The urban and rural divide for women giving birth in NSW, 1990-1997

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ABSTRACT

OBJECTIVE: To examine trends in the pregnancy profile and outcomes of urban and rural women.
METHODS: Data were obtained from the NSW Midwives Data Collection on births in NSW, 1990-1997. Associations between place of residence (urban/rural) and maternal factors and pregnancy outcomes were examined, including changes over time.
RESULTS: From 1990 to 1997 there were 685,631 confinements in NSW and these mothers resided as follows: 76% metropolitan, 5% large rural centres, 8% small rural centres, 11% other rural areas and 1% remote areas. Rural mothers were more likely to be teenagers, multiparous, without a married or de facto partner, public patients and smokers. Births in rural areas declined, particularly among women aged 20-34 years. Infants born to mothers in remote communities were at increased odds of stillbirth and low Apgar scores (all women) and small-for-gestational-age (SGA) (Indigenous women only).
CONCLUSIONS: The profile of pregnant women in rural NSW is different from their urban counterparts and is consistent with relative socioeconomic disadvantage and possibly suboptimal maternity services in some areas. While increased risk of SGA is associated with environmental factors such as smoking and nutrition, the reasons for increased risk of stillbirth are unclear. Although there does not appear to be an increased risk of preterm birth for rural women this may be masked by transfer of high-risk pregnancies interstate.
IMPLICATIONS: Maternity services need to be available and accessible to all rural women with targeting of interventions known to reduce low birthweight and perinatal death.

Introduction

Australia's rural communities have many health disadvantages compared with their urban counterparts, including higher morbidity and mortality rates for some diseases and lower life expectancy.[1] Adverse health outcomes associated with area level socio-economic disadvantage are largely explained by individual factors.[2,3] However, there is some support for the hypothesis that poor areas compound the disadvantage of poor people.[4,5] Residents of socioeconomically disadvantaged communities may suffer from a combination of poor opportunities, poor services, sometimes high crime rates and low morale which compound the individual's experience of poverty.[5] Other factors contributing to a rural health disadvantage include geographic isolation and problems of access to care, shortage of healthcare providers and health services and a larger Indigenous population who experience much poorer health than other Australians.[1]

The impact of rural residence on mortality, chronic diseases, injury, risk factor prevalence and uptake of preventive measures and health resource utilisation has recently been documented.[1] However, little attention has been paid to the impact of rural residence and declining rural maternity services on the outcomes of pregnancy.[6] There is a shortage of general practitioners (GPs) and obstetric specialists in many rural areas.[7,8] Further, many rural GPs have ceased obstetric practice for lifestyle reasons and because of rising insurance premiums.[8,9] Certain maternal behaviours (e.g. cigarette smoking during pregnancy, late initiation of antenatal care) and sociodemographic characteristics (young age, nutritional status, parity, marital status) are associated with increased risk for adverse perinatal outcomes (e.g. preterm birth, small-for-gestational-age[SGA] infants).[10-12] SGA is used as an indicative measure of intrauterine growth retardation.[13] SGA and preterm infants are at increased risk of perinatal morbidity and mortality, and long-term effects include neurologic disorders, learning disabilities and delayed development.[14-16] In addition, SGA is associated with earlier and higher prevalence of hypertension, coronary heart disease, adult onset diabetes, autoimmune thyroid disease and some forms of cancer.[17] Thus the aims of this study were to examine trends in the pregnancy profile and outcomes of urban and rural women.

Methods

The study population included all NSW residents who gave birth in NSW from January 1, 1990 to December 31, 1997. Data were obtained from the NSW Midwives' Data Collection (MDC), a population-based surveillance system covering

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TABLE 1: MATERNAL FACTORS BY PLACE OF RESIDENCE AMONG WOMEN BIRTHING IN NSW 1990-1997

