


# A Multilevel Analysis to Determine the Factors Associated with Institutional Delivery in Nepal: Further Analysis of Nepal Demographic and Health Survey 2016

Health Services Insights  
Volume 14: 1–10  
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DOI: 10.1177/11786329211024810



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## ABSTRACT

**BACKGROUND:** One out of two neonatal deaths and 2 out of 5 maternal deaths occur at home in Nepal. An essential intervention in reducing maternal mortality and neonatal death is institutional delivery. The objective of this study was to find out the external environmental, predisposing, and enabling factors associated with the use of institutional delivery care in Nepal.

**METHODS:** Data from Nepal Demographic and Health Surveys (NDHS) 2016 was used to estimate socio-economic, provincial, and use of media differentials with institutional delivery under the Andersen behavioral model framework using multilevel regression analysis.

**RESULTS:** More than half of the women (60.9%) among 3899 women with last birth had their babies delivered in a health facility. In the multilevel logistic regression analysis, we found that women from province 2 (OR = 0.47 95%CI: 0.28-0.79) were significantly less likely to deliver in health institutions, and province 7 (OR = 1.76, 95%CI: 1.05-2.94) were significantly more likely deliver in a health institution. Age (OR = 0.94, 95%CI: 0.92-0.95) was also significantly associated with the place of delivery. Women with higher education (OR = 3.17, 95%CI: 2.09-4.81) were most likely to go for institutional delivery. The odds of women opting for institutional delivery were 3 folds more for those who had visited Antenatal Care (ANC) 4 or more times compared to those who did not.

**CONCLUSION:** The results highlight the need for governments and health care providers to emphasize the promotion of institutional delivery and ANC visits as per protocol with a special focus on underprivileged communities. The use of multi-media is a vital strategy to promote the use of institutional delivery services.

**KEYWORDS:** Home delivery, institutional delivery, health utilization, Andersen behavioral model

**RECEIVED:** December 11, 2020. **ACCEPTED:** May 21, 2021.

**TYPE:** Original Research

**FUNDING:** The author(s) received no financial support for the research, authorship, and/or publication of this article.

**DECLARATION OF CONFLICTING INTERESTS:** The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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## Background

United Nations International Children's Emergency Fund (UNICEF) in 2015 illustrated that every day 800 women and 2700 newborns died due to the complication of pregnancy and childbirth.<sup>1</sup> Approximately 99% of total maternal death occur in developing nations, one-third of which occurs in South Asia.<sup>2</sup> In 2015, the maternal mortality rate (MMR) in developing countries was 239 pregnant women per 100 000 live births, compared with 12 per 100 000 in developed countries. At the end of 2015, the number of women giving birth was high, and approximately 303 000 women died during pregnancy, and almost all deaths occur in low-resource areas, and most are preventable.<sup>3</sup> In Nepal, maternal mortality is 239 deaths per 100 000 live birth, which is considerably high.<sup>4</sup>

Most maternal deaths might occur within 42 days of delivery, with the most crucial time being the time of delivery.<sup>5</sup> Most of the deaths in Nepal occur due to hemorrhage before reaching the health facility.<sup>5</sup> One out of two neonatal death

