Influence of Aboriginal and Socioeconomic Status on Birth Outcome and Maternal Morbidity

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Abstract

Objective: To assess the association of Aboriginal and socioeconomic status with birth outcome and maternal morbidity in Alberta.

Methods: A retrospective cohort study using Alberta health service and vital statistics data from 1997 to 2000. Aboriginal women registered with the Department of Indian and Northern Development (DIAND) were linked to a personal health number. Low socioeconomic status was defined as either receiving subsidization for the Alberta Health Care Insurance premium or receiving welfare.

Results: Women registered with DIAND and women receiving subsidy or welfare were younger, more often unmarried, smoked more, consumed more alcohol, and abused more illicit drugs than other women in Alberta during the time period studied. Fewer women registered with DIAND and women receiving subsidy or welfare had physician prenatal visits, attended prenatal classes, had forceps or vacuum deliveries, and more of these women frequently had gestation ages less than 37 weeks. Women registered with DIAND had more deliveries in smaller, non-metropolitan facilities; and more of these women delivered outside their region of residence; more had longer lengths of hospital stay; more mothers and neonates were readmitted to hospital within 28 days of discharge after delivery; fewer delivered small for gestational age neonates; fewer delivered neonates with birth weight less than 2500 g, but more delivered neonates with birth weight greater than 4000 g. There were fewer Caesarean sections in women registered with DIAND (OR = 0.84, 95% CI 0.76–0.93) and in women receiving subsidy or welfare (OR = 0.88, 95% CI 0.82–0.93).

Conclusion: Women receiving subsidy or welfare and women registered with DIAND had many demographic similarities and generally had worse maternal and neonatal outcomes than other women in Alberta. Medical system interaction may be different for these two groups of women than it is for other women in Alberta.

Résumé

Objectif : Évaluer le rapport entre les conditions socio-économiques des Autochtones albertains et les issues des accouchements au niveau de la morbidité maternelle et du nouveau-né.

Méthode : Cette étude rétrospective de cohortes a utilisé les données des services de santé et les statistiques démographiques de l'Alberta, de 1997 à 2000. On a donné aux femmes autochtones inscrites auprès du ministère des Affaires indiennes et du Nord canadien (MAINC) un numéro de santé personnel. On a défini le statut socio-économique inférieur comme le fait de recevoir soit des primes de subventions du Régime d'assurance-maladie de l'Alberta, soit l'assistance sociale.

Résultats : Comparées aux autres Albertaines, pendant la même période de temps, les femmes inscrites auprès du MAINC et les femmes recevant des subventions ou l'assistance sociale étaient plus jeunes et le plus souvent non mariées; elles fumaient davantage, consommaient de l'alcool et abusaient plus des drogues illicites. Moins de femmes inscrites auprès du MAINC et recevant des subventions ou l'assistance sociale ont eu des consultations prénatales chez un médecin, ont assisté à des rencontres prénatales ou ont eu des accouchements à l'aide des forceps ou de ventouse obstétricale; les accouchements à un âge gestationnel de moins de 37 semaines étaient plus fréquents. Chez les femmes inscrites auprès du MAINC, un plus grand nombre d'accouchements ont eu lieu dans des centres plus petits, non métropolitains, et situés à l'extérieur de la région où habitait la mère; davantage de ces femmes ont eu des séjours hospitaliers plus longs; plus de mères et de nouveau-nés ont été ré-admis à l'hôpital dans les 28 jours suivant la sortie après l'accouchement; moins de ces femmes ont accouché d'un nouveau-né jugé petit pour son âge gestationnel; moins de ces femmes ont accouché d'un nouveau-né ayant un poids de naissance de moins de 2 500 grammes, mais le poids de naissance dépassait les 4 000 grammes dans un plus grand nombre de cas. Le nombre de césariennes était inférieur chez les femmes inscrites auprès du MAINC (OR = 0,84, IC de 95 % : 0,76 à 0,93) et chez les femmes recevant des subventions ou l'assistance sociale (OR = 0,88, IC de 95 % : 0,82 à 0,93).

Conclusion : Les femmes recevant des subventions ou l'assistance sociale ainsi que les femmes inscrites auprès du MAINC avaient beaucoup de ressemblances démographiques et, de façon générale, elles ont connu des issues maternelles et néonatales plus défavorables, comparativement aux autres femmes de l'Alberta. Il se pourrait que l'interaction du système médical soit différente pour ces deux groupes de femmes.