Maternal Factor	Metro-politan areas	Large rural centre	Small rural centre	Other rural area	Remote area
	N=517,648	N=35,210	N=51,316	N=75,209	N=6,248
	%*	%*	%*	%*	%*
Indigenous					
Yes	0.7	4	4.6	4.2	23.6
No	96.4	94	93.2	92.8	73.2
Maternal age					
<20 years	4.5	7.9	7.9	7.2	11.8
20-34 years	81.4	82	82	81.9	80.9
≥35 years	13.8	9.7	9.7	10.4	6.7
Married/de facto					
Yes	87.6	81.1	84.5	86.4	79.1
No	11.1	17.5	14	11.9	19.1
Australian-born	67.1	94.3	92.5	93.8	95.3
Patient classification					
Private	44.8	30.8	28.6	22.5	21
Public	54.9	68.9	70.8	76.2	78
Parity					
0	41.2	36.7	35.6	33.7	32.4
1-3	54.7	58.7	59.7	60.2	58.9
≥4	3.1	4	4	4.9	6.9
Medical complication					
Yes	1.9	1	1.4	1.2	2.5
None reported	98.1	99	98.6	98.8	97.5
Obstetric complication					
Yes	14.5	11.2	10.9	10.3	11.8
None reported	85.5	88.8	89.1	89.7	88.2
Antenatal care began†					
<20 weeks	84.8	90.4	89.9	92.6	81.8
20-29 weeks	11.7	7.8	7.9	5.8	13.1
≥30 weeks	3.5	1.8	2.2	1.6	5.1
Smoking status†					
None	80.8	69.6	71.1	69.9	61.4
1-10 per day	8.3	12	11.4	11.8	13
>10 per day	9	15.4	14.9	15.4	21.9

Notes:
**Percents may not add to 100% because of missing values*
†Data only available for July 1, 1993 to December 31, 1997.

all births (≥20 weeks gestation or ≥400g birthweight) in NSW.[18]

Each woman's usual place of residence was classified by the Rural, Remote and Metropolitan Areas (RRMA) classification into metropolitan (incorporating residents of Sydney and the major metropolitan centres with population ≥100,000 such as Newcastle and Wollongong), large rural centres (population ≥25,000 e.g Dubbo), small rural centres (population 10,000-24,999 e.g. Broken Hill), other rural areas (population <10,000 e.g. Bega) and remote areas (population <5,000, e.g. Bourke).[19] Other maternal factors available for analyses included: maternal age (categorised as <20 years, 20-34 years and ≥35 years), self-reported Indigenous status (Aboriginal or Torres Strait Islander yes/no), marital status (categorised as married including defacto/other), patient classification at the time of birth (private /public), parity (categorised as 0, 1-3 or ≥4 previous births ≥20 weeks gestation), antenatal care (begun <20 weeks, 20-29weeks, ≥30 weeks), smoking status (reported for the second half of pregnancy as none, 1-10 cigarettes per day or >10 cigarettes/day), medical complications (any/none reported including pre-existing diabetes mellitus, hepatitis B and essential hypertension) and obstetric complications (any/none reported including antepartum haemorrhage, pregnancy induced hypertension, gestational diabetes, threatened premature labour and prelabour rupture of membranes). Data on antenatal care and smoking status were only available from July 1, 1993 to December 31, 1997. Pregnancy outcomes were examined for singleton infants including: preterm birth (gestational age <37 weeks), SGA (<10th birthweight percentile),[20] Apgar score at 5 minutes (categorised as <7 or ≥7) and stillbirths (fetal deaths). Gestational age was reported in completed weeks of gestation, and was calculated from the first day of the last menstrual period (LMP). If LMP was missing or inaccurate, the estimate of gestation was based on prenatal and/or postnatal assessment.[18]

