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The impact of mode of birth delivery on child health in India

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ABSTRACT

Background: A skilled birth attendant and the place of delivery have significant effects on child growth.

Aims: The present paper aims to examine the mode of delivery and its impact on child health among children (0 – 59 months) in India.

Methods: The life table estimation of mortality and both bivariate and multivariate logistic regressions were used to identify the association between child health and mode of delivery using data from the National Family Health Survey conducted in 2015 – 2016.

Results: After adjusting for socioeconomic and biodemographic factors, poor child growth (measured through Z-scores for stunting, wasting, and underweight categories) was more significant in cesarean delivery compared to normal delivery. In contrast, live birth for different groups of women was reportedly higher in normal vaginal delivery than in cesarean delivery. Neonatal and infant mortality rates were lower for normal delivery than cesarean delivery, particularly in public hospitals. The risk of child death was also higher in cesarean delivery, particularly in the neonatal period.

Conclusion: The findings from this study could inform the development of health-care policies and the implementation of strategies aimed at improving the quality of painless labor and prompt delivery in health-care facilities, particularly public hospitals.

Relevance for Patients: The present study may help pregnant women and their providers decide whether a cesarean delivery is appropriate.

1. Introduction

Child malnutrition and mortality represent major public health challenges, particularly in low- and middle-developing countries like India. In 2017, nearly 151 million (22%) of children reported stunted growth [1], and 45% of global child deaths were among children <5 years old [2,3]. The major causes of child malnutrition and mortality in low and middle-developing countries are poor nutrition, infectious diseases, household environment, and different modes of birth delivery [4]. In general, human birth can occur through natural delivery, assisted delivery, or cesarean section, with the latter sometimes performed due to social factors [5]. Several studies have suggested that cesarean sections can have a negative impact on both maternal and child health outcomes [6-11]. The World Health Organization (WHO) recommended that the utilization of cesarean section should be limited to 5 – 15% in any population to avoid any negative health impact [12-17]. A cesarean section rate below 5% implies that a substantial proportion of women experience successful delivery without surgical complications, indicating adequate access to skilled delivery services [18]. In addition, it is indicative of favorably saving both infant and maternal lives during emergency obstetric situations and has also contributed to reductions in maternal and neonatal mortality, as well as morbidity [19].

Conversely, cesarean rates above 15% suggest an increased risk of mortality, financial burden, and clinical risks on the health of both mother and baby, as well as the health-care system [20-22]. The previous studies conducted in high-income countries have examined how women with various obstetric histories may influence the likelihood of cesarean delivery and its impact on neonatal and infant mortality rates [23,24]. Polidano *et al.* suggested that cesarean birth is associated with negative cognitive growth of the child [25], such as the development of asthma, Type I diabetes, allergies [26-28], and obesity [29], and is also correlated with poor academic performance [30,31]. Infants born vaginally pass through the birth canal directly, whereas cesarean-born infants come into contact with the mother's skin through assistance from doctors or nurses in the hospital. An early study by Rowe-Murray and Fisher found that cesarean-born infants are less likely to immediately come into contact with the mother's skin after birth, and they also reported delayed breastfeeding, that is, after 24 h in post-delivery [32].

Globally, cesarean birth rates have increased and vary across different countries due to diverse socioeconomic factors and differential health-care services. Moreover, cesarean birth rates are higher in Asian countries compared to other countries. In Ghana, the cesarean birth rate increased from 3% to 23% between 2003 and 2014 [33,34]; in Iran, cesarean section operations contribute to 40.0% of all births [35]; in China, the cesarean birth rate has reached 34.9% [36]; and in Brazil, the cesarean birth rate accounts for 56%, corresponding to approximately 90% in the private sector [37]. In India, the Fourth National Family Health Survey (NFHS-4) reported an increase in cesarean delivery rates from 8.5% to 17.2% between 2005 and 2016, but this was still lower compared to other developing countries such as Brazil and China [38]. As reported in an earlier study, women from higher-educated and wealthier backgrounds are more likely to undergo cesarean sections than women from less-educated and lower-income families. Furthermore, women admitted to private health institutions are more likely to have cesarean births than those admitted to government-owned health facilities [39].

