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Magnitude of Caesarean Deliveries in India: An Analysis at Subnational level using HMIS Data

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Abstract: An attempt has been made in this paper to analyze the magnitude of caesarean deliveries in India at the National and Subnational level (Zonal, State/UT and District). Health Management Information System (HMIS) data (2015-16 to 2019-20) has been used separately for public and private health facilities. Caesarean deliveries are increasing in India during recent years at National, zonal and State/UT level, both at the public and private health sector. Magnitude of caesarean deliveries to the total deliveries is very high at private sector (35 percent) compared to public sector (14 percent). South zone has tremendously higher proportion of caesarean deliveries as a whole and at public sector. North Eastern zone has high performance of C-sections at its private health sector. Total 12 States/UTs have very high prevalence of Caesarean deliveries and 4 States have very low level of performance in India. Within the State, inter-district variation is not observed. Districts in South and extreme North are to be cautious for going for caesarean deliveries whereas the districts at central and east zone are required to increase their caesarean deliveries. Overall, India needs to curb its caesarean deliveries especially in its private sector.

Keywords: Caesarean deliveries, Subnational variation, Health facilities performance, HMIS, India.

Introduction

Caesarean deliveries also called as C-section or Caesarean section is the use of surgery to deliver babies. Caesarean section is lifesaving when vaginal delivery poses a risk to the mother or baby due to obstructed labor, fetal distress or an abnormal position of the baby (Mia *et al.,* 2019). 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, ante partum hemorrhage, pre-eclampsia toxemia, eclampsia, fetal distress and prolapse of the cord, malpresentation, maternal diseases such as heart problems, bad obstetric history, habitual intra-uterine death of the fetus and elderly primigravida (Cunningham *et al.,* 1989). World Health Organization (WHO) recommends that Caesarean deliveries should be performed only when it is medically necessary.

The International Health Care Committee has considered previously the rate of 10 to 15 percent of the total deliveries as an ideal for Caesarean deliveries (WHO, 2015) and rates outside this range are considered as medically unjustified or unnecessary (No authors mentioned, Lancet, 1985; Betrán *et al.,* 2007; WHO, 2010). Some evidence finds a higher rate of 19 percent may

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result in better outcomes. More than 45 countries globally have C-section rates less than 7.5 percent, while more than 50 have rates greater than 27 percent (Molina *et al*. 2015). The rate of caesarean section has increased over the years among many countries in the world.

In India also, the rate of cesarean deliveries has increased significantly during the last 3 decades (from the NFHS-1 to the NFHS-4), both at the public and private health facilities. (Bhatia *et al.*, 2020). NFHS-4(2015-16) has reported 17 percent of the total deliveries as Caesarean deliveries and it is 12 percent in public health sector and as high as 41 percent in private health sector. Further, NFHS-4 data shows that more than 63 percent of C-section deliveries take place in private hospitals. There has been a considerable change in the percent distribution of C-section deliveries by place of delivery between NFHS-1 to NFHS-4 (Das and Sahoo, 2019). The NFHS-4 survey also reveals that, C-section is relatively higher in some parts of the country and most of the southern states of India have recorded high C-section delivery. (https://www.dhsprogram.com/data/available-datasets.cfm). The main reason for the increase in the C-section deliveries in India is increase in the institutional delivery in all the southern states (Srivastava *et al.*, 2020).

After the implementation of NRHM, there was a two-fold increase in the use of institutional delivery care services in India (43 to 83 percent) from 2004 to 2014. This increase was primarily associated with substantial uptake in public sector services among the poor. Consequently, the patterns of socioeconomic inequalities in delivery care also changed. Prior to NRHM, utilization of public sector delivery care services had a pro-rich bias whereas post-NRHM the distribution has turned pro-poor (Joe *et al.*, 2018). Additional determinant factors are ASHA supporting services, cash incentives under JSY, availability of good quality institutional delivery care and support from nurses and doctors, and fully or partially subsidized institutional delivery care facilities including doctor and nurse services, medicines and diagnostic services as enabling factors (Vellakkala *et al*, 2017). Apart from the medical reasons, other factors like type of health institution and Physicians also have associated with high caesarean section rate. The availability of facilities and trained obstetricians (Kabra *et al.*, 1994), women who admitted one day before delivery (Kumar, 2006), source of payment for the delivery, women covered by Private Insurance have the highest cesarean section rates and the place of birth, i.e. either it was a private or a public sector institution also influenced the performance of C-sections. Women who deliver at private facilities or households that they belong to are more likely to be from urban areas and more likely to be socio-economically and educationally advantaged (Surana and Dongre, 2018). Thus generally C-sections are common in private health facilities and there is a positive association between private facility delivery and caesarean delivery. Women with bachelor degrees delivering in private facilities had 11 times greater odds of delivering by caesarean. As far as type of facility is concerned, either private or public, the mothers will select well equipped set up for surgical procedures and also ill equipped facilities refer the cases to these facilities (Neuman *et al.*, 2014). Hence, where the public facilities are having lack of infrastructure there might have low performance of C-section.

WHO Global Survey on Maternal and Perinatal Health carried out in 33 countries during 2004-08 including India, reveals that around one percent of the caesarian deliveries take place without any medical reason (Souza *et al*., 2010) and this proportion may be high in the current scenario. One more important determinant factor is voluntary C-section that nationally, 9 percent

of the women reported that they decided to deliver by voluntary C-section (Singh *et al.*, 2020). The surgical intervention may save the life of baby and mother but on the other hand the health consequences due to C-section cannot be neglected. Very few studies have highlighted on increased morbidity following C-section and on the surgical site (Balci *et al*., 2007, Santhanalakshmi *et al.*, 2015; Das *et al.*, 2018). Although, a necessary or a desirable procedure, still caesarean births may also be medically unnecessary many a time (Souza *et al*., 2010).

