Colostrum Feeding And Complications Faced Post Caesarean Delivery: A Propensity Score Matching Approach

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Abstract

Background: In previous decade, the rate of caesarean section has increased disproportionately in India. Breastfeeding in an hour post birth i.e. Colostrum feeding has benefits associated to both mother as well as child. Cesarean delivery is one of the most remarkable risk factor for postpartum infection. The infection can be there in the uterus or vagina and can be accompanied by fever, sepsis etc. Both these aspects in the periphery of C-section need to be thrown a light because these are proximately affecting maternal health. This paper aims to examine the colostrum feeding practices of mothers giving birth via C-section and the difference that exists between C-section and normal delivery on post-natal complications or intrication faced by women.

Method: The study used data from the Demographic and Health Survey (DHS) acquired in India, i.e., the fourth round of National Family and Health Survey (2015-16). Bivariate and multivariate has been carried out to know the difference in prevalence of colostrum feeding among mothers who have delivered by C-section and those who delivered normally. Propensity score matching (PSM) has been used in the study; it helped us to find an effective strategy for controlling the confounding influence of post-natal complications faced among caesarean and normal delivery mothers.

Results: It is found, among the unmatched treatment group i.e., mothers delivered under caesarean section, the prevalence of post-natal complications is around 24%, and the same for control group i.e. those who delivered normally is 18%. After matching, the value of ATT is around 24% in treatment group and 17.4 in control group.

Conclusion: Study concluded that women who delivered via C-section actually had lower prevalence of feeding colostrum to the new born in comparison to those who delivered normally. Results of PSM analysis also showed that post-natal complications faced by women who delivered normally were higher than those who delivered via C-section.

Background

Cesarean section (CS) surgery is becoming more common around the world. CS is the most common abdominal surgery procedure performed worldwide, which explains its high prevalence. A ‘caesarean section’ or ‘under the knife delivery’ is a surgical procedure in which incisions are made through a woman's abdomen and uterus to deliver a baby. Caesarean section can be a lifesaving operation when either the mother or her baby faces certain complications or intrication before or during labor and delivery. The decision to have a caesarean delivery can be made in advance, in the event of complications sduring pregnancy, or in an emergency situation at the time of delivery. Caesarean delivery can be of two types based on the time of operation. It can either be voluntary or emergency (1). Voluntary when operation is done at a pre-arranged time during pregnancy to ensure best quality of obstetric care, anesthesia, neo-natal, resuscitation and nursing services. It’s called emergency when operation has to be performed due to some uncertain emergency resulting in posing a threat to life of mother and child (2). The World Health

Organization (WHO) recommends a caesarean rate of 5–15%; a rate greater than 15% indicates an unnecessary and unjustified use of surgical delivery, whereas a rate less than 5% may be related to the population's lack of access to medical technology (3), (4). In India, C-section deliveries are also on the rise. According to National Family Health Service-4 (NFHS-4) data, total percentage of births delivered by caesarean section nearly doubled in prevalence from 8.5–17.2% between 2005-06 and 2015-16 (5).

Despite a lack of evidence supporting substantial maternal and perinatal benefits with CS rates above a certain threshold, and some studies showing a link between increasing CS rates and poorer outcomes, the use of CS has increased dramatically worldwide in the last decades, particularly in middle- and high-income countries (6), (7). The root causes of this increments are multifaceted and poorly understood. This trend has been attributed to changes in maternal characteristics and professional practise styles, as well as increased malpractice pressure, as well as economic, organizational, social, and cultural factors (8), (9), (10), (11).

There is a huge speculation about the sharp increase in the rates of caesarean section, some say it’s completely due to non-medical reasons and due to rising number of women going for voluntary C-section instead of normal delivery which is very painful. The belief that vaginal delivery would spoil a woman’s future sexual performance and ultimately the sexual pleasure of her husband is also there (12).

Breastfeeding in an hour post birth i.e. Colostrum feeding has benefits associated to both mother as well as child. Maternal benefits of breastfeeding include faster involution of the uterus and lower risk of hemorrhage after birth. Breastfeeding within the first hour post-delivery has been cited as an important predictor of continued breastfeeding i.e. colostrum feeding. Even WHO universally recommends colostrum, a mother's first milk or the 'very first food' as the perfect food for every new born. Colostrum feeding needs to be started in the first hour.

