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High caesarean rates in Madras (India): a population-based cross sectional study

S. Sreevidya[a,b,*], B.W.C. Sathiyasekaran[c,d]

Objective To estimate the population caesarean section rate in urban India.

Design Population-based cross sectional study.

Setting Madras City (Chennai), India.

Sample Seven hundred and eighty resident women who delivered in Madras between June 1997 and May 1999.

Methods Cluster sampling was done using streets as cluster units. Thirty clusters were selected from 1255 clusters by the probability proportion to size method and 26 women were selected randomly from each cluster.

Main outcome measures Total and primary caesarean rates.

Results Total population caesarean section rate was 32.6% (95% CI 27–38) and primary caesarean section rate was 25% (95% CI 20–30). Total caesarean section rates in the public, charitable and private sectors were 20%, 38% and 47%, respectively. Private sector deliveries had an odds ratio of 2.4 (95% CI 1.5, 3.8) of a primary caesarean section delivery in comparison with the public sector after adjustment for parity, age at delivery of mother and educational status.

Conclusions Forty-seven percent of births by caesarean section in the private sector is alarming and could implicate private sector care as the main contributing factor behind the high population caesarean section rates. Policymakers should urgently institute systems for accountability and ethical practice and regularly monitor all medical interventions, before large scale exploitation of the rural markets begins.

INTRODUCTION

In the past three decades, the rate of caesarean births has risen dramatically[1]. Although infant mortality has declined during the same period, there is little evidence that more frequent caesarean births are the cause. Chile[2] and Brazil (both developing countries) have the highest caesarean section rates in the world (40% and 37%, respectively). Many European countries like Sweden[3], Belgium and Ireland have very low caesarean rates (5–12%); yet have much better maternal and neonatal outcomes. Hence, the appropriateness of high caesarean rates continues to generate much debate. Many countries such as the USA and Canada have recognised high caesarean rates (25% and 20%, respectively)[4] as a major public health problem[5], and have instituted mechanisms to reduce these rates.

In a large study of 33 teaching hospitals in 1993 in India, caesarean rates varied from 8% to 36%[6]. Increasing rates of caesarean section are not recognised by policymakers in India, as this information is not routinely collected in a reliable way. Rates in the huge unmonitored private sector are also largely unknown. Hence, this population-based study was undertaken to determine the caesarean section rate in an Indian city and to identify factors commonly associated with caesarean section delivery.

METHODS

Madras (Chennai) is one of the largest cities in India (population: 4.7 million). The city is divided into north, south and central constituencies. This highly populated city is cluttered with hospitals; it has 110 corporation health centres, four teaching centres with attached large tertiary care centres and hundreds of private hospitals.

A population-based cross sectional study was undertaken in the south and central constituencies, which has a total population of 2.8 million. Eligible mothers were those resident women who delivered in Madras during the two-year period from June 1997 to May 1999, regardless of the place of delivery (hospital or home). All such deliveries

[a]*Epidemiology Unit, Tata Institute of Fundamental Research, Deemed University, Mumbai, India*
[b]*Institute of Community Medicine, Madras Medical College and Research Institute, Madras, India*
[c]*Department of Community Medicine, Sri Ramachandra Medical College and Research Institute, Mumbai, India*
[d]*Clinical Epidemiology Unit, Madras Medical College and Research Institute, Madras, India*

* **Correspondence**: Dr S. Sreevidya, D-304, Epidemiology Unit, Tata Institute of Fundamental Research, Colaba, Mumbai-400005, India.

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whether resulting in live or stillbirth, were considered for inclusion in the study. The EPI cluster sampling method was used for random sampling of the eligible mothers. A population-based approach was used in this study to avoid the biases inherent in hospital-based studies.

