

Trends in Caesarean Section Rates at a Maternity Hospital in Mumbai, India

A. Mehta¹, L. Apers², H. Verstraelen², and M. Temmerman²

¹Department of Gynaecology and Obstetrics, Nowrosjee Wadia Maternity Hospital, Bombay, India; and ²International Centre for Reproductive Health, Ghent University, Belgium

ABSTRACT

The steady rise in caesarean section rates is an emerging area of concern in mother-child healthcare and a matter of international attention, since the trend is no longer confined to western industrialized countries. Crude and caesarean section-related perinatal mortality and case-fatality rates may well serve as public-health indicators. Monitoring time-trends in caesarean section rates has been considered a useful approach in the recognition of this rapidly-changing health policy and in estimating the magnitude of this problem. The study examined the observed time-trends in caesarean section rates in relation to perinatal mortality rates and maternal case-fatality rates in a hospital setting in Mumbai, India, using 1957-1998 data on retrospective cohort. Both overall rates and those specific to type of delivery were assessed. During 1957-1998, the caesarean section rates in the Nowrosjee Wadia Maternity Hospital (NWMH) increased from 1.9% to 16%, with the most significant rise over the past decade. The perinatal mortality rate showed a significant reduction from 69 per 1,000 in 1957 to 36 per 1,000 in 1992 and remained steady in the 1990s despite the higher caesarean section rates. The caesarean section rate in the NWMH rose by almost 10-fold during 1957-1998. No improvement in perinatal outcome was observed beyond a caesarean section rate of 10%, but the perinatal mortality rate in caesarean births increased significantly due to a more liberal use of caesarean sections in preterm deliveries and those that yielded low-birth-weight babies.

Key words: Caesarean section; Foetal death; Neonatal mortality; Infant mortality; India

INTRODUCTION

What has already been described as the "caesarean birth epidemic" (1) may now well be considered a true pandemic emerging issue in mother-child healthcare. A recent leading editorial stressed that the rise in caesarean section is now a matter that deserves international attention (2), since the trend is no longer confined to western industrialized countries.

Noteworthy in this respect is the study by Belizan *et al.* reporting on caesarean section rates in 19 Latin

Correspondence and reprint requests should be addressed to: Dr. Marleen Temmerman
International Centre for Reproductive Health
Ghent University Hospital
De Pintelaan 185, P3, Ghent
Belgium
Email: marleen.temmerman@rug.ac.be
Fax +32 9 240 3867

American countries, revealing caesarean section rates ranging from 16.8% up to 40% in 12 of these countries (3).

Other reports from developing countries, albeit scarce, are often based on vital statistics in providing crude population-based caesarean birth rates. However, caesarean rates tend to vary widely with clinical and sociodemographic factors of patients and attitudes of health providers. Hence, it has been suggested that national caesarean delivery rates do not reflect what is happening locally (4), supporting the trend toward monitoring rates at the level of individual hospital or physician (5).

The use of caesarean rate as a clinical indicator for healthcare quality has been the subject of an ongoing debate (6-12), albeit much of the controversy has focused on high caesarean rates in the USA and the UK. Yet,

from a public-health perspective, WHO (13) endorsed the principle that there is no region in the world where a population-based caesarean section rate exceeding 15% of all live-births is justified. Even when the rate put forward by WHO was set as an arbitrary upper limit, it is an interesting concept in itself, as it may be considered a 'threshold', beyond which the benefits of performing caesarean section are no longer outweighing short- and long-term morbidity and mortality associated with the actual procedure.

An assessment of the patterns and trends over time in caesarean section rates and maternal-perinatal mortality rates might be useful to analyze the past, current and future caesarean section scenario, which may help in advising healthcare providers about optimal caesarean section rates. With this background, a study was undertaken to assess and compare time-trends in caesarean section rates and their association with maternal case-fatality rates and perinatal mortality since 1957 at the Nowrosjee Wadia Maternity Hospital, Mumbai, India.