There are currently more debates on the surgical procedures involved in birth delivery among women in private and public health institutions. Some studies suggested normal vaginal delivery [40,41], whereas others recommended cesarean delivery [42]. Vaginal delivery is reportedly more commonly associated with postpartum hemorrhage [41], whereas postpartum morbidity occurs more often in cesarean delivery [40]. In comparison with cesarean delivery, normal vaginal delivery is a physiological process of human reproduction and has many positive effects. For example, first contact with the mother and early breastfeeding is important for the child's psychological development [43]. Conversely, cesarean birth is an unnatural mode of delivery and is associated with an increased risk of endometritis, pneumonia, and other conditions, leading to poorer psychological development of newborns [5,41]. Therefore, the present paper aims to identify the impact of different birth delivery methods on child growth.

2. Methods

2.1. Data collection

The present study utilized data from NFHS-4, which was conducted in 2015 – 2016 by the Ministry of Health and Family Welfare. The NFHS is one of the important large-scale biodemographic and health surveys in India, providing sufficient information on fertility, mortality, nutritional status, family planning, and health-care utilization. The sample size of the survey included 259,627 birth records from the 5 years preceding the survey. During the survey, all women (aged 15 – 49 years) provided comprehensive birth histories, including the sex, delivery date, and survival status of each newborn. Detailed information on the survey is available in the national report [38].

2.2. Outcome variables

Neonatal and infant mortalities were two dependent variables evaluated in the study. Neonatal mortality is defined as the death of newborn babies within 28 days of birth. Infant mortality is defined as the death of newborn babies before reaching 12 months. Another dependent variable evaluated in the study was child growth, which was categorized into stunting, wasting, and underweight. Stunting refers to children (aged 0 – 59 months) whose height-for-age Z-score is < -2 standard deviation ($-2SD$) (i.e., $Z < -2SD$) below the median of the reference population. Likewise, underweight and wasting refer to children (aged 0 – 59 months) whose weight for age and height Z-scores are $< -2SD$ (i.e., $Z < -2SD$) below the median of the reference population. These indicative Z-scores were then computed based on the WHO-recommended reference population [44]. The above variables were classified as absent if $Z \geq -2SD$. The mortality variables were coded as 1 if the baby had died and 0 if the baby survived.

2.3. Explanatory variables

The place of delivery was considered a primary independent variable in the study. According to NFHS-4, the place of delivery could be categorized into: (i) Public hospital (government hospital, government health center, government health post, or other public sector) and (ii) private medical sector (private hospital or clinic and other private medical facility). We also categorized the delivery method accordingly: Cesarean section or normal vaginal delivery. Based on the reviewed literature, we investigated several biodemographic and socioeconomic variables that could also significantly impact a child's health [45-48], including the mother's age during childbirth (15 – 19, 20 – 29, 30 – 39 years, or 40 – 49 years), preceding birth interval (< 24 or ≥ 24 months), birth order (1, 2, or 3), place of residence (urban or rural), household wealth (poorest, poorer, middle, richer, or richest), and birth attendant (doctors or nurses).

2.4. Statistical analysis

A comparative analysis was performed to evaluate the effect of different delivery methods (normal vs. cesarean) on child

growth. The life-table technique was developed to estimate neonatal and infant mortality rates based on birth history variables collected from the Child Mortality Census dataset. Binary logistic regression models were used to identify the odds of normal and cesarean delivery. Childbirth through cesarean section and normal delivery were coded as 1 and 0, respectively. Following the collection of bivariate data, multivariate logistic regression models were constructed for each of the dependent variables. The results of the regression analysis were presented as odds ratios (OR), along with the corresponding 95% confidence intervals (CIs). All statistical analyses were performed using STATA® software (version 15.0).