Majority of the countries with high mortality rates have caesarean section rates well below the recommended range of 10-15 percent, and in these countries there appears to be a strong ecological association between increasing caesarean section rates and decreasing mortality (Betrán *et al.*, 2007). On the other hand, in many developed countries, caesarean section rates have increased, and attention has focused on strategies to reduce it, due to the concern that higher caesarean section rates do not confer additional health gain but may increase maternal risks, as they have implications for future pregnancies and have resource implications for health services (Thomas, 2001). Hence, globally efforts are being made to improve the access as well as reduce the use of caesarean section. In this context, an attempt has been made in this paper to analyze the regional disparities in the magnitude of caesarean deliveries in India with the following objectives:

1. To assess the disparities in the magnitude of caesarean deliveries at Subnational level (Zone, State and District) at public and private health facilities
2. To analyze the trend in the magnitude of caesarean deliveries during recent past at Subnational level (Zone and State) at public and private health facilities

Materials and Methods

Health Management Information System (HMIS), a digital initiative under National Health Mission (NHM) facilitates the flow of physical and financial performance from the District level to the State and the Centre. It collects facility based information covering all the Health Sub centres (HSCs), Primary Health Centres (PHCs), Community Health Centres (CHCs), Sub Divisional Hospitals (SDHs), District Hospitals (DHs), Tertiary Hospitals as well as private health facilities on periodic basis. HMIS has following 6 data elements which are related to assess the total deliveries and caesarean deliveries which are used in the present paper for analysis.

1. Number of deliveries conducted at Home and attended by trained SBA (i.e. Doctor or Nurse or ANM).
2. Number of deliveries conducted at Home and attended by non-trained SBA (i.e. trained TBA or Relatives etc.).
3. Deliveries conducted at Public Institutions (Including C-Sections).
4. Deliveries conducted at Private Institutions (Including C-Sections).
5. Total Number of Caesarean (C-Section) deliveries performed at Public facilities.
6. No. of C-section deliveries performed at Private facilities.

HMIS data for the year 2015-16 to 2019-20 (5 years) has been used for the analysis to assess the trend.

Definition of variables

Total Deliveries: Home deliveries (SBA)+Home deliveries (Non SBA)+ Deliveries at Public Institutions +Deliveries at Private Institutions
Total C-section Deliveries: C-section deliveries at Public health facilities+ C-section deliveries at Private health facilities.
Rate of C-section Deliveries: C-section deliveries *100/Total deliveries
Regional categories: Regional disparities has been assessed at the National, Zonal, State/UT and District level
Zonal categories: The States/UTs of India have been grouped into six zones based on the Zonal Councils set up vide Part-III of the States Reorganisation Act, 1956., the North Eastern Council Act, 1971 and its Amendment, 2002 (https://en.wikipedia.org/wiki/Administrative_divisions_of_India). *Northern Zonal Council*, comprising Chandigarh, Delhi, Haryana, Himachal Pradesh, Jammu and Kashmir, Ladakh, Punjab, and Rajasthan; *North Eastern Council*, comprising Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim. *Central Zonal Council*, comprising the States of Chhattisgarh, Madhya Pradesh, Uttarakhand and Uttar Pradesh; *Eastern Zonal Council*, comprising Bihar, Jharkhand, Odisha, and West Bengal; *Western Zonal Council*, comprising Dadra and Nagar Haveli and Daman and Diu, Goa, Gujarat, and Maharashtra; *Southern Zonal Council*, comprising Andhra Pradesh, Karnataka, Kerala, Puducherry, Tamil Nadu, and Telangana. Andaman and Nicobar Islands, Lakshadweep are not members of any of the Zonal Councils. However, they are presently special invitees to the Southern Zonal Council.
QGIS maps: District level performance has been presented using QGIS 3.12.

Results and Discussion

Magnitude of caesarean deliveries in India

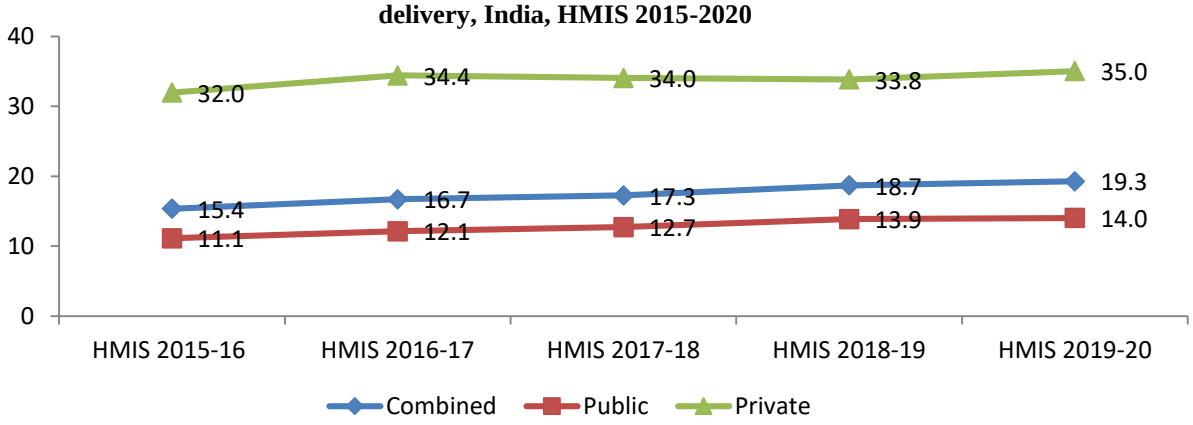
As per the HMIS data 2,11,72,780 deliveries are reported in India during 2015-16, and it is 2,08,53,438 during 2019-20. Table 1 indicates the distribution of deliveries between public and private hospitals. As observed, proportion of home deliveries to the total deliveries have decreased from 11 percent to 6 percent from 2015-16 to 2019-20 in India. Proportion of deliveries conducted in public sector has increased from 63 to 65 percent during this period. Similarly, contribution of private sector in conducting the deliveries has increased from 26 to 29 percent during this period of 5 years. Further, HMIS has reported as high as 40 lakh Caesarean deliveries every year. Contribution of public hospitals in conducting caesarean deliveries has increased from 45 to 48 percent whereas that of private sector has reduced from 55 to 52 percent in India during the period 2015-16 to 2019-20. Hence, though the contribution of private hospitals in conducting deliveries is less than 30 percent, they perform more than 50 percent of the total caesarean deliveries in India.

