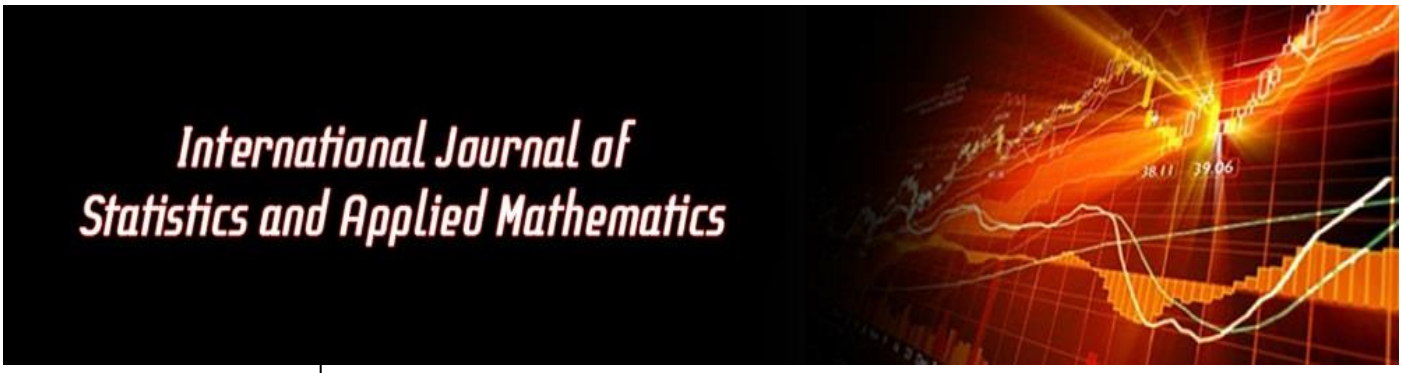
International Journal of Statistics and Applied Mathematics 2021; 6(6): 38-45



ISSN: 2456-1452
Maths 2021; 6(6): 38-45

www.mathsjournal.com
Received: 16-09-2021
Accepted: 18-10-2021

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Statistical study for utilization of institutional delivery: An evidences from NFHS data

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DOI: https://doi.org/10.22271/maths.2021.v6.i6a.748

Abstract
Objectives: The health of women during pregnancy and child birth is crucial for the mother and her children. The purpose of this study is to examine the determinants and current status of institutional deliveries in Uttar Pradesh on NFHS-4 data.
Materials and Methods: The information collected from women who had a live birth in the five years preceding the survey. The study used bivariate analysis and logistic regression to examine the individual and household characteristics of women utilizing institutional delivery.
Results: Findings reveal that 70 percent of women go for institutional delivery in Uttar Pradesh. Women's education, parity, exposure of mass media, ANC visits, wealth index and place of residence were found to be most significant predictor of institutional delivery. Highly educated women were 3.85 times and lower parity women were 2.38 times significantly more likely to prefer institutional delivery. Urban women were slightly in better position to prefer (1.23 times) to deliver child at institution than rural women.
Conclusions: The logistic regression results reveal that utilization of institutional delivery is influenced by maternal age, women's educational level, birth order, mass media exposure, ANC visits, religion, caste, wealth index and type of residence. This study specified the need for an adequate health strategy for the target population and policy implementation to improve maternal healthcare.

Keywords: maternal health care, institutional delivery, women's education, logistic regression

1. Introduction
Skilled birth attendance (SBA) at delivery is an important indicator in monitoring progress towards Millennium Development Goal 5 to reduce the maternal mortality ratio by three quarters between 1990 and 2015 [1]. Health care services during pregnancy and childbirth and after delivery are salient for the survival and well-being of both the mother and their infant. Antenatal care (ANC) can reduce the health hazards for mothers and their infants by monitoring pregnancies and screening for complications. Delivery at a healthcare facility, with skilled medical attentiveness and hygienic conditions, reduces the risk of complications, and infections during delivery. To improve the availability and access to quality health care, especially for those residing in rural areas, the poor, women, and children, the government launched the National Rural Health Mission for the 2005-2012 periods. One of the important goals of the National Rural Health Mission (NRHM) is to provide access to improved health care at the household level.
Reduction of mortality of women is an area of concern for the Governments across the globe. The International Conference on Population and Development in 1994 had recommended reduction in maternal mortality by at least 50 percent of the 1990 levels by the year 2000 and further one half by the year 2015 [2]. It is well known and widely accepted that maternal morbidity and mortality reduces as use of maternal health services increases. Improved maternal health care is a very important goal of Sustainable Development Goal (SDG) and Millennium Development Goal (MDG) which is the strong predictor for reducing the pregnancy complication, maternal morbidity, maternal mortality and infant mortality [3, 4]. Different countries around the world have already introduced different programs and policies

