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Delivery-related complications and determinants of caesarean section rates in India

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Caesarean section rates have been increasing worldwide, raising the question of the appropriateness of the selection of cases for the procedure. This paper examines the levels and correlates of delivery-related complications and caesarean section deliveries in 18 selected states of India in terms of specific maternal and institutional factors, using data from the National Family Health Surveys, 1992–93. Goa (15.3%) and Kerala (13.7%) were the two states with relatively higher caesarean section rates. There is reason to believe that current rates are part of a rising trend. This cannot be attributed entirely to the rise in institutional deliveries alone because of the strong association between caesarean sections and private sector institutions. Apart from the fact that the states of Kerala and Goa have relatively high caesarean section rates, in Andhra Pradesh, Bihar, Gujarat, Karnataka, Punjab and Uttar Pradesh the risk of undergoing caesarean section in private sector institutions is four or more times that in the public sector. It is possible that this extremely useful surgical procedure is being misused for profit purposes in the private sector in several states. There is therefore a need to examine this phenomenon using data disaggregated by the nature of caesarean sections, i.e. whether it was an elective or an emergency caesarean section along with the reasons for the choice.

Key words: delivery complications, c-section, maternal, institutional, India, public/private sector

Introduction

Surgical interventions during pregnancy are usually performed to ensure safety of the mother and child under conditions of obstetric risk. They are justified under certain circumstances such as cephalo-pelvic disproportion and contracted pelvis, dystocia due to soft parts, inadequate uterine forces, antepartum haemorrhage, pre-eclamptic toxaemia, eclampsia, foetal distress and prolapse of the cord, malpresentation, maternal diseases such as heart problems, bad obstetric history, habitual intra-uterine death of the foetus and elderly primigravida (Cunningham et al. 1989).

Besides these medical reasons, certain factors related to institutions and physicians have also been found to be associated with high caesarean section (c-section) rates. The availability of facilities and trained obstetricians was found to be associated with the performance of a caesarean (Kabra et al. 1994). The source of payment for the delivery (Stafford 1990; Betrollini et al. 1992; Haas et al. 1993) and the place of birth, i.e. whether it was a private or a public sector institution (Peterson 1990) also influenced the performance of c-sections. The incidence of caesarean deliveries in Belo Horizonte, Brazil was found to be strongly associated with the occurrence of the delivery in a private hospital as opposed to a public facility (Chacham and Perpetuo 1998).

The physician factors that affect c-section incidence include physician practice styles (Goyert et al. 1989), the obstetrician's clinical attitude and fear of litigation (Belizan et al. 1991), the physician's convenience (Gomes et al. 1999) and supervision by a private physician (De Regt et al. 1986).

C-sections are, however, not entirely related to health facility or physician related factors alone. Patients' demand constituted the third commonest reason for an elective c-section in the UK in 1992 (Atiba et al. 1993). Some of the reasons for such demands could be the need to avoid labour pain or the belief that vaginal delivery will spoil a woman's future sexual performance and her husband's pleasure (Mello e Souza 1994). In India, the need for births to occur at a predetermined auspicious time on the astronomical calendar resulted in a patient demand for c-sections (Kabra et al. 1994).

While c-sections are done to improve parturition outcomes, this surgical intervention also carries accompanying risks. For example, it has been established that maternal morbidity is higher following a c-section compared with vaginal delivery. The main causes for this higher morbidity are related to surgical or anaesthetic problems, puerperal infections, antibiotic therapy, blood transfusions, increased length of hospital stay, length of convalescence and possible psychological impacts (Baskett and McMillen 1981; Sachs et al. 1983; Danforth 1985). There is evidence to indicate that maternal mortality following c-sections is also higher than mortality following vaginal deliveries (Hall 1994).

C-section deliveries have other serious implications for the health of women undergoing them. The uterine scar thus caused may prove to be weaker in successive pregnancies resulting in increased maternal morbidity (Mudaliar and Menon 1978) or in rare cases infertility (Schenker and Margalioth 1982). Also, in the case of an elective c-section, if not properly timed (that is before the onset of spontaneous labour), neo-natal problems because of 'iatrogenic

prematurity' and respiratory distress syndrome due to pulmonary immaturity may ensue (Bowers et al. 1982).

Therefore the performance of a c-section is justified only when obstetric risks outweigh the risks of the procedure itself. Given the increasing trend towards institutional deliveries and antenatal measures for early detection of potential obstetric problems, it is expected that the incidence of childbirth related problems as well as the need for c-section deliveries would decline. However, there has been an increasing incidence of c-section deliveries worldwide (Biggs 1984; Nortzon 1990). This increasing trend raises the question of appropriateness in the selection of cases for c-section (Nortzon et al. 1987; Pai 2000).