Table 1: Distribution of deliveries and caesarean deliveries by place of delivery, India, HMIS, 2015-2020

Year	Total deliveries				Caesarean deliveries		
	Home	Public	Private	Number	Public	Private	Number
2015-16	11.1	62.7	26.2	2,11,72,780	45.4	54.6	32,52,142
2016-17	9.6	64.6	25.8	2,07,10,361	46.9	53.1	34,62,386
2017-18	7.8	66.4	25.9	2,07,83,191	49.0	51.0	35,88,587
2018-19	6.6	64.7	28.7	2,11,18,228	48.1	51.9	39,49,027
2019-20	5.7	65.5	28.8	2,08,53,438	47.6	52.4	40,22,108

To assess the magnitude of caesarean deliveries and its trend during recent past, HMIS data has been analyzed, for the period of 5 years; from 2015-16 to 2019-20 (Figure1). During the year 2015-16 proportion of caesarean deliveries to the total deliveries in India was 15 percent and it has increased to 19 percent during 2019-20. The increasing trend is observed at both, Public (11 to 14 percent) and private health facilities (32 to 35 percent). This clearly indicates an increasing trend in the proportion of caesarean deliveries in India and the higher contribution of private hospitals in the magnitude of caesarean deliveries.

Figure 1: Percentage of Caesarean deliveries to the Total deliveries by Place of delivery, India, HMIS 2015-2020



Zonal disparities in the magnitude of caesarean deliveries

All the States and Union Territories of India are categorized into 6 zones as mentioned earlier, as Central, East, North, North East, South and Western zones. During all the five years, South zone consistently shows higher prevalence of caesarean deliveries compared to other zones and it has increased from 37 to 41 percent during this period of 5 years. North-Eastern and Western zone fall in the next level and especially western zone has increased its C-section deliveries from 13 to 23 percent during this period. Central, North and East zone show very less prevalence of caesarean deliveries as a whole (Figure 2).

Figure 2: Percentage of Caesarean deliveries to the Total deliveries by Zone, India, HMIS 2015-20

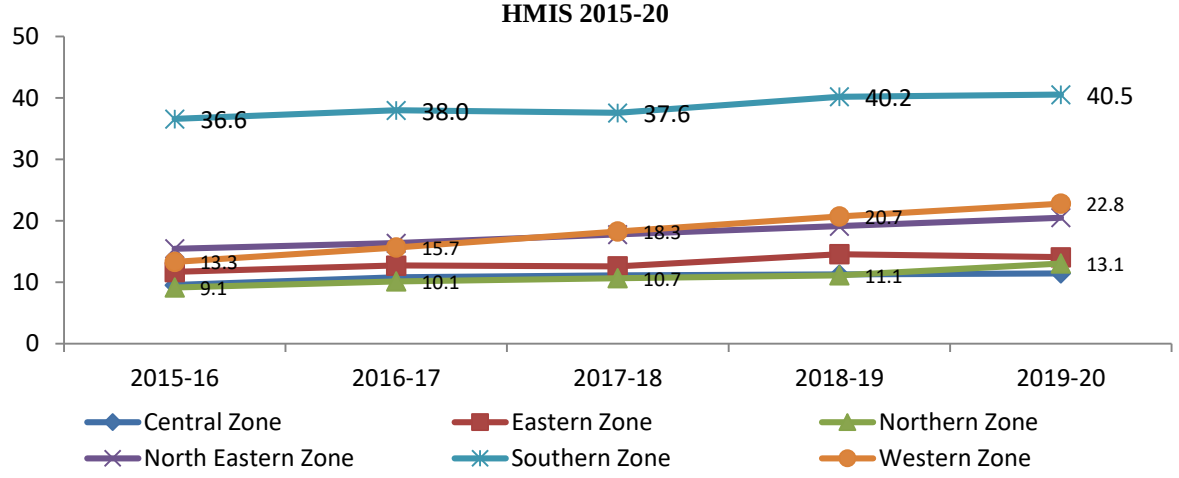


Figure 3: Percentage of Caesarean deliveries to the Total deliveries at PUBLIC health facilities by Zone, India, HMIS 2015-20