3. Results

Table 1 presents the total number of births delivered through different delivery methods and places of delivery, along with their background characteristics. Mothers in the 15 – 19 years age group reported the highest number of births through normal delivery in both public (i.e., 98% normal birth vs. 3% cesarean birth) and private hospitals (i.e., 67% normal birth vs. 33% cesarean birth). Notably, older mothers (e.g., >30 years) reported higher cesarean births than normal births in both private and public hospitals, most likely due to their capability and means compared to young mothers (i.e., <19 years). Mothers who gave

birth more than 24 months after a preceding birth were more inclined toward cesarean section than those who had given birth less than 24 months after a preceding birth. Interestingly, birth order was negatively correlated with cesarean section and positively correlated with normal delivery. This could be associated with Muslim families who prefer normal delivery over cesarean section. Cesarean sections were reportedly more common in urban residences compared to rural residences (42.0% vs. 35.5%) due to the availability and accessibility of medical facilities and transportation. Household wealth plays a dominant role in determining the birth delivery method. The “richest” households would prefer cesarean birth more than the “poorest” households (43.8% vs. 24.3%, respectively). The differences between normal and cesarean births in the “richest” households in private and public hospitals were 12% and 57%, while the differences in the “poorest” households were much wider at 52% vs. 92%, respectively. In both private and public hospitals, most cesarean births were delivered by doctors, while most normal births were delivered by the nurse.

Table 2 presents the neonatal and infant mortality rates by different birth delivery methods in public and private hospitals along with their biodemographic and socioeconomic characteristics. Results indicate that neonatal and infant mortalities varied across the socioeconomic and biodemographic

Table 1. Total number of births (%) based on the delivery method and place of delivery according to different biodemographic and socioeconomic backgrounds in India (2015 – 2016)

Background	Number of births, n (%)			
	Private hospital		Public hospital	
	Cesarean	Normal	Cesarean	Normal
Mother's age (years)				
15 – 19	399 (33.3)	798 (66.7)	391 (3.4)	3764 (97.6)
20 – 24	5525 (34.6)	10424 (65.4)	4564 (9.9)	41497 (90.1)
25 – 29	8179 (38.0)	13338 (62.0)	5891 (10.8)	48428 (89.2)
>30	6585 (42.0)	9090 (58.0)	4782 (13.1)	31711 (86.9)
Preceding birth interval (months)				
<24	1950 (29.3)	4712 (70.7)	1674 (7.5)	20553 (92.5)
≥24	18738 (39.3)	28938 (60.7)	13954 (11.7)	104847 (88.3)
Birth order				
1	11066 (42.1)	15197 (57.9)	8067 (14.0)	47923 (86.0)
2	6899 (39.5)	10559 (60.5)	5399 (12.1)	39201 (87.9)
>3	2723 (25.7)	7894 (74.3)	2162 (5.3)	38276 (94.7)
Place of residences				
Rural	11307 (35.5)	20712 (64.5)	10197 (9.2)	100062 (90.8)
Urban	9381 (42.0)	12938 (58.0)	5431 (17.6)	25338 (82.4)
Household wealth				
Poorest	1102 (24.3)	3249 (75.7)	1417 (4.0)	33661 (96.0)
Poorer	2034 (28.9)	4983 (71.1)	2822 (7.8)	33546 (92.2)
Middle	3745 (36.0)	6648 (64.0)	4208 (13.3)	27386 (86.7)
Richer	5703 (40.5)	8377 (59.5)	4178 (17.6)	19597 (82.4)
Richest	8104 (43.8)	10393 (56.2)	3003 (21.1)	11210 (78.9)
Delivered by				
Doctor	18509 (42.3)	25237 (57.7)	13184 (16.3)	67825 (88.9)
Nurse	11613 (35.9)	20662 (64.1)	9126 (9.0)	92869 (91.0)

Table 2. Neonatal and infant mortality rates (*n* per 1000 live births) based on the delivery method and place of delivery according to different demographic and socioeconomic backgrounds in India (2015 – 2016)