Studies show, Cesarean sections are one of the most significant barriers to breastfeeding in hospital-born babies (13). It is found that women who deliver by caesarean section are less likely to breastfeed, or delay breastfeeding initiation. According to a study, infants born by caesarean section are four times less likely than vaginally delivered infants to receive breastfeeding within the first hour of life (14). Another set of studies goes in line with the fact that mothers who gave birth via caesarean section were more likely to discontinue breastfeeding compared to those who gave birth vaginally (15), (16). The major concern is that mothers and babies are frequently monitored for several hours after a caesarean section, often in separate rooms. This deprives them of the opportunity to breastfeed and bond with their children. Delays in breastfeeding initiation accompanying caesarean section deliveries are associated with maternal/infant separation, reduced suckling ability, decreased infant receptivity, and insufficient milk supply, which are predictive of shortened breastfeeding duration (17).

However, other literatures present contradict these results. For instance, Pérez-Escamilla and others in their study asserted that caesarean section delivery did not affect breastfeeding duration if women initiated breastfeeding from birth and maintained breastfeeding for at least four weeks postpartum (18).

Cesarean section could reduce the risk of birth trauma, asphyxia, and breech presentation. However, it is one of the safe-guard of the health interventions for the newborn and the mother during complicated delivery. Still, many of the times it has been observed that in caesarean section have performed with the utmost safety, but it is also associated with a higher rate of morbidity and maternal complications. Cesarean delivery is one of the most remarkable risk factor for postpartum infection. The infection can be there in the uterus or vagina also, it can be accompanied by high fever, sepsis etc. (19), (20), (21).

It should kept in mind, if done without the medical need, there are additional problems attached to this delivery procedure. Such deliveries are associated with increased risk of blood transfusion, hysterectomy, maternal and child death, uterine rupture, placenta accreta, and placenta previa in subsequent pregnancies (22).

Both these aspects in the periphery of C-section need to be thrown a light on because these are proximately affecting the maternal health. We want to know whether there is any significant difference between the breast feeding (colostrum feeding) practice of mothers who delivered by caesarean section and those who delivered normally in addition to that, whether there is any difference between the complications faced by caesarean mothers and normal mothers if any.

Against this backdrop, the main objectives of the paper are to examine the colostrum feeding practices of mothers giving birth via C-section and normal delivery; also, to examine the difference that exists between C-section and normal delivery on post-natal complications faced by women. In fact both difficulty in breastfeeding and post-natal complications can be called as maternal health intrication.

Data And Methods

The data used in this paper was of National Family Health Survey's 4th round conducted in India in 2015-16 by MOHFW, government of India with International Institute of Population Sciences (IIPS), Mumbai serving as regional coordinator. NFHS is a nationally representative, large scale, repeated cross sectional survey in representative samples of households throughout India and is similar to Demographic Health surveys that are conducted in other countries. The principal objective of NFHS is to provide updates and evidence of trends in key population, health and nutrition indicators, including HIV prevalence. Moreover, the survey covers a range of health-related issues, including fertility, infant and child mortality, maternal and child health, perinatal mortality, adolescent reproductive health high-risk sexual behaviour, safe injections, tuberculosis, and malaria, non-communicable diseases, domestic violence, HIV knowledge, and attitudes toward people living with HIV. The survey adopted uniform sample design in all states. In each state, the rural sample was selected in two stages, with the selection of Primary Sampling Units (PSUs), which are villages, with probability proportional to population size (PPS) at the first stage, followed by the random selection of households within each PSU in the second stage. In urban areas, a three-stage procedure was followed. In the first stage, wards were selected with PPS sampling. In the next stage, one census enumeration block (CEB) was randomly selected from each sample ward. In the final stage, households were randomly selected within each selected CEB. The survey collected information from a

nationally representative sample of 103,411 men and 699,686 women age 15–49 during the period 2015-16.

Statistical Analysis

Bivariate and multivariate analysis has been carried out to know the difference in prevalence of colostrum feeding among mothers who have delivered by C-section and those who delivered normally. Propensity score matching (PSM) has been used; it helped us to find an effective strategy for controlling the confounding influence of post natal complications faced among caesarean and normal delivery mothers in simpler words, it is a counterfactual model which has been used to compute the effect of caesarean section and normal delivery on post natal complications controlling all other background characteristics and biases. This model gives us the actual impact of the treatment or intervention, and it does not introduce any bias. We have used nearest neighborhood propensity score matching for our paper.