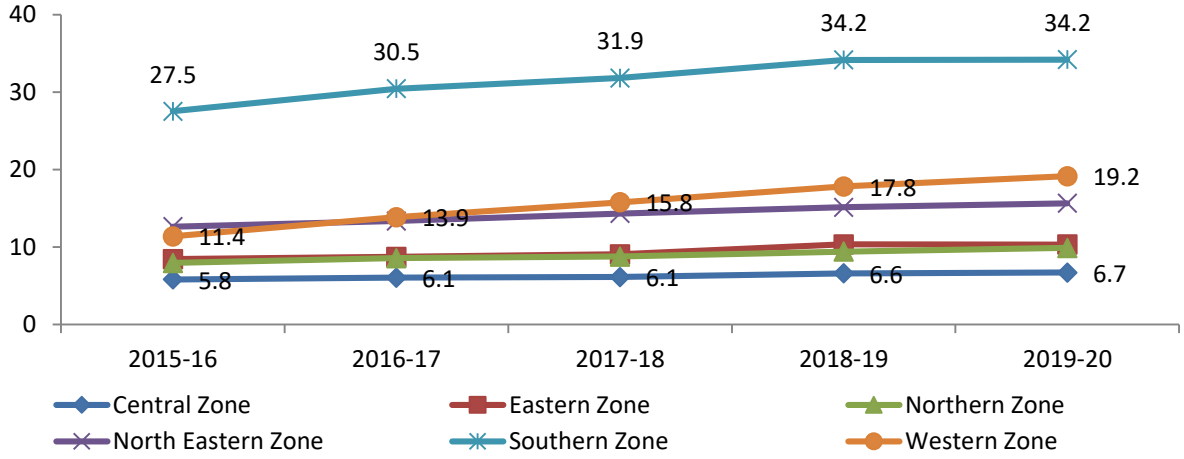
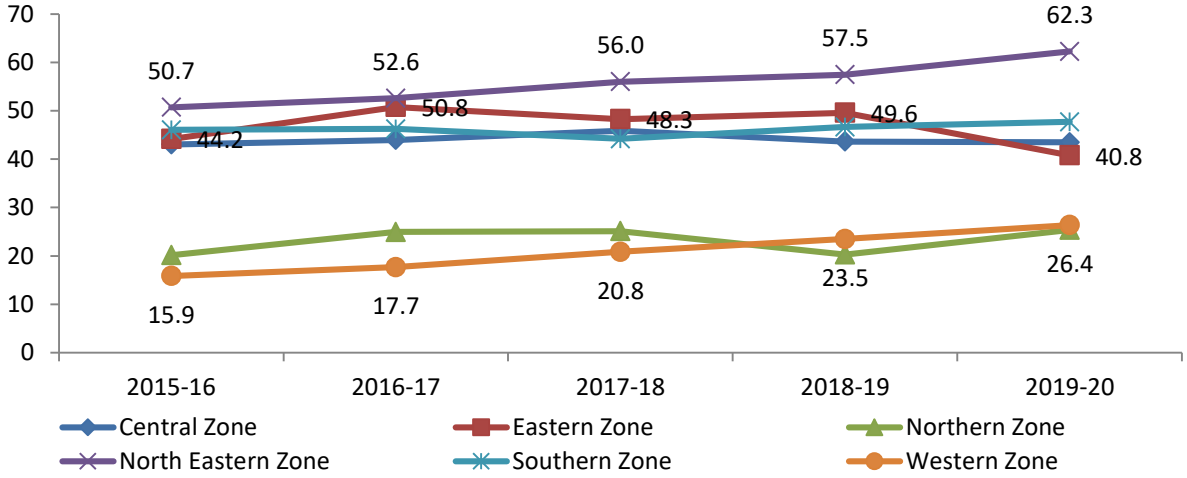


Figure 4: Percentage of Caesarean deliveries to the Total deliveries at PRIVATE health facilities by Zone, India, HMIS 2015-20



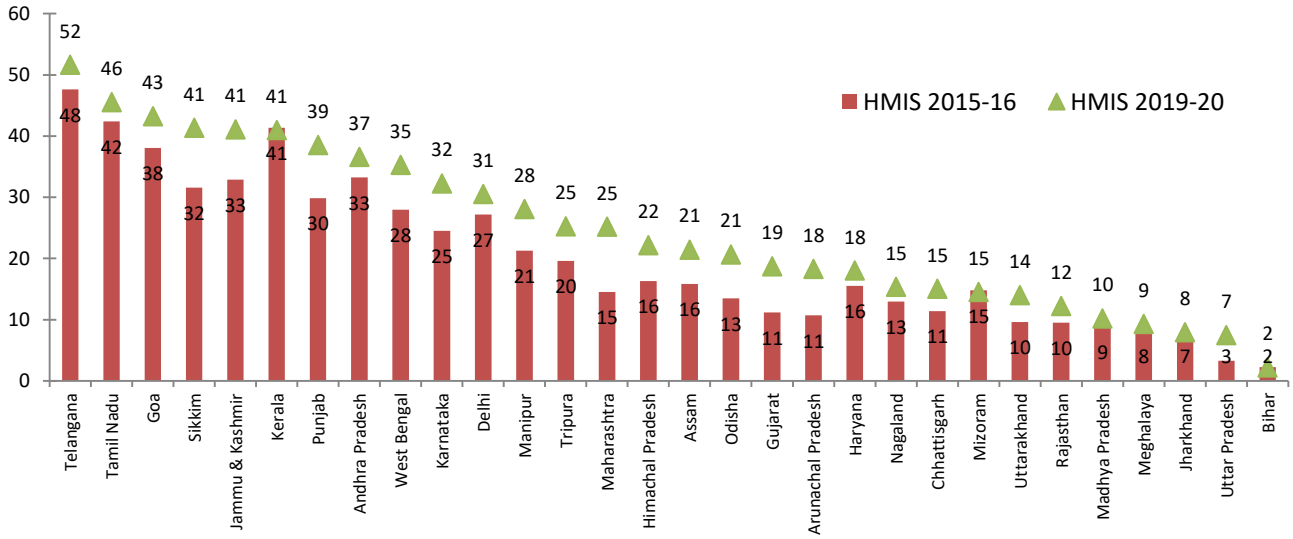
When analyzed separately for public and private health facilities (Figure 3 and 4), South zone is the highest contributor of caesarean deliveries even at the public health sector and it has increased from 28 to 34 percent during past 5 years. Western and North Eastern zone of India fall in the next level and especially Western zone has increased its C-section deliveries from 11 to 19 percent during this period. Central zone has very low prevalence of caesarean deliveries consistently during all the years. As far as caesarean deliveries reported in private sector is concerned only North and Western zones seems to be reporting appropriately and in North eastern zone underreporting of deliveries is observed at private sector as they have reported more than 50 percent of their deliveries as conducted by caesarean section.

Inter-State/UTs variation in the magnitude of caesarean deliveries

Further, an attempt has been made to assess the proportion of caesarean deliveries to the total deliveries by States/UTs. As observed in Fig. 5, during the year 2019-20, Telangana reported the highest (52 percent) proportion of caesarean deliveries to the total deliveries, followed by Tamil Nadu (46 percent), Goa (43 percent), Sikkim (41 percent), Jammu & Kashmir

(41 percent), Kerala (41 percent), Punjab (39 percent), Andhra Pradesh (37 percent), West Bengal (35 percent), Karnataka (32 percent), Delhi (31 percent) and Manipur (28 percent). Among these 12 top performing States/UTs, 6 are from South zone and 6 States/UTs are from North zone. On the other side, Bihar reports very low proportion of caesarean deliveries (2 percent) followed by Uttar Pradesh (7 percent), Jharkhand (8 percent) and Meghalaya (9 percent).