Key Words

Socioeconomic status, Aboriginal, obstetrics, newborns

Competing interests: None declared.

Received on August 28, 2001

Revised and accepted on October 22, 2001

J Obstet Gynaecol Can 2002;24(8):633-40.

INTRODUCTION

The course of pregnancy in Aboriginal women has been reported to be dissimilar from that of non-Aboriginal women, including a higher birthweight-specific newborn mortality rate,[1] a higher incidence of low birthweight newborns,[2] a higher incidence of stillborns,[2] and a shorter interpregnancy interval.[3] The reason for these differences is unknown, and may include biological, access, socioeconomic, and cultural determinants. Specific policies in the United States between 1955 to 1975 to improve maternal-child Aboriginal health resulted in an 81% decrease in maternal mortality and a 71% decline in newborn death over the time span.[4] In Canada, despite a decrease in Aboriginal infant mortality, the infant death rate is still twice that of non-Aboriginal infants.[5] Further, up to 50% of Aboriginal children live in poverty,[5] compared to 20% of non-Aboriginal children.[6] Increased maternal morbidity and poorer newborn outcomes surrounding Aboriginal births may have both socioeconomic and racial underpinnings. In this study, we compared the maternal and newborn outcomes between a non-Aboriginal, low socioeconomic status group and an Aboriginal group of unknown socioeconomic status. We hypothesized that Aboriginal maternal morbidity and neonatal outcome would differ from that of a low socioeconomic group. If true, then policies and programs that addressed only those health determinants affected by poverty would be insufficient to address the special needs of Aboriginal women during pregnancy.

METHODS

DATABASES

Four administrative health service databases were used:

1. Canadian Institute for Health Information's (CIHI) Inpatient Discharge Abstract Database (DAD) for the province of Alberta for fiscal years 1997/98 to 1999/00,
2. Alberta Vital Statistics Birth Database for calendar years 1997 to 1999,
3. Alberta Health Insurance Plan Registry File for fiscal years 1997/98 to 1999/00,
4. Alberta Physician Claims Assessment System Database (CLASS) for fiscal years 1997/98 to 1999/00.

The four databases are maintained by Alberta Health and Wellness. Welfare, Alberta Health Insurance Premium subsidy, and Aboriginal status (recorded as federal band registry identification with the Department of Indian and Northern Development) were indicated in the Alberta Health Insurance Registry databank. Eligibilities for welfare and Alberta Health Insurance Premium subsidy depend on reported personal income.

IDENTIFYING BIRTHS

Births were identified using CIHI (Canadian Institute for Health Information) DAD (Discharge Abstract Database). Ninety-nine percent of the births that occur in Alberta every year take place in acute care facilities. All separations with a main patient service (MPS) area of "obstetrics delivered" for 1997/98, 1998/99, and 1999/00 were extracted for the last available three fiscal years. The decision to combine three years of data was made because of the small volume of deliveries in some facilities.

IDENTIFYING THE NEWBORN

To obtain newborn data, all separations with the MPS area of "newborn" were extracted from CIHI DAD for 1997/98, 1998/99, or 1999/00. Stillbirths are not included in this specific field.

TABLE 1

DEMOGRAPHICS FOR POPULATION OF ABORIGINAL STATUS, SUBSIDY/WELFARE, AND ALL OTHER WOMEN IN THE PROVINCE OF ALBERTA, 1997/98–1999/00

All deliveries	Aboriginal	Subsidy/welfare	All others	Significance
Maternal deliveries during time period	6461	18,729	78,955	NA
Individual mothers during time period	5591	16,808	71,700	NA
% deliveries with maternal age <17 years	4.5	1.1	0.5	$p < 0.000^*$
% deliveries with maternal age > 40 years	0.4	0.9	1.2	$p < 0.000^*$
Median maternal age in years (25–75% quartiles)	24 (20–29)	25 (22–30)	29 (25–33)	$p < 0.000^*$
Alberta population of women between 12 and 51 years old	33,706	174,554	798,827	NA
Rate of deliveries per 100 women between 12 and 51 years old	19.2	10.7	9.9	$p < 0.000^*$

*Significant differences between all paired comparisons.
NA: Not applicable.

MATCHING THE NEWBORN AND MOTHER

The AHCIP (Alberta Health Care Insurance Plan) registry file group number was used to match each newborn to each mother and to determine multiple births.