to improve the availability and access to the use of maternal health care services where India take many programmes and initiatives i.e. Janani Suraksha Yojana, Janani Shishu Suraksha Karyakaram, Matrima, Matrika and so on [5]. Although there is considerable variation by different determining factors (age, age at marriage, educational attainment, the educational level of the spouse, parental education, caste, religion, place of residence, mass media exposure, economic condition and so on), education directly have a strong impact on the utilization of maternal health care services [6-10].

The proportion of women age 15-49 in India who received ANC has raised from 77 percent in NFHS-3 (2005-06) to 84 percent in NFHS-4 (2015-16), and in NFHS-4, 79 percent received ANC from a skilled provider (i.e., doctors, auxiliary nurse midwives, nurses, midwives, and lady health visitors). It has observed that use of a skilled provider for ANC services increases with rising education of female. In India, institutional deliveries have increased markedly from 39 percent in 2005-06 to 79 percent in 2015-16 by NFHS. The most common reason for not delivering in a health facility was that the woman did not think it was necessary (40 percent), but 18 percent of women said that it was too far or there was no transportation, 18 percent said that the husband or family did not allow them to have the delivery in a health facility, and 16 percent said it costs too much according to NFHS-4.

A number of studies have demonstrated various socioeconomic and regional factors in maternal healthcare utilization in India. Some studies found that utilization of economic status emerges as a more crucial determinant than access for institutional care seeking for child birth and SBA significantly varied by the place of residence, state of residence, socio-economic conditions and cultural constraints in India [8, 11-13]. There were also a number of studies which stated that the low utilization of maternal health care services was found among the illiterate or low educated women which are very poor in terms of economic status [14], who resided the very remote areas and among the Muslim community women who were not engaged with the any method (listening radio, watching television and reading newspaper) of mass media [15-19]. The improper utilization of maternal health care services is another type of problem which leads to the high risk of maternal mortality and also a risk of newborn health [14, 20, 21].

The present article attempts to identify various background characteristics of institutional delivery using NFHS-4 data among women who had a live birth in the five years preceding the survey in Uttar Pradesh. This article provided evidence on the factors associated with the utilization of institutional delivery in Uttar Pradesh, which would help in policy formulation to improve the use of institutional delivery services among the socio-economic disadvantaged groups.

Materials and Methods

Data

This study used secondary data from 4th round of National Family Health Survey (NFHS), a nationally representative survey conducted by International Institute of Population Science (IIPS) under the guidance of Ministry of Health and Family Welfare (MoHFW), Government of India. The unit of analysis for this study was women who had a live birth in the five years preceding the survey in Uttar Pradesh (N = 28740).

Outcome Variables

The outcome variable for this study was place of delivery is divided into two sections named institutional delivery (coded as 1) and home delivery (coded as 0).

Study covariates

After using factor analysis and principal component analysis some socio-demographic variables have been extracted as covariates for the institutional delivery. In the present study to show the determining effect on the utilization of maternal health care services for age of the respondents which has been categorized into five categories i.e. less than 25 years, 25-30 years, 30-35 years, 35-40 years and 40 above, women's education (no education, primary education, secondary education and higher education), parity (1,2 and 3 or more), mass-media (exposure and non-exposure), covered by health insurance (yes and no), antenatal care visit (<4 times and >=4 times), gender of household head (male and female), caste (SC/ST, OBC & General), religion (Hindu and Muslim), number of eligible women in household (1, 2 or more), wealth index (poorest, poorer, middle, richer and richest) and place of residence (urban & rural) has been considered.

Statistical Analysis

In the initial phase of the analysis, all variables were tested using a collinearity test to ensure there was no collinearity between variables. Multicollinearity is a state of very high inter correlations or inter-associations among the independent variables. It is therefore a type of disturbance in the data, and if present in the data the statistical inferences made about the data may not be reliable.

Multicollinearity referred to a perfect linear relationship between the independent variables, or a weighted sum of the independent variables; however, it is now used to refer to multiple correlations amongst the predictor variables, known as collinearity. The effect of collinearity is to increase the standard error of the regression coefficients (and hence to increase the confidence intervals and decrease the p-values). For diagnosing collinearity two closely related statistics variance inflation factor (VIF) and tolerance are used [22].