Both the dependent variables taken for the study are dichotomous viz. colostrum feeding and post-natal complications are having response ‘yes’ or ‘no’. Colostrum feeding was created by considering the duration of breast feeding initiation within an hour post birth. Post-natal complication variable was created by compiling ‘excessive vaginal bleeding’ and ‘very high fever’. The presence of either of the complication was taken as a ‘yes’ for complications/ intricaton. The independent variables included were various socio-economic background characteristics and some selected characteristics of mother. The important characteristics assessed in this study were Current age; Parity; Mother’s education; Place of residence; Wealth index; Region; Religion; Caste; Multiple births; Age at first birth; ANC visits; Place of delivery and BMI of women.

Results

<Figure 1>

Figure 1 compares the prevalence of delivery by caesarean section in different states of India. Among the states, the highest prevalence of caesarean section can be found in the southern state of Telangana (57%), followed by Andhra Pradesh (40%), Kerala (36%), Tamil Nadu (34%), Jammu and Kashmir (33%) and Goa (31.4%), The National Capital Territory has also a higher prevalence of such delivery by surgical procedure, around 27%. Orissa has experienced a whopping of around 375% in caesarean deliveries between 2005-06 to 2015-16. Jharkhand is the only state which has witnessed a decline in caesarean deliveries. NFHS-4 shows that 7 states have prevalence of C-section deliveries that is more than 30%, and, 8 states have the same in between 10% to 20%, and, 9 states less than 10%.

< Table 1>

Table 1 shows the distribution of women who have given at least one birth in last five years preceding the survey by some selected background characteristics. Majority of mothers, around 39 percent of women

belong to the prime reproductive age group i.e. (25-29) years. When it comes to educational level, around 45 percent of the women were educated up to secondary level, also a large portion of the women belong to the rural area. Caste and religion wise people of other backward classes and Hindus are predominant 44 percent and 79 percent respectively. Around one-fourth of mothers belong to the poorest quartile and when it comes to the topmost quartile, only 15 percent belong to the richest section. Region wise, around one-fourth of women, belong to Northern region and around three percent, i.e. minimum sample was taken from the North-eastern region which accounts to sample of around 91,113 from this region. Overall, the total observations are 259,627.

<Table 2>

Table 2 demonstrates the feeding practices (whether colostrum feeding was done by women post-delivery) of women who have given birth under caesarean section or normal delivery. It was observed that colostrum feeding percentages are high among women who delivered their babies normally, because the sample size belong to the group is high compare to the caesarean section delivery. It was found that total 56.6% and 72% women whose delivery was under caesarean and normal, respectively, have practiced colostrum feeding.

As it can be vividly seen in the table, the percentage of women who could breastfeed their children in earlier age-group are much higher in case of normal delivery as compared to caesarean section delivery; this is uniform across all the age groups. For instance, under caesarean section, around 49% women in age-group of less than 20 years, while under normal delivery around 72% women have experienced colostrum feeding. Whereas, in age-group of 35 years and above, around 57% women under caesarean and 68% women under normal delivery have fed their children.

Education is also seen to be going upward hand in hand with colostrum feeding. Under caesarean section delivery, about 50% women with no education fed colostrum to their children; under normal delivery, about 66% women with no education level fed their children. However, 56% women under caesarean delivery and 74% women under normal delivery with higher education level, have experience colostrum feeding to their children.

In urban area, the percentage of colostrum feeding women is high among women with normal (i.e., 74%) delivery in comparison to caesarean delivery (i.e., 57%). Colostrum feeding is highest among christian women in both types of deliveries. Among muslim women, around 55% with caesarean delivery and around 69% with normal deliveries have fed this children.

A significant percent point difference can be seen between colostrum feeding practice of the top most wealth quintile in comparison to those quintiles at bottom. Only around 52% women who belong to poorest wealth quintile and caesarean deliveries and around 68% from normal deliveries have experienced colostrum feeding. Further, North Eastern and Southern region have a higher prevalence of women feeding colostrum to their babies across both the types of delivery.

Besides, the colostrum feeding practices was observed among women who had given birth by caesarean and normally by some maternal characteristics. In case of multiple births (twins, triplets etc.) the percentage of women feeding colostrum is less as that of in single births, also higher percent of women of second parity are practicing the same.

ANC visits seems to be playing a positive relation with colostrum feeding. For instance, around 58% women with four and above ANC visits and caesarean delivery, which is highest among women with none and one to three ANC visits. Similarly, in normal delivery category, around 73% women with four and above ANC visits have fed colostrum to their children. Further, it is very surprising to observe that only around 38% women whose child's size at birth was very small and delivered via caesarean section, have fed colostrum to their children, and among normal delivery group around 57% women.

