP experienced positive outcomes such as early access to antenatal care, low rates of preterm birth and low birthweight babies in comparison with other population-based data. Increasing early access to antenatal care and decreasing the rates of prematurity and low birthweight are key priority areas in maternal and infant health both nationally and globally.[27,29]

These findings have demonstrated that midwifery continuity of care is possible in a remote location. This particular model of care satisfies several action areas of the National Maternity Services Plan and recommendations for 'Closing the Gap'.[5,33] Midwifery continuity of care in this remote context can assist in 'Closing the Gap' and ensure Aboriginal babies have the optimal start to life.

It is hoped that in order to improve health outcomes this model of care is expanded across Australia so that all women in remote areas have access to midwifery continuity of care from early pregnancy until six weeks postpartum.

References

1. AIHW. The Health and Welfare of Australia's Aboriginal and Torres Strait Islander Peoples: An overview (Cat no IHW 42). Canberra: Australian Institute of Health and Welfare; 2011.
2. Department of Health and Ageing. Improving Maternity Services in Australia: The Report of the Maternity Services Review. Canberra: Australian Government; 2009.
3. Australian Health Ministers' Advisory Council. National Maternity Services Plan. Canberra: Commonwealth of Australia; 2011.
4. NACCHO. The Close the Gap campaign. 2015. http://www.naccho.org.au/aboriginal-health/close-the-gap-campaign/ (accessed 13 January 2016).
5. Holland C. Close the Gap: Progress and priorities report 2015. Canberra: The Close the Gap Campaign Steering Committee; 2015.
6. Commonwealth of Australia. National Aboriginal and Torres Strait Islander health plan 2013-2023. Canberra: Australian Government; 2013.
7. Noor K. Closing the gap in mortality rates for Indigenous children under five in Queensland. Brisbane: Queensland Government; 2012.
8. Kildea S, Kruske S, Barclay L, Tracy S. 'Closing the Gap': How maternity services can contribute to reducing poor maternal infant health outcomes for Aboriginal and Torres Strait Islander women. *Rural and Remote Health* 2010; **10**(1383): 1-18.
9. Australian Bureau of Statistics. 2011 Census Data. 2013. http://www.censusdata.abs.gov.au/ (accessed 8 August 2014).
10. AIHW. Rural, regional and remote health: A guide to remoteness classifications. Canberra: Australian Institute of Health and Welfare,; 2004.
11. Australian Bureau of Statistics. Australian Social Trends. 2003. http://www.abs.gov.au/ausstats/abs@.nsf/7d12b0f6763c78caca257061001cc588/2e1d3b9176cc05b6ca2570eb00835394!OpenDocument (accessed 11 August 2014).
12. Northern Territory Government. Hospitals. Darwin: Government of the Northern Territory, 2014.
13. Li Z, Zeki R, Hilder L, Sullivan E. Australia's mothers and babies 2011. Perinatal statistics series no. 28. Cat. no. PER 59. Canberra: AIHW National Perinatal Epidemiology and Statistics Unit.; 2013.
14. Northern Territory Government. Remote Health Atlas: Births in Hospital Darwin: Department of Health, Northern Territory; 2014.
15. Sandall J, Soltani H, Gates S, Shennan A, Devane D. Midwife-led continuity models versus other models of care for childbearing women. *Cochrane Database of Systematic Reviews* 2015; **Issue 9**: Art. No.: CD004667. DOI: 10.1002/14651858.CD004667.pub4.
16. Tracy S, Hartz D, Tracy M, et al. Caseload midwifery care for women of all risk compared to standard hospital care: a randomized controlled trial. (Midwives @ New Group practice Options: M@NGO trial). *The Lancet* 2013; **382**(9906): 1723 - 32.
17. McLachlan H, Forster D, Davey M, et al. Effects of continuity of care by a primary midwife (caseload midwifery) on caesarean section rates in women of low obstetric risk: The COSMOS randomised controlled trial. *BJOG* 2012; **119**(12): 1483-92.
18. Northern Territory Government. Remote health atlas, antenatal and postnatal care. Darwin: Government of the Northern Territory, 2014.

19. Gao Y, Gold L, Josif C, et al. A cost-consequences analysis of a midwifery group practice for Aboriginal mothers and infants in the Top End of the Northern Territory, Australia. *Midwifery* 2014; **30**(4): 447-55.
20. Tracy S, Welsh A, Hall B, et al. Caseload midwifery compared to standard or private obstetric care for first time mothers in a public teaching hospital in Australia: a cross sectional study of cost and birth outcomes. *BMC Pregnancy and Childbirth* 2014; **14**: 46.
21. Steenkamp M, Rumbold A, Barclay L, Kildea S. A population-based investigation into inequalities amongst Indigenous mothers and newborns by place of residence in the Northern Territory, Australia. *BMC Pregnancy and Childbirth* 2012; **12**: 44.
22. Johnson S, Bonello M, Li Z, Hilder L, Sullivan E. Maternal deaths in Australia 2006-2010. Canberra: Australian Institute of Health and Welfare; 2014.
23. Thompson F. Northern Territory Midwives' Collection. Mothers and Babies 2011. Darwin Department of Health; 2014.
24. WHO. Pregnancy, Childbirth, Postpartum and Newborn Care: A Guide for Essential Care. Geneva: World Health Organization; 2006.
25. Steering Committee for the Review of Government Service Provision. Overcoming Indigenous Disadvantage: Key Indicators 2009. Canberra: Productivity Commission; 2009.
26. Bar-Zeev S, Barclay L, Kruske S, Bar-Zeev N, Yu G, Kildea S. Use of maternal health services by remote dwelling Aboriginal women in northern Australia and their disease burden. *Birth: Issues in Perinatal Care* 2013; **40**(3): 172 - 81.
27. AIHW. National key performance indicators for Aboriginal and Torres Strait Islander primary health care: first national results. Canberra: Australian Institute of Health and Welfare; 2014.
28. Liu L, Johnson H, Cousens S, et al. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. *The Lancet* 2012; **379**: 2151-61.
29. March of Dimes, PMNCH, Save the Children, WHO. Born Too Soon: The global action report on preterm birth. Geneva: World Health Organization; 2012.
30. Australian Health Ministers' Advisory Council. Clinical practice guidelines: Antenatal care - module 1. In: Department of Health and Ageing, editor. Canberra; 2012.
31. Gyamfi-Bannerman C, Fuchs KM, Young OM, Hoffman MK. Nonspontaneous late preterm birth: etiology and outcomes. *Am J Obstet Gynecol* 2011; **205**(5): 456.e1-.e6.
32. Josif C, Barclay L, Kruske S, Kildea S. 'No more strangers': investigating the experiences of women, midwives and others during the establishment of a new model of maternity care for remote dwelling Aboriginal women in northern Australia. *Midwifery* 2014; **30**(3): 317-23.
33. Australian Health Ministers Conference. National Maternity Services Plan. Canberra: Commonwealth of Australia; 2011.