C-section delivery was the most common surgical procedure among women in the US, being found to account for 24.4% of all deliveries in the US (Stafford 1990). In Europe, high c-section rates, with a statistically increasing time trend over the period 1985–87, were reported from Italy (Bertollini et al. 1992). A study in England revealed a 14% c-section rate for a 6-month period between March to August 1992 (Atiba et al. 1993), and this is not a low c-section rate either.

C-section rates have been increasing in the developing countries with increasing institutional deliveries and growing access to gynaecological and obstetric care. Similar trends have been reported from the Latin American region. In Brazil c-section rates have increased from 30.3% in 1978–79 to 50.8% in 1994 (Gomes et al. 1999). In Chile c-section rates have risen following a comprehensive privatization programme during the 1980s when the private insurance sector of the market also rose. C-section rates increased from 27.7% in 1987 to 37.2% in 1994 (Murray and Pradenas 1997).

The Indian scenario

A study in Jaipur showed that c-section rates in a leading private hospital rose from 5% in 1972 to 10% in the late 1970s and to 19.7% between 1980–85. The rates were as high as 23% in 1989 (Kabra et al. 1994). In Chennai City the c-section rate was reported to be 45% of all live births, based on reporting by mothers of 210 children aged 12–36 months, a level that is considered unjustifiable (Pai et al. 1999).

A rising trend in c-section rates, from 11.9% in 1987 to 21.4% in 1996, has also been reported from Kerala, the state with the best demographic characteristics and access to health care within India (Thankappan 1999). Another study on c-section delivery rates in Kerala has indicated that they are more likely to occur in private health-care institutions (Padmadas et al. 2000).

Objectives and data

Objectives

This paper proposes to analyze delivery-related complications and c-sections in selected states of India and to examine their correlates in terms of selected maternal and institutional factors. An analysis of community level data collected using a household survey would provide a clear picture of the existing situation and help to identify medical and non-medical factors associated with this phenomenon.

Data

The Indian National Family Health Survey (NFHS) 1992–93 provides information on reported delivery-related complications[1] for live births occurring during a 4-year reference period preceding the survey (IIPS 1995). This is a large-scale survey commissioned by the Government of India and funded by USAID to provide estimates of fertility and its correlates at the state level (for more details see IIPS 1995).

C-sections have been listed as one of several delivery-related complications experienced by women. Use of the NFHS data limits this study to births that occurred during the past 4 years. As a consequence, the data have been biased in favour of younger women and lower order births. But on the other hand this gives a picture of the current scenario of maternity experience of Indian women. The survey also lists the nature of delivery-related complications such as long period of labour, use of forceps for delivery, excessive bleeding, delayed delivery of placenta and c-section for delivery.

Details regarding c-sections were available only for women who reported delivery-related complications for deliveries that occurred during the 4-year reference period. These reports of delivery-related complications are based on self-reports and not verified by alternative sources such as medical records. However, since the 4-year recall period is short enough to prevent severe recall lapse, this analysis has been undertaken. It is also possible that such reporting by women regarding delivery-related complications will be based on self perceptions, and women's perceptions of prolonged labour, excessive bleeding or delayed delivery of placenta may vary. But it is unlikely that women would misrepresent/misunderstand a surgical procedure such as c-section, or a minor intervention like the use of forceps, as there is evidence to indicate that women's reports about the birth process with respect to matters like the sex of the child and duration of labour were indeed more accurate than the researcher-perceived 'gold standard' of medical records (Oakley et al. 1990).

In addition the data have been analyzed with the underlying assumption that errors in reporting have been uniform over the different states, as women are less likely to misreport a c-section regardless of their background. Two sets of factors have been considered, one set that concern the wellbeing of mother vis-à-vis maternal factors and the other set consisting of institutional factors that concern the availability/utilization of medical services.

Maternal risk factors for pregnancy complications and c-sections

Maternal age

Women who deliver at ages below 18 years or in later ages, i.e. beyond 35 years, are said to be at high risk for

delivery-related complications, c-sections (Bottoms et al. 1980) and pregnancy outcomes (Hobcraft et al. 1984). Other individual characteristics like education, working status and income levels have not been considered because it has been found in other countries that these variables operate through age and parity. For instance, highly educated women postpone first births and are thus more prone to have caesarean delivery (Hurst and Summey 1984; Parazzini et al. 1992). In general, both primiparae and older mothers are likely to have pregnancy complications that may lead to delivery by c-section. In addition older women tend to have more complications during pregnancy and delivery, and also tend to have bigger babies (Adasekh et al. 1993). C-sections are more common among older women because doctors tend to perform them for older women, especially older primiparae, even in the absence of complications (Peippert and Bracken 1993).

