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Māori and non-Māori differences in caesarean section rates: a national review

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Abstract

Aim To investigate the relationship between caesarean section (CS), deprivation, and ethnicity; and to examine Māori/non-Māori differences in CS after controlling for possible confounding factors.

Method Total, acute, and elective CS rates (as proportions of women giving birth in New Zealand hospitals) during 1997–2001 were examined by ethnicity and area deprivation. Logistic regression was used to adjust for age, deprivation, some clinical factors, and District Health Board (DHB).

Results Total, acute, and elective CS rates were significantly higher among non-Māori compared to Māori women (total CS, 21% vs 13%, ratio 1.59, p<0.0001). CS rates decreased with increasing levels of deprivation. After controlling for deprivation and age, differences between Māori (M) and non-Māori (nM) remained (total CS odds ratio nM:M 1.43, 95% confidence interval 1.39–1.48; elective OR 1.44 (1.36–1.52); acute OR 1.38 (1.33–1.43)). Differences also remained after controlling for other factors including a limited number of clinical factors.

Conclusion Results suggest that non-clinical factors may be contributing to ethnic differences in CS in New Zealand. While deprivation contributes to this difference it does not fully explain it. Further research is needed to investigate whether ethnic differences in CS impact on birth outcomes, and which factors, other than those clinically indicated, contribute to ethnic differences in caesarean section in New Zealand.

Caesarean section (CS) births have become increasingly common in New Zealand; they have risen from 9.6% in 1983/84 to 22.1% in 2001.[1–4] Within the context of rising CS rates, concerns over disparities by ethnicity have also been raised with the lowest rates among Māori women compared with other groups.[2,3,5–7]

In 2001, of women giving birth in hospital, the CS rate for Māori was 15.2% compared with 24.5% among European women.[4] Pacific women had a CS rate between that of Māori and European women at 18%.

Lower rates of other obstetric interventions have also been documented among Māori, including instrumental vaginal delivery, inductions, epidural analgesia, and episiotomy.[2–4] It has been suggested that, given higher risk pregnancies and more health problems among Māori women, higher rates of obstetric intervention, including caesarean section, might be expected.[2] This raises questions about why there is an apparent inverse relationship.

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While differences persist after considering maternal age, clinical factors (such as parity,[5,7] and non-clinical factors) have been raised as possible contributors to ethnic differences.[2,7]

One New Zealand study[5] undertaken at National Women's Hospital (NWH) examined associations between ethnicity and obstetric intervention (including caesarean section) after controlling for parity and obstetric risk in more detail. Among 43,367 singleton, cephalic deliveries, not preceded by caesarean section between 1992–1999, results showed that rates of pre-labour caesarean remained lower for Māori and Pacific women than for all other ethnicities (after controlling for age, parity, and multiple clinical risk factors). For caesarean delivery rates overall, however, adjusted analyses were not significantly different for Māori or Pacific Island women compared to 'Other' ethnic groups.

Differences in CS by deprivation have also been documented in New Zealand with lower rates of CS at increasing levels of area deprivation.[2] As with ethnicity, the authors suggest that given the likely higher clinical need for intervention among women from more deprived areas, one might expect higher rates of intervention.

Ethnic disparities in deprivation (with the skewed distribution of the Māori population towards the most deprived areas)[8] may therefore contribute to differences in CS between Māori and non-Māori women. The impact of socioeconomic position on ethnic disparities in CS has not been considered in New Zealand. The interplay between ethnicity and deprivation requires further consideration in order to contribute to our understanding of ethnic disparities in caesarean section.

This study aimed to investigate the relationship between caesarean sections, deprivation, and ethnicity. It also aimed to examine Māori/non-Māori disparities in caesarean section after controlling for possible confounding factors using national hospital information.

Method

National hospital data with any diagnosis of ICD-9-CM V27, the code for outcome of delivery, were obtained from the New Zealand Health Information Service (NZHIS). This includes deliveries in public and private hospitals. Coding of caesarean sections as elective and acute was introduced in 1996.[9] Therefore, data analyses were restricted to the period 1 January 1997 to 30 June 2001. For any women having a hospital birth during this period, all admissions up to one year prior to birth, and any previous hospital births after 1 January 1988 were also obtained.

