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Research

Timeliness of antenatal care for mothers of Aboriginal and non-Aboriginal infants in an urban setting

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Abstract. To compare the timing of first hospital antenatal care visit by mothers of Aboriginal and non-Aboriginal infants, and to identify the risk and protective factors associated with timeliness of accessing care, mothers who delivered at Campbelltown hospital between October 2005 and November 2006 were surveyed on the maternity ward. This survey was linked to hospital administrative data. Gestational age at first visit to a hospital-based antenatal clinic was compared for mothers of Aboriginal and non-Aboriginal infants. Risks and protective factors associated with timing of antenatal care were also examined using Cox regression and Kaplan–Meier survival curves. Data on 1520 deliveries were included in this study. Mothers of Aboriginal infants presented slightly later to hospital-based antenatal clinics than mothers of non-Aboriginal infants (median 15.6 weeks versus 14.0 weeks). This difference did not remain after adjustment for all risk and protective factors. The three significant factors remaining were: maternal smoking; not in paid employment; and residence in a disadvantaged suburb. The results may reflect the complex associations that exist between the clustering of disadvantage among families of Aboriginal infants. A multifaceted approach is required to improve the timeliness of hospital-based antenatal care for the mothers of Aboriginal infants.

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Introduction

Antenatal care is important to ensure early screening to identify and manage issues likely to impact on the pregnancy and its outcomes, and to provide education and advice about pregnancy and birth (Barlow-Stewart and Saleh 2007*a*, 2007*b*). Late antenatal care or inadequate attendance at antenatal clinics has been associated with poor pregnancy outcomes, such as low birthweight, prematurity and increased delivery intervention (de Costa and Child 1996; Lazariu-Bauer *et al.* 2004; Heaman *et al.* 2008). While there is an agreed schedule of visits for antenatal care in Australia, there does not appear to be agreement on when that care should start (Hunt and Lumley 2002). The definition of what constitutes 'late' antenatal care also differs, ranging from after 13 weeks gestation (Rogers and Schiff 1996; Dietz *et al.* 1997), later than 20 weeks gestation (Johnson *et al.* 2003; Trinh and Rubin 2006), to during the third trimester (McCaw-Binns *et al.* 1995; Perloff and Jaffee 1999; Nothnagle *et al.* 2000).

Previous studies have identified several maternal socio-demographic characteristics that are associated with late antenatal care including: maternal age (McCaw-Binns *et al.* 1995; Dietz *et al.* 1997; Perloff and Jaffee 1999; Nothnagle *et al.* 2000; Johnson *et al.* 2003; Trinh and Rubin 2006); low educational attainment or completion (McCaw-Binns *et al.* 1995; McDermott *et al.* 1996; Dietz *et al.* 1997); marital status (McCaw-Binns *et al.* 1995; McDermott *et al.* 1996; Rogers and Schiff 1996; Dietz *et al.* 1997); previous pregnancies (McCaw-Binns *et al.* 1995; McDermott *et al.* 1996; Nothnagle *et al.* 2000; Trinh and Rubin 2006); not being in paid employment (McCaw-Binns *et al.* 1995; Johnson *et al.* 2003); low socioeconomic status (McCaw-Binns *et al.* 1995; Dietz *et al.* 1997); and financial problems (Rogers and Schiff 1996). The international literature has also associated late antenatal care with some ethnic groups (Rogers and Schiff 1996; Heaman *et al.* 2008). Further, several psychosocial characteristics have also been found to be associated with late antenatal care. These include: insufficient social and family support during pregnancy (Webster *et al.* 2000); maternal smoking (McCaw-Binns *et al.* 1995; Trinh and Rubin 2006); and drug and alcohol issues (Burns Mattick and Cooke 2006*a*, 2006*b*; Burns *et al.* 2007).

Barriers to Aboriginal women accessing antenatal care, particularly those living in regional, rural and remote locations,

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have been identified (de Costa and Child 1996; Chamberlain *et al.* 2001; Trinh and Rubin 2006). However, there is little literature on the risk and protective factors associated with the timing of antenatal care for mothers of Aboriginal infants, particularly in an urban setting. Many of the socio-demographic and psychosocial characteristics associated with late antenatal care are common among urban Aboriginal mothers (de Costa and Child 1996) and mothers of Aboriginal infants (Comino *et al.* 2010). Mothers of urban Aboriginal infants are more likely to live in suburbs that are socioeconomically disadvantaged than mothers of non-Aboriginal infants who access the same public hospital, reflecting disadvantage at the community level (Titmuss Harris and Comino 2008; Comino *et al.* 2010). The way in which services are provided and experienced by urban Aboriginal people will influence how and when they access those services (Ivanitz 2000).