Both younger and older women are at risk of having delivery complications and this has been captured using a categorization as 'high-risk age' including deliveries that occurred before 18 or after 35 years and categorizing deliveries at other ages as low risk.

Maternal parity

Since primiparae are found to have greater risk for pregnancy complications, the variable birth order, classifying all births into two groups (first order births and others), was constructed to include this feature.

Institutional correlates of pregnancy complications and c-sections

Apart from maternal factors, institutional factors such as the availability and utilization of health care services have been considered for the analysis of the co-variates of pregnancy complications and c-sections. These include use of antenatal care, the residential location of the woman, whether the delivery was in an institution or at home, and if the birth occurred in an institution, whether the institution belonged to the private or the public sector.

Antenatal care

When a higher proportion of women receive antenatal care, it is expected that more women will be brought within the ambit of the health services. Antenatal care is hypothesized as identifying women who are at risk of having pregnancy-related complications and therefore results in higher incidence of elective c-sections. Even though information on the number and timing of antenatal care visits is available in the NFHS 1992–93, for analytical convenience this variable has been constructed on the basis of the self-reports of the women as to whether or not the pregnancy under consideration received antenatal care.

Institutional deliveries

Institutional deliveries would result in use of medical intervention in order to facilitate better outcomes. This would involve use of surgical procedures such as c-sections when necessary and therefore we would expect a higher proportion of institutional deliveries to be associated with a higher proportion of reported pregnancy complications and also c-section deliveries.

Woman's residential status

The women's residential status has been included as part of the analysis. This is because access to medical institutions is governed by rural or urban residence. In most states of India, there are more medical institutions in urban areas where institutional deliveries are quite possible, along with a higher proportion of reported pregnancy complications and c-sections.

Public/private facility

It was mentioned earlier that there has been an increase in c-sections associated with the type of institution, i.e. whether the institutions are in the private sector or public sector. Since private sector institutions have profit motives, it is possible that c-sections are sometimes performed even if not medically required. This is because a c-section delivery involves an extended stay in the hospital in comparison with vaginal delivery and this results in extra costs for the stay and other related services. Also, if there were differentials in the quality of services and legal mechanisms associated with public and private facilities, this would also influence the choice of surgical interventions like c-sections in the private sector.

Methodology

As a preliminary exercise the women reporting delivery-related complications were classified by type of complication (Table 1) and this was followed by a computation of c-section rates across the different states (Table 2).

For each of the covariates identified, the associations with delivery-related complications and c-sections have been examined using simple bivariate χ^2 analysis. These results are presented in Tables 3 and 4, respectively.

Apart from the bivariate analysis of c-sections by specific characteristics, a logistic regression model was used to study the link between the place where the birth took place (public or private facility) and delivery by c-section. This analysis was done to understand the relationships between the individual independent variable and the practice of c-sections, while controlling for the effects of other maternal and institutional factors. It should be remembered that these results are based on small sample sizes (with respect to c-sections in some states) and can only be taken as indicative and not conclusive. Further, it should also be remembered that multi-collinearity between the independent variables (even though two-by-two χ^2 tests were not statistically significant) may also cause some distortion in the results of the multivariate analysis. The results of this analysis are presented in Table 5 for all the 18 states considered here.

Table 1. The distribution of delivery complications in selected states, National Family Health Survey, India, 1992–93

States	C-section (%)	Use of forceps (%)	Excessive bleeding (%)	Long period of labour (%)	Delayed delivery of placenta (%)	Others (%)	Total no. of women
Andhra Pradesh	30.80	12.05	7.14	45.54	9.38	2.23	224
Assam	21.30	13.89	4.63	51.39	4.63	6.02	216
Bihar	9.67	3.04	10.50	72.65	6.91	1.93	362
Delhi	35.44	7.28	9.71	44.17	5.83	4.85	206
Goa	54.55	10.06	7.79	30.52	2.60	1.95	308
Gujarat	37.29	11.86	8.47	40.68	3.39	4.24	118
Haryana	24.81	4.51	4.51	63.16	0.75	3.76	133
Himachal Pradesh	10.65	6.02	9.26	69.44	2.78	6.02	216
Karnataka	30.20	7.84	5.88	45.88	8.63	3.92	255
Kerala	58.52	6.87	11.26	24.73	3.30	1.92	364
Madhya Pradesh	11.21	6.54	28.97	48.13	6.07	12.62	214
Maharashtra	25.99	7.58	11.91	42.60	7.94	13.36	277
Orissa	10.32	4.37	9.13	67.46	21.03	2.38	252
Punjab	38.76	5.43	4.65	46.51	5.43	3.10	129
Rajasthan	9.80	1.96	31.86	47.55	15.20	2.45	204
Tamil Nadu	39.64	23.64	2.91	28.73	4.36	4.36	275
Uttar Pradesh	6.41	2.97	28.28	65.16	6.25	10.63	640
West Bengal	22.22	5.39	9.76	55.89	7.07	4.38	297

The percentages do not add up to 100 because one woman can experience more than one delivery-related complication.