Public health facility deliveries had higher percentage of women feeding colostrum to their children in comparison to private. Around 53% women who delivered via caesarean in private facility, and around 77% women whose normal delivery took place in public health facility have experienced colostrum feeding.

<Table 3>

Table 3 compares the post-natal complications faced by women within two months after delivery, who had undergone delivery by caesarean section or normal delivery. In this table, unlike the previous table, the percentage of post-natal complications are significantly higher in case of caesarean delivery compared to normal delivery. In fact such pattern is uniform across all the covariates. It was found that total 23.9% and 19.2% of women have faced post-natal complications under caesarean section and normal delivery, respectively.

It can be seen; higher the age-group of the women, lower was the chance of facing post-natal complications. As, around 31% and 25% of women experienced caesarean delivery and belongs to age-groups less than 20 years and 20-24 years, who faced post-natal complications, whereas, only around 25% and 19% of women who delivered their children normally and comes under the same age-group, respectively.

In case of education level, similar pattern was found. Around 22% women with higher education level and caesarean delivery, while around 21% women with same education but normal delivery have faced the risk of post-natal complications. In both types of delivery, women from rural areas have faced higher percentage of post-natal complications than its counterpart (i.e., urban areas).

Highest percent of ones who faced complications and delivered under caesarean section are, 25% women who belongs to schedule tribe. Whereas, highest percentage of women who faced post-natal complications and delivered normally are, 20% women who belongs to schedule castes social group.

Women of the bottom most quintile is more prone to post-natal complications, this is independent of the delivery procedure also those at the top of the quintile were seen to be facing less complications. Around

26% women from poorest quintile and caesarean delivery have faced post-natal complication, while, only around 20% women from same wealth quintile but under normal delivery have experience complications. In case of richest wealth index, around 23% and 21% women under caesarean and normal delivery, respectively face the post-natal complications. Northern region has maximum percent of women 27 percent and 21.3 percent facing any sort of post-natal complications in caesarean delivery and normal delivery respectively.

Further it also shows the comparison between post-natal complications faced by women undergone caesarean section or the normal delivery by some maternal factors. It was found that women who delivered her first child in younger age-group, have faced high post-natal complications in caesarean section deliveries, while the same case was not with the normal deliveries. For instance, among caesarean section delivered, around 25% women in age-group 20-24 years, and around 20% women .in age-group of 35 years and above have faced the post-natal complications; whereas, among normally delivered, around 19% and 20% women have faced the complications in same age-group categories, respectively.

Women with multiple births have experienced less post-natal complications compare to the women who did not had multiple births, in both types of delivery categories. Among women who have practiced caesarean section and normal delivery, out of them around 30% and 27% of women, respectively, with first parity faced complications.

Women who did not go for any ANC checkup and those whose child born was very small in size, faced more post-natal complications independent of the type of delivery procedure undergone. In case of caesarean section delivery, around 26% underweight, and around 22% overweight women, while in case of normal delivery, around 19% underweight, and 20% overweight women had to face more complications.

Overall, it can be noted women who delivered by caesarean section had higher prevalence of post-natal complications in first two months following delivery. Even if we compare by delivery place i.e public or private, it has been observed that independent of the type of delivery facility, women who delivered by caesarean section faced more complications.

<Table 4>

Table 4 shows the effect of caesarean section on postnatal complications through propensity score matching, we have used it to control biases related to background characteristics and to find out actual effect that caesarean section has on post-natal complications. Average treatment effect on the treated (ATT), Average treatment effect on the untreated (ATU), Average treatment effect (ATE) show the estimate after matching.

It is seen that among the unmatched treatment group i.e., those had undergone for caesarean section delivery, the prevalence of post-natal complications is around 24%, and the same for control group i.e.

those who had undergone for normal delivery is 18%. After matching, the value of ATT is around 24% in treatment group and 17.4 in control group, it means that if these women, who had caesarean delivery, would they not have undergone for caesarean section delivery then the prevalence of post-natal complications among them would have been only 17.4%. Average treatment effect on untreated show that women who had not undergone for C-section, if they would have undergone for the caesarean section, the post-natal complication would have increased to 19.6%. ATE shows the difference between the treated and untreated women, here it is around 2.4%.

Discussions

To our knowledge, this is one of the few attempts to systematically and comprehensively study the two most prominent concerns associated with caesarean deliveries: the feeding of colostrum to the baby within an hour or so of birth and the postnatal complications that mothers must deal with after the surgical delivery.

Concordant with findings in other studies, the current study found that, nationally, the prevalence of C-section deliveries has considerably increased during last one decade. With the increase in institutional deliveries and growing access to gynecological and obstetric care, C-section deliveries too have shown an increasing trend (23).