MATERIALS AND METHODS

The Nowrosjee Wadia Maternity Hospital (NWMH), a semi-private teaching hospital in obstetrics and gynaecology, is the single largest maternity facility in Mumbai (Bombay), accounting for approximately 5% of all births in the district of Mumbai. Nearly 10,000 births were registered annually throughout the study period. The precise catchment area is difficult to delineate, as women attending the NWMH virtually come from all over the city of Mumbai. Ninety-nine percent of these women are booked in the antenatal clinic of the NWMH, while 0.3% receive antenatal care elsewhere, and another 0.7% arrive for an unbooked 'emergency delivery.' The number of NWMH antenatal-care attenders who deliver at home or elsewhere is unknown, but is considered low by the health staff. As the hospital does not have a maternal intensive care unit, pregnant women with obstetrical, medical or surgical complications are referred to the K.E.M. Hospital, a tertiary care-level municipal teaching hospital. However, the NWMH has good emergency obstetric services, including blood-bank facilities and anaesthetic services. Its Newborn Intensive Care Unit is adequate, and round-the-clock service is guaranteed.

Relatively small percentages of poor women come to the hospital. The hospital rather caters to the need of

mainly rich, low-middle to mid-middle classes of the population. The literacy rate of women attending the NWMH is over 90%, with the majority having secondary or higher-level education. The educational status of the parturients shows that 8.9% did not have any formal education, 3.7% had primary-level only, 54.4% had secondary-level education, and 33.0% had higher education.

All basic obstetric, perinatal and neonatal data of 1957-1998 as recorded in the hospital files were compiled in annual reports throughout the entire study period. Published materials on these (interim analyses) were also used as an additional source to the current analysis (21,22). Separate analyses were made for 1991 to 1998 based on the 'Minimum Obstetric-Neonatal Record' database from Sir Ness Wadia Research Centre of the NWMH. All information was collected by the first author, who is a physician at the NWMH.

From the early 1990s, data were stored in a computer database on 'Minimum Obstetric-Neonatal Record' at Sir Ness Wadia Research Centre of the hospital. Data from earlier registers were entered into a database. Data were analyzed using the EPI Info[®] (version 7.0) statistical package. When found appropriate, simple Pearson's chi-square test of significance was applied for time-trend analysis.

RESULTS

From the late 1950s to the mid-1970s, only a small but discernable rise in the caesarean section rate was observed, when the caesarean section rates rose from less than 2% to just over 3% (Fig. 1). This slowly-evolving trend was followed by a far sharper incline in the late 1970s onward. Where caesarean sections at this maternity facility remained at a rather steady rate during the first half of 1970s at about 3%, the caesarean section rate reached a level of more than 8% of all births by the end of 1980s. However, from 1990s onward, even a more accelerated rise in the caesarean section rate was observed from 9% to 16% in less than a decade.

During the first half of the study period, rates of instrumental vaginal delivery (through forceps or vacuum extraction) were comparable to caesarean rates and showed similar trends (Fig. 2). These rates were less than 2% during the late 1950s and increased to about 3% during the mid-1970s. During this period, vacuum extraction was not performed at the NWMH. Hence, forcep-aided deliveries entirely accounted for the observed operative vaginal delivery rates. From the mid-1970s to the early

1990s, the operative vaginal delivery rate increased from 3% to over 6%. Vacuum extraction was introduced in practice in the early 1980s, and its application gradually increased at the NMWH till its rate nearly equalled the

Figure 3 presents the overall perinatal mortality rate (PNMR) per 1,000 births and the caesarean-related PNMR (perinatal mortality rate per 1,000 caesarean sections).