Results and discussion

It must be remembered that c-section has been reported as one of the delivery-related complications. More than half of the reported delivery-related complications in Kerala and Goa were c-sections. Other states like Delhi, Gujarat, Punjab and Tamil Nadu had more than one-third of the women reporting c-section deliveries. The lowest proportions of c-section as a delivery complication were reported from Bihar, Uttar Pradesh and Rajasthan (all under 10%). Orissa and Himachal Pradesh both had slightly above 10% of the delivery-related complications culminating in c-sections.

Table 2. The proportion of delivery complications and c-sections among deliveries from 1988–89 to 1992–93, selected states, National Family Health Survey, India, 1992–93

States	Proportion of c-sections	Proportion of delivery complications	No. of deliveries
Andhra Pradesh	4.33	14.05	1594
Assam	2.96	13.91	1553
Bihar	1.20	12.44	2909
Delhi	4.91	13.87	1485
Goa	15.29	28.03	1099
Gujarat	2.94	7.87	1499
Haryana	2.47	9.94	1338
Himachal Pradesh	1.93	18.12	1192
Karnataka	3.95	13.07	1951
Kerala	13.74	23.48	1550
Madhya Pradesh	0.81	7.18	2980
Maharashtra	4.10	15.78	1755
Orissa	1.44	13.93	1809
Punjab	4.38	11.31	1141
Rajasthan	0.82	8.38	2433
Tamil Nadu	7.64	19.27	1427
Uttar Pradesh	0.64	10.01	6395
West Bengal	3.50	16.74	1887

The number of pregnancies relates to those occurring during the 4 years preceding the date of survey. It also refers to the last order of birth that occurred during these 4 years. In so far as this restriction is applied, it does not refer to other pregnancies that may have also occurred during this 4-year period to the same women.

Table 3. Percentage of delivery-related complications by maternal and institutional characteristics