Figure 5: Percentage of caesarean deliveries to the total deliveries by State/UT, India, HMIS 2015-16 and 2019-20



Further, when proportion of caesarean deliveries to the total deliveries is analyzed, exclusively for public health facilities (Table 2), it is interesting to note that the southern states- Telangana, Kerala, Tamil Nadu, Andhra Pradesh and Goa; and Northern states/UTs Jammu & Kashmir, Punjab; and Sikkim in North-Eastern zone continue to be on the higher prevalence of caesarean deliveries. On the other side, again Bihar reports very lower proportion of caesarean deliveries – 2 percent followed by Jharkhand, Uttar Pradesh, Chhattisgarh and Madhya Pradesh. These states have reported less than 10 percent of their deliveries as caesarean deliveries in public health sector. Again it proves except Karnataka, Southern states of Andhra Pradesh, Telangana, Tamil Nadu, Kerala and Goa; and Jammu & Kashmir, Punjab in Northern India continue to be on the higher proportion of caesarean in public health sector. Whereas states at central zone - Bihar, Jharkhand, Uttar Pradesh, Chhattisgarh and Madhya Pradesh - do not perform even minimum required number of caesarean deliveries.

When the proportion of caesarean deliveries is analyzed for private health sector, it is interesting to note that except Bihar all the states fall in the higher category of more than 27 percent. Bihar reported 9 percent of its deliveries in private hospitals as caesarean. Haryana, Gujarat, Uttarakhand, Rajasthan, Jharkhand and Uttar Pradesh fall under the category of less than 27 percent of caesarean deliveries in private sector. Except these states all other states are in the category of exceptionally high caesarean deliveries. Especially, Jammu & Kashmir, West Bengal, Assam, Telangana, Goa, Delhi and Tamil Nadu are performing significantly higher number of caesarean sections in their private hospitals.

When analyzed the proportion of Caesarean deliveries to the total deliveries year-wise, similar pattern is observed for all the 5 years, in most of the States/UTs (Figure 5 and Table 2). All those States/UTs reporting higher proportion of C-sections have consistently reported the same pattern during all the 5 years. On the other hand all the low performing States/UTs have consistently followed same pattern during all the 5 years. When analyzed separately for public health facilities also, performance of most of the States/UTs is consistent during all the 5 years. However, some fluctuation is observed at Private health facilities in reporting their performance on C-section deliveries especially at the UTs and North eastern states. This again indicates the quality of data reported from private health facilities in HMIS.

Table 2: Percentage of caesarean deliveries to the total deliveries in India by type of health facility according to State/UTs, HMIS 2015-2020