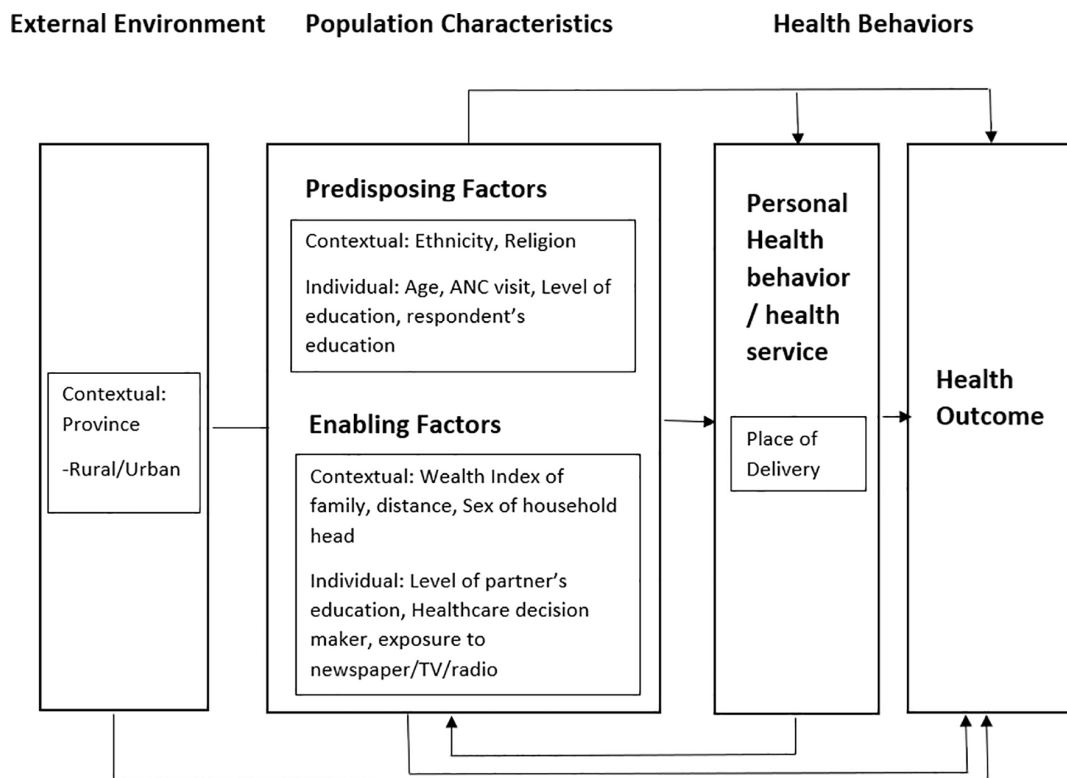
and 2 out of 5 maternal death occurs at home in Nepal.<sup>6</sup> Studies have depicted that younger women aged 10 to 24 are more at the risk of death related to pregnancy and childbirth compared to adult women.<sup>2</sup>

An essential intervention in reducing maternal mortality and neonatal death is institutional delivery. Institutional delivery addresses the risk associated with complications and infections by ensuring comprehensive medical assistance and aseptic conditions during delivery.<sup>7</sup> Complications related to delivery and death can be prevented mainly with institutional delivery with the help of skilled providers and strong referral.<sup>8-10</sup> Access to quality institutional delivery care also improves neonatal health outcomes as maternal complications during delivery can lead to neonatal death.<sup>11</sup> Hence, it is essential to improve access to delivery care to reduce maternal and neonatal death.

It is estimated that of all the births conducted between the period of 2014 to 2019, almost 81% of those were conducted in the presence of skilled birth attendants, compared to 60% in



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**Figure 1.** Conceptual framework of Andersen's behavior model. Abbreviation: ANC, antenatal care.

period of 2000 to 2006.<sup>12</sup> However, the proportion of women delivering in health facilities; and in the presence of skilled birth attenders in Nepal has increased from 37% to 57% and 36% to 58% respectively in the period between 2011 and 2016.<sup>4,6</sup> Similarly, the proportion of home delivery is still as high as 41%. The 2 figures show some improvement over the past few years but depict a deeply rooted gap in the country. At this rate, the SDG goal of achieving a mortality rate of less than 70 per 100 000 live births is a very tough assignment.<sup>13</sup>

Nepal has taken various steps to increase women's access to maternal health care services, including safe delivery. With the formulation of the National Health Policy in 1991, the Safe Motherhood Program (SMP) has been a priority.<sup>14</sup> SMP prioritized antenatal care, delivery, postnatal care, neonatal care, and emergency obstetric care.<sup>15</sup> Similarly, a maternity incentive scheme was launched in 2005 to raise the demand for maternal health services. Along with this, the Government of Nepal initiated the Ama Surakshya Program (Mother's Safety) and Birth Preparedness Package (BPP) in all districts of Nepal.<sup>16</sup> Despite the immense effort, disparity lies between women coming from different socio-economic backgrounds in using the institutionalized delivery services.<sup>6</sup> These disparities need to be addressed if improvements are to be made in the demand and utilization of institutional delivery services.<sup>17</sup>

Studies conducted in Ethiopia and Burkina Faso have shown that women from higher wealth quintile use health services often compare to women from poor economic backgrounds.<sup>18,19</sup> A study has shown that women in urban areas

who had primary and secondary/higher education levels were 2.2 and 3.3 times more likely to deliver at a health facility than those who had no education.<sup>20</sup> However, there are limited numbers of studies about the effect of socio-economic differentials on the choice of place of delivery in Nepal. There are very few studies related to inequality due to the province of residence. The objective of our study was to find out the external environmental, predisposing, and enabling factors associated with the use of institutional delivery care in Nepal using a multilevel analysis approach.