States	Age at maternity = high risk/ low risk	Birth order = 1/ >1	Antenatal care = yes/no	Institutional delivery = yes/no	Residence = rural/urban	Institutional delivery = private/public
Andhra Pradesh	17.6 (307)	22.5 (432)	14.6 (1389)	25.3 (538)	12.8 (1194)	27.6 (312)
	13.2[b] (1287)	10.9[a] (1162)	10.2 (205)	8.3[a] (1056)	17.8[b] (1194)	22.1 (226)
Assam	14.5 (296)	27.3 (326)	17.5 (914)	30.5 (341)	11.8 (1068)	33.9 (124)
	13.8 (1257)	10.4[a] (1227)	8.8[a] (639)	9.2[a] (1212)	18.6[a] (485)	28.6 (217)
Bihar	12.7 (545)	19.8 (678)	16.6 (1106)	25.0 (408)	12.0 (2364)	25.2 (210)
	12.4 (2364)	10.2[a] (2231)	9.9[a] (1803)	10.4[a] (2501)	14.5 (545)	24.7 (198)
Delhi	14.1 (1365)	12.7 (1516)	14.8 (1253)	20.2 (712)	3.2 (125)	23.8 (340)
	11.7 (120)	17.3[a] (369)	9.1[b] (232)	8.0[a] (773)	14.9[a] (1360)	16.9[b] (372)
Goa	30.0 (150)	36.7 (368)	28.9 (1057)	30.9 (975)	27.0 (566)	35.2 (528)
	27.7 (949)	23.7[a] (731)	4.8[a] (42)	5.6[a] (124)	29.1 (533)	25.7[a] (447)
Gujarat	8.7 (126)	14.8 (418)	8.9 (1152)	14.6 (568)	6.0 (1011)	19.0 (326)
	7.8 (1373)	5.2[a] (1081)	4.3[a] (347)	3.8[a] (931)	11.7[a] (488)	8.7[a] (242)
Haryana	9.6 (177)	15.9 (340)	12.1 (1003)	24.5 (265)	9.5 (920)	26.9 (130)
	10.0 (1161)	7.9[a] (998)	3.6[a] (335)	6.3[a] (1073)	11.0 (418)	22.2 (135)
Himachal Pradesh	23.2 (82)	29.0 (300)	19.7 (939)	28.6 (304)	19.0 (861)	27.0 (37)
	17.7 (1110)	14.5[a] (892)	12.3[a] (253)	14.5[a] (888)	15.7 (331)	28.8 (267)
Karnataka	16.8 (321)	21.3 (488)	14.2 (1654)	22.7 (754)	11.0 (1359)	25.1 (339)
	12.3[b] (1630)	10.3[a] (1463)	6.7[a] (297)	7.0[a] (1197)	17.9[a] (592)	20.7 (415)
Kerala	22.2 (135)	28.3 (540)	23.8 (1518)	26.0 (1378)	23.2 (1157)	26.9 (769)
	23.6 (1415)	20.9[a] (1010)	6.3[b] (32)	3.5[a] (172)	16.5[a] (393)	24.8 (609)
Madhya Pradesh	6.6 (503)	9.8 (697)	8.7 (1590)	15.2 (540)	6.4 (2328)	12.9 (116)
	7.3 (2477)	6.4[a] (2283)	5.5[a] (1390)	5.4[a] (2440)	10.1 (652)	15.8 (424)
Maharashtra	17.1 (257)	22.1 (452)	17.5 (1474)	22.7 (802)	13.1 (1062)	25.4 (421)
	15.6 (1498)	13.6[a] (1303)	6.8[a] (281)	10.0[a] (953)	19.9 (693)	19.7 (381)
Orissa	14.3 (231)	20.4 (446)	15.9 (1182)	25.9 (336)	13.6 (1356)	23.5 (68)
	13.9 (1578)	11.8[a] (1363)	10.2[a] (627)	11.2[a] (1473)	15.0 (453)	26.5 (268)
Punjab	11.8 (1052)	19.4 (268)	12.2 (1002)	24.9 (301)	10.4 (857)	24.5 (188)
	5.6 (89)	8.8[a] (873)	5.0[a] (139)	6.4[a] (840)	14.1 (284)	25.7 (113)
Rajasthan	8.2 (388)	11.6 (567)	13.4 (777)	21.5 (298)	7.7 (2035)	11.0 (73)
	8.4 (2045)	7.4[a] (1866)	6.0[a] (1656)	6.6[a] (2135)	11.8[a] (398)	24.9[a] (225)
Tamil Nadu	18.9 (1272)	27.4 (456)	19.7 (1349)	26.0 (912)	17.5 (921)	27.0 (434)
	22.6 (155)	15.4[a] (971)	11.5 (78)	7.4[a] (515)	21.7 (506)	25.1 (478)
Uttar Pradesh	10.9 (1161)	13.0 (1321)	10.9 (2905)	21.9 (758)	9.9 (5226)	22.4 (299)
	9.8 (5234)	9.2[a] (5074)	9.3[b] (3490)	8.4[a] (5637)	10.4 (1169)	21.6 (459)
West Bengal	16.4 (365)	22.1 (512)	17.6 (1386)	27.4 (532)	15.3 (1571)	36.3 (91)
	15.7 (1512)	13.5[a] (1365)	10.8[a] (491)	11.2[a] (1345)	18.3 (306)	25.6[b] (441)

[a] significance of difference at 1% level of significance; [b] significance of difference at 5% level of significance.
The numbers in brackets indicate the number of cases in that category.

The most frequently reported delivery-related complication was 'long period of labour'. However, it should be remembered that the duration of labour depends on maternal characteristics like order of pregnancy and age. Women who are experiencing parturition for the first time may misinterpret the waiting time between commencement of labour and delivery. Further, even women with previous experience may not be aware of the possibility of reduction in waiting time with increasing order of pregnancy (Cunningham et al. 1989). Therefore, the chance of any duration of labour being perceived as prolonged would vary from woman to woman and for the same woman, by order of pregnancy. This makes comparisons between cohorts of women on the length of labour difficult. The same could also be true for proportion of women reporting delayed delivery of placenta. This showed a variation between 0.75% in Haryana to 21.03% in Orissa.

Excessive bleeding was reported by more than a fifth of the women in the states of Madhya Pradesh, Rajasthan and Uttar Pradesh. As these percentages are based on self-reports, they are also dependent on women's perceptions of what amount of bleeding is normal and what is abnormal. Such perceptions may have been shaped by knowledge gained from previous experiences of delivery and therefore may improve with higher fertility, which is indeed true in these states (IIPS 1995). While a woman is in labour it may be possible to be confused as to these various delivery-related complications including the one related to the use of forceps. What is reported as forceps may be a vacuum assisted delivery. It is therefore felt that most of the delivery-related complications cannot be compared. However, a major surgical procedure like the c-section cannot be misunderstood and therefore reports of c-section have been taken to be reasonably accurate compared with reports of other delivery complications.