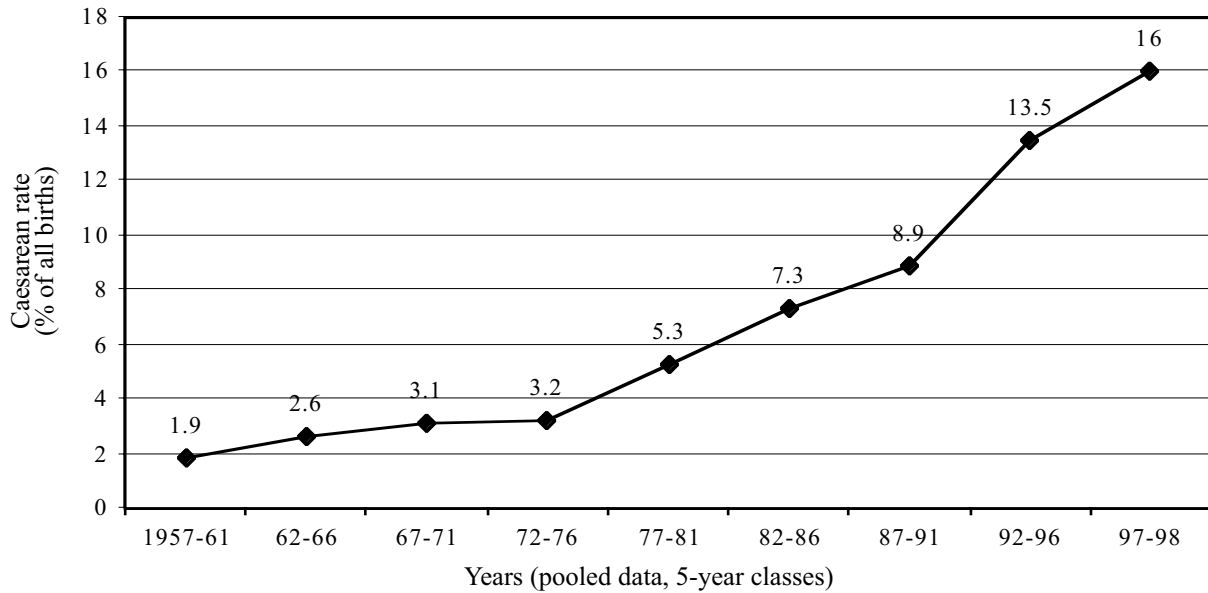


Fig.1. Time-trends in caesarean rates at NMWH, 1957-1998

forcep-aided delivery rate in the beginning of 1990s. The slow but steady rise in instrumental vaginal deliveries has generally been attributed to more active management of the second stage of labour with intrapartum foetal distress as the major indication.

Overall, the PNMR showed a slow but steady decline over the entire study period. However, the decline was most pronounced during the first half, reflecting general achievements and improvement in both obstetrical and neonatal care. During the same period, i.e. from the late

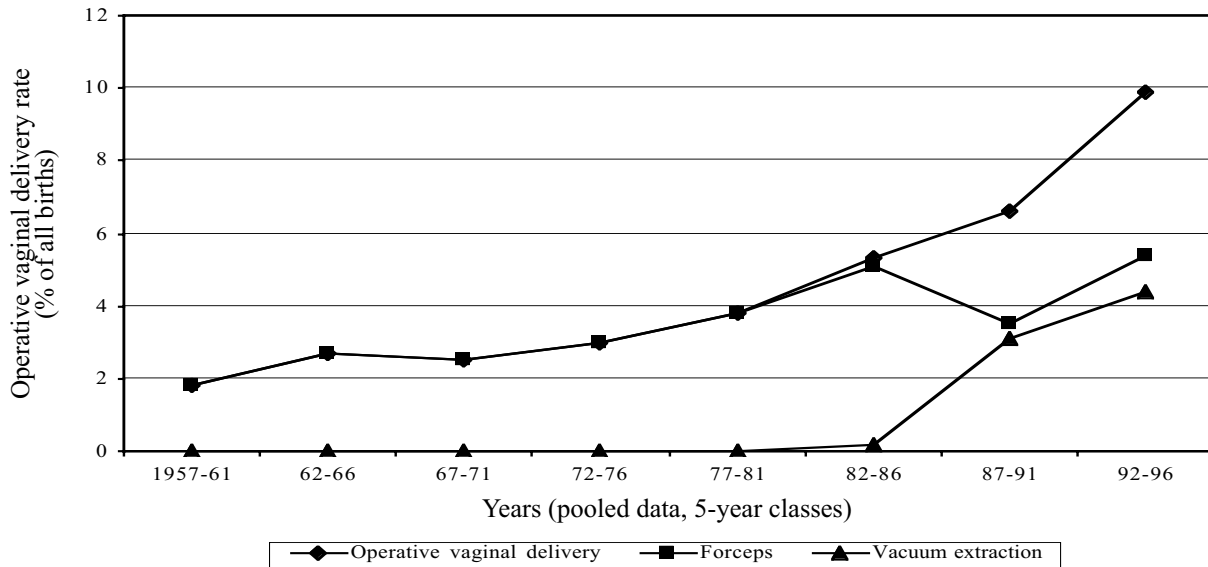


Fig. 2. Time-trends in operative vaginal delivery at NMWH, 1957-1996

1950s to the mid-1970s, when caesarean section was mainly performed for maternal indications, the caesarean-related PNMR showed an even sharper decline.

the PNMR in the caesarean section cases increased slightly. Hence, we observed no reduction at all in the PNMR over the past decade despite the significant rise in caesarean rates at this centre.