The Campbelltown district, in the south-western fringe of Sydney, New South Wales, has an estimated Aboriginal population of around 5000 (Australian Bureau of Statistics 2006*a*). The establishment of the Gudaga Study, a longitudinal cohort study of Aboriginal infants from birth to age 5 years in the Campbelltown area (Comino *et al.* 2010), provided an opportunity to explore antenatal and peri-natal experiences of mothers of Aboriginal and non-Aboriginal infants. Campbelltown Hospital provides maternity services for the area. While women may access antenatal care services from sources other than the hospital (e.g. Tharawal Aboriginal Medical Service or a GP), all who plan to deliver at the hospital are required to book in by attending the mainstream antenatal clinic. During the data collection period there was not a specific hospital-based clinic for the mothers of Aboriginal infants.

The aims of this paper are to compare the timing of first hospital antenatal care visit by mothers of Aboriginal and non-Aboriginal infants, and to identify the associated risk and protective factors.

Methods

The recruitment process for the Gudaga Study has been reported elsewhere (Comino *et al.* 2010). Briefly, mothers admitted to the maternity ward at Campbelltown Hospital between October 2005 and May 2007 were invited to complete a brief survey that included questions on their Aboriginal status and that of their infant's biological father. In total, 2108 mothers completed the survey, and 178 mothers of Aboriginal infants were identified. Of these, 159 mothers agreed to participate in the study. Basic demographic data (maternal age, maternal education, maternal partnership status, parity and suburb of residence) were collected at this point.

For all mothers who participated in the survey, information on antenatal care and delivery were extracted from the hospital administrative obstetric data collections and deterministically linked to the survey data on the medical record number (MRN) of both mother and baby. During the recruitment period, changes were made to the hospital administrative data management system, making it difficult to extract the same data on all mothers over the entire recruitment period. For the purposes of this paper, only data from the obstetrics data package (ODP) (October 2005 – November 2006) have been included in the analysis. Obstetrics data package data are routinely collected by midwives at the first antenatal visit and completed at delivery and discharge. The antenatal data included information on maternal demographic characteristics (employment status at booking in), maternal psychosocial screening and duration of pregnancy at the first hospital antenatal visit (Centre for Epidemiology and Research 2009).

The outcome measure for the study was gestational age (weeks) at first antenatal visit to the hospital. Gestational age at this visit was calculated by the midwives based on the date of last menstrual period. The results from dating ultrasounds were not used.

Study factors

We grouped our study factors into three dimensions: maternal socio-demographic characteristics; psychosocial characteristics; and one community characteristic. The maternal socio-demographic characteristics included: mother of an Aboriginal infant; age; in paid employment at booking in; completion of year 12; primiparity; and partnership status ('partnered' was defined as being married or in a de facto relationship). The psychosocial characteristics included: maternal smoking (at first antenatal visit); maternal depression at first antenatal visit (Edinburgh depression scale (EDS) $\geq$10 or suicidal thoughts); and maternal vulnerability (defined by the presence of at least one vulnerability characteristic from the antenatal screening routinely conducted by the midwives). The possible vulnerability factors included: unsupported parent; major stressor in the past year (e.g. the death of someone close to the mother); mild anxiety and/or depression (e.g. ever felt anxious or depressed for more than a couple of weeks); current or history of mental health problems or disorders; history of abuse as a child; or history of domestic violence. The community characteristic used was state SEIFA (socioeconomic indexes for areas) quintile of disadvantage based on the suburb of residence (Australian Bureau of Statistics 2006*b*).