Table 4. Percentage of c-section deliveries by maternal and institutional characteristics

States	Age at maternity = high risk/ low risk	Birth order = 1/ >1	Antenatal care = yes/no	Residence = rural/urban	Institutional delivery = private/public
Andhra Pradesh	29.6 (54)	39.2 (97)	32.5 (203)	22.9 (153)	55.8 (86)
	31.2 (170)	24.4[b] (127)	14.3 (21)	47.9[a] (71)	34.0[b] (50)
Assam	14.0 (43)	29.2 (89)	26.9 (160)	10.3 (126)	50.0 (42)
	22.5 (173)	15.0[b] (127)	3.6[a] (56)	35.6[a] (90)	33.9 (62)
Bihar	10.6 (293)	11.2 (134)	17.4 (184)	4.6 (283)	41.5 (53)
	5.8 (69)	8.8 (228)	1.7[a] (178)	27.8[a] (79)	22.4[b] (49)
Delhi	35.7 (14)	46.9 (64)	37.0 (185)	50.0 (4)	51.9 (81)
	35.4 (192)	30.3[b] (142)	19.0 (21)	35.1[a] (202)	47.6 (63)
Goa	71.1 (45)	57.0 (135)	54.9 (306)	47.7 (153)	61.3 (186)
	51.7[b] (263)	52.6 (173)	0.0 (2)	61.3[a] (155)	47.0[b] (115)
Gujarat	36.4 (11)	51.6 (62)	40.8 (103)	27.9 (61)	61.3 (62)
	37.4 (107)	21.4[a] (56)	13.3[b] (15)	47.4[b] (57)	23.8[a] (21)
Haryana	23.5 (17)	24.1 (54)	27.3 (121)	13.8 (87)	51.4 (35)
	25.0 (116)	25.3 (79)	0.0[b] (12)	45.7[a] (46)	50.0 (30)
Himachal Pradesh	10.5 (19)	12.6 (87)	11.9 (185)	6.1 (164)	10.0 (10)
	10.7 (197)	9.3 (129)	3.2 (31)	25.0[a] (52)	28.6 (77)
Karnataka	25.9 (201)	38.5 (104)	31.9 (235)	19.5 (149)	56.5 (85)
	31.3 (54)	24.5[b] (151)	10.0[b] (20)	45.3[a] (106)	33.7[a] (86)
Kerala	60.0 (30)	61.4 (153)	58.8 (362)	52.8 (269)	69.6 (207)
	58.4 (334)	56.4 (211)	0.0 (2)	74.7[a] (95)	45.7[a] (151)
Madhya Pradesh	12.1 (33)	13.2 (68)	10.1 (138)	11.5 (148)	20.0 (15)
	11.0 (181)	10.3 (146)	13.2 (76)	10.6 (66)	13.4 (67)
Maharashtra	18.2 (44)	34.0 (100)	27.9 (258)	14.4 (139)	46.7 (107)
	27.5 (233)	21.5[b] (177)	0.0[a] (19)	37.7[a] (138)	28.0[b] (75)
Orissa	3.0 (33)	17.6 (91)	12.2 (188)	4.9 (184)	25.0 (16)
	10.5 (219)	5.0[a] (161)	1.6[a] (64)	22.1[b] (68)	23.9 (71)
Punjab	40.0 (5)	46.2 (52)	40.2 (122)	32.6 (89)	63.0 (46)
	38.7 (124)	33.8 (77)	14.3 (7)	52.5[a] (40)	65.5 (29)
Rajasthan	6.3 (32)	15.2 (66)	11.5 (104)	5.1 (157)	37.5 (8)
	10.5 (172)	7.2 (138)	8.0 (100)	21.1[a] (47)	23.2 (56)
Tamil Nadu	22.9 (35)	44.8 (125)	40.6 (266)	33.3 (165)	46.2 (117)
	42.1[b] (240)	35.3 (150)	11.1 (9)	49.1 (110)	45.0 (120)
Uttar Pradesh	0.8 (127)	13.4 (172)	11.7 (317)	2.9 (518)	26.9 (67)
	7.8 (513)	3.9[a] (468)	1.2[a] (323)	21.3[a] (122)	22.2 (99)
West Bengal	15.0 (60)	34.5 (113)	28.5 (244)	15.4 (241)	60.6 (33)
	24.1 (237)	14.7[a] (184)	5.7[a] (53)	51.8[a] (56)	39.8[b] (113)

[a] significance of difference at 1% level of significance; [b] significance of difference at 5% level of significance.
The numbers in brackets indicate the number of cases in that category.

Among all the deliveries that occurred during a 4-year period prior to 1992–93, the proportion of women experiencing delivery complications and c-section deliveries are presented in Table 2. In a majority of the states analyzed, the proportion of women who had delivery-related complications is less than 20%. In only two states, Goa and Kerala, were more than 20% of deliveries reported as having complications. These are the two states where the proportions of c-section deliveries are also relatively higher, 15.3% for Goa and 13.7% for Kerala.