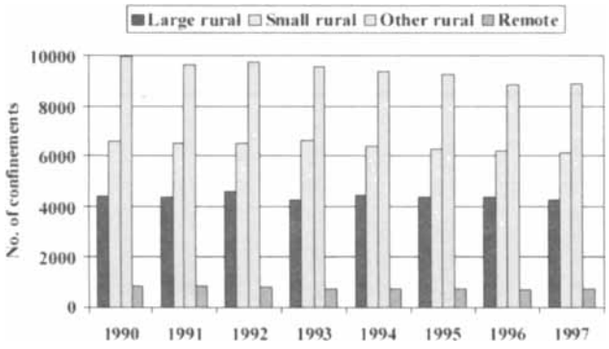
STATISTICAL ANALYSES

Associations between place of residence and maternal factors were examined by contingency table analyses. As the data pertain to the whole population over an 8-year period and were not a sample that is subject to sampling variability, confidence intervals were not determined for the measures of effect. Significance testing has been used with the multivariate analyses. Because of the large number of comparisons, a p-value of 0.01 was used as the criteria for statistical significance. To determine changes over time births were plotted by year, place of residence category and maternal factors. A linear trendline was fitted to each plot using the least squares method to produce an estimate of the annual change in the number of births in place of residence/factor of interest strata.[21] Statistically significant changes ($p<0.01$) in the number of births over time were assessed by determining whether the slope of the line was significantly different from zero. We used logistic regression analyses to examine the impact of mother's place of residence and Indigenous status, and the interaction of these factors, on the pregnancy outcomes while controlling for possible effects of known predictors. Analyses were conducted using SAS via the NSW Health Department's HOIST (Health Outcomes Information and Statistical Toolkit) data warehouse system.

Results

From 1990 through 1997 there were 694,779 births to 685,631 women in NSW. Of these women, 76% resided in metropolitan areas, 5% in large rural centres, 8% in small

FIGURE 1: CONFINEMENTS AMONG RURAL WOMEN IN NSW BY MOTHERS PLACE OF RESIDENCE, 1990-1997



rural centres, 11% in other rural areas and 1% in remote areas. The sociodemographic profile of mothers varied by rurality (table 1). Most notably, increasing distance from urban centres was associated with a larger Indigenous population, more teenage mothers, fewer married/de facto mothers, fewer mothers were private patients, and more with previous births. Fewer women in metropolitan and remote areas reported starting antenatal care before 20 weeks and more initiated care from 30 weeks compared with all the other rural areas. Reported smoking rates were notably lower for metropolitan women. Not only did more rural and remote women report higher rates of smoking, they also reported smoking more cigarettes per day. Mothers in metropolitan and remote areas were more likely to have a medical complication reported than mothers in the other rural areas. This was accounted for by higher reported rates of hepatitis B in these two areas. Mothers in metropolitan areas were also more likely to have an obstetric complication reported and this was largely accounted for by higher rates of gestational diabetes.

Singleton infants of other rural area mothers had slightly lower rates of preterm birth (table 2). In contrast, remote area mothers had a lower rate of prolonged pregnancy and a higher rate of SGA, low Apgar scores and stillbirths.

Trends 1990-1997

Overall, there was no significant change in the average number of confinements per annum in NSW. However, the large number of births in the metropolitan areas (~64,706 per annum [pa]) masked significant declines in the number of women giving birth in small rural, other rural and remote areas (figure 1). The greatest decline occurred in other rural areas, an average decline of 1.7% per annum.

The number of mothers identified as Aboriginal or Torres Strait Islanders increased overall from 1192 (1.4%) in 1990 to 1829 (2.1%) 1997, and the increase occurred in all areas except remote areas.

Over the 8-year period, there was a significant overall decline in teenage mothers in NSW but these changes were not uniform by rurality. Significant declines in teenage mothers occurred only in the metropolitan (-89 births pa) and remote areas (-5 births pa). Although there was no change in the overall population in mothers aged 20-34 years, the larger (more urban) areas masked declines in births in this age group in small rural (-82 births pa), other rural (-175 pa) and remote areas (-12 births pa).

There was a marked decline (~2,400 women or 7% pa) in private patients in NSW from 1990 to 1997. This decline occurred in all areas but was sharpest in the more remote areas; by 1997, only 16.9% of women in small rural centres were private patients, 13.5% in other rural areas and 14.9% in remote areas.

Women reported to have obstetric complications increased from 10.5% in 1990 to 14.8% in 1997 and this increase occurred in all areas with the increased reporting of gestational diabetes making the greatest contribution.

From 1993 to 1997, there was no significant change either overall or in any areas in the number of women reported as non-smokers. However in metropolitan areas alone, there was a significant decrease in the number of women who reported smoking >10 cigarettes per day in the 2nd half of pregnancy.