Table 1: Characteristics of the women included in the study

	Overall N=763 (%)	Aboriginal N=306 (%)	Non-Aboriginal N=457 (%)
Aboriginality			
Aboriginal	306 (40)		
Non-Aboriginal	457 (60)		
Age (in years)			
≤20	134 (18)	127 (42)	7 (2)
21 – 25	167 (22)	99 (32)	68 (15)
26 – 30	189 (25)	50 (16)	139 (30)
31 – 35	188 (25)	20 (7)	168 (37)
≥36	85 (11)	10 (3)	75 (16)
Parity			
Primiparous	358 (47)	142 (46)	216 (47)
Multiparous	405 (53)	164 (54)	241 (53)

Table 2: Pregnancy-related events and outcomes

Pregnancy Outcome	Overall N=763 (%)	Aboriginal N=306 (%)	Non-Aboriginal N=457 (%)
Timing of the first antenatal care visit**			
< 13 weeks	568 (74)	165 (54)	403 (88)
13 to 20 weeks	121 (16)	78 (25)	43 (9)
>20 weeks	57 (7)	51 (17)	6 (1)
Unknown	17 (2)	12 (4)	5 (1)
Number of antenatal visits**			
1 to 4	29 (4)		
5 to 10	417 (55)		
1 to 10[1]		201 (66)	245 (54)
>10	314 (41)	102 (33)	212 (46)
Complications during pregnancy**			
Anaemia	45 (6)	36 (12)	9 (2)
Gestational diabetes	44 (6)	23 (8)	21 (5)
Combined complications[2]	38 (5)	17 (6)	21 (5)
Pre-eclampsia	24 (3)	14 (5)	10 (2)
Other (not specified)	119 (16)	62 (20)	57 (12)

[1]The two groups '1 to 4' and '5 to 10' have been combined for the two sections defined by Aboriginality. This was necessary as the cell size was too small to represent one of the four cells.
[2] The four following antenatal complications were combined based on small cell size: antepartum haemorrhage, preterm rupture of membranes, multiple birth and intrauterine growth restriction.
**p<0.05

Table 3: Labour and birth outcomes

Labour and birth outcomes	Overall N=763 (%)	Aboriginal N=306 (%)	Non-Aboriginal N=457(%)
Onset of labour**			
Spontaneous	511 (67)	197 (65)	314 (69)
Induced	209 (27)	99 (32)	110 (24)
No labour	43 (6)	10 (3)	33 (7)
Type of Birth			
Spontaneous vaginal birth	566 (74)	235 (77)	331 (72)
Vaginal Breech	6 (1)		
Ventouse Assistance	27 (3)		
Forceps Assistance	16 (2)		
Emergency Caesarean Section	113 (15)	52 (17)	61 (13)
Elective Caesarean Section	35 (5)	8 (3)	27 (6)
Place of birth			
Alice Springs Hospital	710 (93)	297 (97)	413 (90)
Planned at home	41 (5)		
Born before arrival at hospital	12 (2)		

**p<0.05

Table 4: Neonatal Outcomes

Neonatal Outcomes	Overall N=769 (%)	Aboriginal N=308 (%)	Non Aboriginal N=461 (%)
Outcome of baby at birth			
Livebirth	762 (99)	305 (99)	457 (99)
Stillbirth	7 (1)		
Birth weight**			
<2500g	39 (5)	23 (7)	16 (3)
≥2500g – 4000g	636 (83)	262 (85)	374 (81)
>4000g	94 (12)	23 (7)	71 (15)
Gestational age at birth**			
<37 weeks	49 (6)	27 (9)	22 (5)
Between 37-40 weeks	570 (74)	237 (77)	333 (72)
41weeks	138 (18)	40 (13)	98 (21)
≥ 42	7 (1)		
Unknown	5 (1)		
Admitted to SCN within 3 days**			
Yes	81 (10)	46 (15)	35 (8)
No	679 (88)	257 (83)	422 (92)
Unknown	9 (1)	5 (2)	4 (1)

[1]The denominator for this section is different to the rest of the table. These data are collected from women antenatally and so the denominator represents 'number of women' as opposed to 'number of babies'.
**p<0.05