In a majority of the states, the proportion of c-sections is less than 5%. Only in Tamil Nadu is it higher than 5%, at about 8%. However, at least for Kerala State, it is possible to determine if indeed this proportion is part of a trend of increasing c-section deliveries. A community-based survey found the c-section rate to be 11.9% in 1987 (Kannan et al. 1991). The present analysis indicates that in 1988–92 it had increased to 13.74%. Using a subset of the same data set as of the 1987 study, the c-section rate in 1996 had increased to 21.4% (Thankappan 1999). Even allowing for differences in measurement techniques and errors between these two data sets, there is reason to believe that the present rates of c-section are part of a rising trend for this state with a higher proportion of institutional deliveries.

Further analysis of the association between delivery complications and the selected variables was carried out. Delivery complications were associated with maternal age in two states, Andhra Pradesh and Karnataka. Deliveries that occurred for women in the lower risk ages of maternity (between 18–35 years) were associated with significantly lower delivery complications. Delivery complications were also significantly lower among higher order pregnancies (birth orders greater than one). This comparison of higher order and lower order has been made between first order and

Table 5. Logistic regression coefficients showing the effects of private institutional delivery on caesarean section for various states, National Family Health Survey, India, 1992–93

States	Regression coefficient 'b'	Standard error of 'b'	Odds ratios
Andhra Pradesh	1.6832	0.3421	5.3827[b]
Assam	1.0971	0.4194	2.9954[a]
Bihar	2.0313	0.4296	7.6243[b]
Delhi	1.0797	0.3115	2.9437[a]
Goa	0.6737	0.2499	1.9615[a]
Gujarat	2.3624	0.5469	10.6163[b]
Haryana	1.3434	0.4763	3.8321[a]
Himachal Pradesh	–0.6119	1.1227	0.5423[a]
Karnataka	1.6725	0.3180	5.3256[b]
Kerala	1.1374	0.2285	3.1188[b]
Madhya Pradesh	0.9273	0.7567	2.5276 (n.s.)
Maharashtra	1.3548	0.3154	3.8761[b]
Orissa	0.3794	0.6874	1.4615[b]
Punjab	0.4242	0.4087	4.1545[a]
Rajasthan	1.6435	0.8831	5.1731 (n.s.)
Tamil Nadu	0.2526	0.2637	1.2873[b]
Uttar Pradesh	1.4713	0.3968	4.3549[a]
West Bengal	1.1513	0.4358	3.1622[a]

[a] significance at 95% confidence interval; [b] significance at 99% confidence interval; n.s. = not significant.
The model used here controls for maternal age, birth order, residential status and antenatal care as categorized in Tables 3 and 4. The dependent variable was caesarean section delivery (no = 0 and yes = 1), and the independent variable was type of institution (public = 0 and private = 1). The analysis is based on the last birth experience among those who gave birth during the 4 years prior to 1992–93 and among those who had an institutional delivery alone.

the higher order as the data pertains to births during the last 4 years and hence is selective to first parity and women of younger ages. This was noticed in all the states examined and this association was also statistically significant in all the 18 states selected.

Delivery-related complications were significantly higher among those who had accessed antenatal care and those who had institutional deliveries. However, these are in the expected direction. Antenatal care is expected to help identify high-risk pregnancies and it is likely that this leads to an increase in institutional deliveries. With respect to the relationship between institutional deliveries and delivery-related complications, it is possible that the identification of the risk for these complications resulted in moving the site of delivery from the home to the institution.

It was also noticed that the proportion of deliveries with delivery-related complications was higher in urban areas than in rural areas and this difference was statistically significant in Andhra Pradesh, Assam, Delhi, Gujarat, Karnataka and Rajasthan. Kerala was the lone exception to this pattern, where rural areas had a significantly higher proportion of deliveries reported as having complications. This may be because Kerala has a better network of health care facilities, especially private health care facilities in the rural areas (Kannan et al. 1991).

Considering whether the institutional deliveries occurred in public or private sector units, it was found that delivery-related complications were higher in private sector institutions in most of the states. The proportion of reported deliveries with complications was significantly lower in the public sector in Delhi, Goa, Gujarat and West Bengal. In five states, Himachal Pradesh, Madhya Pradesh, Orissa, Punjab and Rajasthan, the proportion of deliveries with complications was higher in the public sector, but only in Rajasthan was this proportion statistically significant. In all of these five states, the public sector dominated the health sector in terms of both hospitals and beds available (Bhat 1993). Since deliveries would take place in the public sector institutions more often than in private institutions in these states, this finding is not surprising.