Statistical methods

SPSS version 15.0 was used for the data linkage (Rel. 17.0.0 2008, SPSS Inc., Chicago, IL, USA) and Stata version 9.2 (Stata Corporation, College Station, TX, USA) was used for the data analysis. Descriptive statistics (median and inter-quartile range, IQR) compared the gestational age at the first hospital antenatal care visit between Aboriginal and non-Aboriginal infants. Kaplan–Meier curves (Cleves *et al.* 2004) were used to display the cumulative proportion of women presenting for antenatal care at each time point. Cox regression (Cleves *et al.* 2004) was used for the statistical modelling of predictors of antenatal care presentation. As the event of interest (timing of first hospital antenatal care visit) was a positive outcome, a predictor with a hazard ratio (HR) of greater than one indicates earlier presentation for antenatal care with increasing values of the predictor (perceived protective factor) and a predictor with an HR of less than one indicates later presentation for antenatal care (perceived risk factor). An HR >1 is 'protective' and an HR <1 is 'risk'. Women who had not presented to hospital at any stage before delivery had their date of presentation for antenatal care censored at the date of delivery.

Ethics

The Gudaga Study was approved by the NSW Aboriginal Health and Medical Research Council and the Ethics Committees of Sydney South West Area Health Services and University of NSW. Mothers participating in the ward survey gave informed verbal consent. Mothers of Aboriginal infants who agreed to be part of the Gudaga Study gave informed written consent. The research was undertaken in accordance with national guidelines for health research within Indigenous communities (National Health and Medical Research Council 2002, 2003; Knight *et al.* 2009). The study has strong links with the local Aboriginal community that has been described elsewhere (Knight *et al.* 2009).

Results

A total of 1520 singleton infants were identified over the recruitment period from October 2005 to November 2006. Of these infants, 122 (8.0%) were identified by their mother as being Aboriginal: 77 (63.1%) had an Aboriginal mother; and 45 (36.9%) had a non-Aboriginal mother and an Aboriginal father.

As Table 1 shows, many of the study factors were associated with being a mother of an Aboriginal infant. For example 16.4% of mothers of Aboriginal infants were aged less than 20 years compared with 6.4% mothers of non-Aboriginal infants (OR = 2.88, $P < 0.001$).

Timing of presentation to antenatal care services

Of the 1520 pregnancies, information on gestational age at first hospital antenatal care visit was missing for seven pregnancies (0.5%); these pregnancies were excluded from the analyses. Seventeen women presented at delivery and so were censored. The median gestational age at first presentation to hospital antenatal care services was 14.1 weeks (IQR 12–19); for mothers of Aboriginal infants it was 15.6 weeks (IQR 12–21); and for mothers of non-Aboriginal infants it was 14.0 weeks (IQR 12–19).

The unadjusted baseline survival curve for Aboriginal infant status in Fig. 1 shows that, although mothers of Aboriginal and non-Aboriginal infants have a similar rate of presentation up until 13 weeks gestation, after 13 weeks mothers of Aboriginal infants

Table 1. Distribution of study factors by Aboriginality of infant

*$\chi^2(2) = 27.66$. Bold represents results with $P < 0.05$. CI, confidence interval; EDS, Edinburgh depression score; OR, odds ratio; SEIFA, socioeconomic indexes for areas

	Overall		Mother of a non-Aboriginal infant		Mother of an Aboriginal infant				
	Count	%	*n*	%	*n*	%	OR	95% CI	*P*-value
Overall	1520		1398		122				
Socio-demographic									
Mother <20 years									
No	1411	92.8	1309	93.6	102	83.6	**1**		
Yes	109	7.2	89	6.4	20	16.4	**2.88**	**1.70–4.88**	**<0.01**
Mother in paid employment									
No	826	54.3	735	52.6	91	74.6	**1**		
Yes	668	44.7	641	45.9	27	22.1	**0.34**	**0.22–0.53**	**<0.01**
Completed Year 12 or above									
No	667	43.9	590	42.2	77	63.1	**1**		
Yes	846	55.9	802	57.4	44	36.1	**0.42**	**0.28–0.62**	**<0.01**
Marital status									
Not partnered	276	18.2	229	16.4	47	38.5	**1**		
Partnered	1244	81.8	1169	83.6	75	61.5	**0.31**	**0.21–0.46**	**<0.01**
Mother's first baby									
No	966	63.6	877	62.7	89	73.0	**1**		
Yes	554	36.5	521	37.3	33	27.0	**0.62**	**0.41–0.95**	**0.03**
Psychosocial									
Mother smoker									
No	1142	75.1	1083	77.5	59	48.4	**1**		
Yes	378	24.9	315	22.5	63	51.6	**3.67**	**2.50–5.38**	**<0.01**
EDS Score ≥10									
No	1275	83.9	1174	84.0	101	82.8	1		
Yes	221	14.8	201	14.4	20	16.4	1.16	0.70–1.91	0.57
Mother has other vulnerabilities									
No	957	63.0	894	63.9	63	51.6	**1**		
Yes	563	37.0	504	36.1	59	48.4	**1.66**	**1.14–2.42**	**0.01**
Community									
SEIFA quintile									**<0.01***
1 (most disadvantaged)	548	36.1	477	34.1	71	58.2	**3.57**	**2.19–5.81**	**<0.01**
2	347	22.8	321	23.0	26	21.3	**1.94**	**1.09–3.46**	**0.02**
3–5	625	41.1	600	42.9	25	20.5	**1**		

