
Socio-economic Determinants of Maternal and Neonatal Healthcare Utilization in Bihar: An Econometric Approach Using NFHS-4 Data

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Abstract:

Maternal and neonatal healthcare utilization remains a critical public health concern in India, particularly in socioeconomically disadvantaged states like Bihar. This study examines the patterns and determinants of maternal and neonatal healthcare service utilization using data from the National Family Health Survey (NFHS-4). The analysis focuses on key indicators such as antenatal care visits, institutional delivery, and postnatal care, while assessing the influence of socio-economic, demographic, and regional factors. The findings reveal significant disparities in healthcare utilization across different population groups. Women's education, household wealth status, place of residence, and exposure to mass media emerge as strong predictors of maternal healthcare use. Additionally, social factors such as caste and autonomy play a crucial role in shaping access to services. Despite improvements over time, the utilization of adequate antenatal and postnatal care remains suboptimal, especially among rural and marginalized communities. The study underscores the need for targeted policy interventions to address structural inequalities and improve accessibility and awareness. Strengthening health infrastructure, enhancing female education, and promoting community-level awareness programs are essential to ensure equitable maternal and neonatal healthcare utilization in Bihar.

Keywords: *Maternal Healthcare; Neonatal Care; NFHS-4; Bihar; Health Inequality; Socio-economic Determinants; Institutional Delivery; Antenatal Care; Postnatal Care.*

Introduction:

Health is a critical concern that demands attention even before a child's birth, as maternal malnutrition, socioeconomic conditions, and the mother's social status significantly influence both maternal and newborn health outcomes. Ensuring proper healthcare policies is essential for sustainable economic development and human capital formation. Antenatal and postnatal care is complementary, yet a transitional gap exists between them, bridged by the process of childbirth.

Without access to medically supervised delivery, both the mother and newborn remain vulnerable to life-threatening complications.

Newborns are particularly susceptible to infections and other health risks, and inadequate delivery care can contribute to perinatal and postnatal mortality, as well as long-term child health disparities. Notably, health outcomes and healthcare utilization vary significantly across socioeconomic strata, with household socioeconomic status differentially influencing key health determinants.

This paper examines the critical transition between prenatal and postnatal care—childbirth—focusing on the determinants of effective prenatal care and institutional delivery. Key factors include maternal counselling, skilled birth attendance, safe delivery mechanisms, access to trained medical professionals, and an environment that fosters neonatal immunity development. Understanding these determinants is vital for improving maternal and child health in diverse socioeconomic contexts.

Literature Review: Maternal Healthcare Utilization in Developing Countries: A Focus on Bihar, India

In many developing countries, maternal healthcare services—including prenatal care and institutional delivery—remain inadequately institutionalized, contributing to elevated risks of pregnancy complications and high-risk deliveries. Over the past few decades, extensive research has explored the determinants of underutilization of these services, emphasizing socioeconomic, geographic, and cultural barriers. Acton's seminal work (1975) highlighted the critical role of nonmonetary factors, such as travel distance, in shaping demand for both free and subsidized maternal healthcare. Subsequent studies, including Halim et al. (2011), Ensor et al. (2004, 2005), and Makate (2014), further corroborated the influence of accessibility, cost, and sociocultural norms on healthcare-seeking behavior.

Education and Urban-Rural Disparities:

Female education is a robust predictor of maternal healthcare utilization, though its impact varies across contexts. While primary schooling showed no significant effect on delivery assistance rates in Bangladesh and Thailand (Raghupathy, 1996; Dharmalingam et al., 1999), it correlated positively with skilled birth attendance in Peru and Guatemala (Elo, 1992; Goldman & Pebley, 1994). Similarly, urban residence was linked to higher antenatal care use in Thailand (Raghupathy, 1996), yet no urban-rural disparity was observed in Turkey and Karnataka, India (Bhatia & Cleland, 1995; Celik & Hotchkiss, 2000). These inconsistencies underscore the need for context-specific analyses.