The standard error of a regression estimate of the variable $j\left(\hat{\beta}_j\right)$ is given by

$$SE\left(\hat{\beta}_j\right) = \sqrt{\frac{\sigma^2}{\sum x_j^{\,2}} \times \frac{1}{1-R_j^{\,2}}}$$

Where R_j^2 is the R^2 found when regressing all other predictors onto the predictors j. The term $\frac{1}{1-R_j^2}$ is known as the variance inflation factor (VIF). The reciprocal of the VIF is called the tolerance. It is equal to $1-R_j^2$ [22]. If the value of tolerance is less than 0.2 or 0.1 and, simultaneously, the value of VIF 10 and above, then the multicollinearity is problematic.

The bivariate analysis has been performed with select background variables to investigate the socioeconomic and demographic characteristics of women utilizing institutional delivery in Uttar Pradesh. Before including these background variables in regression analysis, all the predictor variables were verified for association with outcome variables at bivariate level using chi square tests. At the final stage, we employed unadjusted and adjusted logistic regression for checking whether these background characteristics (including individual and household characteristics) is deterministic or not. Logistic regression analysis is the task estimating the log odds of an event. Mathematically, logistic regression estimates a multiple linear regression function defined as:

$$\text{logit } p(x) = \ln\left(\frac{p(x)}{1-p(x)}\right) = \beta_0 + \sum_{i=1}^{n} \beta_i x_i$$

where β_i are parameters of the model. The results of the multivariate logistic regression are reported as odds ratios (ORs) with 95 percent confidence intervals adjusted for both individual characteristics (i.e. maternal age, women's education, husband's education, parity, mass media exposure, women covered by health insurance and antenatal care visits) and household characteristics (i.e. gender of household head, religion, caste, number of eligible women in household, wealth index and type of residence) of women in Uttar Pradesh.

Result

Table 1 shows the results of the collinearity test of all variables in analyzing determinants of delivery care utilization among women who had a live birth in the five years preceding the survey in Uttar Pradesh. Collinearity test results showed that there was no co-linearity between independent variables. The tolerance value of all variables is greater than 0.10, while the variance inflation factor (VIF) value for all variables is less than 10.00. Based on the conclusion of the multicollinearity test, there were no indications of multicollinearity in the regression model. This analysis is based on 28,740 women who had a live birth in the five years preceding the survey in Uttar Pradesh provided complete information for the present study in which 20,130 women are observed to have gone for institutional delivery.

Table 1: Results for the colinearity test of Institutional Delivery (N=28,740)

Variables	Colinearity Statistics	
	Tolerance	VIF
Maternal Age	0.673	1.486
Educational Level	0.587	1.704
Parity	0.609	1.643
Media exposure	0.687	1.456
Covered by health insurance	0.991	1.009
Four or more ANC visit	0.860	1.163
Household head sex	0.996	1.004
Religion	0.816	1.226
Caste	0.846	1.183
eligible women in household	0.922	1.085
Wealth index	0.442	2.265
Type of residence	0.711	1.407

Table 2 presents the distribution of women according to institutional delivery and stratified by the background characteristics considered in the study. It may be noted from Table 2 that nearly 29 percent of the women are less than 25 years old and as the age is increasing the percentage of using institutional delivery is decreasing. In the study sample 41 percent women have no education and as education is increasing the preference of institutional delivery is significantly increasing. It is obvious that the percentage of institutional delivery for higher order births is lesser that the significantly lower order of births. Media exposure and coverage of health insurance is positively associated with institutional delivery. There are only 2 percent women who were covered with health insurance and are more intended to go for institutional delivery. Those women who have more than or equal to 4 ANC visit (27 percent) more wished for to go for institutional delivery (86 percent). The percentage of female headed household is only 12 percent, while 88 percent household's head are male. According to religion, there are 79 percent women who are Hindu and 21 percent women are Muslim and 62 percent Muslim women are using institutional delivery however 72 percent Hindu women are using institutional delivery. As far as caste is concerned, 26 percent belong to the SC/ST category, 55 percent of women come from OBC (other backward castes), and the remaining 19 percent are from General category. General caste women are more user of institutional delivery than others. There are 58 percent household in which only one eligible woman and 42 percent household in which 2 or more eligible women. In the study sample poor women are more than others and a richer woman uses institutional delivery more. In urban are the institutional delivery is significantly more prevalent.