The analysis of the proportion of c-section deliveries with selected variables also yielded mixed results. The proportion of c-section deliveries was higher among the group with maternal age (between 18 and 35) in 11 out of the 18 states examined. This difference in the proportion of c-section deliveries between the high risk and the low risk age groups was statistically significant only in Tamil Nadu. This proportion was more or less equal in the two states (Delhi and Himachal Pradesh) and lower in the low risk ages in Bihar, Kerala, Madhya Pradesh and Punjab. The proportion of c-section deliveries was found to be lower in higher order pregnancies (higher in lower order pregnancies). This difference in the proportion of c-sections between the first birth order and the higher order births was found to be statistically significant in Andhra Pradesh, Assam, Delhi, Gujarat, Karnataka, Maharashtra, Orissa, Uttar Pradesh and West Bengal. This is expected as delivery-related complications are higher among primiparae (Cunningham et al. 1989) and consequently a higher proportion of c-section deliveries is expected.

The relationship between antenatal care and proportion of c-section deliveries was the same in all the states examined. The proportion of c-section deliveries was higher among those who had used antenatal care than among those who had not, clearly indicating that antenatal care could have been useful in identifying high risk pregnancies and therefore elective c-sections. However, this needs further examination with a data set that distinguishes between elective and emergency c-sections.

The proportion of c-section deliveries was higher in urban areas in comparison with rural areas. The only exception was Delhi and the number of c-section deliveries reported in rural areas of Delhi was only four. Therefore it is expected that the small sample size would have contributed to some degree of distortion. Referral hospitals are usually located in urban areas and they are more likely to deal with complications as these are referred to them. Also, in terms of distribution of health services, in most of the states there are more facilities, both public and private, available in urban areas. These facilities would be utilized for both emergency c-sections as well as elective c-sections conducted for non-medical reasons, thus resulting in the relatively higher c-section rates in urban areas.

The proportion of c-section deliveries was higher in private sector institutions than in public sector institutions in most of the states. Haryana, Delhi and Punjab had more or less similar trends in private and public sector institutions, and in these three states the proportion of c-section deliveries in both sectors were closer to or greater than 50%. In Tamil Nadu the proportion of c-sections was about 45%, with rates more or less equal for deliveries in the public and the private sectors. In Orissa the rates were also almost equal but lower both in the public and the private sectors institutions (about 25%). In Andhra Pradesh, Bihar, Goa, Karnataka, Kerala, Maharashtra and West Bengal, the proportions of c-sections were significantly higher in the private than in the public sector. One possible explanation could be the profit motive operating in private sector institutions, which results in the performance of a higher volume of elective c-sections.

To examine this difference in the proportion of c-section deliveries, after controlling for maternal as well as other institutional factors, logistic regression analysis was used, taking the dependent variable as the occurrence or non-occurrence of a c-section delivery and the independent variable as the type of institution, i.e. whether private or public sector. All other factors, maternal factors (age and parity) and institutional (utilization of antenatal care, and rural/urban residence) were control variables in the model used. Madhya Pradesh and Rajasthan excepted, the association between the occurrence of a c-section delivery and the type of institution (whether private or public sector) was statistically significant in all the other 16 states examined. In Himachal Pradesh, c-sections were more likely to occur in public sector institutions, but in all the other 15 states the odds favoured the private sector institutions. It should be remembered that given the small proportions of c-sections in some states, the results of this analysis are only indicative and not conclusive. However, as they serve to reiterate the findings of the bivariate χ^2 analysis that has already been presented, the results are reassuring.

Conclusions

The levels of c-section deliveries in the selected states of India are not very high. Except for the states of Goa and Kerala, the proportions of deliveries that resulted in c-sections were below 10%. However, there is reason to believe that the current c-section rates are part of a rising trend in proportion of c-section deliveries. If the level of c-section deliveries is rising due to the rise in the proportion of institutional deliveries, then the existing rates are within the accepted margin. But an analysis of the correlates of the occurrence of c-section indicates a strong association with private sector institutions.

The analysis of the levels of c-sections in the community identified Goa and Kerala as states where the rates were relatively higher. However, the detailed analysis of the correlates of c-section indicated that for states like Gujarat, Bihar, Andhra Pradesh, Karnataka, Uttar Pradesh and Punjab the problem was serious as well. In the latter states the risk of undergoing c-section for delivery in the private sector health services is four or more times that in the public sector services. Therefore the phenomenon of c-section deliveries needs to be examined for the levels and the correlates. Since c-section deliveries cost more than vaginal deliveries, both in terms of the number of days of institutionalization required as well as financial costs, it is possible that this extremely useful surgical procedure is being misused for profit purposes in the private sector in several states. This needs to be examined further using data disaggregated by the nature of c-section, that is whether it was elective or an emergency c-section and the reasons for the choice or the nature of the emergency.

Endnotes

[1] Delivery-related complications refers to the pregnancy complications reported in the NFHS, 1992–93 (IIPS 1995). We have chosen the label 'delivery-related complications' instead of the label 'pregnancy complications' used in NFHS, 1992–93, because the categories listed are more related to delivery than to pregnancy itself.

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