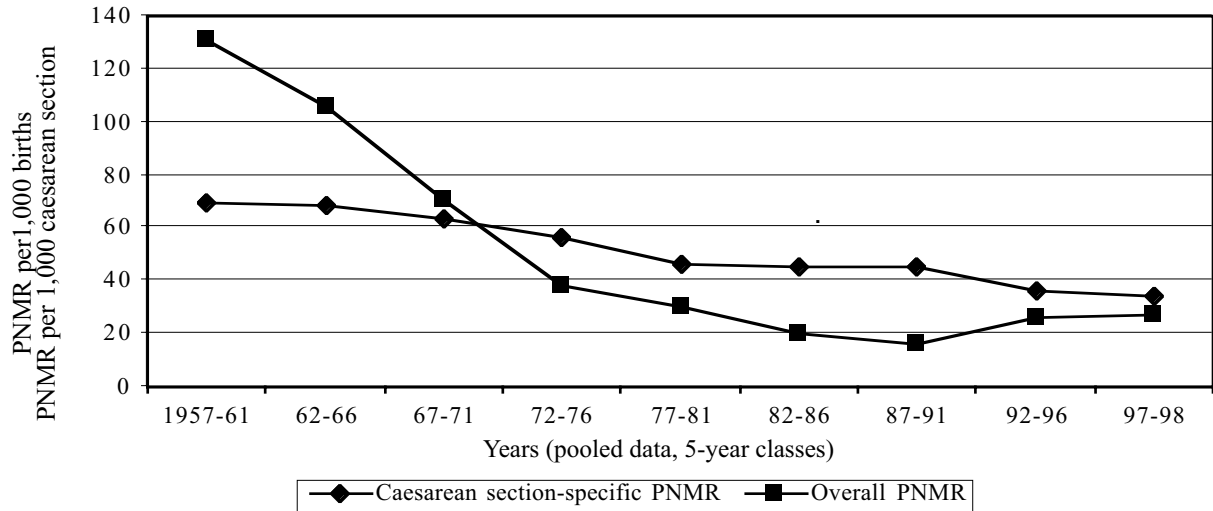


Fig. 3. Trends in perinatal mortality rates at NMWH, 1957-1998

It was not until the late 1970s that a distinct transition could be seen when foetal survival became an indication for caesarean section, followed by a significant reduction in the PNMR, particularly in the caesarean section cases.

Finally, as shown in Fig. 4 and Table 1 and 2, both case-fatality rate and maternal mortality rate have changed to a considerable extent over the study period. As mentioned above, technical aspects relating to the actual obstetrical procedure, such as improved acquaintance with the surgical procedure, increasing availability of peroperative IV antibiotics, better blood-bank facilities, and safer anaesthesia, undoubtedly played a pivotal role in the latter observations. Although there was an apparent lowering of the overall maternal mortality rate over the

While the reduction in perinatal mortality continued and perinatal outcome in caesarean section cases showed dramatic improvement, it is important to note that from the late 1980s to the end of the study period, the spectacular rise in caesarean section rate was not associated with any improvement in the PNMR. In fact,