### Conceptual framework

To classify the factors associated with place of delivery, we adopted Andersen's behavioral model framework. Developed by Ronald M. Andersen in 1968 and advanced in 1990 (the fourth version), his multilevel model incorporated individual and contextual determinants of health services use.<sup>21,22</sup> It has different layers, including the external environment, population characteristics, and health behavior (Figure 1). This study does not study the outcome variable and need factor due to the unavailability of data in the Nepal Demographic and Health Survey (NDHS).

## Methods

### Data source

Data from a national-level household survey, Nepal Demographic and Health Survey (NDHS) 2016, was used for present analyses. The survey began in June 2016 and lasted until January

2017 under the Ministry of Health. A total of 11 473 households were selected for the sample, and 11 040 were successfully interviewed. Among the interviewed households, 13 089 women age 15 to 49 were identified for individual interviews; interviews were completed with 12 862 women, with a response rate of 98%. Our analyses were restricted to individual women age 15 to 49 of reproductive age who had given birth 5 years before NDHS 2016. Women of age group 15 to 49 selected for the study either were permanent residents of the household chosen for an interview or an eligible visitor who had stayed there a night before the survey.<sup>4</sup>

### *Outcome variable*

Our outcome variable was the place of delivery, that is, institutional delivery or home delivery. People who gave birth on the way to the institution were added to institutional delivery, while people who gave birth in other countries like India were omitted from this analysis.

### *Study variables*

Altogether 16 characteristics relevant to the study were selected and divided into different categories.<sup>22-24</sup> Province of residence (province 1-7), place of residence (urban/rural), age of the women, ethnicity (Brahmin/Chettri, Janjati, Dalit, Muslim, and others), religion (Hindu, non-Hindu), women's education (no education, primary, secondary, and higher), partner's education (no education, primary, secondary, and higher), respondent's occupation (didn't work, skilled worker, unskilled worker, and agriculture), household wealth index (poor, middle class, rich), Antenatal Care (ANC) visits (<4 or 4/more times), sex of household head (male, female), health care decision-maker (women herself, herself along with someone else, solely others), distance to health facility (easily accessible, difficult to access), exposure to the newspaper (not at all, less than once a week, at least once a week), exposure to the radio (not at all, less than once a week, at least once a week) and exposure to television (not at all, less than once a week, at least once a week).

### *Statistical analyses*

A total of 3899 ever-married women between 15 and 49 years were eligible and were included in our study. We estimated the latest pregnancy in recent 5 years with the institutional delivery service and the socio-economic differentials in these indicators by age, ANC visit, residence, religion, wealth, media exposure were analyzed executing a multilevel logistic regression model.

The variables were divided into external environmental factors, predisposing, and enabling factors. Descriptive statistics were performed to find the frequency of various independent variables. Furthermore, the variables were divided into contextual factors and individual factors for further analyses in multilevel regression. Province, household wealth index, religion,

ethnicity, and distance were considered contextual factors, while the rest were the individual factors. The multilevel nested structure of analysis comprised 3899 individuals grouped into 380 primary sampling units (PSUs): wards in rural areas and enumerator areas in the urban area (level 1). Again, the PSUs were nested into the place of residence (urban and rural area) (level 2). Multilevel logistic regression was performed to test the association of contextual and individual independent variables with the institutional delivery among Nepalese pregnant women. Variables associated with institutional delivery at a significant level  $P < .05$  in bivariate analysis were considered for the multivariable analysis. A 2-level random intercept and fixed-slopes model structure with PSUs nested within urban-rural areas were fitted to estimate the odds ratios (OR) and 95% CIs, indicating the likelihood of having a higher mean of institutional delivery. The overdispersion of the data was handled by using a 2-level random intercept model.