Streets were taken as the cluster unit and small streets with less population were clubbed so that the population of each cluster was approximately 2000 to 2500. One thousand two hundred and fifty-five such clusters of streets were identified in south and central Madras, from which 30 clusters were selected using the probability proportion to size method[7]. All areas (slum and other) were included in the process of cluster formation (reliable and recent street-wise population estimates were available). Assuming a population caesarean section rate of 20% and a design effect of 2 (to account for cluster sampling), it was calculated that a sample of 768 women would be required for a relative precision of 20% on the caesarean section rate, assuming a Type 1 error less than 0.05. Therefore, 26 eligible mothers were interviewed from each of the 30 clusters selected by cluster sampling, to give a total sample size of 780.

In each cluster (selected streets), the first house was selected randomly. Any eligible mother if available in the house was interviewed, after obtaining her informed consent. Adjacent houses were visited consecutively until 26 eligible mothers were interviewed in each cluster. Since each cluster in the study had a population of about 2000–2500, a complete door-to-door survey was required in most clusters to get 26 eligible mothers. If more than one eligible mother was available in a house the first contact only was selected for the study. The investigator personally interviewed all the selected mothers with a structured questionnaire and also abstracted information from the relevant medical records if available with the mother. (Hospital notes of the selected mothers were not used in this study as the sorting and compiling of records in the public hospitals is not very efficient. The records may be poorly maintained in many private hospitals and thus are not generally available to researchers.) Local health care workers who have good rapport with the population accompanied the investigator during the interviews. Women consider it a privilege to be visited by a doctor especially when it concerns mother and child health and therefore only two women declined to participate in the study. Two other women were included from the same clusters instead. Fifty eligible mothers were not available at the time of survey and the information was obtained from the grandparents caring for the children in the absence of the mother. Two maternal deaths were recorded and data pertaining to the deliveries were obtained from close relatives.

Data entry and analysis were done using EPI Info 6.0 statistical software. The caesarean section rates were found and 95% confidence intervals appropriate for cluster sampling were calculated using the CSAMPLE program in EPI Info. Odds ratios and 95% confidence intervals were used to evaluate the strength of association between the variables and caesarean rates. Logistic regression analysis was done using 'MINITAB'[8] to develop a model for the covariables. The final multivariable model included only those variables significantly associated ($P < 0.05$) with the outcome. Adjusted odds ratios with their 95% confidence intervals were derived from the estimated regression coefficients.

Definitions of caesarean rates employed:

$$\text{Total caesarean rate} = \frac{\text{total number of births by caesarean section}}{\text{total number of births}} \times 100$$

$$\text{Primary caesarean* rate} = \frac{\text{no. of primary caesarean section births}}{(\text{no. of primary caesarean births} + \text{no. of vaginal births})} \times 100$$

(excluding vaginal births after caesareans)

*A primary caesarean is a caesarean section birth to a woman who has had no previous caesarean section.

RESULTS

The mean age of the mothers at delivery was 24.6 years. Eighty-one percent of them were 20–29 years old and 11% were 30 or above (Table 1). Seventy-four percent of the mothers resided in areas other than those declared as slums. Forty-six percent of the mothers had educational level of less than 10th standard (total of 10 years of schooling) and 12% were illiterate. Thirteen percent were gainfully employed during their pregnancy. Thirty percent of the fathers were graduates or postgraduates and 37% were educated up to the 10th or 12th standard. Fifteen percent of the fathers were semiprofessionals (this includes men who have their own business) or professionals by occupation. The educational and occupational status of this sample was good, it being representative of both slum (30%) and other areas (70%) in Madras City.

This was the first delivery for 47%, second delivery for 42% and third delivery for 9% of the mothers. Forty-eight percent of the mothers received antenatal care at public hospitals, 45% in private hospitals and 7% in charitable institutions. Only 0.43% of the mothers had not received any antenatal care. Almost equal number of births had occurred in public and private sector hospitals, delivery at home being rare (Table 1). Public sector hospitals here include government and corporation hospitals where the services are provided free of cost. Private sector hospitals include corporate hospitals/nursing homes/private hospitals where services are provided on payment, and the charitable trusts, which operate at a lower profit margin. The National Program for Child Survival and Safe Motherhood has been operational here for more than a decade; hospitals are therefore easily accessible and most women access antenatal services and deliver in hospitals.