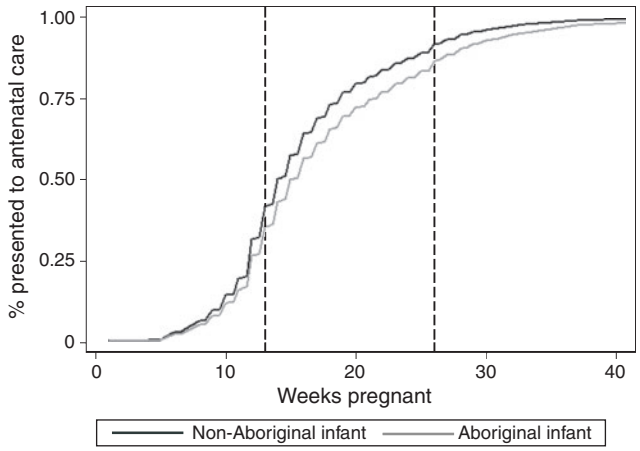

Fig. 1. Kaplan–Meier survival curve for Aboriginal infant status alone obtained using Cox regression. The dashed vertical lines indicate pregnancy trimesters.

present later. However, 75% of mothers of Aboriginal infants had presented by 21 weeks gestation.

The results of the Cox regression models are shown in Table 2. In an unadjusted model, mothers of Aboriginal infants were less likely to present earlier than mothers of non-Aboriginal infants (HR = 0.81, $P = 0.025$). However, after adjusting by the other nine study factors, the difference in the timing of presentation between mothers of Aboriginal and non-Aboriginal infants was no longer statistically significant (HR = 1.07, $P = 0.485$).

As Table 2 shows, eight factors were associated with the timing of presentation in the unadjusted model. However, only three of these remained significant in the full model (adjusting for all factors): mothers who smoked were less likely to present earlier to antenatal care than non-smoking mother (HR = 0.77, $P < 0.001$); mothers in paid employment were more likely to present earlier than mothers who were not in paid employment (HR = 1.44, $P < 0.001$); and mothers residing in two most disadvantaged SEIFA quintiles were less likely to present earlier than mothers in the least disadvantaged SEIFA quintiles (quintile 1 HR = 0.78; quintile 2 HR = 0.91, $P < 0.001$).

Discussion

We found that the majority of mothers presented for hospital-based antenatal care between 10 and 20 weeks gestation with very few presenting after 30 weeks. While mothers of Aboriginal infants first presented to the hospital antenatal service a little later than mothers of non-Aboriginal infants from the same geographic region, this difference did not remain when adjustments were made for all of the study factors. Several factors were independently associated with later antenatal care (HR <1), including: being a young mother; maternal smoking; and living in a disadvantaged suburb. In addition, four factors were independently associated with earlier antenatal care (HR >1): being in paid employment; completing year 12 of school; being partnered; and primiparity. Three characteristics remained associated with timing of presentation to antenatal services when all other factors were adjusted for: maternal smoking; paid employment; and SEIFA quintile. Maternal smoking has been found in previous studies to be associated with later antenatal care (McCaw-Binns *et al.* 1995; Trinh and Rubin 2006). Similarly, our finding that employed mothers presented to the antenatal clinic early agreed with the literature (McCaw-Binns *et al.* 1995; Johnson *et al.* 2003). Our finding that community socioeconomic status was associated with timing of antenatal care was similar to Perloff and Jaffee (1999).