Calculating Post-Delivery Length of Stay

Average length of stay (ALOS) after delivery was calculated using the neonatal admission time and date and the maternal discharge time and date. *Average length of stay (ALOS) before delivery* was calculated using the maternal admission time and date and the neonatal admission time and date.

Defining Maternal Reproductive Comorbidity

Maternal reproductive comorbidity associated with pregnancy was defined as multiple pregnancy, fetal malposition or malpresentation, abnormalities of cervix or uterus, and cephalopelvic disproportion (ICD-9CM 651.x to 654.x in any of the 16 CIHI DAD diagnosis fields, or as the Case Mix Grouper [CMG] groupers 602, 603, 608, or 610 for previous Caesarean sections).

Defining Fetal Coexisting Diagnosis

Fetal coexisting diagnosis associated with pregnancy was defined as developmental problems, or fetal, placental, or uterine problems (ICD-9CM 655.x to 658.x in any of the 16 CIHI DAD diagnosis fields), and not a maternal comorbidity as defined above.

Defining Maternal Hypertension Comorbidity

Maternal hypertension comorbidity was defined as ICD-9CM 401.x to 405.x and 642.x in any of the 16 CIHI DAD diagnosis fields.

Defining Maternal Medical Interventions

Caesarean section was defined as ICD-9CM 74.0, 74.1, 74.3, 74.4, 74.99 in any of the 10 CIHI DAD procedural fields. *Vaginal birth after Caesarean (VBAC)* was defined as CIHI DAD CMG grouper 610 or 608. *Forceps/vacuum use for delivery* was defined as ICD-9CM 72.0, 72.1, 72.2x, 72.3x, 72.4, 72.5x, 72.6, 72.71, 72.79, 73.3 in any of the 10 CIHI DAD procedural fields. *Medical or surgical induction* was defined as ICD-9CM 73.4, 73.01, 73.09 in any of the 10 CIHI DAD procedural fields.

LINKING TO VITAL STATISTICS

Alberta vital statistics birth records contain questions completed by the family physician or pediatrician within 24 hours of delivery, and by the mother prior to hospital discharge. Because the vital statistics database does not record each patient's unique Alberta Health Insurance Registry number, a deterministic linkage to maternal records for each of the three years was done, using newborn birth date (365 unique values), birth weight (3007 unique values), delivery site (87 facilities), newborn sex, and maternal age (39 unique values). Variables unique to vital statistics included weeks of gestation; history of smoking, consumption of alcohol and use of illicit drugs during the current pregnancy; marital status at the time of birth; number of total maternal aborted pregnancies; number of maternal neonatal and infant deaths; presentation (breech and cephalic); newborn small for gestational age; Apgar at 1, 5, and 10 minutes; and attendance at prenatal classes. Vital statistics data from January 1 to March 31, 2000, were unavailable.

LINKING TO PHYSICIAN CLAIMS

Physician claims for prenatal visits were extracted for identified maternal deliveries, using the Canadian Classification of Procedures (CCPx) code 03.03B (prenatal visit), with a service date within 270 days prior to the delivery date. *No physician prenatal visits* was defined as (a) no physician claim for a prenatal visit during the pregnancy and (b) no prenatal physician

TABLE 2

LOCATION, EFFICIENCY, AND SIZE OF DELIVERY ORGANIZATION

All deliveries	Aboriginal n = 6461	Subsidy/welfare n = 18,729	All others n = 78,955	Significance
Delivery in hospital size (1–2)	353 (5%)	966 (5%)	3006 (4%)	
Delivery in hospital size (3)	2536 (39%)	2633 (14%)	10,463 (13%)	
Delivery in hospital size (4)	956 (15%)	3193 (17%)	12,084 (15%)	
Delivery in hospital size (5–6)	2616 (40%)	11,936 (64%)	53,402 (68%)	
Resident region different than service delivery region	1711* (26%)	1721 (9%)	8108 (10%)	$p < 0.000$
Non-metropolitan service region	3836* (59.5%)	6766 (36.2%)	25,352 (32.3%)	$p < 0.000$
Potentially preventable maternal re-admission	70* (1.24%)	13 (0.81%)	568 (0.78%)	$p < 0.000$
Potentially preventable newborn re-admission	352* (6.21%)	516 (3.21%)	2550 (3.49%)	$p < 0.000$

*Notes significant difference from other women.
Values in parentheses stipulate percent of all deliveries.

visits recorded on the vital statistics birth record. To our knowledge, all physicians submit claims for hospital-based services; however, nurse-practitioners may provide prenatal services, which are not recorded in administrative databases.