Institutional Delivery and Health Outcomes:

Evidence from studies such as Bloom et al. (2001), Grabowski et al. (2013), and Sarkar et al. (2014a, 2014b) underscores the protective role of institutional deliveries in reducing childbirth-related complications. However, utilization remains suboptimal in many regions, particularly in South Asia. Research focusing on India—including works by Maitra (2004), Maitra and Pal (2007), and Bhargava et al. (2011) has examined determinants such as household income, education, and healthcare infrastructure. Yet, existing studies predominantly analyze national datasets or specific regions (e.g., Shroff, 2011; Navaneetham et al., 2002), neglecting Bihar, a socioeconomically disadvantaged state in eastern India with persistently poor maternal health indicators.

Research Gap and Contribution:

Despite a rich body of literature on maternal healthcare utilization in developing countries, critical gaps persist. While studies like those of Becker et al. (1993), Kerber et al. (2007), and Agha (2000) provide valuable insights into demand-side barriers, Bihar remains conspicuously absent from empirical scrutiny. This study addresses this gap by analyzing the determinants of maternal healthcare demand in Bihar, offering region-specific evidence to inform targeted policy interventions.

Data and measurement of variables:

This study utilizes data from India's **National Family Health Survey-4 (NFHS-4)** (2015–2016), which employed a multi-stage, self-weighted sampling design across all Indian states. The analysis focuses on **ever-married women** who reported maternal healthcare utilization during their most recent pregnancy (resulting in a live birth within 4 years prior to the survey). Data from individual and household questionnaires were integrated to examine four key maternal healthcare services:

1. Antenatal care (ANC):

- At least one ANC visit (yes/no).
- Adequacy (≥ 4 visits vs. < 4 , per WHO guidelines).
- Timeliness of first visit (first trimester vs. later).

2. Tetanus Toxoid (TT) vaccination: Receipt of ≥ 2 doses during pregnancy.

3. Place of delivery: Home vs. institutional (public/private healthcare facility).

4. Delivery assistance: Skilled professionals (doctors, nurses) vs. untrained individuals.

Explanatory Variables

Variables were selected based on theoretical relevance and NFHS-4 availability, categorized as follows:

Individual-Level Factors

- **Age:** Dichotomized as <25 vs. ≥25 years to capture generational differences in healthcare-seeking behaviour.
- **Birth order:** Lower parity (first births) linked to higher healthcare utilization due to inexperience and cultural practices (e.g., returning to the maternal home for first delivery).
- **Reproductive history:** Prior stillbirth/abortion is associated with increased healthcare use in subsequent pregnancies.
- **Education:** Categorized as illiterate, primary, middle, or high school+. Higher education correlates with autonomy, health awareness, and decision-making capacity.
- **Employment status:** Non-working, working without income, or working with income. Mixed effects: employment may enhance autonomy but could also reflect poverty-driven constraints.
- **Media exposure:** Composite measure (radio/TV access weekly) to assess information dissemination and cultural influence.

Household/Community-Level Factors

- **Residence:** Urban vs. rural, reflecting healthcare access and sociocultural norms.
- **Caste/Religion:**
 - Scheduled Castes/Tribes (SC/ST) face structural barriers (e.g., geographic isolation from healthcare facilities).
 - Muslims may underutilize services due to cultural norms (e.g., *purdah*, gender segregation).
 - Christians show higher openness to modern healthcare.
- **Husband's education:** Proxy for socioeconomic status and household decision-making influence.

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- **Standard of Living Index (SLI):** Constructed from household amenities (water, sanitation, electricity, assets). Higher SLI linked to modern healthcare utilization.

Key Rationale for Variable Selection

- **Education and employment** reflect women's autonomy and resource control (Caldwell, 1979; Raghupathy, 1996).
- **Media exposure** bridges information gaps and challenges traditional health beliefs (Rao et al., 1998).
- **Caste/religion and residence** highlight structural inequities (Appasamy et al., 1995; Pebley et al., 1996).
- **SLI** captures economic capacity to afford care (Bhat & Xavier, 1999).

Purpose and Context

The analysis aims to identify determinants of maternal healthcare utilization in **Bihar, India**—a region with persistently poor maternal health outcomes and understudied in existing literature. By integrating individual and household factors, the study provides insights for targeted policy interventions to address systemic barriers.