Background	Mortality, <i>n</i> per 1000 live births							
	Neonatal				Infant			
	Private hospital		Public hospital		Private hospital		Public hospital	
	Cesarean	Normal	Cesarean	Normal	Cesarean	Normal	Cesarean	Normal
Mother's age (years)								
15 – 19	28	61	41	34	36	72	51	55
20 – 24	21	35	31	28	27	44	44	40
25 – 29	20	24	30	24	26	31	38	34
>30	21	27	31	25	27	35	42	37
Preceding birth interval (months)								
<24	28	48	27	34	37	62	37	53
≥24	20	26	32	24	26	33	42	34
Birth order								
1	19	29	37	30	24	36	46	40
2	17	22	22	21	24	28	32	31
>3	43	39	32	27	53	52	50	41
Place of residence								
Rural	28	37	36	28	35	46	48	40
Urban	13	18	24	19	18	23	31	29
Household wealth								
Poorest	56	59	60	35	64	73	84	49
Poorer	41	49	38	28	53	63	50	40
Middle	25	31	30	22	33	41	41	34
Richer	18	23	22	20	24	27	30	27
Richest	11	15	25	13	15	20	30	19
Delivered by								
Doctor	20	25	27	25	26	32	38	34
Nurse	21	33	32	25	28	42	42	36

characteristics for different birth delivery methods and places of delivery. Both neonatal and infant mortality rates were reportedly lower for cesarean births than normal births in both private and public hospitals. Mothers who gave birth at ages 15 – 19 years old reported higher infant and neonatal mortality rates compared to those who gave birth at ages 25 – 29 years old. Similarly, the mortality rate was also high for mother's aged above 30 years old for both normal and cesarean births in public and private hospitals. Higher birth order is associated with higher rates of infant and neonatal mortalities for cesarean births compared to normal births in both public and private hospitals. The infant mortality rate in rural residences was higher compared to urban residences. Likewise, the infant mortality rate was higher in private hospitals compared to public hospitals for normal births in rural residences. The "richest" households had lower rates of neonatal and infant mortalities compared to the "poorest" households. Similarly, the mortality rate is also lower for births delivered by doctors compared to nurses.

Table 3 displays overall child growth according to different birth delivery methods. It was found that child malnutrition (i.e., stunting, wasting, and underweight) was lower for normal births compared to cesarean births. For example, stunted child growth from cesarean and normal births was 40% and 27%,

Table 3. Child growth indicators according to the birth delivery method

Child growth	Delivery method	%	SD	95% CI	χ^2	P
Stunting	Cesarean	40.2	0.5	(0.40 – 0.40)	2.0	0.000
	Normal	27.1	0.4	(0.26 – 0.27)		
Wasting	Cesarean	21.0	0.4	(0.20 – 0.21)	310.0	0.000
	Normal	16.8	0.4	(0.16 – 0.17)		
Underweight	Cesarean	36.3	0.5	(0.36 – 0.36)	2.1	0.000
	Normal	23.2	0.42	(0.22 – 0.23)		

Abbreviations: CI: Confidence interval; SD: Standard deviation.

respectively (Figure 1). Similarly, wasted children from cesarean and normal births were 21% and 17%, while underweight children from cesarean and normal births were 36% and 23%, respectively.

Table 4 presents the ORs for neonatal and infant mortalities of cesarean and normal births along with their background characteristics. Results suggested that the ORs of neonatal and infant mortalities of cesarean births were 0.24 and 0.28 times, respectively, lower than normal births in public and private hospitals. The differences in risk of neonatal and infant mortalities for cesarean births were negligible between

private and public hospitals. Conversely, neonatal mortalities were 0.88 times lower in public hospitals compared to private hospitals for normal births. This could be due to the preferences of private hospital doctors to perform cesarean sections over normal deliveries, thereby significantly increasing neonatal and infant mortalities of normal births in private hospitals. With

mothers aged 15 – 19 years old during delivery as the reference category, it was observed that mothers aged 25 – 29 years old reported a lower risk of neonatal mortality from normal births compared to cesarean births. Mothers, who gave birth more than 24 months after a preceding birth, reported significantly lower risks of neonatal and infant mortalities compared to those who gave birth less than 24 months after a preceding birth. Birth orders of more than the third births were at significantly higher risks of neonatal and infant mortalities (i.e., 1.23 and 1.32 times, respectively) for cesarean births compared to normal births. Newborns from the “poorer” households were at a higher risk of neonatal and infant mortalities compared to newborns from the “richest” households for both normal and cesarean births. In addition, the risk of neonatal mortality was significantly lower for normal births delivered by doctors than nurses (OR: 0.91 vs. 0.93).