Table 2: Bivariate analysis of Institutional Delivery by Women according to Background Characteristics

Background Characteristics	Number of female (*N*=28,656)	Number of Female Utilizing Institutional Delivery (20,130)	p-value
Individual Characteristics			
Maternal Age			
<25	8233 (28.7)	6293 (76.2)	0.000
25-30	10579 (36.9)	7537 (71.1)	
30-35	5994 (20.9)	4073 (67.7)	
35-40	2711 (9.5)	1669 (61.3)	
>=40	1139 (4.0)	558 (48.7)	
Women's Education			
No Education	11707 (40.9)	6817 (58.0)	0.000
Primary	3965 (13.8)	2642 (66.5)	
Secondary	9613 (33.5)	7584 (78.7)	
Higher	3371 (11.8)	3087 (91.3)	
Order of birth			
1	7412 (25.9)	6236 (83.8)	0.000
2	7711 (26.9)	5726 (74.0)	
>=3	13533 (47.2)	8168 (60.2)	
Mass Media Exposure			
No	10801 (37.7)	6652 (61.3)	0.000
Yes	17855 (62.3)	13478 (75.3)	
Covered by Health Insurance			
No	28144 (98.2)	19732 (69.9)	0.000
Yes	512 (1.8)	398 (77.6)	
ANC Visit			
<4 Visits	20793 (72.6)	13351 (64.0)	0.000
>=4 Visits	7863 (27.4)	6779 (86.0)	
Household Character			
Gender of household head			
Female	3372 (11.8)	2418 (71.6)	0.031
Male	25284 (88.2)	17712 (69.8)	
Religion			
Hindu	22674 (79.1)	16398 (72.1)	0.000
Muslim	5982 (20.9)	3732 (62.2)	
Caste			
SC/ST	7453 (26.0)	4916 (66.0)	0.000
OBC	15878 (55.4)	11029 (69.5)	
General	5325 (18.6)	4139 (77.7)	
Eligible women in household			
1	16736 (58.4)	11354 (67.7)	0.000
>=2	11920 (41.6)	8776 (73.4)	
Wealth Index			
Poorest	8541 (29.8)	5083 (59.3)	0.000
Poorer	6783 (23.7)	4655 (68.4)	
Middle	5154 (18.0)	3701 (71.7)	
Richer	4207 (14.7)	3226 (76.4)	
Richest	3971 (13.9)	3465 (87.1)	
Type of residence			
Rural	6574 (22.9)	15345 (69.3)	0.000
Urban	22082 (77.1)	4785 (72.6)	

Percentage is given in parenthesis.

Table 3 presents the results of three adjusted logistic models to assess the impact of individual characteristics and household characteristics of female on institutional delivery. Model-I shows the effect of individual characteristics of women on institutional delivery. Model-I shows that women whose age is less than 25, 25-30, 30-35 and 35-40 have 58 percent, 43 percent, 36 percent and 21 percent significantly higher chance to go for an institutional delivery, respectively, as compared to women above 40 years old. Education plays an important role in using institutional delivery. Higher educated women are significantly more likely (about 4 times) to have facility of institutional delivery. As order of birth is increasing the chance of using institutional delivery is decreasing significantly. The chance of institutional delivery is 2.38 for first order birth in comparison of 3+ order births. Women who have any type of mass media exposure are 12 percent significantly higher chance to go for institutional delivery than non-exposure of mass media.

Table 3: Adjusted Logistic Regression output of Likelihood of Institutional Delivery in Uttar Pradesh