Name of the State/UT	Combined					Public					Private				
	2015-16	2016-17	2017-18	2018-19	2019-20	2015-16	2016-17	2017-18	2018-19	2019-20	2015-16	2016-17	2017-18	2018-19	2019-20
A & N Islands	27.8	26.5	23.3	26.8	28.0	28.8	27.2	23.9	27.4	28.6	DNA	DNA	DNA	DNA	DNA
Andhra Pradesh	33.3	37.3	31.9	36.2	36.6	22.8	27.3	26.9	29.3	32.6	41.9	46.1	36.7	42.0	40.1
Arunachal Pradesh	10.7	12.4	18.1	16.0	18.3	10.0	10.6	17.9	14.0	16.5	24.4	33.8	34.4	39.2	43.2
Assam	15.8	16.9	18.8	20.4	21.5	11.9	13.0	14.2	15.3	15.3	52.8	54.0	59.3	60.8	65.8
Bihar	2.3	2.1	1.9	2.2	2.2	1.3	1.4	1.5	1.8	1.8	22.6	32.9	29.8	19.6	8.5
Chandigarh	31.4	32.7	32.1	33.1	33.7	31.6	32.8	32.2	33.1	33.7	DNA	DNA	DNA	DNA	DNA
Chhattisgarh	11.4	14.4	15.1	15.4	15.0	4.4	4.7	5.2	5.6	5.9	47.7	48.8	50.8	48.0	45.6
Dadra & Nagar Haveli	20.3	25.9	27.9	31.4	31.6	17.9	23.5	25.9	29.2	28.8	39.7	48.3	45.0	51.0	54.7
Daman & Diu	26.8	26.0	26.2	30.8	32.8	24.8	26.1	25.9	31.0	32.5	31.1	26.5	27.9	30.1	34.1
Delhi	27.2	27.8	27.9	29.8	30.6	22.9	23.6	23.8	25.0	25.5	57.9	59.1	58.8	57.8	59.6
Goa	38.1	36.1	40.9	43.1	43.2	30.9	30.4	32.1	32.5	31.3	48.7	46.1	53.6	58.6	59.8
Gujarat	11.2	13.3	15.4	16.5	18.7	9.9	10.9	12.5	13.2	14.2	12.3	15.0	17.3	18.6	21.9
Haryana	15.5	16.1	16.1	17.6	18.0	9.5	10.1	10.8	12.5	13.1	29.7	29.6	26.6	27.7	27.1
Himachal Pradesh	16.3	17.2	19.6	21.2	22.2	14.3	15.0	17.1	18.9	19.1	45.3	46.4	47.2	49.7	47.6
Jammu & Kashmir	32.9	34.8	36.6	38.8	41.1	32.6	33.7	34.7	36.3	39.0	84.0	87.8	88.9	88.7	89.4
Jharkhand	6.6	7.1	7.1	7.6	7.9	2.8	2.9	3.1	3.9	4.3	19.5	19.5	19.5	19.0	19.7
Karnataka	24.5	27.1	28.1	30.7	32.3	18.1	20.2	21.6	24.3	26.1	36.0	38.7	39.1	41.2	42.2
Kerala	41.4	41.3	40.8	40.8	41.0	40.5	41.0	40.8	40.2	39.3	41.8	41.6	41.0	41.1	41.8
Lakshadweep	37.9	36.8	38.2	41.8	39.5	37.9	36.8	38.2	41.8	39.5	DNA	DNA	DNA	DNA	DNA
Madhya Pradesh	8.9	9.5	9.6	9.8	10.2	6.2	6.5	6.4	6.9	7.0	40.1	40.5	42.0	39.9	41.8
Maharashtra	14.5	17.0	19.9	23.2	25.2	11.8	15.0	17.0	19.7	21.4	19.5	20.1	24.0	27.4	29.6
Manipur	21.3	21.7	18.7	20.9	28.1	20.2	19.4	16.3	18.3	27.0	55.5	55.5	52.6	56.1	55.3
Meghalaya	7.7	8.0	7.8	8.6	9.3	8.3	8.0	6.5	6.6	7.1	39.3	42.6	42.0	42.4	43.1
Mizoram	14.8	15.0	15.9	16.8	14.5	12.4	12.8	13.4	14.4	14.8	34.3	33.2	35.6	37.7	34.8
Nagaland	13.0	13.3	14.3	14.5	15.4	11.7	11.3	12.8	11.4	12.5	33.7	36.0	34.2	37.9	39.1
Odisha	13.5	16.1	15.3	20.7	20.7	11.5	12.1	12.9	14.3	14.7	42.0	59.9	46.8	59.7	56.9
Puducherry	30.0	32.2	32.8	31.9	28.9	25.4	27.3	28.4	26.7	26.8	41.2	45.2	46.3	48.4	68.2
Punjab	29.9	32.2	34.3	36.2	38.5	25.0	26.2	26.5	27.1	28.4	40.8	43.2	45.6	47.6	50.0
Rajasthan	9.5	10.3	10.5	11.0	12.2	7.3	7.9	8.4	9.5	10.0	18.1	19.8	18.9	17.1	20.4
Sikkim	31.6	28.8	29.5	35.0	41.4	27.8	24.6	27.6	27.9	36.4	47.7	44.6	36.5	49.6	56.3
Tamil Nadu	42.4	44.6	45.6	46.1	45.5	35.2	38.4	39.0	40.9	37.8	52.8	52.8	54.4	52.2	57.5
Telangana	47.6	43.5	44.9	50.4	51.6	32.1	35.9	40.2	43.7	43.7	58.0	51.8	50.9	58.4	60.4
Tripura	19.6	21.8	21.6	22.1	25.3	18.6	19.2	18.8	19.7	19.6	74.7	100.0	97.8	97.0	97.9
Uttar Pradesh	3.3	3.9	4.3	4.8	7.5	3.2	3.6	3.8	3.9	4.4	8.3	13.1	14.3	10.4	19.2
Uttarakhand	9.6	10.8	11.9	13.7	14.0	11.0	11.0	10.9	12.1	13.5	15.7	19.8	21.9	23.1	21.6
West Bengal	27.9	30.6	31.6	34.9	35.3	20.7	21.2	22.5	24.9	25.3	70.8	74.7	73.1	77.3	80.1
All India	15.4	16.7	17.3	18.7	19.3	11.1	12.1	12.7	13.9	14.0	32.0	34.4	34.0	33.8	35.0

This clearly indicates that the states/UTs in South and extreme North need special attention on selective caesarean section, particularly in private hospitals. On the other hand, the states at the central and western zone need some efforts to increase their caesarean deliveries by improving their health infrastructure and manpower as well as creating awareness among the people so as to access the available health services.

District level variation in the magnitude of caesarean deliveries

Further an attempt has been made to understand the disparities in the magnitude of caesarean deliveries at district level. Fig. 6, 7 and 8 indicate the distribution of districts into 4 categories, based on prevalence of caesarean deliveries, for public and private health facilities as well as for combined. The states/UTs which show higher prevalence of caesarean deliveries, have majority of their districts in the category of higher proportion of caesarean deliveries. Telangana having higher proportion of caesarean deliveries has 28 out of 31 districts falling under the category of more than 27 percent caesarean deliveries. Tamil Nadu has 30 out of 32 districts falling under the higher prevalence category. Both the districts of Goa show the higher prevalence; 2 out of 4 districts of Sikkim, 9 out of 22 districts of Jammu & Kashmir, 13 out of 14 districts of Kerala, 21 out of 22 districts of Punjab, 10 out of 13 districts of Andhra Pradesh, 9 out of 11 districts of Delhi have reported higher prevalence caesarean deliveries. The names of the districts which are falling in the high prevalence category are mentioned in Table 3.

On the other hand, as observed in Table 4, as a whole Bihar has lower proportion of caesarean deliveries and this phenomenon is observed in its 37 districts out of 38. Except Patna all the districts in Bihar report less than 10 percent of caesarean deliveries. Similarly, 57 out of 75 districts of Uttar Pradesh report significantly lower proportion of caesarean deliveries. Further, in Jharkhand also 17 out of 24 districts, in Meghalaya 10 out of 11 districts have performed caesarean deliveries less than 10 percent of their total deliveries.

Hence 12 States/UTs in India report very high magnitude of caesarean deliveries and this trend is observed in most of their districts also. On the other hand, 4 states report very low proportion of caesarean deliveries and it is observed in most of their districts also. Hence, as such, it is very clear that performance of either very high caesarean deliveries or very low caesarean deliveries is not the district level phenomenon but occurs at the state level and at the zonal level. Thus the districts in South and extreme North zone are to be cautious for going for caesarean deliveries whereas the districts at central Zone require good number of health infrastructure, man power and awareness from the community. The high performing states, especially at private sector need extra vigilance and health system has to be improved in poor performing states.