There were significant declines in the number of SGA infants in small (-18 births pa) and other rural (-24 births pa)

TABLE 2: INFANT OUTCOMES FOR SINGLETON BIRTHS BY MATERNAL PLACE OF RESIDENCE

Infant outcomes	Metropolitan areas N=510,705 %	Large rural centre N=34,774 %	Small rural centre N=50,626 %	Other rural area N=74,299 %	Remote area N=6,158 %
Gestational age (weeks)					
20-31	1.1	1.0	1.1	0.9	1.3
32-36	4.6	4.4	4.4	3.8	4.2
37-41	91.3	90.1	90.8	91.9	92.2
≥42	3.1	4.4	3.8	3.5	2.3
Birthweight/gestational age percentile					
0.0-9.9	10.3	10.9	11.1	10.6	12.7
10.0-24.9	15.1	15.1	15.4	15.4	14.6
25.0-75.0	50.1	50.1	50.4	49.8	48.6
75.1-90.0	14.5	14.4	13.8	14.3	14.4
90.1-100	9.9	9.5	9.5	9.9	9.7
Apgar at 5 mins <7	2.5	2.8	2.7	2.7	3.9
Stillbirths	0.6	0.6	0.6	0.7	1.2

TABLE 3: CRUDE ODDS RATIOS FOR MATERNAL RISK FACTORS AND PREGNANCY OUTCOMES AMONG INDIGENOUS AND NON-INDIGENOUS WOMEN BY PLACE OF RESIDENCE

	<20 years old[1]	Married[2]	First birth[3]	ANC ≥20 wks[4]	Smoker[5]	SGA[6]	Preterm birth[7]	Stillbirth[8]
Indigenous women								
Overall %	22.8	51.5	30.8	32	60.6	18.1	10	1.24
Metropolitan	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Large rural	1.09	0.89	0.80*	0.71*	0.85	1.11	0.85	0.7
Small rural	1.32*	1.32*	0.87	0.60*	0.88	1.31*	0.9	0.9
Other rural	1.20*	1.50*	0.77*	0.49*	1.11	1.39*	0.73*	0.69
Remote	1.92*	1.32*	0.75*	0.9	1.33	1.60*	0.9	1.55
Non-indigenous women								
Overall %	4.9	87.7	40.1	13.4	20	10.5	5.4	0.6
Metropolitan	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Large rural	1.73*	0.63*	0.84*	0.53*	1.76*	1.03	0.94	1.08
Small rural	1.67*	0.84*	0.79*	0.58*	1.65*	1.02	0.94	1.08
Other rural	1.53*	1.01	0.74*	0.41*	1.71*	0.97	0.80*	1.20*
Remote	1.57*	0.94	0.77*	0.78*	1.76*	0.94	0.71*	1.66*

Notes:
ANC=antenatal care commenced
SGA=small-for-gestational-age
ref=referent group for odds ratio calculation
Odds ratio comparison groups:
1. All other ages;
2. Not married;
3. Previous birth(s);
4. Commencing antenatal care <20 weeks;
5. Non-smoker;
6. Not SGA;
7. Term birth (³37 weeks);
8. Live birth
**p<0.001*

areas but these declines were consistent with the overall decline in the number of births in these areas. Small for gestational age by definition is the lowest 10% of the birthweight distribution by infant sex for each gestational age. There was no change in parity, marital status, medical complications, the initiation of antenatal care, preterm births, low Apgar scores or stillbirths in any area during the study period.

Effect of place of residence on Indigenous mothers

For both Indigenous and non-Indigenous mothers there was a shift in the prevalence of risk factors between metropolitan and rural residence (table 3). The size and direction of the urban/rural gap was different for Indigenous and non-Indigenous mothers for some factors. Rural Indigenous women were more likely to be married than metropolitan Indigenous women while rural non-Indigenous women were less likely to be married. The reported rates of smoking also showed divergence between metropolitan and rural mothers. Indigenous mothers from remote areas were significantly more likely to smoke than metropolitan Indigenous mothers, and in large and small rural centres the rates tended to be lower. For both Indigenous and non-Indigenous mothers, rural smokers were heavier smokers than their metropolitan counterparts. Rural Indigenous mothers were significantly more likely than metropolitan Indigenous mothers to have an infant that was small for gestational age. There was no such trend for the infants of non-Indigenous mothers. Non-Indigenous mothers in other rural and remote areas had a higher odds of stillbirth. While this was also true for Indigenous mother in remote areas, it did not reach statistical significance (p=0.05).