Defining Potentially Preventable Readmission

Potentially preventable maternal re-admission was defined as the first admission to any acute care hospital within 28 days post delivery for the following most responsible (i.e., first recorded) diagnosis: postpartum care and re-examination (ICD-9CM V24.x); encounter for other and unspecified procedure and aftercare (ICD-9CM V58.x); healthy person accompanying sick person (ICD-9CM V65.0); convalescence and palliative care (ICD-9CM V66.x).

Potentially preventable newborn re-admission was defined as the first admission to any acute care hospital within 28 days post delivery for the following most responsible diagnosis: inadequate weight gain (ICD-9 CM 783.2, 783.4); jaundice (ICD-9CM 773.1, 774.2, 774.3x, 774.6, 774.7); dehydration (ICD-9CM 276.0, 276.5, 777.5, 778.4); feeding problem (779.3, 783.3); social reasons (V20.1, V65.0). Re-admissions for non-singleton deliveries of newborns of less than 2500 g and newborns delivered by Caesarean section were excluded.

Defining Hospital Size

Hospitals providing maternal delivery services were categorized into six groups on the basis of the average number of deliveries per year over the three-year study period, the metropolitan location, and the level of newborn facilities: Group 1 (1 to 49 deliveries/year: 29 hospitals); Group 2 (50 to 99 deliveries/year: 13 hospitals); Group 3 (100 to 405 deliveries/year: 32 hospitals); Group 4 (631 to 1691 deliveries/year: 5 hospitals located in one of the five non-metropolitan regional health care cities); Group 5 (5 hospitals located in the metropolitan health regions of Calgary and Capital hospitals); Group 6 (2 hospitals containing a Level 3 neonatal intensive care; one hospital in each of two metropolitan centres).

Identifying Service Region

Service regions were defined as either metropolitan (2 regions each with populations of 1 million) or non-metropolitan (15 other health regions with a combined population of 1 million). *Health regions* are legislatively determined geographic regions, in which the medical care of the residents is managed by an elected/appointed health board.

STATISTICS

Contrasts between Aboriginal treaty status, subsidy or welfare, or others for descriptive variables used chi square or ANOVA as appropriate. Caesarean section as a maternal process of care was modelled by forward stepwise logistic regression. The independent variables were maternal age (< 17, 17 to 40, > 40 years); Aboriginal treaty status; welfare recipient or Alberta health insurance premium subsidy; no physician prenatal visits; first live birth; regional health authority of service (metropolitan or non-metropolitan); hospital size as defined above; delivery in service region different than region of residence; gestation (< 37 weeks, > 40 weeks); newborn sex; birth weight in grams (< 2500 g, > 4000 g); maternal reproductive comorbidity as defined above; fetal coexisting diagnosis as defined above; breech or cephalic presentation; maternal hypertension comorbidity as defined above; and multiple births. The order of factor entry into the model was used to rank the magnitude of factor influence. Significance was defined as $p < 0.05$.

TABLE 3

OUTCOMES OF PREVIOUS PREGNANCIES AND MATERNAL SOCIAL SUPPORT DURING CURRENT PREGNANCY

Per unique mother during the study period	Aboriginal n = 4686	Subsidy/welfare n = 13,127	All others n = 57,083	Significance
Not married at time of conception	3750 (80.0%)	6525 (49.7%)	9771 (17.1%)	p < 0.000*
Never married at time of conception	3556 (75.9%)	5715 (43.5%)	8309 (14.6%)	p < 0.000*
Live births per mother (SD)	2.7 (1.8)	2.1 (1.3)	1.9 (1.0)	p < 0.000*
Past stillbirths per mother (SD)	0.032 (0.22)	0.021 (0.174)	0.015 (0.14)	p < 0.000*
Newborn or infant death per mother (SD)	0.026 (0.213)	0.011 (0.133)	0.008 (0.099)	p < 0.000*
Abortions per mother (SD)	0.49 (0.90)	0.49 (0.89)	0.4 (0.78)	Not significant

*Significant differences between all paired comparisons.
Note that for multiple pregnancies, the responses extracted from the first pregnancy during the time period were used.
Values in parentheses stipulate percent of all deliveries (%), or standard deviation (SD).