A parsimonious final model for institutional delivery was obtained with a stepwise forward selection of variables in subsequent models as per the conceptual framework (Figure 1). The first and second models consisted of contextual predisposing and enabling factors, and the second and third models comprised individual predisposing and enabling variables, respectively. Predictors that remained statistically significant at 5% ( $P \leq .05$ ) were retained in the analysis for adjustment in the next model. Thus, the final models included all significant contextual and individual predisposing and enabling factors. The statistical analyses were executed using R version 3.6.3 with the "lme4" package.

## **Results**

### *Respondent's socio-economic and demographic characteristics*

Table 1 shows the socio-economic characteristics of respondents and chi-square values to test the associations. Almost 59% of pregnant women lived in urban areas, 70.9% of women had institutional delivery in urban areas compared to 47% in rural areas, and place of residence was significantly associated with place of delivery ( $P < .001$ ). Similarly, the percentage of women attending institutional delivery was low in province 2 and province 6, that is, 45.6% and 50.6%, respectively, while it was almost the same for the rest of the provinces. Province was also significantly associated with place of delivery ( $P < .001$ ).

As for predisposing factors, age ( $P < .001$ ) and ethnicity ( $P < .001$ ) also had a significant association with place of delivery. Women from the age group 15 to 19 had the highest percentage, with 70.1% of women attending institutional delivery. Similarly, the percentage was higher among the women who were Brahmin/Chettri; 68.5%. Besides, the number of ANC visits was also significantly related to the place of delivery ( $P < .001$ ), where 72.9% of women who had visited ANC 4 or more times went for institutional delivery over 33% of women who had visited ANC <4 times. The percentage of women

**Table 1.** Respondent's characteristics divided into environmental, predisposing and enabling factors.

VARIABLE	TOTAL (N)	HOME DELIVERY N (%)	INSTITUTIONAL DELIVERY N (%)	P-VALUE
External environmental factor				
Province				
Province 1	561	183 (32.6)	378 (67.4)	<.001
Province 2	717	390 (54.4)	372 (45.6)	
Province 3	431	138 (32)	293 (68)	
Province 4	435	135 (31)	300 (69)	
Province 5	631	223 (35.3)	408 (64.7)	
Province 6	597	295 (49.4)	302 (50.6)	
Province 7	527	157 (29.8)	370 (70.2)	
Residence				
Urban	2282	664 (29.1)	1618 (70.9)	<.001
Rural	1617	857 (53)	760 (47)	
Predisposing factor				
Age (y)				
15-19	338	101 (29.9)	237 (70.1)	<.001
20-29	2599	971 (37.4)	1628 (62.6)	
30-49	962	449 (46.7)	513 (53.3)	
Ethnicity				
Brahmin/Chettri	1339	422 (31.5)	917 (68.5)	<.001
Janjati	1254	461 (36.8)	793 (63.2)	
Dalit	567	279 (47.6)	297 (52.4)	
Muslim	207	100 (48.3)	107 (51.7)	
Others	532	268 (50.4)	264 (49.6)	
Religion				
Hindu	3401	1316 (38.7)	2085 (61.3)	.291
Non-Hindu	498	205 (41.2)	293 (58.8)	
ANC visit				
Less than 4	1165	780 (67)	385 (33)	<.001
Four or more	2734	741 (27.1)	1993 (72.9)	
Level of education				
No education	1190	731 (61.4)	459 (38.6)	<.001
Primary	738	348 (47.2)	390 (52.8)	
Secondary	1370	368 (26.9)	1002 (73.1)	
Higher	601	74 (12.3)	527 (87.7)	
Respondent's occupation				
Didn't work	1400	559 (39.9)	841 (60.1)	.634

(Continued)

Table 1. (Continued)

