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CLINICAL ARTICLE

The effect of midwifery care on rates of cesarean delivery

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ABSTRACT

Objective: To examine whether changing to a midwifery-led maternity service model was associated with a lower national rate of cesarean delivery. *Methods:* We analyzed trends in the rate of cesarean delivery per 1000 live births between 1996 and 2010 in New Zealand. Estimates of relative increases in rate were calculated via Poisson regression for several maternal age groups over the study period. *Results:* Rates of cesarean delivery increased over the study period, from 156.9 per 1000 live births in 1996 to 235 per 1000 in 2010: a crude increase of 49.8%. Increasing trends were apparent in each age group, with the largest increases occurring before 2003 and relatively stable rates in the subsequent period. The smoothed estimate showed that the increase in cesarean rate across all age groups was 43.7% (95% confidence interval, 41.6–45.8) over the 15-year period. *Conclusion:* A national midwifery-led care model was not associated with a decreased rate of cesarean delivery but, instead, with an increase similar to that in other high-resource countries. This indicates that other factors may account for the increase. Further research is needed to examine maternity outcomes associated with different models of maternity care.

1. Introduction

Rising rates of cesarean delivery are a cause for global concern [1]. The US rate increased from 205 per 1000 live births in 1996 to 328 per 1000 in 2009: an increase of 60% [2,3]. Similarly, the UK reported a 52% increase in cesarean rate between 1996 and 2010 (163 and 248 per 1000 live births, respectively) [4].

Cesarean delivery is associated with increased maternal morbidity, longer maternal hospital stays, and greater complications in subsequent pregnancies—including uterine rupture and placental implantation problems—as well as respiratory problems for infants [5,6].

Drivers of cesarean rates are thought to include model of care, cost of care, and threat of litigation [7]. Possible contributing factors are increasing comorbidities associated with advanced maternal age, maternal choice, and changes in practice such as cesarean delivery for breech presentation and decreased trial of labor after cesarean [5,7]. The type of provider may also influence cesarean rates, with midwives less likely than obstetricians to favor interventions such as induction and cesarean delivery [8,9].

The recent COSMOS study found that women with low obstetric risk who were randomized to midwifery care were less likely than women receiving standard care to have a cesarean delivery [10]. A matched cohort study of low-risk women attending free-standing midwifery units showed reduced maternal morbidity and fewer cesarean deliveries compared with women receiving obstetric unit care [11]. A Cochrane review of 11 trials found fewer instrumental deliveries, reduced rates of episiotomy, and less use of intrapartum anesthesia with midwifery care compared with medical-led models. However, the review reported no difference in cesarean rates between these models of care, although it suggested that more research is needed on midwifery models [12]. A recent prospective cohort study of 79 birth centers and 15 574 births in the USA found a low cesarean rate of 6.1%, compared with the estimated rate of 25% for similarly low-risk women in a hospital setting [13].

In 1990, New Zealand shifted from a model of maternity care led by medical doctors to one led by autonomous midwives [14]. Midwives in New Zealand work as independent practitioners with responsibility for all care provided to women throughout pregnancy, delivery, and the postpartum period. This service is free to New Zealand residents. Since the law change in 1990, which legalized autonomous practice for midwives, the number of women registering with a midwife lead carer increased from 53.4% of all mothers in 2001 to 78.2% in 2010 [15]. Over that time, registering with an obstetrician for maternity care dropped from 10.1% of all pregnancies in 2001 to 5.8% in 2010; registering with a family doctor decreased from 17.3% of pregnancies in 2001 to 1.6% in 2010, with the remaining women cared for by public-hospital midwives and obstetricians [15].

New Zealand is the only country that has converted to a midwifery-led service using this independent practitioner model. Prior to this shift in maternity care, cesarean rates in New Zealand had increased from

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9.6% in 1983–1984 to 11.6% in 1988–1989; before the current study period (i.e. in 1994–1995), these rates had further increased to 15.3% [16].

The objective of the present study was to determine whether the shift from a traditional medical model to a midwifery-led maternity service was associated with a decrease in cesarean rate over time.

2. Materials and methods

We examined the changes in cesarean rate in New Zealand over a 15-year period. Data on numbers of cesarean deliveries in New Zealand between January 1, 1996, and December 31, 2010, were derived from the National Minimum Dataset (NMDS), as maintained by the New Zealand Ministry of Health. The NMDS is a national collection of discharge records for hospital discharges, including reasons for each admission and procedures performed. Live birth data were collated from the registers of Births, Deaths, and Marriages (part of the Department of Internal Affairs), covering all registered live births in the study period (including home births and other births outside of a hospital setting). Formal ethics approval and informed consent were not required because only aggregate non-identifiable data were used in the study.

Women with cesarean deliveries were identified based on publicly funded hospital events with an appropriate recorded ICD procedure code (ICD-9: 74.0-74.2, 74.4-74.9; ICD-10-AM-v1: 16520-00, 16520-01, 16520-02, 16520-03).

We examined cesarean rates (number of cesarean deliveries over number of live births) first across all ages and then stratified by maternal age group (10–19 years, 20–29 years, 30–39 years, and 40–54 years). This enabled us to compare trends in cesarean rates across different age groups and to consider changes in rates independent of changes in the age profile of mothers giving birth. Calculation of crude cesarean rates per annum (both overall and in each age group) was performed using R 2.15.0 (R Foundation, Vienna, Austria) and plotted using ggplot2. Confidence intervals for crude rates and age-stratified rates were calculated on the log-rate scale (using the δ method) [17]. *P* values less than 0.05 were considered to be statistically significant.