RESULTS

Women registered with DIAND and women receiving subsidy or welfare shared the following traits: compared to other women in Alberta, they were younger; had higher fertility rates (births in population); were more frequently not married; had more live births (births per identified mother), more stillbirths, and more neonatal or infant deaths. Women registered with DIAND and women receiving subsidy or welfare were more likely smokers or consumers of alcohol or street drugs, had fewer physician prenatal visits, and were less likely to attend a prenatal class. Fewer women registered with DIAND or receiving subsidy or welfare had maternal comorbidity, Caesarean sections, or forceps or vacuum deliveries. Infants of women registered with DIAND and of women receiving subsidy or welfare were more likely to have gestational ages of less than 37 weeks, and fewer had breech presentations.

Those women registered with DIAND, but not those women receiving subsidy or welfare, had more deliveries in smaller, non-metropolitan facilities; fewer delivered in their region of residence; more had longer antenatal and total length of stay; more women and neonates were re-admitted to hospital within 28 days of discharge after delivery; fewer had fetal comorbidity; fewer delivered small for gestational age neonates; fewer delivered neonates with birth weight less than 2500 g; and more delivered neonates with birth weight greater than 4000 g.

Women registered with DIAND and women receiving subsidy or welfare were similar to other women in Alberta in the rate of abortions, rate of VBAC, rate of medical or surgical induction, neonatal sex, and neonatal Apgars at 1, 5, and 10 minutes.

We chose delivery by Caesarean section to be an indicator for process of maternal care (Table 6). Belonging to the group of women registered with DIAND (OR = 0.84, 95% CI 0.76–0.93) or belonging to the group of women receiving subsidy or welfare (OR = 0.88, 95% CI 0.82–0.93) were still influential factors associated with Caesarean sections after adjustment for demographics, organizational factors, and course of pregnancy.

DISCUSSION

Compared to all other women in Alberta, women receiving subsidy or welfare and women registered with DIAND generally have worse maternal and newborn outcomes. As well, Caesarean

TABLE 4

PROCESS INDICATORS FOR CURRENT PREGNANCY

All deliveries	Aboriginal n = 6461	Subsidy/welfare n = 18,729	All others n = 78,955	Significance
Any smoking during pregnancy	2872 (57.1%)	4810 (33.6%)	11,152 (18.2%)	p < 0.000*
Any alcohol consumption during pregnancy	670 (13.4%)	809 (5.8%)	2227 (3.7%)	p < 0.000*
Any use of illicit drugs during pregnancy	313 (6.4%)	338 (2.4%)	472 (0.8%)	p < 0.000*
No physician prenatal visits	504 (9.2%)	535 (3.6%)	1661 (2.6%)	p < 0.000*
Frequency of prenatal family physician visits (SD)	6.4 (4.1)	8.3 (4.3)	8.9 (4.2)	p < 0.000*
Frequency of prenatal obstetrical visits	5.7 (4.1)	7.7 (4.1)	8.3 (4.3)	p < 0.000*
No prenatal classes only if first live birth	858 (62.8%)	2682 (51.0%)	6869 (28.3%)	p < 0.000*
(n = number of first live births)	n = 1366	n = 2682	n = 24,286	
Hypertension comorbidity	249† (3.9%)	679† (3.6%)	3543 (4.5%)	p < 0.000
Any maternal reproductive comorbidity	1060† (16%)	3024† (16%)	14,779 (19%)	p < 0.000
Any fetal coexisting diagnosis	1153† (18%)	4020 (21%)	16,826 (21%)	p < 0.000
Length of maternal hospital stay (antenatal) in hours (SD)	13.6 (31.6)†	12.2 (32.6)	11.7 (29.4)	p < 0.000
Length of maternal hospital stay (postnatal) in hours (SD)	46.8 (28.3)†	46.0 (26.6)†	47.6 (26.9)	p < 0.000
Length of maternal stay (total) in days (SD)	2.4 (1.3)†	2.3 (1.3)	2.3 (1.3)	p < 0.000
Delivery by Caesarean section	902 (14%)	2936 (16%)	14,618 (19%)	p < 0.000*
Vaginal birth after Caesarean section	274 (4%)	705 (4%)	3105 (4%)	Not significant
Medical/surgical induction	3254 (50%)	9323 (50%)	36,917 (47%)	Not significant
Forceps/vacuum used for delivery	630 (10%)	2836 (15%)	13,041 (17%)	p < 0.000*

*Significant differences between all paired comparisons.
†Notes significant difference from other deliveries.
Values in parentheses stipulate percent of all deliveries (%), or standard deviation (SD).