Figure 6: Proportion of Caesarean deliveries to the Total deliveries by district, India, HMIS 2019-20

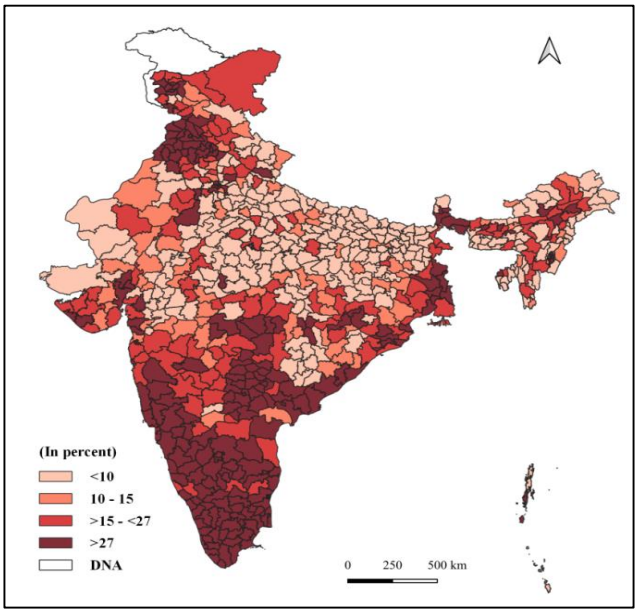


Figure 7: Prop. of Caesarean deliveries to the Total deliveries at PUBLIC health facilities by district, India, HMIS 2019-20

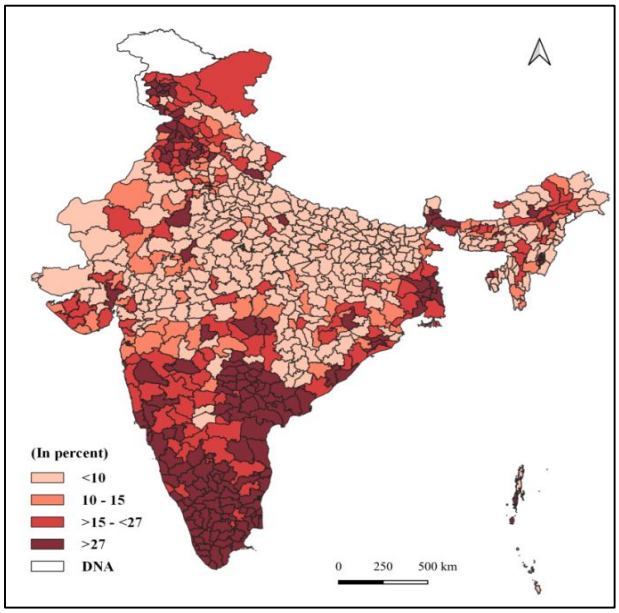


Figure8: Proportion of Caesarean deliveries to the total deliveries at PRIVATE health facilities by district, India, HMIS 2019-20

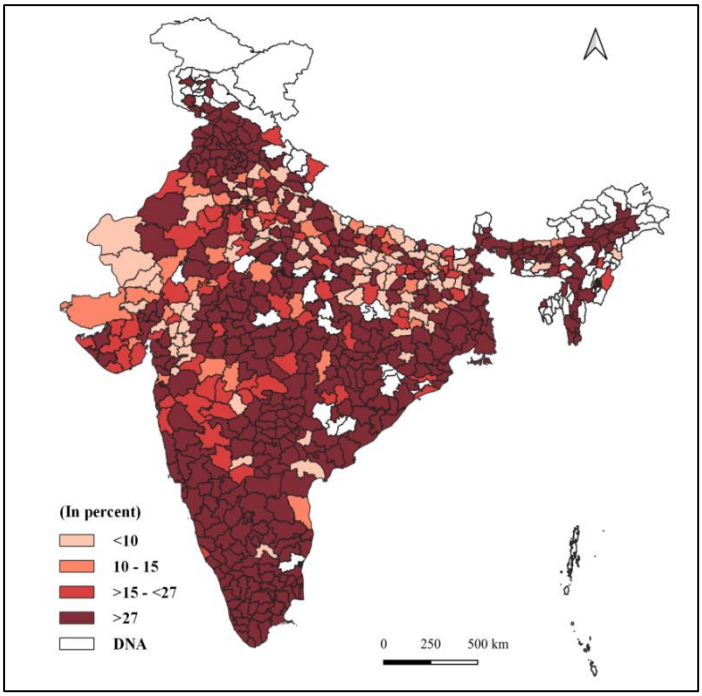


Table 3: States/UTs and Districts having very high proportion of Caesarean deliveries (>27%)