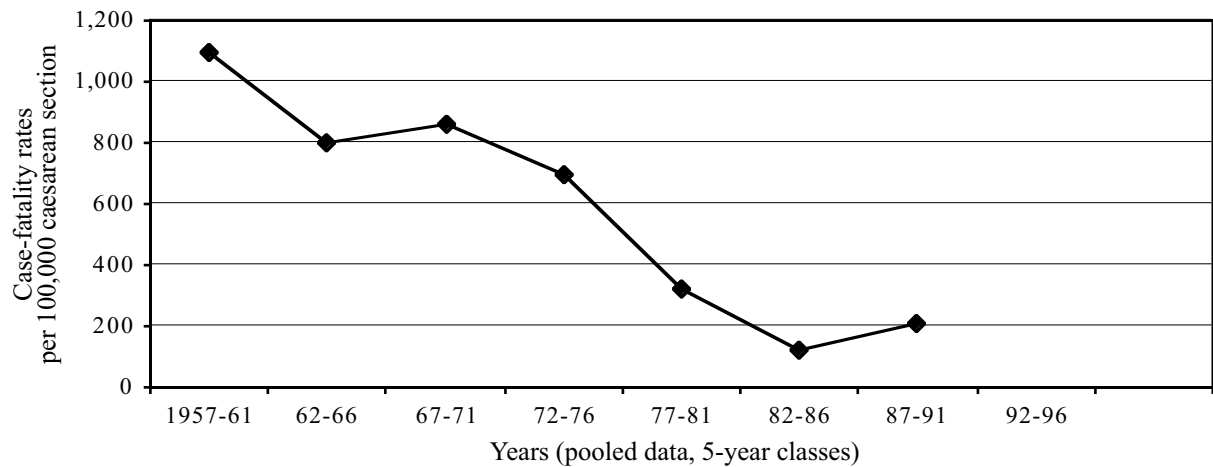


Fig. 4. Case-fatality rates for caesarean section at NMWH, 1957-1996

years, one cannot draw any clear conclusions as the overall number of maternal deaths was relatively low. Since most critical patients were transferred to the K.E.M. Hospital for intensive care, maternal deaths in these transferred women were not recorded at the NWMH. Thus, both maternal mortality rate and case-fatality rate at this hospital did not give accurate assessment of maternal mortality at the NWMH. It would be interesting and worthwhile to maintain a separate register for recording of follow-up and outcome details of these transferred women, as this information would be useful in evaluating case fatalities at the NWMH.

DISCUSSION

At the NWMH, the caesarean section rate increased from 1.9% to 16% in 40 years, but without any improvement in overall perinatal outcome beyond a caesarean section rate of 10%. The figures provided are hospital-based and do not necessarily reflect what is happening in the community. The percentage of hospital deliveries in Mumbai is unknown, and the people attending the

NWMH are probably not a representative cross-section of the overall population. Hence, comparison with settings of other countries is difficult. However the strength of these data rests on the extended period of time with consistent data collection on large numbers of women giving birth at the same place. Weaknesses include potential selection biases because of more middle-class women attending the NWMH, calculation errors because of missing denominators, and the different registration methods used over time. Nevertheless, we are reasonably confident that the figures on their own are interesting and concur with trends in other countries.

Caesarean section rates have increased also in many other countries. In the USA, caesarean birth rate rose from 5.7% to over 21% during 1970-1984, followed by a levelling of phase at about 24% in the early 1990s (23-25), and in Brazil, rates of over 40% have been reported recently (3). On the contrary, caesarean deliveries remained constant at around 4% at the National Maternity Hospital, Dublin, from 1965 to 1975, and increased only marginally to nearly 5% in the early 1980s

Table 1. Trends in caesarean section rate, perinatal mortality rate, and case-fatality rate at NWMH, 1957-1998

Year	CS rate (%)	Overall PNMR (per 1,000 births)	PNMR in CS cases (per 1,000 CS)	Case-fatality rate (per 100,000 CS)
1957-1961	1.9	69	131	1100
1962-1966	2.6	68	106	800
1967-1971	3.1	63	71	860
1972-1976	3.2	56	38	700
1977-1981	5.3	46	30	320
1982-1986	7.3	45	20	120
1987-1991	8.9	45	16	210
1992-1996	13.5	36	26	-
1997-1998	16.0	34	27	-

NWMH=Nowrosjee Wadia Maternity Hospital; CS=Caesarean section; PNMR=Perinatal mortality rate

Table 2. Trends in caesarean section rate, maternal mortality rate, and perinatal mortality rate at NWMH, 1991-1998