section rates for both these groups are lower than that of other mothers. Our results also suggest that as groups women of low socioeconomic status and women registered with DIAND differ from each other with respect to newborn outcomes, such as small for gestational age and low/high birth weight. Although both groups had generally poorer outcomes, socioeconomic status alone is insufficient to account for all differences noted for mothers of Aboriginal treaty status. Although low socioeconomic and Aboriginal status are not mutually exclusive, in this study, all identified women of low socioeconomic status were non-Aboriginal. The proportion of Aboriginal women registered with DIAND who are also of low socioeconomic status is not known. However, anything less than 100% low socioeconomic status magnifies the association of Aboriginal women registered with DIAND and outcome. These results extend previous research demonstrating an association of race to low birth weight[7,8] as well as low socioeconomic class to low Apgars,[9] small for gestational age, and low birth weight.[10,11]

The term Aboriginal does not refer to a homogenous group as it includes Aboriginal women registered with DIAND, non-registered Aboriginal women, Métis women, and Inuit women. The proportion of Aboriginal women registered with DIAND living off-reserve has increased from 29% in 1982 to 42% in 1997.[6] Alberta census data have described a decrease in the population with Aboriginal origin from 148,000 in 1991 to 123,000 in 1996.[12,13] In 1991, census data indicated that there were 47,000 women between the ages of 10 and 54 years with Aboriginal origin, and another 7000 women in this age group with Métis or Inuit origin. During the study years, 34,000 Aboriginal women were registered with the Department of Indian and Northern Development and linked to an Alberta personal health number identification. Compared to other Albertan women, a greater proportion of Albertan Aboriginal women registered with DIAND delivered in smaller, rural hospitals, and a higher proportion were transferred to a hospital not situated in their resident health region. The literature documents that although Aboriginals' residence is more often rural, they also differ from their non-Aboriginal rural neighbours.[14]

Despite the poorer outcomes for both women registered with DIAND and women of low socioeconomic status, neither group demonstrated more maternal or fetal comorbidity. Furthermore, Apgars were similar across all births in Alberta, regardless of socioeconomic status or racial origin. Apgars are a reliable predictor of newborn mortality.[15]

Two process-of-care indicators (length of stay and Caesarean section rates) were significantly different in women registered with DIAND and in women of low socioeconomic status compared to other Alberta women. Although statistically significant, the few hours of increased length of stay among women registered with DIAND are of limited clinical interest. The decreased Caesarean section rate in women registered with DIAND had been noted previously.[16] Using regression, we adjusted for biological influences (age, breech or cephalic presentation, multiple births, multiple pregnancies, maternal and fetal comorbidity), which were, as expected, the most influential factors as determined by their rank order of model entry. Anatomical or biological factors unique to Aboriginal women seem unlikely, as similar findings were noted in low socioeconomic status women.

TABLE 5

NEWBORN OUTCOMES

All newborns	**Aboriginal n = 5500**	**Subsidy/welfare n = 14,877**	**All others n = 63,572**	**Significance**
Sex (% female)	49.9	48.9	48.6	Not significant
Gestation < 37 weeks	406 (7.4%)	1025 (6.9%)	3832 (6.0%)	$p < 0.000^*$
Breech presentation	139† (2.5%)	393† (2.6%)	2090 (3.3%)	$p < 0.000^*$
Non-cephalic delivery	1817† (33.0%)	4124 (27.7%)	17,718 (27.8%)	$p < 0.000^*$
Apgar at 1 min less than 7	891 (16.2%)	2572 (16.8%)	10,671 (16.8%)	Not significant
Apgar at 5 min less than 7	108 (2.0%)	339 (2.3%)	1252 (2.0%)	Not significant
Apgar at 10 min less than 7	28 (0.5%)	69 (0.5%)	270 (0.4%)	Not significant
Small for gestational age	365 (6.6%)	1534 (10.3%)	4894 (7.7%)	$p < 0.000^*$
Birth weight in grams (< 2500 g)	313 (4.9%)	1156 (6.2%)	3622 (4.6%)	$p < 0.000^*$
Birth weight in grams (> 4000 g)	1154 (17.9%)	1816 (9.7%)	9780 (12.4%)	$p < 0.000^*$
Birth weight in grams (average, SD)	3496 (613)	3340 (559)	3414 (550)	$p < 0.000^*$

*Significant differences between all paired comparisons.
†Denotes significant difference from other deliveries.
Values in parentheses stipulate percent of all deliveries (%), or standard deviation (SD).