Multivariable analyses showed the increased risk for small for gestational age infants among rural Indigenous mothers persisted after adjusting for the effects of maternal age, parity, medical and obstetric complications and smoking. Compared with metropolitan Indigenous mothers the adjusted odds ratios (aOR) for a small for gestational age infant among Indigenous rural mothers were: large rural centre aOR=1.11 (p=0.40), small rural centre aOR=1.46 (p<0.001), other rural area aOR=1.63 (p<0.001) and remote areas aOR=1.65 (p<0.001). In contrast, there was no significant area effect for non-Indigenous women.

There was no significant interaction between maternal place of residence and Indigenous status when examining the impact on stillbirths. The odds of stillbirth for rural women not only persisted, but increased, after adjusting for age, Indigenous status, medical and obstetric complications, smoking and SGA. Compared with metropolitan women, the adjusted odds for stillbirths were: large rural centre aOR=1.16 (p=0.16), small rural centre aOR=1.28 (p=0.004), other rural area aOR=1.31 (p<0.001) and remote areas aOR=2.05 (p<0.001).

For preterm birth, multivariate analyses showed no independent area effect for Indigenous women but for non-Indigenous women those residing in other rural areas who gave birth in NSW were less likely (aOR=0.92, p=0.002) to have preterm infants than their metropolitan counterparts.

Discussion

The profile of pregnant women in rural NSW is different

from their urban counterparts and is consistent with relative socioeconomic disadvantage which could put them at increased risk of poorer perinatal outcomes. And in fact, there were higher rates of stillbirth and low Apgar scores for remote area mothers and of SGA infants for rural Indigenous mothers relative to metropolitan mothers.

In rural NSW mothers are more likely to be teenagers, to have had previous births, to be without a married or de facto partner, to be public patients and to be smokers. This is generally true for Indigenous and non-Indigenous women. All these factors have been associated with poor pregnancy outcomes.[10-12] More children plus high rates of poverty, unemployment and poor social and health conditions may add strain to the overall health of the population.[22] Although in most rural areas women are generally more likely to start antenatal care early, this may be a reporting artefact. In urban areas antenatal care may be counted from a first clinic or specialist visit and may not include an initial consultation with a GP. However in rural areas where all antenatal care is likely to be conducted by the GP the earlier visit would be counted.

Further, the gap between rural and urban women is widening. Not only are births declining in the more remote rural areas but these declines are disproportionately among women in the 20-34 year old age group. This may represent urban drift and suggests erosion of the community's socioeconomic base.[1,23] If urban drift is among differentially lower-risk women, the odds of outcomes such as stillbirth for rural women may increase in the future.

Lifestyle factors (e.g. smoking, drinking alcohol, poor nutrition) pose serious health hazards to the mother and fetus.[11,24] The high smoking rates in rural areas suggest lack of provision or poor uptake of prevention messages or a lack of services to aid smoking cessation. This may be especially true for rural Indigenous women. Their baseline rate for late commencement of antenatal care was over twice that of non-Indigenous women. Early initiation of antenatal care can help assure identification of maternal disease and risks for complications of pregnancy or birth, and provide opportunities for women to receive counselling about the risks of health behaviours that can contribute to adverse perinatal and maternal outcomes.[12] Even if antenatal services are available, they may not be accessible to all women in rural communities. The lack of change in smoking rates among all women (with exception of decrease in the quantity smoked in the cities) is disappointing as randomised trials show a modest reduction in smoking can be achieved by programs aimed at smoking cessation during pregnancy.[25] Effective strategies to eliminate exposure to unhealthy lifestyle factors and to ensure all women receive adequate antenatal care are important challenges for this century.

Despite the relative socioeconomic disadvantage, rural women appear to have a lower or equal risk for preterm birth. However, it must be noted that the MDC may differentially miss the births of high-risk rural mothers due to 'leakage' to perinatal centres in the ACT, Victoria, South Australia and Queensland. All but three of the border communities in NSW are classified as other rural (reduced rate of preterm birth) or remote (average rate of preterm birth).[19] As threatened preterm birth is the major reason for transfer to a perinatal centre and the nearest centre may be interstate, the preterm birth rates in these areas are likely to be underestimated perhaps even masking an excess of preterm births.[26] The MDC does not collect information on births to NSW residents outside NSW so there is currently no way to monitor cross-border flows using a state-based collection.[18] However, even if the rates of preterm birth are underestimated, the reported rates did not increase over the period of the study.