Table 1. Sociodemographic and other details of the selected mothers. Values are given as *n* and percentage.

Variables	No. of women	Percentage
Age at delivery		
<20	60	7.7
20–29	635	81.4
≥30	85	10.9
Educational status: mother		
<10th standard	357	45.8
10th standard and above	423	54.2
Area of residence		
Slum area	205	26.3
Other areas	575	73.7
Place of delivery		
Public sector hospitals	379	48.6
Charitable trusts	63	8.0
Private sector hospitals	332	42.6
Home	6	0.8
Parity		
1	370	47.4
2	330	42.3
3	73	9.4
>3	7	0.9

Two hundred and fifty-four births were by caesarean section and the total caesarean section rate was 32.6% (95% CI 27–38). Elective caesarean sections were 12.2%. The total caesarean rates increased steadily across the public, charitable and private hospitals, 20%, 38% and 47%, respectively (Table 2) (χ^2 for a linear trend = 58.25, $P < 0.00001$). The total caesarean section rate in the private sector was more than twice that in the public sector hospitals.

Six hundred and eighty-four mothers did not have any previous caesarean sections. Out of them, 171 had a caesarean section during their current delivery. The primary caesarean section rate was thus 25% (95% CI 20–30). The primary caesarean rates also showed a significant and steady increase across the public, charitable and private hospitals, 13%, 29% and 39%, respectively (Table 2) (χ^2 for a linear trend = 58.5, $P < 0.00001$).

Table 2. Total and primary caesarean section rates according to place of delivery. Values are given as *n*, percentage of caesarean section rate [95% CI] and odds ratio.

Hospital type	No. of women	Caesarean section rate [95% CI]	Odds ratio
Total caesarean rates			
Public sector	379	19.8 [16–24]	1.00
Charitable	63	38.1 [22–54]	2.49
Private	332	46.7 [41–52]	3.55
Primary caesarean rates			
Public sector	346	12.7 [9–16]	1.00
Charitable	55	29.1 [14–44]	2.82
Private	283	39.2 [34–45]	4.43

Table 3. Tubal Sterilisation according to place and mode of delivery*. Values are given as *n* (%).

Sterilisation	**No. of women**	
	Public sector	Private sector
Performed during caesarean section	7 (6.9)	9 (18.8)
Performed after vaginal delivery	94 (93.1)	39 (81.2)
Total sterilisations	101 (100)	48 (100)

* In women with at least two children and with no previous caesarian section before the index birth.

Two hundred and seventeen (28%) of the 780 mothers studied had been surgically sterilised after the index birth. Out of 316 women with two or more children and with no history of caesarean section, 149 (47%) had been surgically sterilised (tubal sterilisations in India are generally performed only on women with at least two children). Sixty-eight percent of these sterilisations had been done in the public sector (6.9% during a caesarean section) and 32% in the private sector (18.8% during a caesarean section) (Table 3). Thus, the performance of sterilisation during caesarean sections appears to be 2.7 times more frequent in the private sector compared with the public sector.

Primary caesarean section rates and odds ratios for the different age groups, educational status, parity and place of delivery are given in Table 4. High unadjusted odds ratios were found for private patients (OR = 4.1) and area of residence (OR = 4). Data relating to mothers with singleton deliveries and with no history of caesarean section were analysed using logistic regression analysis. The adjusted odds ratios for primary caesarean section were the highest for primiparity (4.4) followed by age over 30 at delivery (4.1). Parity and age at delivery, the classical obstetric variables, were thus important predictors of caesarean risk. Private patient status with an adjusted odds ratio of 2.4 (95% CI 1.5, 3.8) was a significant predictor of caesarean risk (Table 4). Area of residence was not significantly associated with the outcome ($P > 0.05$) and hence was removed from the final model. Mothers with a history of previous caesarean and those with twin deliveries (six births) were not included for logistic regression analysis as they form groups with much higher risk for caesarean.