Even though our results showed that the Aboriginality of an infant was not associated with late antenatal care after other factors were taken into account, care must be taken in interpreting these results. Mothers of Aboriginal infants were significantly more likely to have all but one of the other study factors. It is therefore misleading to suggest that being the mother of an Aboriginal infant does not impact upon timeliness of antenatal care. The results might reflect the complex associations that

Table 2. Cox regression models for the timing of antenatal care

*$\chi^2(2) = 14.62$. Bold represents results with $P < 0.05$. CI, confidence interval; EDS, Edinburgh depression score; HR, hazard ratio; SEIFA, socioeconomic indexes for areas

Study factors	Study factor alone (univariable analysis)		Full model (multivariable analysis)		
	HR	*P*-value	HR	95% CI	*P*-value
Socio-demographics					
Aboriginal infant	**0.81**	**0.03**	1.07	0.88–1.30	0.49
Mother <20 years	**0.74**	**0.01**	0.89	0.71–1.12	0.32
Mother in paid employment	**1.69**	**<0.01**	**1.44**	**1.28–1.62**	**<0.01**
Mother completed Yr 12 or above	**1.31**	**<0.01**	1.04	0.94–1.17	0.43
Mother partnered	**1.28**	**<0.01**	1.07	0.92–1.24	0.38
First baby	**1.13**	**0.02**	1.04	0.93–1.17	0.49
Psychosocial					
Maternal smoking	**0.65**	**<0.01**	**0.77**	**0.67–0.88**	**<0.01**
High EDS score	0.89	0.08	0.93	0.82–1.08	0.35
Any other vulnerability	0.98	0.73	1.03	0.92–1.15	0.64
Community					
SEIFA quintiles					**<0.01***
1	**0.64**	**<0.01**	**0.78**	**0.69–0.89**	**<0.01**
2	**0.82**	**0.05**	**0.91**	**0.79–1.04**	**0.18**

exist between the clustering of disadvantage among families of Aboriginal infants.

The factors that remained significant in the adjusted model came from three dimensions: maternal socio-demographic characteristics; psychosocial factors; and community factors. The inclusion of predictive factors from all three dimensions reflects the complexity in providing timely antenatal care to these mothers. The delivery of successful antenatal care needs to take into account the mothers' psychosocial and socioeconomic profile (at both the individual and community level). It must be multifaceted and innovative, taking into account issues such as transport, phone access and ongoing support. A sustained nurse home visiting program that begins antenatally and continues postnatally may begin to address some of these issues for mothers who may need additional support (Kemp *et al.* 2008).

Strengths and limitations

The NHMRC has called for Aboriginal health research to be conducted in urban settings, including the 'urban fringe' (National Health and Medical Research Council 2002). This study's population is based in the outer fringes of south-west Sydney, an area in line with the NHMRC's recommendation. Another strength of the present study was its use of data complimentary to routinely collected hospital administrative data. Hospital administrative data have been shown to under-identify Aboriginal infants (Comino *et al*. 2007). Our use of a survey of all new mothers admitted to the maternity ward aimed to identify Aboriginal infants systematically. The ward survey also collected basic demographic information that enhanced the administrative data. However, this method had its limitations. The survey did not ask about antenatal care and the hospital data included only the duration of the pregnancy at the first hospital visit and provided no data on the number of visits. We had originally planned to use hospital data from the complete recruitment period (October 2005–May 2007); however, in December 2006 there was an administrative change to the database structure. We were unable to extract data on the outcome variable 'timing of antenatal care' for some cases. These cases were 'missing not at random' and we therefore considered it appropriate to exclude all cases after December 2006. However, we believe our results can be generalised to the subsequent 6-month period after the change in the database structure. The subset of the data used was complete (with only 7 missing data from 1520 observations) and avoided serious biases. Additionally, the present study used only data on presentation to hospital antenatal care services; however, previous antenatal care may have been provided earlier by an alternate service, such as a general practitioner.

Conclusion

These results suggest that mothers of Aboriginal infants in an urban environment are generally accessing antenatal care in a timely way, albeit one to two weeks later than mothers of non-Aboriginal infants. Overall disadvantage, not being in paid employment before pregnancy and maternal smoking were associated with late antenatal care. Further research is needed to further explore the use of services following initial contact and to investigate access to ongoing care for mothers of Aboriginal infants.

The Gudaga Study describes the health and development of Aboriginal infants in south-west Sydney. Over time, results of the study, such as those presented in this paper, will provide significant information on a range of pertinent issues relating to maternal and child health that highlight equity and access issues for Aboriginal families. This information will influence the way that services think about their interaction with mothers of Aboriginal infants and enable service response initiatives to close gaps in outcomes for infants and their mothers.

Conflicts of interest

None declared.

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