State/UT	District
Telangana 28/31 districts	Yadadri Bhonagiri, Suryapet, Nirmal, Medchal Malkajgiri, Karim Nagar, Warangal Urban, Nizamabad, Siddipet, Warangal Rural, Mancherial, Rajanna Sircilla, Khammam, Jangoan, Nalgonda, Kamareddy, Jagitial, Nagarkurnool, Wanaparthy, Jayashankar Bhupalpally, Peddapalli, Medak, Bhadradri Kothagudem, Sangareddy, Adilabad, Vikarabad, Ranga Reddy, Hyderabad, Mahbubnagar
Tamil Nadu 30/32 districts	Erode, Namakkal, Thiruvarur, Ariyalur, Kanniyakumari, Virudhunagar, Thanjavur, Tirunelveli, Nagapattinam, Coimbatore, Tirupur, Ramanathapuram, Toothukudi, Cuddalore, Sivaganga, Theni, Pudukkottai, Kancheepuram, Karur, Chennai, Perambalur, Dharmapuri, Thiruvallur, Salem, Dindigul, Madurai, Tiruchirappalli, Nilgiris, Vellore, Viluppuram
Goa 2/2 districts	South Goa, North Goa
Sikkim 2/4 districts	East and South
Jammu & Kashmir 9/22 districts	Srinagar, Pulwama, Baramula, Badgam, Jammu, Kulgam, Anantnag, Shopian, Poonch
Kerala 13/14 districts	Pathanamthitta, Alappuzha, Kollam, Idukki, Ernakulam, Kottayam, Thiruvananthapuram, Kannur, Thrissur, Kozhikkode, Palakkad, Wayanad, Malappuram
Punjab 21/22 districts	Pathankot, Gurdaspur, Nawanshahr, Kapurthala, Hoshiarpur, Jalandhar, Sangrur, Patiala, Amritsar, Rupnagar, Firozpur, Ludhiana, Moga, Mohali SAS Nagar, Bathinda, Fatehgarh Sahib, Faridkot, Fazilka, Tarn Taran, Muktsar, Barnala
Andhra Pradesh 10/13 districts	West Godavari, Srikakulam, East Godavari, Prakasam, Krishna, Cuddapah, Chittoor, Vizianagaram, Vishakapatnam, Anantapur
West Bengal 13/23 districts	Nadia, Hugli, Kolkata, Purba Medinipur, Purba Barddhaman, North Twenty Four Parganas, Haora, Alipurduar, Darjiling, Paschim Barddhaman, Murshidabad, Koch Bihar, Jalpaiguri
Karnataka 23/30 districts	Tumkur, Udupi, Chikmagalur, Chikkaballapur, Bangalore Rural, Chitradurga, Kolar, Shimoga, Hassan, Mysore, Ramanagar, Dakshina Kannada, Mandya, Gadag, Dharwad, Chamrajnagar, Uttara Kannada, Bangalore Urban, Bellary, Haveri, Belgaum, Bagalkote, Davanagere
Delhi 9/11 districts	South East, Central, West, East, South, New Delhi, North West, Shahdara, South West
Manipur 3/9 districts	Imphal East, Imphal West, Thoubal

Table 4: States/UTs and Districts having very low proportion of Caesarean deliveries (<10%)

State/UT	District
Bihar 37/38 districts	Sheohar, Madhubani, Saharsa, Khagaria, Lakhisarai, West Champaran, Begusarai, East Champaran, Samastipur, Nawada, Madhepura, Arwal, Banka, Sheikhpura, Sitamarhi, Buxar, Araria, Katihar, Purnia, Aurangabad, Siwan, Jamui, Supaul, Muzaffarpur, Jehanabad, Rohtas, Saran, Kaimur Bhabua, Kishanganj, Gaya, Gopalganj, Darbhanga, Bhagalpur, Vaishali, Bhojpur,Munger, Nalanda,
Uttar Pradesh 57/75 districts	Auraiya, Maunathbhanjan, Chitrakoot, Etah, Ghazipur, Shrawasti, Ballia, Siddharth Nagar, Kanpur Dehat, C S M Nagar, Budaun, Mathura, Shahjahanpur, Mahoba, Bulandshahar, Sitapur, Moradabad, Bareilly, Hamirpur, Jaunpur, Ambedkar Nagar, Sambhal, Unnav, Banda, Kashi Ram Nagar, Bahraich, Bagpat, Azamgarh, Sonbhadra, Lakhimpur Kheri, Balrampur, Hardoi, Sant Ravidas Nagar, Sant Kabir Nagar, Mirzapur, Kushinagar, Kaushambi, Fatehpur, Agra, Maharajganj, Kannauj, Mainpuri, Shamli, Pratapgarh, Lalitpur, Deoria, Hathras, Varanasi, Farrukhabad, Jalaun, Sultanpur, Saharanpur, Hapur, Aligarh, Ghaziabad, Basti, Gorakhpur
Jharkhand 17/24 districts	Chatra, Latehar,Pakur, Jamtara, Garhwa, Simdega, Godda, Dumka, Saraikela, Pashchimi Singhbhum, Lohardaga, Sahibganj, Gumla, Khunti, Bokaro, Ramgarh, Hazaribagh
Meghalaya 10/11 districts	East Garo Hills, East Jaintia Hills, North Garo Hills, Ri Bhoi, South Garo Hills, South West Garo Hills, South West Khasi Hills, West Garo Hills, West Jaintia Hills, West Khasi Hills

Conclusion and Policy Recommendation

During recent years, proportion of Caesarean deliveries has shown an increasing trend in India, both in public and private sector, in almost all the zones and States/UTs. Though the contribution of private hospitals in conducting deliveries is less compared to public sector, their contribution in performing Caesarean deliveries is more than 3 times than that of public health sector.

South zone has comparatively higher proportion of caesarean deliveries when seen as a whole and at public health sector. In the private sector, only North and Western zone have expected range and it is very high in all the remaining 4 zones, more so at North eastern zone. Telangana, Andhra Pradesh, Tamil Nadu, Goa, Sikkim, Jammu & Kashmir, Kerala, Punjab, Andhra Pradesh, West Bengal, Karnataka, Delhi and Manipur have remarkably higher prevalence of caesarean deliveries as a whole. Bihar reports very low proportion of caesarean deliveries followed by Uttar Pradesh, Jharkhand and Meghalaya.

In the States/UTs reporting very high magnitude of caesarean deliveries, most of their districts also show the same trend. On the other hand, in the states which report very low proportion of caesarean deliveries, most of their districts show very less proportion of caesarean deliveries. Hence, as such, performance of either very high caesarean deliveries or very low caesarean deliveries is not the district level phenomenon but occurs at the state level.

Hence, the districts in South and North zone are to be cautious for going for caesarean deliveries, especially at their private sector extra vigilance is needed. On the other hand, the districts at central region need to increase their C-section deliveries by improving their health infrastructure, manpower and awareness from the community. Efforts are needed to both, improve the access to and reduce the use of C-section. Overall India needs to curb its caesarean deliveries especially in its private sector!

Limitation of the study

HMIS data is the information of services delivered through the public and private health facilities in India and it does not provide the information on the socio-economic and demographic characteristics of the people accessing the services.

Availability of data and materials

The data used for the study is obtained from the web portal of Health Management Information System (https://nrhm-mis.nic.in/SitePages/Home.aspx). No separate ethical statement and consent for publication was required for this study as the HMIS collect the secondary data from the health facilities of India.

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