Changes in cesarean rates over time (within each age group) were calculated using Poisson regression. The Poisson regression estimation process calculated change over time, taking into account data from all years, to produce a smoothed estimate of change for each 5-year period. This method produced a more stable estimate than calculating the rate change for 2010 relative to 1996, for which the result would be unduly influenced by data in those 2 years to the exclusion of information from all intervening years.

For presentation purposes, these changes are summarized within 3 contiguous 5-year time periods (1996–2000; 2001–2005; 2006–2010), as well as across the entire period. We used a likelihood ratio test to formally test whether differences in trends were significant across age groups (testing an age group–time interaction).

3. Results

There were 888 572 live births, including 188 149 cesarean deliveries, during the study period. The annual crude (i.e. across mothers of all ages) cesarean rates per annum over the study period are presented in Table 1. The total rates increased from 156.9 per 1000 live births in 1996 to 235 per 1000 in 2010: a relative increase of 49.8% between these 2 years (the smoothed estimate, taking into account rates in the intermediate years, gives a relative increase of 43.7% over this period; Table 2). Rates increased substantially between 1996 and 2002, but from 2005 onward the rates fluctuated around 230 cesarean deliveries per 1000 live births.

Trends in cesarean rates over time are presented stratified by maternal age in Fig. 1. The steepest increase was among women aged 40–54 years (a smoothed increase over the study period of 49.7%); however, increases in cesarean rates occurred across all age groups in the study period.

Table 1
Rate of cesarean delivery per 1000 live births, 1996–2010.

Year	Number of cesarean deliveries	Number of live births	Crude cesarean rate per 1000 live births (95% confidence interval)
1996	9009	57 434	156.9 (153.7–160.1)
1997	9498	57 734	164.5 (161.2–167.9)
1998	10 088	55 521	181.7 (178.2–185.3)
1999	10 551	57 421	183.7 (180.3–187.3)
2000	11 488	56 994	201.6 (197.9–205.3)
2001	11 915	56 224	211.9 (208.1–215.8)
2002	12 114	54 515	222.2 (218.3–226.2)
2003	12 585	56 575	222.4 (218.6–226.4)
2004	13 070	58 722	222.6 (218.8–226.4)
2005	13 355	58 726	227.4 (223.6–231.3)
2006	14 406	60 273	239.0 (235.1–242.9)
2007	14 856	65 117	228.1 (224.5–231.8)
2008	14 880	65 332	227.8 (224.1–231.4)
2009	15 132	63 285	239.1 (235.3–242.9)
2010	15 202	64 699	235.0 (231.3–238.7)

Table 2 summarizes smoothed relative increases in cesarean rates within each 5-year period by age group (estimated using Poisson regression). Estimates of change across the 15-year study period are also reported stratified by age group. Cesarean rates increased across all age groups in the first period (1996–2000), with increases ranging from 23.7% for women aged 30–39 years to 29.6% for those aged 10–19 years. The rate changes were not significantly different across age groups (interaction likelihood ratio χ^2 [3 df] = 0.67; $P = 0.881$).

For the second period (2001–2005), there were significant differences between the changes in cesarean rates across age groups (interaction likelihood ratio χ^2 [3 df] = 10.97; $P = 0.012$). The 2 older age groups (30–39 and 40–54 years) had significant increases in cesarean rates (6.6% and 15.6%, respectively), while the rates for younger mothers did not change significantly (−1.3% and 0.6%, respectively for 10–19 and 20–29 years). In the final period (2006–2010), no significant trends were apparent for either increases or decreases in rates in any age group (Table 2) and there were no significant differences in changes across age groups (interaction likelihood ratio χ^2 [3 df] = 3.71; $P = 0.294$).

4. Discussion

The introduction of independent midwifery care in New Zealand was not associated with decreased cesarean rates. Rather, the rates of cesarean delivery increased over the study period, from 156.9 per 1000 live births in 1996 to 235 per 1000 in 2010: a relative increase of 49.8%. The smoothed estimate (taking into account rates in intermediate years) showed that the increase in cesarean rate across all age groups was 43.7% (95% confidence interval, 41.6–45.8). This is equivalent to a 2.6% increase on average per annum.

This rate of increase in cesarean delivery is comparable to the 46.5% increase in Canada and the 52% increase in England [4] but less than the 62% increase in Australia and the 60% increase in the USA over the same period of time [18,19]. By contrast, Finland and Iceland saw virtually no change in the rate of cesarean delivery between 1996 and 2010 [18]. Although several of these countries have a significant number of deliveries conducted by midwives, no country other than New Zealand has a fully independent midwifery-led service. The present results are consistent with the Cochrane review that found no change in cesarean rates with midwife-led models of maternity care compared with other models [12].

There were limitations to the present study. It could not distinguish between primary and repeat cesareans, and it did not control for clinical demographics such as obesity. Previous studies have found that the rate of primary cesarean contributes to approximately 50% of the increase in cesarean rates [5,20,21]. The present results cannot be generalized to other midwifery models internationally, which may involve differing education and protocols of practice.