In contrast to threatened preterm labour, antenatal detection of small-for-gestational-age infants is difficult (requiring accurate assessment of both fetal weight and gestational age) and an uncommon reason for antenatal transfer.[26] Further, the predictive factors for SGA are largely environmental rather than obstetric including smoking and other drugs, low weight gain, low body mass index and short stature.[11] As data on the latter markers of low socioeconomic status are not available it may be that the independent area effect of SGA is a surrogate for these factors. Socioeconomic disadvantage is probably not a direct, independent determinant of fetal growth. Rather, socioeconomic disadvantage may lead to adverse psychological, behavioural or other environmental exposures that restrict fetal growth.[27] SGA rates are likely to be a better indicator than preterm birth rates of the impact of rural socioeconomic disadvantage. Systematic reviews of antenatal interventions to improve fetal growth and reduce low birthweight provide some evidence for benefit from three: balanced protein/energy supplementation (also reduced stillbirths and neonatal deaths), strategies to reduce maternal smoking and antimalarial prophylaxis.[25,28,29]

Maternal and perinatal mortality have been extensively used as outcome measures for assessing the quality of care.[30] It has been suggested that these are now of less value because of their diminished frequency in developed countries.[30] It has also been suggested that low Apgar scores may be correlated with sub-optimal care.[31] Our data show that the increased stillbirth and low Apgar rates for women in other rural and remote communities is well beyond chance ($p<0.001$) and may indicate that women in rural and remote communities may have less access to antenatal detection services. Over 20% of all perinatal deaths are due to congenital malformations and at least 4% are associated with infections.[32] In the 1997 review of Victorian perinatal deaths by an expert panel, 39% of stillbirths had factors present such that had another course of action been taken in the management of the mother or infant, a better outcome may have resulted.[32] This included inadequate antenatal monitoring of fetal wellbeing in high-risk pregnancies (24% of all stillbirths) and inappropriate management, usually failure of recognition, of growth retarded fetuses (10%).[32] Although these and other potentially avoidable factors in stillbirth have also been identified (eg inadequate management of medical conditions and intrapartum care),[32] there has been little change in the stillbirth rates during the 1990s.[6,18]

When interpreting the results of this study, a number of things need to be considered. First, there is no information on the MDC about NSW women who give birth outside NSW and this is likely to be disproportionately rural women. Second, the method of allocating rurality by SLA is not perfect. As both the size of the SLA and the distribution of the population within SLAs vary, within a rural SLA there can be pockets that are remote rather than rural and vice versa.[1] Third, variation in some factors are more likely to represent change in practice rather than change in prevalence. For example the reported increases in gestational diabetes mellitus (GDM) are more likely due to increased screening than increased prevalence of GDM. This may also explain the different hepatitis B rates. Fourth, information based on self-reporting such as smoking and Indigenous status may be under-reported. If midwives do not always ask women if they are Aboriginal or Torres Strait Islanders, or if Indigenous women are reluctant to identify themselves to midwives,[33] some women and their infants may be misclassified as non-Indigenous. The increase in Indigenous births in some areas may be due to greater self-identification. Fifth, the MDC is known to under-enumerate perinatal deaths and particularly neonatal deaths as the MDC notification is completed when the birth occurs.[18] As the MDC has been shown to record 97% of stillbirths, only stillbirths were analysed in this study.[34] Finally, there is potential for variation in reporting, completeness and validity of gestational age and other perinatal data on the MDC over time. For example, if late initiation of antenatal care (higher in remote communities) is associated with inaccurate assessment of gestational age, this may result in the misclassification of some babies' SGA-status and may explain the lower rate of gestations ≥42 weeks. However, there have been no major changes to the data collection form over the study period and a validation study in 1990 showed excellent levels of agreement for most of the factors reported here.[35]

In conclusion, changing social circumstances in rural areas and decreasing rural maternity services remain a cause for concern. These circumstances could have some bearing on the high rates of stillbirth in the more remote communities, and SGA infants born to Indigenous mothers. If rural maternity services become less accessible, more costly, or fewer in number then perinatal outcomes may deteriorate further in the bush.

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