DISCUSSION

The total caesarean section rate was 32.6% and the primary caesarean section rate was 25% in this urban Indian population. The total and primary caesarean section rates increased steadily across the public, charitable and private hospitals, with a very high rate, 47% and 39%, respectively, in the private sector. Private sector care had an odds ratio of 2.4 (95% CI 1.5, 3.8) of a primary

Table 4. The primary caesarean section rates, crude and adjusted odds ratios† by selected maternal characteristics and place of birth*. Values are given as *n*, percentage of primary caesarean section rates [95% CI], odds ratio [95% CI] and adjusted odds ratio [95% CI].

Variables	No. of women	Primary caesarean section rates [95% CI]	Odds ratio [95% CI]	Adjusted odds ratio [95% CI]
Age at delivery				
15–24	385	20 [15, 25]	1.0	1.0
25–29	230	29 [21, 37]	1.6 [1.1, 2.4]	1.8 [1.1, 2.7]
30–40	63	40 [25, 55]	2.6 [1.3, 5.0]	4.1 [2.1, 7.9]
Educational status				
<10th standard	311	14 [9, 18]	1.0	1.0
10th standard and more	367	35 [29, 41]	3.4 [2.4, 5.0]	1.6 [1.0, 2.6]
Parity				
2 and more	315	13 [9, 17]	1.0	1.0
1	363	36 [29, 43]	3.8 [2.6, 5.6]	4.4 [2.8, 6.9]
Place of delivery*				
Public sector	342	13 [9, 16]	1.0	1.0
Private sector	336	38 [32, 43]	4.1 [2.7, 6.1]	2.4 [1.5, 3.8]

* Deliveries at home and twin deliveries are not included.
† Variables significantly associated with the outcome ($P < 0.05$) are only included in the final logistic regression model.

caesarean delivery compared with the public sector after adjustment for parity, age at delivery and educational status of the mother. Surgical sterilisation was more frequently performed during caesareans in private hospitals.

In a study on immunisation status of infants in an urban upper class locality in Madras by Pai *et al.*[9], 45% of 210 babies studied had been delivered by caesarean section. The National Family Health Survey in the State of Kerala, India[10] found 1.7 times greater odds of caesarean delivery in private health institutions. Similarly, a 1995 study in Tiruvananthapuram City, India (RK Homan and KR Thankappan, 'Performance of private and Public sector hospitals in Tiruvananthapuram district, Kerala', unpublished report, UNDP/GOI/IDRC Research Project, Center for Development Studies, Tiruvananthapuram, India, 1995, 26–27) found a three times higher rates of caesarean in the private sector (30%) compared with the public sector (10%). Private patient status has been documented to be an important predictor of caesarean section in several studies[11–13] across the world. A dose–response relationship with type of care, as in this study has been reported from Brazil[14], Australia[15] and the UK[16]. Thus, the findings of this study are consistent with other studies in India and also across the world.

There is no other published study so far on the caesarean rates in the Indian urban population, based on such a large representative, population-based sample. The caesarean rates found here therefore represent the trend in caesarean use in Indian urban areas and its relationship with private sector care. Many factors related to high caesarean rates in other countries such as high private insurance rates (China)[17], widespread use of electronic fetal monitoring (US)[18], restrictive insurance policies (Chile)[19], high demand for caesarean section/illegal status of sterilisation (Brazil)[20] and high malpractice litigation rates (US)[21] are absent in India. These observations suggest that the explanation for the alarmingly high caesarean rates here should be sought for in the private organisation of obstetric care, the 'physician factor' and other incentives.