VARIABLE	TOTAL (N)	HOME DELIVERY N (%)	INSTITUTIONAL DELIVERY N (%)	P-VALUE
Skilled worker	456	182 (39.9)	274 (60.1)	
Unskilled worker	109	45 (41.3)	64 (58.7)	
Agriculture	1934	735 (38)	1199 (62)	
Enabling factor				
Wealth index of family				
Poor	1849	1002 (54.2)	847 (45.8)	<.001
Middle	791	277 (35)	514 (65)	
Rich	1259	242 (19.2)	1017 (80.8)	
Distance to health facility				
Big Problem	2283	1080 (47.3)	1203 (52.7)	<.001
Not a big Problem	1616	441 (27.3)	1175 (72.7)	
Partner's education status (n=3886)				
No education	488	308 (63.2)	180 (36.8)	<.001
Primary	816	425 (52.8)	391 (47.9)	
Secondary	1829	626 (34.2)	1203 (65.8)	
Higher	735	147 (20)	588 (80)	
Sex of household head				
Male	2676	1059 (39.6)	1617 (60.4)	.286
Female	1223	462 (37.8)	761 (62.2)	
Healthcare decision maker (n=3886)				
Herself	835	298 (35.7)	537 (64.3)	.004
Women and someone else	1120	414 (37)	706 (63)	
Others	1931	794 (41.5)	1119 (58.2)	
Exposure to newspaper				
Not at all	2939	1372 (46.7)	1567 (53.3)	<.001
Less than once a week	781	138 (17.7)	643 (82.3)	
At least once a week	179	12 (6.1)	168 (93.9)	
Exposure to radio				
Not at all	1627	759 (46.7)	868 (53.3)	<.001
Less than once a week	1252	434 (34.7)	818 (65.3)	
At least once a week	1020	328 (32.2)	692 (67.8)	
Exposure to television				
Not at all	1481	844 (57)	637 (43)	<.001
Less than once a week	862	328 (38.1)	534 (61.9)	
At least once a week	1556	349 (22.4)	1207 (77.6)	

going for institutional delivery was likely to increase with an increase in education level.

Wealth index of the family, perception about the distance to a health facility, partner's education status, decision making on healthcare, and exposure to multi-media like radio, TV, and newspaper/magazine, were the enabling factors associated with place of delivery. Here, 72.7% of women perceived that the distance was not a big problem choosing institutional delivery over home delivery. Almost 53% of women said that distance was a big problem. The percentage of institutional delivery increased with increased partner education and also with increased frequency of multi-media use.

#### *Multilevel logistic regression between place of delivery and contextual and individual factors*

The result of the multilevel logistic regression model for the place of delivery is presented in Table 2. The effect of contextual factors (predisposing) on the place of delivery is depicted in model 1, where the province of residence and ethnicity were significantly associated with the place of delivery. Model 2 revealed the effect of contextual factors (predisposing and enabling) on the place of delivery. Ethnicity, wealth index of the family, and distance to the health facility were significantly associated with place of delivery in model 2.

Model 3 incorporated individual-level predisposing variables, where province, ethnicity, level of education, age, distance, and frequency of ANC visit were significantly associated with place of delivery.

Finally, both contextual (predisposing and enabling) and individual factors (predisposing and enabling) were incorporated in model 4, where province, age, level of education (women's), distance, frequency of ANC visit, and exposure to the TV were significantly associated with institutional delivery. Pregnant women who had received ANC 4 or more times were approximately 3 folds more likely to have institutional delivery. Women from provinces 2 and 7 were comparatively less likely to give birth in institutions. Similarly, the likelihood of women from the middle/rich class having institutional delivery was 2 times more than women from a poor household. The odds of institutional delivery increased with education level where women with a higher education degree were over 4 times more likely to deliver in an institution over uneducated women. Moreover, the women who went for ANC check-up 4 or more times were significantly more likely to deliver healthcare centers.

## **Discussion**

The analytical approach carried out in this study differs from other studies; multilevel logistic regression was carried out to analyze the relative contribution of contextual factors and individual factors.<sup>24-26</sup> The 2 fold analyses could provide significant insight to define an appropriate level of intervention and design effective policies.

Multiple studies have identified various factors for the existing gaps in the utilization of institutional delivery services. Our model revealed that the women who went for 4 or more ANC visits were significantly more likely to deliver in health institutions. Similarly, we also found out that factors like place of residence, age, ethnicity, wealth index of family, educational level, partner's educational level, and exposure to multi-media were significantly associated with a higher rate of institutional delivery in both contextual and individual level.

Education of women plays a vital role in their choice of place of delivery.<sup>8,27</sup> Similarly, a partner's education level too has been found to play a significant role. Women whose husband has higher-level education have higher odds of delivering in health institutions.<sup>28-30</sup> This was also very evident in our study. Hence, both females' and males' education should not be neglected if we are to improve the situation.