Total, elective, and acute caesarean sections (numerator) were analysed by ethnicity and deprivation among all admissions of women having hospital births (denominator).

Total CS were coded as any ICD-9-CM procedure beginning with 74.0 or 74.1.

ICD-9-CM defines an *elective caesarean* as a caesarean section carried out as a planned procedure before the onset of labour or following the onset of labour, when the decision was made before labour (ICD-9-CM codes 7401, 7411).

An *acute/emergency caesarean* is defined as a caesarean required because of an emergency situation—e.g. obstructed labour, fetal distress. It is best described as "when the caesarean section is performed having not been considered necessary previously" (ICD-9-CM 7402, 7412). Other types of caesarean sections were excluded from the analysis (n=32).

In this study it was assumed that there was likely undercounting of Māori in hospital data.[10] Therefore, any record that included Māori in either the event or National Health Index (NHI) ethnicity fields was identified as being of Māori ethnicity. Where individuals with multiple admissions were 'ever' recorded as Māori in any admission record, the ethnicity for all records for that individual was

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identified as Māori. All remaining records (including those with no ethnicity specified) were classified as 'non-Māori'.

A New Zealand Deprivation Index (NZDep96) scale from 1 to 10 was assigned using women's NHI meshblock. NZDep96 is an area-based measure of socioeconomic deprivation that combines (by principal component analysis) nine variables from the 1996 Census, reflecting eight domains of deprivation.[11] Each variable was calculated as the proportion of people with the specified deprivation characteristic in each meshblock in New Zealand. The ordinal scale ranges from 1 to 10 whereby 1 is assigned to the least deprived 10% of areas and 10 to the most deprived 10% of areas.

All statistical analyses were conducted using SAS version 9.1 (SAS Institute Inc, Cary, North Carolina). Caesarean section rates were calculated as proportions of all admissions of women having hospital births. Univariate associations with ethnicity and deprivation decile were examined. Data with insufficient information available to assign a deprivation decile was excluded from deprivation analyses. Chi-squared (χ^2) tests were used to test for differences in proportions. Mantel-Haenszel Chi-squared tests were used to test for significant trends.

Age is an important confounding factor as CS increases with increasing age, and the age distribution for women having babies is different for Māori and non-Māori (i.e. Māori women tend to be younger). Logistic regression models were run to examine the relationship between CS and ethnicity after adjusting for age, as well as age and deprivation. Ethnicity was entered into the models as a dichotomous variable (non-Māori vs Māori). Age and NZDep96 were included as continuous variables.

Additional models were run on a selected group of women—adjusted for maternal age, deprivation and other potential confounding factors. To control for parity and previous caesarean, this analysis was restricted to women having their first baby—i.e. no hospital delivery since 1988, and no coding of previous caesarean (ICD-9-CM 654.2).

Other available clinical variables coded on the admission with delivery included:

- Fetal presentation (malpresentation ICD-9-CM 652);
- Gestation at delivery (pre-term delivery <37 weeks gestation ICD-9-CM 644.2;
- Post-term delivery >42 weeks gestation ICD-9-CM 645);
- Multiple births (singleton ICD-9-CM V270-271 vs multiple ICD-9-CM 272-279);
- Maternal hypertension (HT, ICD-9-CM 401, 642, 796.2);
- Maternal diabetes (DM, ICD-9-CM 250, 648.0, 648.8); and
- Antepartum haemorrhage (APH, ICD-9-CM 641).

In addition, District Health Board (DHB) of women's residence was also entered into models to assess the impact of regional differences in CS on ethnic disparities.

An interaction term (ethnicity × NZDep96) was added to the models to test for any differences in the relationship between deprivation and CS for Māori and non-Māori women. Odds ratios (OR) and 95% confidence intervals (CI) are presented for non-Māori compared to Māori and for each increasing NZDep96 decile.