It is possible that women's expectations or physician interactions may be different in these two groups, and as such influence the decision to have a Caesarean section. We noted a similar pattern in the use of forceps and vacuum assistance, hence a substitution for less invasive delivery techniques did not explain the difference in Caesarean section rates.

Other researchers have also noted that women registered with DIAND have less prenatal care, a higher rate of deliveries in a non-local hospital, and a higher rate of both early and late hospital discharge.[4] Early discharge is not associated with increased re-admissions in selected low-income populations.[17,18] However, low socioeconomic status is associated with early discharge.[19] Although some programs that offer additional support during pregnancy did not seem to reduce low birth weight or premature newborns,[20] other initiatives using vital statistics to monitor prenatal care did improve access in one community setting.[21] Short-term programs to directly influence behaviours such as smoking cessation or prenatal visits may be within the purview of local health authorities or individual clinicians. Programs influencing other health determinants, such as social support or use of illicit drugs, may require more extensive partnerships.[22]

There was a decreased frequency of maternal and fetal comorbidity in Aboriginal and low socioeconomic status women compared to the general population. Although this finding may be simply related to these two groups being younger, the importance of non-biological determinants of health outcomes during pregnancy is again underscored. Maternal alcohol/substance abuse[23,24] and diabetes[25,26] are more common in Aboriginal mothers. We noted a greater number of neonates with birth weight greater than 4000 g in this group.[27,28] Coding for gestational or maternal diabetes in this cohort was very sparse and not analyzed.

TABLE 6

MODELLING OF MATERNAL PROCESS OF CARE (CAESAREAN SECTION)

Delivery by Caesarean Section	Odds ratio (95% CI)
Breech presentation	2.79 (2.48–3.13)
Any maternal reproductive comorbidity	23.57 (22.29–24.93)
First live delivery	2.44 (2.32–2.56)
Any fetal coexisting diagnosis	2.52 (2.37–2.67)
Cephalic delivery	0.49 (0.47–0.52)
Maternal hypertension comorbidity	1.89 (1.72–2.08)
Birth weight in grams (> 4000 g)	1.44 (1.35–1.54)
Gestation less than 37 weeks	1.35 (1.23–1.49)
Maternal age > 40 years	1.95 (1.62–2.35)
Maternal age < 17 years	0.42 (0.31–0.58)
No prenatal physician visits	0.72 (0.63–0.83)
Male sex (newborn)	1.12 (1.07–1.17)
Birth weight < 2500 g	1.27 (1.15–1.42)
Subsidy/welfare	0.88 (0.82–0.93)
Aboriginal treaty status	0.84 (0.76–0.93)
Multiple births	0.69 (0.57–0.85)
Hospital size 1–3 versus 4–6	0.85 (0.79–0.92)
Non-metropolitan service area versus metropolitan area	1.10 (1.04–1.17)
Gestation more than 40 weeks	1.09 (1.03–1.16)

Rank order of influencing factors indicates the order of entry into the model.

LIMITATIONS

Two major limitations of this study are that women registered with DIAND may not be reflective of urban Aboriginals without registration, and that the place of residence for Aboriginals may be more related to band location than to the actual domicile of the mother. These limitations underscore why secondary use of administrative data should be interpreted with caution. The measurement of low socioeconomic class is difficult, and our proxy (Alberta Health Care Insurance Premium subsidy/welfare) may not be reflective of all women in this group.[29] However, our proxy does not suffer from the potential ecology fallacy, as we used individual-level data. There may exist a reporting bias in smoking, consumption of alcohol, or use of illicit drugs, as greater social stigma may exist for non-Aboriginal groups. This paper restricts its analysis to issues concerning health service utilization in identified populations and does not attempt to address the social implications of low socioeconomic or Aboriginal status.

ACKNOWLEDGEMENTS

This work was partially supported by the Alberta Center for Health Service Utilization Research.