Women who came from the middle and rich class of the wealth index are more likely to deliver their babies in health institutions, as shown by other studies conducted in Nepal, which was comparable to the result of our study.<sup>31,32</sup> Geographical variation has also been found to be an important predictor of institutional delivery. This finding is supported by several studies conducted in developing countries.<sup>29,31,33</sup> Women from rural areas are less likely to deliver in health facilities pertaining to poor infrastructures, fewer health facilities, longer distance, inadequate and unsatisfactory quality of health care services.<sup>34</sup> As Nepal transitioned to the provincial system of governance recently, there are limited studies depicting the relationship between provinces and institutional delivery. The data of institutional delivery in most provinces are more or less similar. However, although geographically more accessible than the other provinces; where most part of Nepal is hills and mountains, province 2 is all flat land with access to road networks which are absent in most rural areas of other provinces, women from province 2 were less likely to go for institutional deliveries. As per various studies, lack of education resulting in low awareness, the majority presence of marginalized population, and low wealth index are some of the reasons contributing to this difference as these factors directly affect the availability, accessibility, and utilization of health care services.<sup>35,36</sup> Factors such as wealth index have also been a contributing factor as per our study. The higher odds of women delivering their babies in health care institutions who complete 4 or more ANC visits than those who do not emphasizes the importance of completing all the ANC visits as per protocol<sup>8,32,37,38</sup> in achieving higher institutional delivery and better health outcomes. Deliveries attended by skilled health workers in health care institutions result in fewer neonatal complications and death and fewer maternal deaths.<sup>7,39</sup> It should be of utter importance to encourage women to attend all 4 ANCs, which is when they are counseled about the importance of institutional delivery.

As shown in this study and many others, the distance from the place of residence to the place of delivery has been identified as one of the most significant hindrances for the women in service

**Table 2.** Multilevel logistic regression showing hierarchical factors associated with the place of delivery in Andersen's behavioral model.

VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL 4
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Contextual factors				
External environmental factor				
Provinces				
Province 1 ( <i>ref</i> )				
Province 2	0.35 (0.19-0.63) <sup>a</sup>	0.3 (0.18-0.52) <sup>a</sup>	0.46 (0.28-0.76) <sup>b</sup>	0.47 (0.28-0.79) <sup>b</sup>
Province 3	1.13 (0.72-2.42)	1.27 (0.74-2.18)	1.25 (0.75-2.1)	1.18 (0.69-1.99)
Province 4	1.24 (0.68-2.3)	1.13 (0.65-1.94)	1.05 (0.62-1.76)	1 (0.59-1.7)
Province 5	0.97 (0.54-1.73)	0.87 (0.52-1.44)	0.89 (0.55-1.44)	0.92 (0.57-1.5)
Province 6	0.41 (0.22-0.73) <sup>a</sup>	0.6 (0.36-1.02)	0.76 (0.46-1.25)	0.78 (0.47-1.31)
Province 7	0.96 (0.53-1.75)	1.3 (0.78-2.25)	1.69 (1.02-2.8) <sup>c</sup>	1.76 (1.05-2.94) <sup>c</sup>
Predisposing factor				
Ethnicity				
Brahmin/Chettri ( <i>ref</i> )				
Janjati	0.48 (0.37-0.62) <sup>a</sup>	0.53 (0.41-0.68) <sup>a</sup>	0.73 (0.55-0.96) <sup>c</sup>	0.78 (0.59-1.04)
Dalit	0.41 (0.31-0.54) <sup>a</sup>	0.57 (0.43-0.77) <sup>a</sup>	0.75 (0.55-1.02)	0.8 (0.58-1.1)
Muslim	0.55 (0.29-1.06)	0.43 (0.25-0.72) <sup>b</sup>	0.97 (0.56-1.66)	1.1 (0.64-1.9)
Others	0.6 (0.41-0.89) <sup>c</sup>	0.51 (0.34-0.75) <sup>a</sup>	0.74 (0.49-1.12)	0.78 (0.52-1.18)
Religion				
Hindu ( <i>ref</i> )				
Non-Hindu	0.99 (0.69-1.44)			
Enabling factors				
Wealth index of family				
Poor ( <i>ref</i> )				
Rich/middle class		2.43 (2.04-2.89) <sup>a</sup>	2.75 (2.2-3.44) <sup>a</sup>	2.32 (1.83-2.94) <sup>a</sup>
Distance as a problem				
Yes ( <i>ref</i> )				
No		3.49 (2.81-4.32) <sup>a</sup>	2.36 (1.97-2.84) <sup>a</sup>	2.39 (2-2.88) <sup>a</sup>
Individual Factors				
Predisposing factors				
Age			0.94 (0.92-0.95) <sup>a</sup>	0.94 (0.92-0.95) <sup>a</sup>
ANC 4 <sup>+</sup> visit				
No ( <i>ref</i> )				
Yes			3.36 (2.77-4.08) <sup>a</sup>	3.16 (2.6-3.84) <sup>a</sup>
Level of education				
No education ( <i>ref</i> )				