4. Discussion

The effect of cesarean deliveries on child health and the higher cost associated with cesarean deliveries compared to

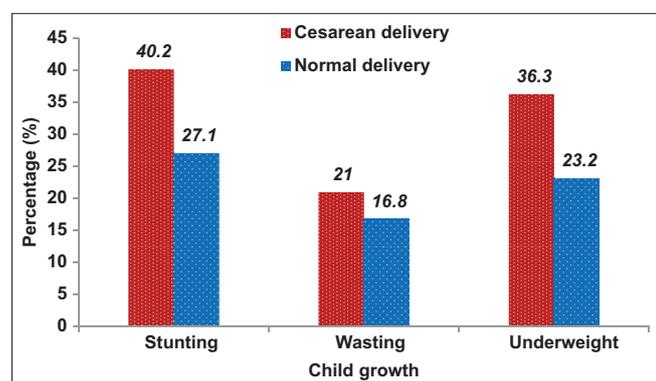


Figure 1. Impact of birth delivery method on child growth.

Table 4. OR and 95% CI for neonatal and infant mortalities based on the delivery method according to different demographic and socioeconomic backgrounds in India (2015 – 2016)

Background	Mortality, OR (95% CI)			
	Neonatal		Infant	
	Cesarean	Normal	Cesarean	Normal
Place of delivery				
Public	0.24 (0.17 – 0.34)***	0.88 (0.81 – 0.96)***	0.28 (0.20 – 0.39)***	0.89 (0.83 – 0.95)***
Private	0.25 (0.17 – 0.35)***	1.33 (1.21 – 1.47)***	0.28 (0.20 – 0.39)***	1.20 (1.10 – 1.31)***
Mother's age (years)				
15 – 19 [®]	-	-	-	-
20 – 24	0.83 (0.57 – 1.19)	0.77 (0.68 – 0.88)***	0.89 (0.63 – 1.25)	0.73 (0.65 – 0.82)***
25 – 29	0.78 (0.54 – 1.13)	0.64 (0.56 – 0.73)***	0.86 (0.61 – 1.21)	0.62 (0.56 – 0.70)***
>30	0.77 (0.52 – 1.13)	0.68 (0.60 – 0.79)***	0.86 (0.60 – 1.23)	0.68 (0.61 – 0.77)***
Preceding birth interval (months)				
<24 [®]	-	-	-	-
≥24	0.74 (0.61 – 0.91)***	0.53 (0.50 – 0.57)***	0.77 (0.64 – 0.92) ***	0.53 (0.50 – 0.56)***
Birth order				
1 [®]	-	-	-	-
2	0.74 (0.63 – 0.88)***	0.58 (0.54 – 0.62)***	0.84 (0.72 – 0.96) **	0.61 (0.58 – 0.65)***
>3	1.23 (1.01 – 1.49)**	0.70 (0.65 – 0.76)***	1.32 (1.11 – 1.56) ***	0.80 (0.75 – 0.85)***
Place of residence				
Urban [®]	-	-	-	-
Rural	1.05 (0.90 – 1.22)	1.02 (0.95 – 1.10)	1.04 (0.91 – 1.18)	1.01 (0.94 – 1.07)
Household wealth				
Poorest [®]	-	-	-	-
Poorer	0.82 (0.66 – 1.02)*	0.84 (0.79 – 0.89)***	0.82 (0.67 – 1.00)*	0.86 (0.82 – 0.91)***
Middle	0.60 (0.48 – 0.74)***	0.68 (0.64 – 0.74)***	0.61 (0.50 – 0.74)***	0.73 (0.69 – 0.78)***
Richer	0.45 (0.36 – 0.57)***	0.57 (0.52 – 0.63)***	0.47 (0.38 – 0.57)***	0.62 (0.57 – 0.67)***
Richest	0.37 (0.29 – 0.47)***	0.40 (0.36 – 0.46)***	0.36 (0.29 – 0.44)***	0.44 (0.39 – 0.48)***
Birth delivered by				
Doctor [®]	0.79 (0.66 – 0.94)**	0.91 (0.88 – 1.00)**	0.81 (0.70 – 0.95)***	0.89 (0.84 – 0.93)***
Nurse	0.99 (0.86 – 1.13)	0.93 (0.87 – 1.00)**	0.95 (0.85 – 1.07)	0.94 (0.89 – 0.99)**