Methodology:

This study employed **multivariate logistic regression models** to analyze determinants of maternal healthcare utilization in Bihar, India. The choice of logit/probit models aligns with the binary nature of the dependent variables (e.g., yes/no outcomes) (Alison, 1984; Hosmer & Lemeshow, 2000). Six key maternal healthcare indicators were examined:

1. **Antenatal care (ANC) utilization** (at least one visit).
2. **Frequency of ANC** (≥ 4 visits vs. < 4 , per WHO guidelines).
3. **Timing of first ANC visit** (first trimester vs. later).
4. **Tetanus Toxoid (TT) vaccination** (≥ 2 doses).
5. **Place of delivery** (institutional vs. home).
6. **Delivery assistance** (health professionals vs. untrained individuals).

Interpretation of Results:

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- **Odds ratios (ORs)** were used to quantify covariate effects.
 - **OR = 1**: No difference in utilization likelihood compared to the reference category.
 - **OR > 1**: Higher likelihood of utilization.
 - **OR < 1**: Lower likelihood of utilization.
 - **Standard errors** accompany ORs to assess statistical precision.

Rationale for Model Selection

Logistic regression is ideal for categorical outcomes, enabling identification of factors significantly associated with healthcare utilization while controlling for confounders.

Results and Discussion:

The dataset provides insights into individual and household characteristics, primarily focusing on women's health and socio-demographic factors. Here's a structured analysis. We can know from Table 1 that 90.82% of women are under 25, indicating a young cohort. The mean (0.091) reflects the proportion of women ≥ 25 (9.18%). First-order birth of the child is about 66%, and the 2nd order birth is about 29% of the total birth and the 3rd and more order of birth is negligible. Around 86% of the women have experienced stillbirth and near about 71% of the women have experienced miscarriage. Most of the women (71%) are illiterate. Most of the respondents are rural (90%), and near about 45% of the respondents lived in a low standard of living, while 35% of the population have a higher standard of living. Most of the people of the state belong to the backward classes (99%). Around 83% of the population do not have any employment, and 94% of them have no media exposure. Hindus comprised the overwhelming majority of all the respondents.

Pattern of maternal healthcare use:

It is clear from Table 2 that about 61% of the respondents don't receive any prenatal care during the time of pregnancy. While 56% of the mothers receive at least 4 antenatal checks, and about 76% of the mothers receive their first antenatal check-up after the first trimester. Among the mothers who received antenatal care, about 89% of respondents have received the TT Vaccine. This implies that most of the women who took antenatal care received the TT vaccine. About 66% of the mothers deliver their babies at the institution (i.e., Govt. / Pvt. Hospital /trusty hospital /N.G.O./nursing home). In case of taking assistance at the time of delivery about 52% of the case is assisted by health professionals (i.e. – Doctor, Nurse, Midwife, Auxiliary Nurse Midwife, Lady health visitors and

trained birth attendants) and 48% of the delivery is done by non-health professionals (i.e. – Traditional Birth Attendants, Dai and relatives or friends). This means that half of the mothers delivered their babies with non-health professionals, who are most risky for the life of the mother as well as for the life of the baby.

Determinants of maternal health care use

Antenatal care:

It is clear from Table -3 that all the variables are not equally important in determining whether a woman received antenatal care or not. The age of women is likely to use maternal and newborn child health care services (i.e., the probability of taking antenatal care) is higher relative to the reference category (odds ratios = 1.02). Birth order is not so important factor in determining the receipt of antenatal health care services. Whether the respondent has experienced a stillbirth or not is also a factor in receiving antenatal care services. The probability of using ANC is relatively 13% higher relative to the reference category if the woman has experience of stillbirth (odds ratios =1.13). on the other hand, in case of the termination of pregnancy the experience of abortion is 99% less likely to be the use of antenatal care services (odd ratios =.99). The women with primary schooling and middle don't not differ from women with no schooling in receiving prenatal care services but the women with education level of high school and above (odd ratios =3.38) are three times more likely to be very strong in receiving antenatal health care services. In case of working status of women who worked but did not earn money, the probability of using ANC is likely to be 82% less than the reference category (odds ratio =.824). On the other hand, the employed women is likely to be a slightly more important determinant factor in receiving antenatal healthcare services (odd ratio =1.008). In case of the covariate's media exposure, the respondents who neither watch TV nor listen radio are less likely to be an important determinant of receiving antenatal care health services of pregnant women. The caste is an important determinant of receiving neonatal health care services. The women who belong to SC/ST are 14% more likely to be important determinants for the use of antenatal health care services compared to the reference category (odds ratios =1.14). On the other hand, religion is the most important determinant of receiving antenatal health care services for pregnant women. The Muslim women are 86% less likely to use antenatal care services (odds ratio .86) relative to the reference category of Hindu, and the Christian & others (odds ratios =.67) are relatively less likely to use antenatal health care services relative to the Hindu counterpart. The husband/partner's education is also an important determinant of the receipt of antenatal health care services. The husband having a high school and above qualification, the probability of antenatal health care seeking behaviour is likely to be near about four times more (odds ratio-4.06) relative to

the reference category of no education. The occupation of the husband is an important covariate of receiving antenatal health care services for safe motherhood. The husband or partner who is employed in service sector, professional etc have the probability of the use of antenatal health care service for the safe motherhood is likely to be more. The standard of living is an important factor determining the use ante antenatal health care. The respondents who belong to the middle and higher classes of standard of living, the probability of the use of antenatal health care is likely to be about 43% and two times, respectively, more (odds ratio=1.43 & 2.30) relative to the reference category (low standard of living). In the case of residence, the rural respondents are about 62% less likely to use antenatal health care services (odds ratios=.62) relative to their urban counterparts.

Frequency of using antenatal care (PNC):

It is clear from the table -4 that all the variables are not equally important in determining whether a woman received adequate number of antenatal care or not. The age of women is likelihood of use maternal and new born child health care services (i.e. – the probability of taking the adequate number of antennal care) is 14% higher relative to the reference category (odd ratios = 1.14). Birth order is not so important factor in determining the receiving of antenatal health care services. Whether the respondent has experienced the still birth or not is also factor for receiving the adequate number of antenatal care services. The probability of use the adequate number of ANC is relatively 85% less relative to the reference category of not having any experience of still birth if the woman has experience of still birth (odd ratios =.85). on the other hand, in case of the termination of pregnancy the experience of abortion is more or less likely to be the use of adequate number of antenatal care services (odd ratios =.838). The women with primary schooling and middle don't not differ from women with no schooling in receiving the adequate number of prenatal care services but the women with education level of high school and above (odd ratios =1.62) is about 62% more likely to be very strong predictor of receiving the adequate number of antenatal health care services. In case of working status of women those worked but not earning money the probability of use the adequate number of ANC is likely to be comparatively about 89% less than the reference category (odd ratio =.89). On the other hand, the employed women is likely to be about 84% less important determinant factor in receiving adequate number of antenatal healthcare services (odd ratio =.84 & .77). In case of the covariates of media exposure, the respondents who neither watch TV nor listen radio is 89% less likely to be important determinant of receiving adequate number of antenatal care health services of the pregnant women (odd ratio= .89) The caste is an important determinant of receiving neonatal health care services. The women who belong to SC/ST community are 19% more likely to be important determinant for the use antenatal health care services in compared to the reference category