(Continued)

Table 2. (Continued)

VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL 4
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Primary school			1.41 (1.11-1.79) <sup>b</sup>	1.28 (1-1.65)
Secondary school			2.5 (1.98-3.15) <sup>a</sup>	1.99 (1.53-2.58) <sup>a</sup>
Higher school			4.46 (3.13-6.34) <sup>a</sup>	3.17 (2.09-4.81) <sup>a</sup>
Enabling factors				
Level of partner's education				
No education ( <i>ref</i> )				
Primary school				1.12 (0.83-1.52)
Secondary school				1.33 (0.99-1.79)
Higher school				1.6 (1.08-2.36)
Healthcare decision maker				
Herself ( <i>ref</i> )				
Women and someone else				0.93 (0.72-1.22)
Others				1.1 (0.87-1.39)
Exposure to newspaper				
Not at all( <i>ref</i> )				
Less than once a week				1.2 (0.9-1.59)
At least once a week				1.92 (0.92-3.97)
Exposure to radio				
Not at all( <i>ref</i> )				
Less than once a week				1.02 (0.81-1.28)
At least once a week				1.98 (0.76-1.26)
Exposure to television				
Not at all( <i>ref</i> )				
Less than once a week				1.07 (0.84-1.36)
At least once a week				1.46 (1.14-1.87) <sup>b</sup>
Variance at PSU: residence (urban/rural)	1.699	1.125	0.865	0.863
Variance at the residence (urban/rural)	0.492	0.258	0.178	0.149
ICC	0.4	0.296	0.241	0.235

Abbreviations: CI, confidence interval; ICC, intra class correlation coefficient; OR, odds ratio; PSU; primary sampling unit.

Model 1: mutually adjusted for contextual predisposing variables.

Model 2: mutually adjusted for contextual predisposing and enabling variables.

Model 3: mutually adjusted for contextual predisposing and enabling variables, and individual predisposing variables.

Model 4: mutually adjusted for contextual predisposing and enabling variables, and individual predisposing and enabling variables.

<sup>a</sup> $P \leq .001$ .

<sup>b</sup> $P \leq .01$ .

<sup>c</sup> $P \leq .05$ .

accessibility and utilization affecting both ANC visit and institutional delivery.<sup>8,31,32,37,38</sup> More so, in geographically challenging countries like Nepal, women have to travel for hours to reach a primary level health facility. Also, poor road conditions, time, and cost related to traveling also pose an obstacle to reaching the

health facilities and utilizing the services.<sup>40,41</sup> Instances like delivering babies on the way to health facilities or the mother and/or child's death are not uncommon.<sup>29</sup> Thus, a provision like maternal waiting homes could significantly increase the willingness and tendency of women to give birth at health facilities.



The study also shows a significant relationship between the frequency of use of multi-media and institutional delivery. The use of multi-media even once a week increased the odds of women delivering babies at health care institutions. Hence, it can be concluded that increased exposure to multi-media like radio, TV, newspaper, etc., could vastly improve the rate of institutional delivery. Although the effect of multi-media is still understudied in Nepal, supported by a study conducted which depicts as much as 6-fold increase in service utilization with increased exposure.<sup>42</sup> Similar results were observed from studies conducted in low- and middle-income countries like Bangladesh, India, Uganda, etc., that showed a positive association between multi-media use and service utilization.<sup>43-45</sup> Thus, we strongly suggest utilizing multi-media as an opportunity to address the gap that lies in the practice of delivery. A study focusing further on the use and content of media could broaden our horizons and enable us to understand the subject better to address the existential gaps.