Present study found a huge difference of around 15% points in practice of colostrum feeding among mothers who delivered via caesarean section and those who delivered normally. This goes in line with the study by Brown and Jordan (2013), they found that, women who delivered by caesarean section had more difficulty in latching and positioning as compared to the normal delivery (16). Another Canadian cohort study showed that the cesarean delivery was associated with greater difficulty in breastfeeding, required more assistance compared to normal delivery (17). This also goes in accordance to the study by Evans and others; they found that breast milk transfer among women with C-section was significantly lower especially in the first 5 days post giving birth in comparison to women with normal births. Lactation is delayed in mothers who deliver by caesarean section because it is disturbed during such deliveries(24). There are various studies that showed women who delivered via c-section were more likely not to have been able to breastfeed the babies after delivery (25), (26).

Further, study explored that the colostrum feeding prevalence was found to be lower in rural areas than urban areas. There are various misconception regarding this; and results of current study speak to the general lack awareness amongst rural women, widely they consider it unfit for drinking and is thrown instead of feeding the baby (27). Besides, results consistent with study by Ijaz et al., the result show that breastfeeding is higher in mothers having lower family income than in mothers with high-income families (28).

Many researchers have proved that the mothers belonging to higher socio-economic status had higher chances of Caesarean Section (29), (13). It was also found in the study that mothers who had no ANC visits, the postnatal complications amongst those were higher, this reiterates that having ANC visits is

associated with increased awareness as well as better preparedness of delivery and complications if any (12).

Post-natal complications were also found to be more prevalent among caesarean mothers. In fact, overall, higher prevalence among caesarean mothers has further been backed by our findings of the PSM model. There are various studies that reinstate that complications following C-section deliveries are very common (30), (20), (31), (32), (21). Complications such as massive vaginal bleeding and high fever were found to be more prevalent in mothers delivering surgically as compared to those delivering. Taylor and other in their study found that mothers who had caesarean section birth were at increased risk of uterine rupture in the subsequent births (33). The prevalence of placenta previa, haemorrhage and caesarean hysterectomy highly occurs in women with the history of caesarean deliveries (30). The complications to the mother and the fetes are very high in caesarean than vaginal delivery (34). The women from lower socio-economic class were found to be more likely to be suffering from postnatal complications especially vaginal bleeding. Further, postnatal complications were also found to be higher in rural areas, this goes in line an Indian study which discusses as compared to women living in urban areas, women living in rural areas are more likely to suffer from excessive vaginal bleeding (OR = 1.39; 95%; CI=[1.29, 1.50]) (32). Younger mothers (< 20 years) were found to be facing postnatal complications more as compared to older ones (35 < years). This underlines that with increasing age women better understand the proper precautions to be taken and hence face lesser complications (35), (12). Caesarean delivery births are generally higher amongst private hospitals however, when it comes to complications following deliveries, it was found that there were more complications when delivery was done in public hospitals This speaks volume of the lack of proper care in public hospitals and the notion of people preferring private hospitals over public for the sake of better healthcare. This was also discussed in a Japanese study by various other researchers which discuss in their study about private hospitals have better quality equipment, and doctors treat patients in a better manner, and that is the reason for the preference (31).

Conclusions

The study concludes that mothers who delivered surgically had difficulty in colostrum feeding practice. Further**,** post-natal complications, following caesarean deliveries are severe. Higher number of institutional deliveries are also a contributing driver of the higher number of caesarean deliveries. Caesarean delivery mothers need encouragement and assistance for initiating early breastfeeding so that it can adhere to implementation of Baby Friendly Hospital Initiatives.

Declarations

Ethics approval and consent to participate: This research does not have an ethical code because the data source used in this study gathered from publically available data and these data considered as secondary data. **All methods were carried out in accordance with relevant guidelines and regulations.**

Consent for publication: Not applicable.

Availability of data and materials: The datasets used in the current study are freely available from the Demographic Health Survey. https://dhsprogram.com/Data/

Competing interests: None.

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Tables

Table 1. Sample distribution of some selected background characteristics of women who have given at least one birth in last five years preceding the survey, India (2015-16).