The private sector accounts for about 50% of in patient care and 60–70% of out patient care[22] currently in India. Public sector health financing is decreasing, and with the advent of private health insurance, the private sector is likely to dominate health care in India in the future. Most private hospitals in urban India have less than 30 beds[23], are run single handily by the doctor owner[24], and thus face severe economic constraints. In addition, private sector care is largely fragmented and uncontrolled[25], and clear evidence of serious quality of care deficiencies have been documented in their practices[26]. Caesarean section is one of the most common major surgical procedures, filling beds/operating rooms and is a major revenue generator. These point to economic incentives as the most important driving force behind increasing rates of caesarean section. Several studies [27–30] suggest that physicians prefer caesarean to vaginal delivery because it allows them 'to work a minimum of non-social hours'. Such less obvious incentives like convenience and leisure may motivate physicians to convince families for a caesarean section as an immediate life-saving proposition.

In the consensus conference held by the World Health Organisation in Brazil in 1986[31], it was concluded on the basis of published evidence that 'there is no justification for any region to have a caesarean section rate higher than 10–15%', for attaining the best maternal and fetal outcome. Even considering the upper limit of 15% for high risk populations, the total caesarean section rates were 217% as high in this population. This might well indicate

that a good proportion of these caesareans might not have been in the best maternal or fetal interest.

It is known that unnecessary caesarean sections do more harm than good. When all is normal with the mother, caesarean section has an eightfold higher mortality than vaginal delivery[32], 8–12 times higher morbidity[33] and a higher incidence of complications in subsequent pregnancies. These are likely to be even higher in the developing world[34]. Caesarean sections result in a higher risk of respiratory distress and prematurity in the newborn[35], delayed first contact and initiation of breastfeeding[9] and at best have only a very small impact on perinatal mortality[36]. That a low perinatal mortality rate can be achieved along with a low caesarean rate in the Indian setting is evident from data from Christian Medical College Hospital, Vellore, India, a tertiary care Centre. The caesarean section rate was 12.4% and the PNMR was 19.8/1000 during 1991–1995 (personal communications, Dr Mathai Matthews, Professor, Department of Obstetrics and Gynecology, Christian Medical College, Vellore; courtesy of Prof Jayaprakash Muliyil).

Interventions to optimise provider attitudes and dissemination of best practice are urgently required and should be based upon an understanding of factors that determine or influence provider behaviour[37] and should be sensitive to the Indian context. Safe reductions in the caesarean rates are possible, as hospital-initiated programs have reduced caesarean section use successfully[38]. The Jaipur experience (India)[39] of a large private hospital successfully reducing caesarean section rates is exceptional and worth noting where by audit, review and action and by raising the fee for a vaginal delivery, the caesarean section rate was brought down to 12% in 1991 from 23% in 1989. There is also a clear need for systems that monitor and guide health care and medical interventions in the country as a whole.

Rejuvenation of the public health system in India to make essential care affordable to the poor is essential, as a large proportion of the population cannot afford medical care. A medical and financial system, which favours midwife and general practitioner involvement in the care of low risk women, like in some European countries, could be beneficial. Studies of interventionist attitudes in physicians[40] and their economic or other basis are urgently needed to help formulate strategies for reducing unnecessary caesarean sections.

CONCLUSION

Non-medically indicated caesarean sections confer a broad array of risks to women, infants and families and cannot be justified by science or ethics. The increasing caesarean rates in urban areas (25.7% of the Indian population) should be recognised as a public health problem, as it could contribute significantly to maternal and infant morbidity and mortality and also multiply the cost of maternal and child health care. Political commitment to enhance accountability of providers and nationwide clinical leadership from doctors towards evidence-based and ethical practice would now be timely, ethical and in the best interest of patients. The barriers to effective change lie not in our technical knowledge, but rather in the intention to achieve safe reductions in the caesarean rate and to apply the available scientific evidence towards that aim. However, when appropriate clinical indications are present, caesarean section should be rapidly performed to ensure a positive maternal and infant outcome.

The caesarean rate found in this study indicates that India is already headed towards a costlier, technology driven and interventionist medical care system. This problem of overutilisation of interventions the world over is not limited to caesarean sections. Interventionist attitudes are detrimental to the health and economic wellbeing of the society and should be urgently addressed. Embracing neglected public health goals and ensuring equity and accessibility of care for all sections of the population is the most efficient way to bring better health to the people.

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