In the present study, the sex of the household head is not found to be significantly influencing the decision to opt for institutional delivery. Studies conducted in Ethiopia<sup>46</sup> and Bangladesh<sup>47</sup> have shown the same result. Women having a say in their healthcare decision-making process has a negligible effect which is surprising to some extent and needs further investigation.<sup>47</sup> Similarly, the involvement of women in economically productive work did not affect the proportion of institutional delivery. A study conducted in Nigeria shows a similar result.<sup>34</sup>

A causal relationship cannot be established due to the cross-sectional nature of the study. As the study was retrospective, there could be accounts of recall bias. Similarly, the quality dimension and the factors affecting it, such as the delay in service delivery, health workers' behaviors, and care practice during the process, have not been taken into account.

However, generalization is not a problem as NDHS uses samples from across the nation. Thus, the findings can be generalized to the entire country. The issue of recall bias has been addressed by analyzing the data regarding the most recent pregnancy, that is, within the past 5 years. The study has made use of stratified multilevel sampling, a set of the standard questionnaire, and multilevel regression, which has been precisely mentioned in the report. Similarly, training was provided to enumerators before the data collection. All the ethical issues were addressed before collecting the data by the DHS, and approval from the institutional review board was taken.

## Conclusion

This study shows a strong association between predisposing factors and institutional delivery, whether contextual or individual-level factors. Province of residence, age, frequency of ANC visits, and women's education were significantly associated with place of delivery. Strong emphasis must be given to 4+ ANC visits which is very likely to promote institutional delivery. Women who have access to TV as a source of multi-media were

significantly more likely to have institutional delivery; efficient use of such multi-media can be focused in coming days to broadcast specific health promotion programs to increase institutional delivery could be a crucial step. A more specific study focusing on the use of multi-media is suggested. Policy emphasis on maternity waiting rooms in health facilities in rural areas might help in increasing the rate of institutional delivery.

## Public Health Implications

The study would contribute a lot in framing up the new target-specific policies in Nepal's federal structure due to the nature of the data analysis used in this study. This study shows a strong association between predisposing factors and institutional delivery. We conclude that strong emphasis must be given to 4+ ANC visits which is very likely to promote institutional delivery. Women who have access to TV as a multi-media source were significantly more likely to go for institutional delivery. Thus, efficient use of such multi-media can be focused on coming days to broadcast specific health promotion programs to increase institutional delivery could be a crucial step. A more specific study focusing on the use of multi-media is suggested. Policy emphasis on having maternity waiting homes in rural areas' health facilities might help increase the rate of institutional delivery.

## Acknowledgements

The authors express their gratitude to The DHS Program, ICF, 530 Gaither Road Suite 500, Rockville, MD 20850, the USA, for conducting a nationwide survey and making it available for further analysis.

## Authors' Contributions

BN and SR contributed to the concept development and data analysis along with the write-ups. TBB guided this work and provided the required technical inputs in data analysis. BN, SGC, and TBB prepared the manuscript. All 4 authors gave final approval and agreed to be accountable for all aspects of work, ensuring integrity and accuracy.

## Ethics Approval and Consent to Participate


The data collection for the NDHS, 2016, was ethically approved by the Nepal Health Research Council (NHRC), a national-level government organization leading in Nepal's research activities. Similarly, ethical clearance was also obtained from ICF Macro Institutional Review Board, Maryland, USA. Data were collected after an online application was submitted to the Demographic Health Survey (DHS) program explaining the study's purpose, intended use, and people who would have access to the data. After reviewing the online application, permission had been granted from the monitoring and evaluation body of the DHS globally, Monitoring and Evaluation to Access and Use Results Demographic and Health Survey (MEASURE DHS), to use the data set for this study. The NDHS, 2016 data are publicly available at the USAID DHS program (at <http://dhsprogram.com/data>) in different formats.

This is a secondary analysis of publicly available data; hence an independent ethical approval was not required.

### Availability of Data and Materials

The datasets generated and analyzed during the current study are available in the Demographic and Health Survey (DHS) program repository [www.dhsprogram.com/data/dataset\\_admin/login\\_main.cfm](http://www.dhsprogram.com/data/dataset_admin/login_main.cfm).

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