Background Characteristics	Sample of Mothers	
	Percentage	Frequency
Current age of mothers (Years)		
<20	2.6	6,699
20-24	30.1	78,177
25-29	38.3	99,396
30-34	18.9	49,005
35+	10.2	26,350
Educational Level		
No education	30.1	78,027
Primary	14.1	36,472
Secondary	45.4	117,915
Higher	10.5	27,213
Residence		
Urban	28.1	72,860
Rural	71.9	186,767
Caste		
SC	21.5	55,928
ST	10.5	27,362
OBC	44.2	114,688
Others	23.8	61,649
Religion		
Hindu	78.7	204,235
Muslims	16.6	42,974
Christian	2.0	5,309
Others	2.7	7,109
Wealth Index		
Poorest	25.4	65813
Poorer	22.0	57054

Middle	19.8	51501
Richer	18.1	47075
Richest	14.7	38184
Region		
Northern	25.1	65,275
Eastern	25.4	66,054
Central	9.3	24,142
Western	18.6	48,249
Southern	18.0	46,795
North-eastern	3.5	9,113
Total	**100**	**259,627**

Table 2. Percentage distribution of Colostrum feeding among women with Caesarean and normal delivery with Socio-economic and maternal factors, India (2015-16).

Background Characteristics	Colostrum feeding	
	Caesarean Delivery	Normal Delivery
Current age of mother (Years)		
<20	49.1	72.3
20-24	56.7	72.8
25-29	57.2	73.0
30-34	56.7	70.8
35+	57.2	67.8
Educational Level		
No education	49.8	65.8
Primary	55.7	70.8
Secondary	58.4	76.4
Higher	56.0	74.3
Residence		
Urban	57.0	74.2
Rural	56.5	71.3
Caste		
SC	59.4	72.0
ST	64.9	76.7
OBC	57.1	69.7
Others	53.4	74.2
Religion		
Hindu	56.8	72.2
Muslims	55.2	68.6
Christian	67.4	85.5
Others	51.6	76.8
Wealth Index		
Poorest	51.9	67.7
Poorer	57.3	72.5

Middle	58.2	74.0
Richer	58.8	75.4
Richest	54.5	73.1
Region		
Northern	36.1	56.1
Eastern	52.5	73.4
Central	47.1	74.1
Western	59.0	77.1
Southern	68.0	86.3
North –Eastern	68.2	86.5
Age at first birth		
15-19	56.5	72.2
20-24	56.5	71.5
25-29	56.6	73.7
30-34	60.1	75.3
35+	56.5	71.3
Multiple Births		
No	56.8	72.1
Yes	50.0	63.4
Parity		
One	55.7	72.1
Two	59.0	75.6
Three and Above	53.4	68.7
Antenatal care visits		
None	54.9	63.7
One-Three	52.9	68.0
Four and Above	57.7	78.3
Size of child at birth		
Very large	60.8	74.0

Larger than average	57.8	75.7
Average	57.5	72.2
smaller than average	49.3	68.8
Very small	37.8	57.3
Place of delivery		
Public health facility	63.8	77.0
Private health facility	52.6	70.9
Body Mass Index of mother		
Underweight	56.5	71.7
Normal	57.0	71.9
Overweight	56.9	73.2
Obese	53.7	72.2
Total	**56.6**	**72.0**

Table 3. Percentage distribution of Post-natal Complications among women with Caesarean and normal delivery with Socio-economic and maternal factors, India (2015-16).

Background Characteristics	Post-natal Complications	
	Caesarean Delivery	Normal Delivery
Current age of mother (Years)		
<20	30.9	24.7
20-24	24.5	19.0
25-29	23.9	18.2
30-34	22.8	19.8
35+	21.9	21.7
Education Level		
No education	25.4	19.0
Primary	24.2	19.0
Secondary	24.3	19.0
Higher	22.2	21.4
Residence		
Urban	22.4	18.6
Rural	25.3	19.4
Caste		
Schedule caste	24.6	20.3
Schedule Tribe	25.0	17.5
Other Backward Class	24.4	19.4
Others	22.7	18.8
Religion		
Hindu	24.2	19.2
Muslims	21.1	18.0
Christian	20.4	18.7
Others	31.5	27
Wealth Index		
Poorest	26.1	19.8
Poorer	24.3	18.4

Middle	24.2	18.8
Richer	24.2	18.9
Richest	22.8	20.6
Region		
Northern	27.1	21.4
Eastern	22.9	20.0
Central	26.8	18.2
Western	20.4	15.5
Southern	24.5	21.1
North –Eastern	18.3	12.7
Age at first birth		
15-19	24.3	19.0
20-24	24.5	19.2
25-29	22.8	19.7
30-34	21.8	21.4
35+	20.1	19.8
Multiple Births		
No	24.3	19.3
Yes	12.4	11.3
Parity		
One	29.6	27.1
Two	20.1	17.2
Three and Above	20.4	16.8
Antenatal care visits		
None	29.9	29.8
One-Three	32.6	26.8
Four and Above	27.9	25.3
Size of child at birth		
Very large	25.4	22.5