(odd ratios =1.19). On the other hand, the religion is the most important determinant of receiving antenatal health care services of the pregnant women. The Muslim women is about 5% more likely to be the use of adequate number of antenatal care services (odd ratio= 1.05) relative to the reference category Hindu and the Christian & others (odd ratios =1.21) are relatively more likely to be the use of adequate number of antenatal health care services relative to the Hindu counterpart. The husband / partner education is also an important determinant of the receiving the adequate number of antenatal health care services. The husband having high school and above qualification, the probability of adequate number of antenatal health care seeking behaviour is likely to be about 52% more (odd ratio- 1.52) relative to the reference category of no education and primary level schooling (odd ratio =.90). The occupation of husband is an important covariate of receiving the adequate number of antenatal health care services for the safe motherhood. The husband or partner who is employed in service sector, professional etc have the probability of the use of antenatal health care service for the safe motherhood is likely to be 28% more (odd ratio=1.28). The standard of living is an important factor determining the use of adequate number of antenatal health care. The respondents who belong to the middle and higher class of standard of living, the probability of the use of antenatal health care is likely to be 36% more (odd ratio=1.36 & 1.06) relative to the reference category (low standard of living). In case place of residence, the rural respondents are about 80% less likely to the use antenatal health care services (odd ratios=.80) relative to their urban counterpart.

Timing of 1st antenatal visit:

It is clear from Table -5 that all the variables are equally important in determining whether a woman received an adequate number of antenatal care during the first trimester of pregnancy or not. The age of women is likelihood of the use of maternal and newborn child health care services (i.e., the probability of receiving adequate number of antenatal care during the first trimester of pregnancy) is 14% higher relative to the reference category (odds ratios = 1.14). Birth order is not so important factor in determining the timing first visit to antenatal health care services. Whether the respondent has experience of a stillbirth or not is also a factor in receiving their first visit to antenatal care services. The probability of use of the timing of first ANC visit is relatively slightly (10%) more relative to the reference category of not having any experience of still birth if the woman has experience of still birth (odds ratios =1.10). on the other hand, in case of the termination of pregnancy, the experience of abortion is more 9% likely to be the use of 1st visit of antenatal care services (odds ratios =1.09). The women with primary schooling and middle don't not differ from women with no schooling in receiving their first visit of prenatal care services but the women with education level of high school and above (odd ratios =3.74) are more than three times likely to be strong predictor of receiving the first visit of antenatal health care services timely. In case of working status of women

those worked but not earning money, the probability of use of their first visit of ANC is likely to be comparatively 87% less than the reference category (odd ratio =.87). On the other hand, the employed women is likely to be 85% less important determinant factor in receiving first antenatal visit (odd ratio =.87 & .85). In case of the covariates of media exposure, the respondents who neither watch TV nor listen radio is 76% less likely to be important determinant of receiving first visit of antenatal care health services of the pregnant women (odd ratio= .76) The caste is an important determinant of receiving neonatal health care services. The women who belong to SC/ST are 74% more likely to be an important determinant for the use of first visit of antenatal health care services timely in compared to the reference category (odds ratios =1.74). On the other hand, religion is the most important determinant of receiving the first visit of antenatal health care services of pregnant women. The Muslim women are 87% less likely to be the use of adequate number of antenatal care services timely (odd ratio= .87) relative to the reference category, Hindu and the Christian & others (odd ratios =1.21) are relatively more likely to be the use of first visit of antenatal health care services during first trimester of pregnancy relative to the Hindu counterpart. The husband/partner's education is also an important determinant of the receiving first visit of antenatal health care services. The husband having a high school and above qualification, the probability of use of the first visit of antenatal health care seeking behaviour in time is likely to be three times more (odds ratio = 3.72) relative to the reference category of no education and primary level schooling (odds ratio =1.72). The occupation of husband is an important covariate of receiving the first visit of antenatal health care services for the safe motherhood. The husband or partner who are employed in service sector, professional etc have the probability of the use of first visit of antenatal health care service during the first trimester of pregnancy for the safe motherhood is likely to be 60% more (odd ratio=1.60). The standard of living is an important factor determining the use of first visit of antenatal health care during the first trimester of pregnancy. The respondents who belong to the middle and higher class of standard of living, the probability of the use of first visit to antenatal health care timely is likely to be two times more (odd ratio=2.56 & 1.38) relative to the reference category (low standard of living). In case of residence, the rural respondents are 53% less likely to use of first visit of antenatal health care services timely (odds ratios=.53) relative to their urban counterparts.

Utilization of TT vaccine.