All odds ratios presented are for each category of caesarean section versus all other types of birth—e.g. total CS vs all else, acute CS vs all else and elective CS vs all else. For acute CS the comparison group also includes women with an elective CS birth. Models were also run estimating the odds of acute CS vs no CS. These showed similar results and are therefore not presented.

Results

From January 1997 to June 2001, there were a total of 243,539 admissions for women having hospital births (21% Māori and 79% non-Māori). The most common age group (in 5-year bands) for Māori women to give birth was 20–24 years, and for non-Māori it was 30–34 years. Thirty-two of these births involved other types of CS and are excluded from the analysis. The CS rate was 19.5% (n=47,363).

Large disparities in area deprivation were evident between Māori and non-Māori women, although both groups were slightly more deprived than Māori and non-Māori in the total population.

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Caesarean section rates, both elective and acute, were significantly higher among non-Māori women compared with Māori women (Table 1). Among women who had a CS, Māori women were significantly more likely (p<0.0001) to have an acute CS (71% of all caesareans) compared to non-Māori women (64%).

Table 1. Caesarean section by ethnicity, Jan 1997–June 2001 (number, percentage of deliveries, and non-Maori to Maori ratio)

Caesareans	Māori (M) (N=51,106)		non-Māori (nM) (N=192,401)		Ratio nM vs M (95% CI)	P values
	n	% of deliveries	n	% of deliveries		
Acute	4777	9.35	25,912	13.47	1.44 (1.40–1.48)	<0.0001
Elective	1989	3.89	14,685	7.63	1.96 (1.87–2.05)	<0.0001
Total	6766	13.24	40,597	21.10	1.59 (1.56–1.63)	<0.0001

There was a significant relationship between CS rates and deprivation (Table 2), with CS rates decreasing with increasing area deprivation for both acute and elective CS (p<0.0001, Mantel-Haenzel chi-square test for trend).

Table 2. Caesarean section by deprivation, Jan 1997–June 2001 (number and percent of deliveries)

Caesareans		NZDep96 decile										P values for trend
		1	2	3	4	5	6	7	8	9	10	
Acute	n	2557	2526	2489	2431	2361	2518	2665	2819	2864	3342	
	%	13.6	14.0	13.9	13.3	12.8	13.0	13.1	12.6	11.7	10.9	<0.0001
Elective	n	1756	1533	1489	1451	1355	1344	1307	1296	1328	1410	
	%	9.3	8.5	8.3	8.0	7.4	6.9	6.4	5.8	5.4	4.6	<0.0001
Total	n	4313	4059	3978	3882	3716	3862	3972	4115	4192	4752	
	%	22.9	22.5	22.3	21.3	20.2	19.9	19.5	18.4	17.1	15.5	<0.0001

Logistic regression modelling showed that after adjusting for age, non-Māori women were significantly more likely to have a CS birth than Māori for total, elective, and acute caesareans (Table 3). After adjusting for age and deprivation, the odds of CS comparing non-Māori to Māori reduced slightly overall and was mostly due to the stronger association between deprivation and elective CS. Adjusting for deprivation had little effect on the association between ethnicity and acute CS.

For total and elective CS there was a significant gradient by deprivation after adjusting for age and ethnicity, with a decreasing chance of CS with increasing deprivation (Table 3). This relationship was not significantly different for Māori and non-Māori.

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Table 3. Logistic regression models—odds ratios of caesarean section among all admissions of women for delivery, January 1997–June 2001

Caesareans	Variables	Age adjusted model OR (95% CI)	Age and NZDep96 adjusted model OR (95% CI)	Age and ethnicity adjusted model OR per decile (95% CI)†
Acute CS	Non-Māori:Māori	1.39 (1.34–1.44)	1.38 (1.33–1.43)	
	NZDep96 (more deprived: less deprived)			0.996 (0.992–1.001)*
Elective CS	Non-Māori:Māori	1.54 (1.46–1.62)	1.44 (1.36–1.52)	
	NZDep96 (more deprived: less deprived)			0.970 (0.964–0.976)
Total CS	Non-Māori:Māori	1.47 (1.43–1.52)	1.43 (1.39–1.48)	
	NZDep96 (more deprived: less deprived)			0.985 (0.981–0.989)

208806 observations, 34701 excluded with missing NZDep96; *Significant interaction; †linear fit from decile 1 (least deprived) to decile 10 (most deprived).