Larger than average	25.2	19.9
Average	23.1	18.2
smaller than average	25.1	21.5
Very small	27.7	25.1
Place of delivery		
Public health facility	24.4	19.7
Private health facility	23.6	19.0
Body Mass Index of mother		
Underweight	26.1	19.3
Normal	24.0	19.1
Overweight	22.4	19.7
Obese	23.0	19.6
Total	**23.9**	**19.2**

Note: Post-Natal Complications include excessive vaginal bleeding and high fever

Table 4. Effect of Caesarean delivery on Post-natal Complications, results from Propensity Score Matching analysis, India (2015-16).

Variable	Treated	Controls	Difference	S.E.	T-stat
PNC Complications					
Unmatched	0.240	0.179	0.061	0.002	27.42
ATT	0.240	0.175	0.065	0.077	0.85
ATU	0.179	0.197	0.018	.	-
ATE			0.024	.	-

Note: Post-Natal Complications include excessive vaginal bleeding and high fever

Figures

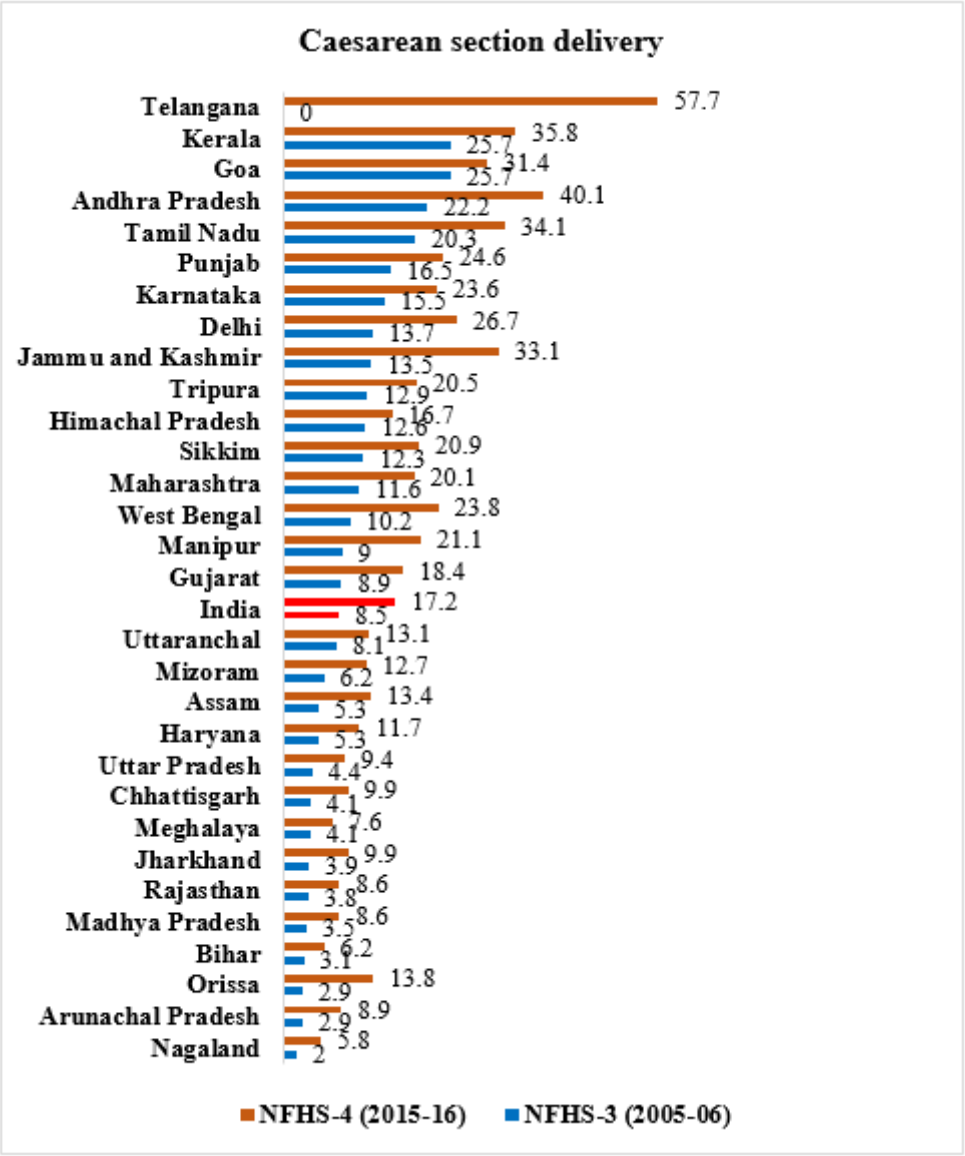

Figure 1

State-wise prevalence of Caesarean section delivery over last one decade, India (2005-16).