The estimated effects of covariates on the utilization of TT vaccine (utilized if received two or more doses of vaccine; not utilized if received one or none) are given in Table -5. It is clear from the table that the older women are likely to be 93% less likely to utilize the TT vaccine (odd ratio=.93). But the birth order of the child is not so important in the utilization of TT vaccine. The experience of

stillbirth before is 78% less likely to be the use of the TT vaccine (odd ratio=.78) in relation to the reference category. The effect of the experience of pregnancy termination (miscarriage, abortion and still birth) on the utilization of TT vaccine are 85% more for the case of abortion and 85% less for the case of experience of still birth (odd ratio=1.85 & .85)). Women education is an important covariate in the determination of the utilization of adequate doses of TT vaccine. The high school above educational attainment are likely to be 54% more significant in the utilization of the adequate doses of TT vaccine (odd ratio=1.54). The primary and middle standard of education are not to very significant as there is no difference in the illiterate women in receiving adequate doses of TT vaccine. Media exposure of the respondents who have no media awareness is 29% more likely to receive the adequate doses of TT vaccine (odd ratio=1.29) relative to the reference category of women who watch TV and listen radio. The SC /ST women are 87% more likely to take the adequate doses of TT vaccine (odd ratio=1.87) in reference to their non- SC/ST counterpart. Religion is an important factor in receiving the adequate doses of TT vaccine. Muslim women are 83% less likely to take the advantage of adequate doses of TT vaccine (odd ration=.83) in reference to their Hindu and Christian counterpart. Husband or partner education has the significant effects on the receiving of the adequate doses of TT vaccine. Husbands with high school and more educational qualification are two times more aware in receiving adequate doses of TT vaccine (odd ratio =2.04) than their illiterate counterpart. Husbands who are employed in agriculture, household and domestic sector are more or less same likely to take the adequate doses of TT vaccine (odd ratio=1.05) in reference to the serviceman. The persons who have higher standard of living (odd ratio=1.57), the probability of taking the adequate doses of TT vaccine increased by 57% than the with a lower standard of living. The rural women (odd ratio=.62) are 62% less likely to receive adequate doses of the TT vaccine in reference to the urban women.

Institutional delivery

The estimated parameter values (odds ratios) for the dependent variable, place of delivery, (health care institution vs home) for the state is given in Table 7. The age of child bearing woman is very significant parameter in the determination of the place of delivery. The older women are about 98% less likely to have delivered their babies at a health care institution (e.g. govt. / Pvt. Hospital). Women who had second order births and above are about 61-78 percent less likely to have delivered their babies at a health care institution (odd ratio=.61 & .78) compared to the younger mother. A woman who had a still birth (odd ratio=.79) in the past is about 79% less likely to deliver their child in an institution in relation to those who had no any experience of still birth. In case of termination of pregnancy due to miscarriage, abortion and still birth, the delivery of child in the health care

institution is raised by about 35% than one who had not any experience of abortion in past (odd ratio = 1.35) but the interesting case is that the experience of still birth in past is 83% less likely to deliver the child in health care institution. Women with education level up to middle complete from the illiterate are more likely to deliver their child at home relative to the institution but women with higher level of education are four and half times (odd ratio=4.56) more likely to have delivered their babies at a health care institution than those who delivering at home. In terms of working status of women, working but not earning mothers are about 77% and working and earning mothers are about 69% less likely to deliver their child at hospital than delivering at home. The woman who neither watch TV nor listen radio is 74% (odd ratio=.734) less likely to deliver their baby at health care institution than at home. The caste is an important determinant of institutional delivery. The women who belong to the SC/ST community are about 90% (odd ratio=.90) less likely to go to the hospital (Govt. /Pvt.) than the non – SC/ST women. They preferred to deliver their child at home. The religion is an important covariate in deterring institutional delivery. Muslim and Christian (odd ratios= .50 & .55) mothers in Bihar are 50% and 55% respectively less likely to prefer institutional delivery compare to their Hindu mothers. Husband or partner education turns to be the striking determining factor of institutional delivery. With primary and middle class of education of husband, there is about 34% and 94% more chance to deliver their baby at health care institution compared to the illiterate one. The most important determining fact is that husband with educational attainment of high school and above, there is 7 times more chance to deliver their babies at hospital than delivering at home(odd ratio=7.31). Husband occupation is an important determining factor of hospital delivery of baby. It is clear from the table that the husband who are employed in agriculture, household and domestic field are about 86% less likely to deliver their child in a health care institution than the others who are employed in other sector. The standard of living is also very important determinant of the place delivery. The respondents who have medium of standard of living are about 63% (odd ratio =.63) more likely to deliver at hospital and the women who have higher standard of living are near about three times (odd ratios=2.75) more likely to have deliver their babies at a health care institution than the reference category. The place of residence is also an important determinant of the place of delivery. The rural women are 60% less likely to deliver their babies at a health care institution (odd ratio=.60) than the urban counterpart. The rural women prefer home to deliver their baby.