Variable	Model 1		Model 2		Model 3	
	OR (95 percent CI)	p-value	OR (95 percent CI)	p-value	OR (95 percent CI)	p-value
Individual Characteristics						
Maternal Age						
<25	1.58 (1.39-1.81)	0.000	-	-	1.57 (1.38-1.79)	0.000
25-30	1.43 (1.24-1.65)	0.000	-	-	1.46 (1.27-1.69)	0.000
30-35	1.36 (1.19-1.55)	0.000	-	-	1.36 (1.19-1.55)	0.000
35-40	1.21 (1.05-1.40)	0.000	-	-	1.21 (1.04-1.39)	0.000
>40 (ref.)	1.00		-	-	1.00	
Women's Education						
No Education (ref.)	1.00		-	-	1.00	
Primary	1.23 (1.13-1.33)	0.000	-	-	1.18 (1.09-1.28)	0.000
Secondary	1.93 (1.80-2.07)	0.000	-	-	1.65 (1.53-1.77)	0.000
Higher	3.85 (3.36-4.40)	0.000	-	-	2.87 (2.49-3.31)	0.000
Parity						
1	2.38 (2.17-2.61)	0.000	-	-	2.33 (2.13-2.56)	0.000
2	1.39 (1.30-1.50)	0.000	-	-	1.33 (1.24-1.44)	0.000
>=3 (ref.)	1.00		-	-	1.00	
Mass Media Exposure						
No (ref.)	1.00		-	-	1.00	
Yes	1.12 (1.05-1.19)	0.000	-	-	1.06 (0.99-1.13)	0.000
Covered by Health Insurance						
No (ref.)	1.00		-	-	1.00	
Yes	1.22 (0.97-1.53)	0.091	-	-	1.17 (0.93-1.47)	0.185
ANC Visits						
<4 times (ref.)	1.00		-	-	1.00	
>=4 times	2.47 (2.30-2.66)	0.000	-	-	2.43 (2.26-2.62)	0.000
Household Characteristics						
Gender of household head						
Female (ref.)	-	-	1.00		1.00	
Male	-	-	0.87 (0.80-0.94)	0.000	0.88 (0.81-0.96)	0.003
Religion						
Muslim (ref.)	-	-	1.00		1.00	
Hindu	-	-	1.91 (1.79-2.04)	0.000	1.47 (1.37-1.58)	0.000
Caste						
SC/ST (ref.)	-	-	1.00		1.00	
General	-	-	1.48 (1.35-1.62)	0.000	1.32 (1.21-1.45)	0.000
OBC	-	-	1.14 (1.07-1.21)	0.000	1.11 (1.04-1.18)	0.002
Eligible women in household						
1 (ref.)	-	-	1.00		1.00	
>=2	-	-	1.07 (1.02-1.14)	0.008	1.01 (0.94-1.07)	0.988
Wealth Index						
Poorest (ref.)	-	-	1.00		1.00	
Poorer	-	-	1.53 (1.43-1.64)	0.000	1.22 (1.13-1.31)	0.000
Middle	-	-	1.89 (1.75-2.05)	0.000	1.23(1.12-1.34)	0.000
Richer	-	-	2.69 (2.45-2.95)	0.000	1.44 (1.29-1.60)	0.000
Richest	-	-	5.78 (5.13-6.51)	0.000	1.98 (1.73-2.27)	0.000
Type of residence						
Rural (ref.)	-	-	1.00		1.00	
Urban	-	-	1.23 (0.95-1.43)	0.000	1.12 (0.91-1.38)	0.000
-2 Log Likelihood	31632.691		33309.171		31350.814	
Cox & Snell R-Square	0.110		0.060		0.119	
Negelkerke R-Square	0.156		0.085		0.168	

Women who are covered by health insurance have 22 percent higher chance of utilization of institutional delivery. ANC visits also show the significant effect from institutional delivery. As ANC visits increases chance of going for institutional delivery is also increases. Women who attended 4 or more ANC visits have 2.47 times significantly higher chance for going institutional delivery than who have attended less than 4 ANC visits.

Further, in Model-II, we studied the effect of household characteristics on an institutional delivery. In Model-II, We found that gender of household head shows the significant effect with institutional delivery ($p<0.05$). In household where the sex of household head is male there is a 13 percent significantly lower chance that pregnant woman in his household to go for institutional delivery than female headed household. Women who belong to Hindu religion have 91 percent more and significantly chance to go for institutional delivery as comparison with Muslim women. Women who belong to general category and OBC category have 48 percent and 14 percent more likely to go for institutional. Women belongs to the household in which 2 or more eligible women has 7 percent significantly more chance to utilize institutional delivery. Furthermore, as wealth index increases utilization of institutional delivery is also increases. Women belong to middle, richer and richest wealth index categories are 1.89

times, 2.69 times and 5.78 times more likely to go for institutional delivery than poorest wealth index. Urban women have 23 percent significant higher chance to use institutional delivery than rural women.

In Model-III, both individual and household characteristics are considered simultaneously. In Model-III, all the individual variables have shown nearly same effects as Model-I and all the household variables have shown nearly same effect as Model II.