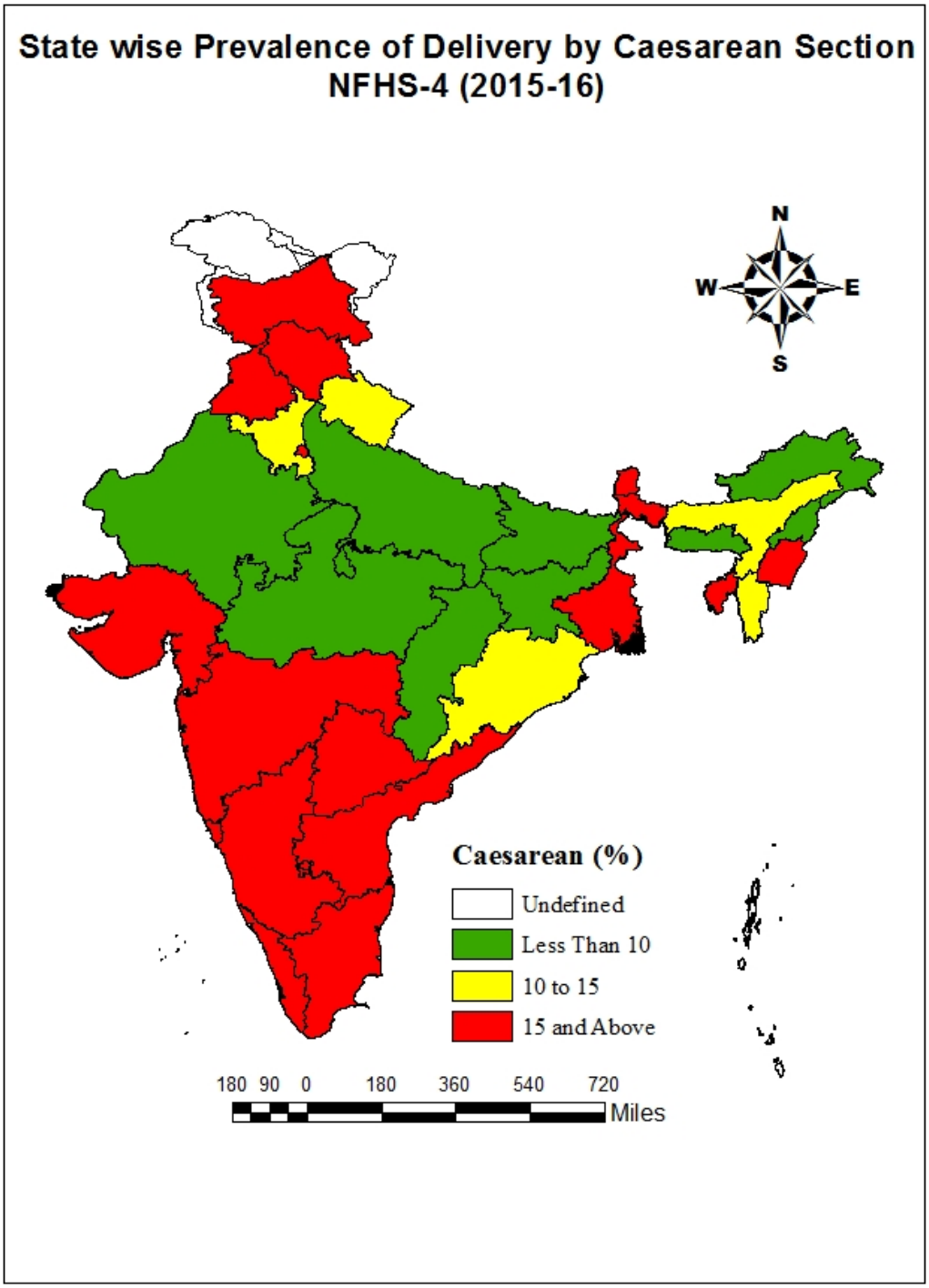

Figure 2

State wise prevalence of Caesarean delivery rates, classified as per WHO caesarean rates classification.