Impact on delivery assistance:

Results presented in the table-8 show the pattern of relationship between different covariates and assistance during delivery. The older women are merely 7% more likely to take the assistance during delivery by health professionals (odd ratio=1.07) than the younger women. Birth order is an important

determining factor of delivery assistance. The women of second and third order of birth are about 89% and 77% less likely to take advantage of assistance during delivery by the health professionals than the women of first-time pregnancy. The women, who have experience of stillbirth in the past, are also 91% (odd ratio=.91) less likely to have been assisted by a professional health worker at the time of delivery. Women who have the experience of abortion are 33% more likely to have been assisted by health professionals. The women with a higher level of educational qualification (i.e., high school and above), the probability of taking assistance at the time of delivery from the professional health worker is about 3 times (odds ratio=2.65) more than the illiterate women. The impact of working but not earning women on receiving the assistance during delivery from the professional health worker is about 71% less (odds ratio=.71), and the women who are working and earning are 81% less likely to take the benefit of assistance from the professional health worker. Media exposure (odd ratio = .73) has more or less the same impact on delivery assistance as working status. The women who neither watch TV nor listen radio are 73% less likely to receive the delivery assistance from health professionals than the reference category. The social status is a very important determinant in receiving delivery assistance. The SC/ST women are about 63% less likely to receive the delivery assistance (odd ratio= .63) than the non-SC/ST women from the professional health worker. In case of religion, the Muslim women (odd ratio=.67) and Christian women (odd ratio= .52) are 67% and 52% less likely to have assisted by health professionals at the time of delivery. The husband education level is very important determinant of delivery assistance. The husband with level of education from illiterate to high school and above, the probability of receiving delivery assistance increase. The husband with high school and above qualification are more than two times higher likely to take the advantage of delivery assistance. Husband occupation is also an important factor in taking delivery assistance from the health professionals. Among the husbands who are employed in service sector sales and professional are about 47% likely to take delivery assistance at the time of delivery. The women who are living in medium and high standard of living are about 35% and 87% more likely to take the advantage of delivery assistance during delivery than the reference category. The place of residence is an important factor determining delivery assistance. The rural women are 64% less likely to receive the delivery assistance from the health professionals during delivery.

Conclusions

Results presented above showed that there are significant variations among in the utilization of maternal health care services. We have also found that the magnitude of regional differences is not the same for all the maternal health care indicators. The observed variation in the use of maternal

health care services is likely to be due to the differences in the availability of and access to maternal health care services in the state.

The effect of various socio-economic, cultural, and programmatic factors in influencing the pattern of utilization has also varied depending on the state and the type of health service. For example, while mothers with first order births are more likely to deliver their babies at health care institutions than mothers with second-order births, there was no difference between the first and second-order births in receiving antenatal care. Also, Muslim women are less likely to deliver their babies in health care institutions and to be assisted by health professionals, and the likelihood of antenatal check-up in the first trimester is lower among them. The order of birth is an important determinant for the use of the place of delivery and delivery assistance maternal health care services: higher order births decreased the likelihood of using the services in the state. Lower utilization of maternal health care services among higher parity women could be due to time and resource constraints faced by those with larger families, and the greater experience of higher parity women with pregnancy and childbirth.