For acute CS, the results did not demonstrate a significant relationship with deprivation after adjusting for age and ethnicity (Table 3). However, modelling with inclusion of the interaction term indicated that the relationship by deprivation is significantly different for Māori and non-Māori (χ^2=6.17, DF=1, p=0.013).

Among Māori women there was a significant relationship between increasing deprivation and less likelihood of an acute CS (OR at each level of deprivation=0.981, 95%CI=0.968-0.994, p=0.0036). Among non-Māori women, there was no significant relationship between deprivation and acute CS (OR at each level of deprivation=0.998, 95%CI=0.993-1.003, p=0.49).

The association between ethnicity and CS may be confounded by other factors such as parity and clinical risk, or differential access to services. Table 4 presents analyses restricted to women having their first baby (no previous admissions since 1988) with no previous CS. There were 108,636 admissions (16% Māori, 84% non-Māori).

Among Māori women, the CS rate was 15% compared with 24% among non-Māori. The elective CS rate among Māori was 1.9% compared with 4.6% among non-Māori. The acute CS rate among Māori was 14% compared with 19% among non-Māori.

Among women having their first baby in hospital, non-Māori women were more likely to have a CS than Māori, after adjusting for age. After adjusting for age, deprivation, and other clinical factors, the OR for non-Māori compared to Māori is reduced towards one for total, elective, and acute CS—but non-Māori are still significantly more likely to have a CS birth than Māori, especially for elective CS.

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Table 4. Logistic regression models—odds of caesarean section (non-Māori [nM]: Māori [M]) among women having their first baby, with no previous CS; January 1997–June 2001

Caesareans		Age adjusted model OR (95% CI)	Age, deprivation and clinical factors adjusted model‡ OR (95% CI)	Age, deprivation, clinical factors and DHB adjusted model‡‡ OR (95% CI)
Acute CS	nM:M	1.17 (1.11–1.23)	1.14 (1.07–1.20)	1.13 (1.06–1.19)
Elective CS	nM:M	1.73 (1.52–1.96)	1.47 (1.28–1.69)	1.36 (1.18–1.56)
Total CS	nM:M	1.25 (1.19–1.32)	1.19 (1.13–1.26)	1.16 (1.10–1.23)

93374 observations, 15262 excluded with missing NZDep96 or other variables; ‡Model adjusted for age, deprivation, multiple births, fetal presentation, gestation at delivery, HT, APH, DM; ‡‡Model adjusted for age, deprivation, multiple births, fetal presentation, gestation at delivery, HT, APH, DM, DHB.

There were no significant interactions between ethnicity and deprivation detected in these analyses.

With the addition of the DHB variable into the models, the odds of CS for non-Māori compared to Māori are further reduced towards one, particularly for elective CS. This suggests that the differences in CS seen across different DHBs may be contributing to the ethnic differences in CS seen at a national level.

Discussion

Our study shows significant differences between Māori and non-Māori for total, elective, and acute CS after controlling for deprivation, with non-Māori women more likely to have a CS than Māori women. This suggests that while deprivation may explain some of the disparity between Māori and non-Māori in CS, it does not explain it all. In addition, lower rates of CS among Māori women persist after also controlling for available clinical factors. Among women having their first baby with no previous CS, differences between Māori and non-Māori are greatest for elective CS.

Strengths of our study are that it explores ethnic disparities in CS among women having hospital births nationally, and considers the role of socioeconomic position (as measured by NZDep96) as well as other potential confounders. However, there are a number of limitations that should be considered in the interpretation of our findings.