Year	Caesarean section rate	Maternal mortality rate	Perinatal mortality rate
1991-1992	11.7	80	33.3
1992-1993	11.5	60	32.5
1993-1994	12.6	40	43.3
1994-1995	13.4	60	35.0
1995-1996	14.6	30	35.3
1996-1997	16.2	20	35.9
1997-1998	16.0	50	34.0
p value	<0.00001	0.10518	0.08

(25). At the NWMH, the caesarean section rate was initially lower than that in Dublin, equalled the caesarean section rate in Dublin by the mid-1970s, and even surpassed it in the early 1980s. A remarkable feature of the Dublin experience was a considerable reduction in perinatal mortality from 42 per 1,000 births in 1965 to 16.8 per 1,000 in 1980 despite the steady caesarean section rate. The extent of rise and the pattern of trends, over time, in caesarean sections have shown considerable variations from country to country, depending on many determinants of caesarean delivery.

The overall trend in caesarean sections at the NWMH, especially the initial slow incline during the

first half of the study period, is undoubtedly related to better obstetrical procedures (improved acquaintance with the surgical procedure, increasing availability of peroperative IV antibiotics, better blood-bank facilities, safer anaesthesia, etc.). Yet, technical factors alone are unlikely to account for the rise over the second half of the study period. Other non-medical factors have probably contributed to a far larger extent to the increasing performance of this procedure. Of particular interest in the NWMH setting is the impact of 'private class of patients' on the management of labour and the caesarean rate. While this group of women is at a lower risk and has better antenatal care than the background population, the trend toward caesarean section seems to be higher, probably as a result of factors relating to both patients and physicians.

Monitoring time-trends in caesarean deliveries has to take the risk-adjusted rates of caesarean births (rates standardized by patient characteristics) into account (14). Hence, in this study, further analysis of time-trends in clinical risk factors for caesarean delivery may improve the attributable risk calculation to the overall observed time-trend in caesarean rates. However, since the NMWH serves as a maternity facility with an almost continuous patient flow from its own antenatal clinic (over 99% of all patients are booked) and since patients with major obstetrical pathologies are referred to a nearby tertiary centre, the NMWH mainly operates at the primary and secondary levels. Therefore, we believe that time-trends in clinical risk factors are unlikely to have biased the observed trend in caesarean rates to a considerable extent, especially since the steepest incline was observed over a single 10-year period. Various clinical risk factors have been associated with caesarean section, the 'major' indications being dystocia or cephalopelvic disproportion, breech presentation, and 'non-reassuring' foetal heart-rate tracings. 'Minor' risk factors, epidural analgesia, and induction of labour, in particular, are more prone to have added some bias, especially in the overall rise over the entire 40-year study period.

With regard to communities experiencing the urban transition in developing countries, two risk factors, both enhancing accessibility to the medical intervention under study, are of particular interest here. First, obstetrical care in the light of increasing prosperity is characterized by a tendency toward a greater patient involvement in clinical decision-making (15-20). Sachs *et al.*, for instance, stated that "a couple's expectation of a perfect

baby, as well as a women's previous experience of difficult labor, undoubtedly also plays a part in the decision to perform a caesarean delivery" (6). Second, mode of reimbursement and type of medical insurance have been quite consistently found to affect caesarean rates, in the direction of patients with better financial means and of physicians getting larger fees for caesarean than vaginal deliveries, leading to a higher performance of operative birth. We believe that both the factors (non-medical) may have considerably contributed to the observed trend at the NMWH, although further investigation is desirable to prove this assumption. The institution being a private nursing home with patients paying an additional fee to senior medical staff may have enhanced this tendency, but potential bias is less likely to have confounded the observed trend in the steep rise over the last 10-year study period.

The perinatal mortality rate decreased significantly over three decades, but remained stable in the 1990s. In fact, an upward trend was noted with a higher PNMR in caesarean births since the early 1990s, which seems to be explained by various factors, such as privatization of care and a more liberal use of caesarean section in women with a compromised foetus.

It is concluded that the caesarean section rate has increased substantially over the last four decades in the NWMH in Mumbai up to 16% since the early 1990s. No improvements, either in maternal or in perinatal outcome, have been observed with caesarean section rates over 10%. On the contrary, the PNMR seems to increase as a consequence of trying to improve the perinatal outcome of the very low-birth-weight children by a liberal caesarean section policy.

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