A noteworthy finding in this study is that there is no significant difference between rural and urban women in receiving adequate antenatal care right from the first trimester in the state. A possible explanation lies in the role played by multipurpose health workers, known as auxiliary nurse midwives, posted in rural areas, who provide antenatal care to pregnant women by visiting their homes. The multipurpose health worker in the rural area provides information on and services related to maternal and child health and family planning. This female health worker is expected to visit every household at least once in two months. She enrolls all the pregnant women in her area and provides antenatal care, supervises domiciliary services, and also provides post-natal services for the mother and the child. Although there remain shortcomings in the quality of services offered by health workers, most rural women were visited by multipurpose health workers. It is suggested that home visits by health workers could reduce the monetary and opportunity costs of pregnant women in the rural areas and thereby increase the utilization of antenatal care. In order to assess the role of multipurpose health workers in influencing the use of antenatal care in rural areas, we carried out a separate analysis of the use of antenatal care by provider type (women visiting a provider vs provider visiting women), controlling for individual and household characteristics. Results showed that the likelihood of women receiving antenatal care by visiting a provider (outside the home) is greater in urban areas than in rural areas. This indicates that health workers (ANMs) are playing a crucial role in providing antenatal check-ups to pregnant women in the rural areas.

We have also found that women's literacy is an important indicator for the use of maternal health care services. Several explanations have been advanced in the literature as to why educated mothers are

more likely to use maternal health care services than uneducated mothers. Educated women may have greater decision-making power on health-related matters and also attach a higher value to welfare and their health. Further, educated mothers will have more confidence in handling the officials and have the ability and willingness to travel outside the home to seek services. It is expected that among educated women, the decision-making power within the household, awareness, knowledge, and acceptance of modern medical treatment and health care institutions vary by their level of education. Consequently, a number of years of schooling is likely to be positively associated with the utilization of maternal health care services. However, we have found that utilization of maternal health care services does not differ significantly among the educated women by their level of education, particularly among the primary and middle levels for most of the services. In contrast to our findings, women with primary schooling do not differ from women with no schooling in receiving delivery assistance.

In general, non-earning working women were less likely to use maternal health care services compared to earning women (antenatal check-up, TT vaccine, and delivery assistance) and Tamil Nadu (TT vaccine). This finding suggests that earning capacity could contribute to the use of maternal health care services by empowering women within and outside the household. It is also possible that earning women have greater exposure to accessing relevant information and knowledge regarding issues related to maternal and child health. It is also found that a non-working woman's likelihood of seeking some maternal health care services is higher than that of working women. This shows that women's work does not necessarily influence the utilization of some maternal health care services. Those not working may be relatively well off compared to those working.

In general, being a member of scheduled caste or scheduled tribe reduced the likelihood of using maternal health care services. This indicates that there could be a general lack of access to health care services for the socially backward communities compared to the rest of the population. The spatial disadvantage combined with social and economic background of these groups, could contribute significantly to the relative under-utilization of maternal health care services among the scheduled caste and scheduled tribe communities. Pregnancy or birth order was an important determinant of use of maternal health care services: the higher the birth order the lower the likelihood of using maternal health care services. In general, illiterate women are less likely to use maternal health care services than the educated ones. In the case of antenatal care, there was no significant rural–urban gap, thanks mainly to the role of multipurpose health workers in providing antenatal care in rural areas.

Policy implications and suggestion:

The findings of the study have policy implications for reducing disparity in the use of maternal health care services have diverse social settings. Since higher order pregnant women are less likely to use the maternal health care services, the integrated maternal and child health programme in India should include an education component designed to target higher order pregnant women. As women's education is an important correlate of use of maternal health care services, improving education among girls, particularly beyond middle school, needs to be strongly encouraged. The integrated maternal and child health programme may also aim to bring about awareness among illiterate women about the benefits of using the maternal health care services for both the mother and the child. Special attention should also be given to meet the needs of women who belong to scheduled caste or scheduled tribes. The infrastructure and health care facilities should be widespread in rural areas in order to reduce disparities in the use of maternal health care services. Multipurpose health workers may also be given effective training to monitor pregnant women so as to increase institutional delivery and delivery assistance by health professionals in rural areas.

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