It is likely that there is some degree of misclassification of variables. We used administrative data, which introduces the possibility of coding errors with regards to ICD-9-CM classification. Despite our attempts to minimise the undercount of Māori hospitalisations by the 'ever Māori' method of categorisation, subsequent studies using this method suggest that it improves but does not fully account for this undercount.[12] Such misclassification applies to both numerators and denominators in this study, and would therefore tend to bias disparities to the null.

Misclassification may also occur where record linkage was used to determine variable classification—e.g. parity. Duplicate or incorrect NHI numbers have been identified as affecting data quality[3] and may lead us to underestimate parity if individuals are not accurately linked to having previous births. Whether this is different for Māori and non-Māori women is unclear.

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There may also be residual confounding of the disparities in CS between Māori and non-Māori. For example, the impact of socioeconomic position on ethnic inequalities in CS may well be underestimated in our study as we only used NZDep96. This is only one measure and will not fully capture all dimensions of socioeconomic position.[13,14]

In addition, we were limited by the data available in the NZHIS dataset. For example, we could not adjust for other potential clinical risk factors such as maternal weight, smoking, and other comorbidities. Health service information such as time at booking, and maternity carer was not available. Nor could we link mother's records to those of the baby. Thus, factors such as type of carer and baby's birth weight were unable to be measured.

However, smoking, obesity, small for gestational age, and a number of other health status measures are closely correlated with deprivation[8,15–17] and their unobserved effect may be partially captured by the inclusion of deprivation. The NWH study[5] was able to control for a wider range of clinical variables. The addition of obstetric risk factors to the model in the NWH study tended to reduce the odds of Māori having a caesarean section compared to non-Maori. Therefore, the addition of other such risk factors to the current analyses may not reduce the disparity between Māori and non-Māori.

Our results are similar to those found at NWH for ethnic inequalities in elective caesarean.[5] However, we found that Māori women also had lower adjusted rates of acute CS, which was not the case at NWH. The differences in these findings may result from the use of different methods and adjustors or perhaps reflect differences at a regional compared with a national level.

Internationally, differences in CS have been examined between various ethnic groups in different countries including the United States,[18-21] Canada,[22] Brazil,[23] South Africa,[24] Norway,[25] and Australia.[26] While there is variation in the magnitude and direction of ethnic disparities in these studies, in most studies[18–20,22,24,25] ethnic differences persist after adjusting for clinical and socioeconomic factors, thus suggesting the influence of non-clinical factors.

Even taking into consideration the limitations of our study, our findings—which show ethnic differences in CS after adjusting for socioeconomic position and various clinical factors—raise the possibility that non-clinical factors may be operating.

Possible non-clinical explanations that may influence ethnic inequalities in CS have previously been suggested. These include: patient factors such as maternal request, and patient preferences and expectations;[2,7,27] provider practice[6] and the patient provider interaction;[2] and, differential access to information and care, and differential management.[2,7]

The reasons for ethnic disparities in CS are likely to be complex and multifactorial, occurring across the continuum of care and associated with wider determinants of health and inequality. We would argue, that to address any 'inequities' between Māori and non-Māori, it is important to take a broad perspective to the investigation of potential explanations.

To focus primarily on patient and Māori 'cultural' explanations risks 'victim blaming'[28] and fails to acknowledge dominant 'cultural' explanations, the role of

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providers, and structural influences of the healthcare system.[29] In addition, it does not consider wider determinants of health and inequality that influence access to care and individual risk.[30,31]

Our study shows that disparities in deprivation may partially contribute to ethnic disparities in CS. However, as a potential risk factor, ethnic disparities in socioeconomic position alone are limited as they fail to incorporate factors that lead to the unequal distribution of socioeconomic resources by ethnicity in the first place. Further research directly examining potential non-clinical reasons for ethnic disparities in CS is required within this wider context.

Finally, we note that our study does not determine appropriate CS rates for Māori and non-Māori, or whether ethnic disparities in type of delivery contribute to ethnic disparities in birth outcomes for mothers and babies. Further research is required to assess this.

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