In assessing the strength of the models, the values of -2Loglikelihood, Cox and Snell R^2 and Nagelkerke R^2 tests were considered. These diagnostic tools indicate that Model-III is a better fit than Model-I and Model-II, because -2Loglikelihood is lower and Cox and Snell R^2 and Nagelkerke R^2 value is higher for Model-III in comparison to other two models. Thus Model-III, which includes both types of characteristics simultaneously, is better at explaining of utilization of institutional delivery in Uttar Pradesh.

Discussion

The study attempts to identify various background characteristics of institutional delivery using NFHS-4 data among women who had a live birth in the five years preceding the survey in Uttar Pradesh. In the present study, two broad categories i.e. individual characteristics and household characteristics have been chosen as factors of institutional delivery which shows the significant difference in the likelihood of delivering at institution. The belief that delivery is a natural process not requiring medical attention is thought to be particularly strong in the North [23]. Women in lower age group (<25 and 25-30) were more likely to deliver at an institution than the other aged women in Uttar Pradesh which may be the possible effect of education which helps in knowing the safety and health care facilities of institutional delivery, this findings is supported by some prior studies [22, 24, 25]. Education of women was strongly associated with institutional delivery which shows that the women who are highly educated are more likely to deliver at an institution than the women who are less educated. The possible reason may be low educated women have no proper knowledge about various obstetric care like antenatal care, timing of antenatal visit, tetanus toxoid injection, iron and folic acid, safe delivery and postnatal care. Similar types of observations are reported in some studies [22, 24-29].

Parity is one of the most important individual covariate of institutional delivery which shows that with the increase of parity there was a decreasing trend of institutional delivery. The women are more likely to deliver her first baby in the hospital, the possible reason may be women with high parity are less educated and might tend to believe in their experiences from previous pregnancies and do not feel the need for antenatal checks, therefore the likelihood of using institutional deliveries becomes low [30, 31]. Women having any type of mass media exposure were more likely to deliver at an institution than who have not any type of mass media exposure possible reason may be exposure to mass media (reading newspaper, listening to radio, and watching television) helps to access health care information and raise people's awareness on health care [29, 32].

Women who have covered by health insurance are more likely to go for institutional delivery because these women have a better opportunity to use health facilities [33]. Women who attended 4 or more ANC visits had a higher chance of utilizing institutional delivery. Antenatal care provides maternal health services that ensure the best pregnancy outcomes for women and their children [34]. The more often pregnant women interact with health workers during the ANC, the higher the chances of childbirth in health facilities [35]. In female headed household women were more likely to go for institutional delivery than male headed household. In India, a household head is usually male and female is the head of the household only when she is widowed. So she does not take risks for her daughter-in-law's children and usually goes to an institution for her delivery. Religion and caste showed considerable influences on institutional delivery. Hindu women were more likely to deliver at institution than Muslim women; this finding is consistent with other studies [13, 35]. Women belonging to General and OBC category were more likely to go for institutional delivery than SC/ST women. The low usage of maternity care services among SC/ST women may be due to lack of access to health care services as women of these social groups have a higher probability of living under unfavorable conditions (36,37). Women belonging to households where more than one eligible woman is living were more likely to deliver at institution than women who are the only eligible woman in the household. A woman is said to be eligible if both (husband and wife) are alive at the time of survey and the age of female is less than 50 years [35]. Low Economic status women were less likely to deliver at institution because family economic status such as household income, occupational status, and medical care cost has often been shown to be the inhibitors for use of delivery care services [38-40]. Urban women were more preferred institution for their delivery than the rural women as because lack of availability and accessibility of health facilities in the rural areas of India [25, 41].

Conclusions

Delivery at institution is increasing over time, still some social issues plays as a barrier. The goal of National Population Policy 2000 is 100 percent deliveries by the trained persons. This study concluded some determinants of institutional delivery among women of Uttar Pradesh. The logistic regression results reveal that utilization of institutional delivery is influenced by maternal age, women's educational level, birth order, mass media exposure, ANC visits, religion, caste, wealth index and type of residence. This suggests the need for a proper health strategy and the execution of policies to increase awareness among communities to improve institutional delivery. The findings of this study also provide specific targets to intervene rural, Muslim women, low education, low wealth status women. The government also needs to start a maternal health services provider mobile unit in remote areas with poor access.

Authors' Contribution

all authors have contributed significantly and that all authors agree with the content of the manuscript.

Conflict of interests: The authors declare no conflict of interest.

Financial Support: There was no financial support received from any agency or institution for their study.

Acknowledgments
The author would like to thank Ministry of Health and Family Welfare (MoHFW) for allowing the use of the NFHS-4 data.

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