[®]Denotes the reference category; *** $P < 0.01$; ** $P < 0.05$; * $P < 0.10$.

Abbreviations: CI: Confidence interval; SD: Standard deviation.

normal deliveries in the private sector are significant issues and challenges today. The present study investigated the different birth delivery methods and their risks to child growth and mortality in India using the current nationally representative data from NFHS-4 (2015 – 2016). Our findings revealed disparities in different birth delivery methods across the various socioeconomic and biodemographic characteristics in India. Women aged 25 – 29 years old were more likely to undergo cesarean delivery compared to those aged 15 – 19 years old. Similarly, pregnant women of more than 24 months of a preceding birth were more likely to opt for cesarean section compared to those of <24 months of a preceding birth. Newborns of higher birth orders (>3) were less likely to be delivered through cesarean section than normal vaginal delivery. In addition, women who only want a single child are more likely to opt for a cesarean section for their pregnancy than those who are expecting two or more childbirths. This was emphasized in earlier studies based on the women's perceptions regarding the efficacy of the cesarean procedure as a means to ensure newborn survival and to avert the risks of birth complications or stillbirth [49]. Women from urban residences were more likely to opt for cesarean section for childbirth compared to rural residences. This preference among urban women could be associated with the easy accessibility and availability of healthcare (public and private hospitals) facilities for maternal and child health services [49]. Women from the "richest" household's preferred cesarean delivery compared to those from the "poorest" households. Household wealth and education are attributed to the female autonomy to develop greater confidence and decision-making power regarding their health [50,51]. An earlier study also suggested that educated women from the "richest" households have access to higher quality services and health-care facilities compared to other less-privileged women [52]. Our study also demonstrated that most childbirth in public hospitals was delivered by normal vaginal delivery than cesarean delivery. In general, in public hospitals, doctors prefer cesarean delivery, especially for complicated pregnancies, including abnormal labor pain and postpartum hemorrhage. In many high- and middle-income countries, cesarean births are more common than normal births in private institutions [53,54]. An earlier study investigating the short- and long-term effects of cesarean section on women and child health suggested that normal vaginal delivery reduced the length of hospital stay, financial cost, and the risk of hysterectomy for postpartum hemorrhage, while cesarean delivery reduced the risk of vaginal injury, abdominal and perineal pain during birth and 3 days postpartum, early postpartum hemorrhage, and obstetric shock [55].

Our study also analyzed the effect of different birth delivery methods on neonatal and infant mortalities and revealed that neonatal and infant mortality rates varied across socioeconomic characteristics. Neonatal and infant mortality rates were lower for cesarean births in private institutions compared to public institutions. Moreover, cesarean delivery plays a dominant role in the survival of newborns and prevents perinatal mortality and severe morbidity, such as intrapartum asphyxia [56]. Another systematic review validated the association between cesarean birth and mortality and concluded that cesarean birth improves

maternal, neonatal, and infant survival by 9 – 16%, but the different socioeconomic factors could be a varied association between cesarean birth and mortality [57]. Betran *et al.* indicated that the risk of newborn mortality is higher when vaginal delivery is performed by untrained medical staff (inexperienced or having inadequate skill), while planned cesarean delivery is the safest option for mothers and babies [56]. Our findings revealed that Indian women do not have adequate access to cesarean services, most likely due to insufficient provision of equipment, lack of emergency room for obstetrics services, lack of skilled birth attendants, untrained medical staff, major geographical barriers (e.g., long-distance), and lack of transportation [58,59].