REFERENCES

1. Rogers RG. Ethnic and birth weight differences in cause-specific infant mortality. Demography 1989;26:335–43.
2. Edouard L, Gillis D, Habbick B. Pregnancy outcome among native Indians in Saskatchewan. Can Med Assoc J 1991;144:1623–5.
3. Khoshnood B, Lee KS, Wall S, Hsieh HL, Mittendorf R. Short interpregnancy intervals and the risk of adverse birth outcomes among five racial/ethnic groups in the United States. Am J Epidemiol 1998;148:798–805.
4. Sullivan DA, Beeman R. Utilization and evaluation of maternity care by American Indians. Arizona J Community Health 1983;9:18–29.
5. Royal Commission on Aboriginal Peoples. Looking forward, looking back – report of the Royal Commission on Aboriginal peoples. Volume 1. Ottawa: Supply and Services Canada; 1996.
6. Canadian Institute of Child Health. The health of Canada's children: a CICH profile. 3rd ed. Ottawa: The Institute; 1996. Available on-line at <http://www.cich.ca>.
7. Starfield B, Shapiro S, Weiss J, Liang KY, Ra K, Paige D, et al. Race, family income, and low birth weight. Am J Epidemiol 1991;134:1167–74.

8. McGrady GA, Sung JFC, Rowley DL, Hogue CJR. Preterm delivery and low birth weight among first-born infants of black and white college graduates. Am J Epidemiol 1992;136:266–76.
9. Hemminki E, Malin M, Rahkonen O. Mother's social class and perinatal problems in a low-problem area. Int J Epidemiol 1990;19:983–90.
10. Sanjose S, Roman E. Low birthweight, preterm, and small for gestational age in Scotland 1981–84. J Epidemiol Community Health 1991;45:207–10.
11. Hemminki E, Merilainen J, Malin M, Rahkonen O, Teperi J. Mother's education and perinatal problems in Finland. Int J Epidemiol 1992;21:720–4.
12. Profile of Canada's Aboriginal Population. 1991 Census. Statistics Canada, Ottawa, 94–325. 1991, p.178
13. Canadian Statistics. Aboriginal identity. 1996 Statistics Canada. <http://www.statcan.ca./english/Pgdb/People/Population/demo38c.htm>
14. Powell J, Dugdale AE. Obstetric outcome in an Aboriginal community: a comparison with the surrounding rural area. Aust J Rural Health 1999;7:13–7.
15. Casey BM, McIntire DD, Leveno KJ. The continuing value of the Apgar score for the assessment of newborn infants. N Eng J Med 2001;344:467–71.
16. Schiff M, Rogers C. Factors predicting Cesarean delivery for American Indian women in New Mexico. Birth 1999;26:226–31.
17. Brumfield CG, Nelson KG, Stotser D, Yarbaugh D, Patterson P, Spaybery NK. 24-Hour mother-infant discharge with a follow-up home health visit: results in a selected Medicaid population. Obstet Gynecol 1996;88:544–8.
18. Kotagal UR, Atherton HD, Eshett R, Schoettker PJ, Perlstein PH. Safety of early discharge for Medicaid newborns. J Am Med Assoc 1999;282:1150–6.
19. Margolis LH, Kotelchuck M, Chang HY. Factors associated with early maternal postpartum discharge for hospital. Arch Pediatr Adolesc Med 1997;151:466–72.
20. Hodnett ED. Support during pregnancy for women at increased risk of low birthweight babies. The Cochrane Library 2001;1:1–13.
21. Cambell BC, Kimball EH, Helgerson SD, Alexander IL, Goldberg HI. Using 1990 national MCH objectives to assess health status and risk in an American Indian community. Public Health Rep 1989;104:627–31.
22. Smylie J. A guide for health professionals working with Aboriginal peoples. J Soc Obstet Gynaecol Can 2000;23:157–67.
23. Kvigne VL, Bull LB, Welty TK, Leonardson GR, Lacina L. Relationship of prenatal alcohol use with maternal and prenatal factors in American Indian women. Soc Biol 1998; 45:214–22.
24. Westphal LL. Prenatal alcohol use among urban American Indian/Alaska native women. Am Indian Alsk Native Ment Health Res 2000;9:38–48.
25. Rodrigues S, Robinson EJ, Ghezzo H, Gray-Donald K. Interaction of body weight and ethnicity on risk of gestational diabetes mellitus. Am J Clin Nutr 1999;70:1083–9.
26. Thomson M. Heavy birthweight in Native Indians of British Columbia. Can J Public Health 1990;81:443–6.
27. Health Canada. Indian Health Information Library. Health programs analysis. Ottawa: First Nations and Inuit Health Programs; 1997.
28. Smylie J. A guide for health professionals working with Aboriginal peoples. J Soc Obstet Gynaecol Can 2001;23:54–68.
29. Parker JD, Schoendorf KC, Kiely JL. Associations between measures of socioeconomic status and low birth weight, small for gestational age, and premature delivery in the United States. Ann Epidemiol 1994; 4:271–8.