Analysis of child growth (i.e., stunting, wasting, and underweight) based on different birth delivery methods displayed a negative association between cesarean births and healthy child growth, such as the influence on feeding practices [60]. The study also revealed a higher prevalence of stunted, wasted, and underweight child growth from cesarean births compared to normal vaginal births. A prior study also suggested that cesarean births may have negative implications related to neuropsychiatric disorders and mother-infant relationships [5]. Another study implied that schizophrenia and mental disorders were 10 times higher among children born through cesarean section [61]. A growing number of studies reported that these children born through cesarean section had poorer sensory integration ability than those born by natural vaginal birth [62-65]. A study by Evans *et al.* reported a significantly faster transfer of breast milk from mother to child in vaginal birth than in cesarean births in the first 5 days postpartum [66]. Similarly, Scott *et al.* also found that delayed onset of lactation was significantly higher for cesarean births compared to normal vaginal births [67].

The logistic regression model examined significant predictors of neonatal and infant mortalities based on different birth delivery methods. After adjusting for potential confounding factors, we identified that the mother's age during delivery, preceding birth interval, birth order, place of residence, wealth index, and skilled birth attendants were significantly associated with the decisions on selecting cesarean or normal vaginal delivery methods. The findings suggest that older mothers during delivery and longer preceding birth intervals reduced the risk of neonatal and infant mortalities from cesarean births. Furthermore, newborns of higher birth orders had higher risks of dying from cesarean delivery compared to normal vaginal delivery. Consistent with previous studies, our findings indicated that women from the "richest" wealth quintile had lower risks of infant mortality than those from the "poorest" households [68,69]. The study confirmed that poverty is the major factor responsible for the reduced odds of newborn mortality from cesarean births. In addition, the higher rate of cesarean deliveries is often attributed to higher costs of healthcare, which also impacts the economic burden of a household as measured by the wealth index.

The major strength of this study is the utilization of nationally representative data, which corresponds to a large sample size that evaluates normal and cesarean births in public and private institutions. This study had several limitations: (i) the data lacked information relating to the clinical indications of cesarean

section, such as the lack of distinguishment between elective and emergency cesarean sections; (ii) various socioeconomic and biodemographic factors were included in the study, but women decision making power was not considered in the study, which would significantly influence in the decision on delivery practice; (iii) the study did not cover the accessibility (e.g., the number of primary healthcare centers, subcenters, and community centers) and quality (e.g., number of doctors and beds) of healthcare facilities, which might influence the decision on healthcare delivery; and (iv) there are insufficient data on the physical barriers, such as distance from health centers, transportation, and road facilities. Notwithstanding, the study has provided important insights into the association between child growth and different birth delivery methods.

5. Conclusion

Cesarean births may have adverse effects on child growth and increase the risk of mortality compared to normal vaginal births. The differences in the prevalence of cesarean births between public and private institutions may be due to the difference in prenatal and delivery care between these two settings, and this could influence the delivery outcome or the preference for a delivery method [70]. The low rate of cesarean delivery in the private sector is highly associated with several socioeconomic factors. Therefore, health policies and programs should aim to improve reproductive and child health-care services, with a particular focus on enhancing the quality of obstetric care, especially for cesarean sections [71]. Furthermore, efforts should focus on improving the quality of painless labor and vaginal delivery in both public and private health-care institutions to reduce the number of cesarean births.

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Conflict of Interest

The authors declare no conflicts of interest in this research.

Ethics Approval and Consent to Participate

Not applicable.

Consent for Publication

Not applicable.

Availability of Data

Data are available from the corresponding author on reasonable request.

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