Nepal Health Sector Support Programme III

(NHSSP – III)

Annual analysis of the equity gaps in health service utilization for selected services and who are being Left Behind

EFFECT OF DISTANCE TO HEALTH FACILITY ON USE OF INSTITUTIONAL DELIVERY SERVICES IN NEPAL

A Further Analysis of Nepal Demographic and Health Survey 2016 and Health Management Information System Data

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Executive Summary

There has been steady progress in improving use of maternal health services in Nepal but inequalities among population groups still persist. Inequitable access to and utilisation of services is a result of a combination of financial, sociocultural, and geographical barriers. Geographical access is problematic owing to the predominantly hilly and mountainous terrain in parts of Nepal. Geographical barriers to obstetric care facilities have a significant influence on women's uptake of institutional delivery.

This study assesses the effect of distance to birthing facilities on utilisation of delivery services in Nepal and provides recommendations on how equitable utilisation of institutional delivery service can be improved.

Methodology

Institutional delivery service utilisation data was gathered from the Nepal Demographic and Health Survey (NDHS) 2016. Geolocation codes of health facilities were taken from the Ministry of Health and Population's (MoHP's) Health Information Management System (HMIS) database. A combined dataset was prepared to determine the distance from the central point of the NDHS 2016 data clusters to the nearest birthing facilities. Multivariable logistic regression analysis was performed to examine the effect of distance to the facility on utilisation of institutional delivery. Separate independent regression models for each category – wealth status, education, ecological zone and province – were carried out to explore the effect of distance in different contexts. Potential socioeconomic factors were controlled to assess the effect of distance on the outcome variable. NDHS 2016 sampling weights were used in the regression models to account for sampling design.

Results

More than one-third of birthing facilities were located within 2km of the central point of NDHS 2016 cluster, 48 percent were located between 2–4 km and 16 percent were located at a distance of 5km or more. This study has shown that the probability of utilising birthing services decreases as the distance to birthing facilities increases in Nepal. The probability of institutional delivery is 26 percent less for women who live 2–4km from the closest birthing facility and 43 percent less for women who live 5km or more away.

The study found inequality in institutional delivery among different socioeconomic population groups. Socioeconomic and contextual variables interact with distance to affect the probability of institutional delivery. Distance impacts the likelihood of poor women delivering in a facility but not the likelihood of non-poor women doing so. The effect of distance on the likelihood of institutional delivery varies by province with, for example, little or no effect in Province 1 and 2, but significant effect in other provinces. Distance to the closest health facility has little effect on women with no education, who have low take-up of institutional delivery, but affects the use of women with primary education and above. For women from all

caste/ethnic/religious groups the probability of institutional delivery decreases as distance to the birthing facility increases. However, the magnitude of probability varies by group. Finally, the distance to a birthing facility affects the likelihood of institutional delivery in Mountain/Hill and Terai zones differently. Women living 5km or further from a facility in Mountain/Hill areas have very low odds of having an institutional delivery compared to women in those areas living closer by. Conversely, there was only a small difference (9 percent) in the institutional delivery rate between women living close (less than 2km) and far (5km or more) in the Terai.

Recommendations

Based on the findings of this study, the following recommendations are made to support Federal, Provincial and Local Governments fulfil their commitments.

Recommendations for Local Government:

- Act to progressively ensure availability of quality delivery services within 4 km of communities.
- Investigate the reasons behind unequal utilization of existing birthing services by population groups and make evidence-based decisions and design evidence-based interventions to increase equitable access and utilization and reduce the equity gap. Specifically,
    a. Introduce interventions that address the socio-economic barriers poor women face in accessing delivery services.
    b. In Hill/Mountain zones, expand birthing services to existing health facilities where services can be strengthened to provide quality delivery care and facilities are appropriately located to serve catchment populations.
    c. In the Terai, strengthen demand for institutional delivery by changing the social norms that deter facility births, and strengthen the referral mechanism.
    d. Focus on the most disadvantaged caste/ethnic/religious groups with low institutional delivery levels and vulnerability to poverty. Target the bottom performers that are being left behind.
    e. Design interventions to raise the institutional delivery of non-educated women.
    f. Design policies that address the drivers of inequality including the inequality created by the distance to birthing facilities.

Recommendations for Provincial and Federal Governments:

- Provide strategic guidance and collaborate with local governments to achieve an equitable distribution of health facilities which are accessible to all population groups.
- Support Local Governments to improve utilization of delivery services in Province 2 and Karnali Province on a priority basis through supply and demand side interventions.
- Undertake or commission additional research and analysis to understand the reasons for low utilization of institutional delivery among poor and excluded populations.
    (1) Support Local level Governments to improve readiness of delivery services and overcome demand side barriers.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

BC	Birthing Centre
BEONC	Basic Emergency Obstetric and Neonatal Care
BS	*Bikram Sambat*
CI	Confidence Interval
CEONC	Comprehensive Emergency Obstetric and Neonatal Care
DFID	UK Department for International Development
EA	Enumeration Area
GIS	Geographic Information System
HMIS	Health Management Information System
km	Kilometre
MoHP	Ministry of Health and Population
NDHS	Nepal Demographic and Health Survey
NGO	Non-governmental Organisation
NHSSP	Nepal Health Sector Support Programme
NJAR	National Joint Annual Review
OR	Odds Ratio
PSU	Primary Sampling Unit
SDG	Sustainable Development Goal
SMNH	Safe Motherhood and Newborn Health
BC	Birthing Centre
BEONC	Basic Emergency Obstetric and Neonatal Care
BS	*Bikram Sambat*
C I	Confidence Interval
CEONC	Comprehensive Emergency Obstetric and Neonatal Care
EAs	Enumeration Areas
FY	Fiscal Year

GIS	Geographic Information System
GP	*Gandaki* Province
HF	Health Facility
HMIS	Health Management Information System
km	Kilometre
KP	*Karnali* Province
MoHP	Ministry of Health and Population
NDHS	Nepal Demographic and Health Survey
NHSSP	Nepal Health Sector Support Programme
OR	Odds Ratio
PSUs	Primary Sampling Units
SDGs	Sustainable Development Goals
SP	*Sudurpashchim* Province

1. Background

Nepal's population is diverse in terms of caste, ethnicity, geographic distribution and wealth. The Government of Nepal is committed to achieving the Sustainable Development Goals (SDGs), 2030. The government aims to 'ensure healthy lives and promote well-being for all, at all ages' by 'achieving universal health coverage leaving no one behind by 2030[1]'. To achieve these goals, a robust, evidence-based understanding of equity in distribution, access and utilisation of health services in the country is essential. Although earlier sectoral strategies acknowledge the importance of and persistent gaps in health equity, the progress towards achieving equity in utilisation of health services has been slow.

Health inequities are not only unnecessary and avoidable but also unfair and unjust, and can be reduced through the right government policies[3]. Gender, education, occupation, income, caste/ethnicity, and place of residence are all closely linked to people's access to, experiences of, and benefits from health care in Nepal[4][5–7].

Despite the aggregate progress in maternal health, parts of the country and certain populations still report poor maternal health outcomes, as a result, in particular, of inequitable access and use of health services. It is well-established that inequitable access to services is the consequence of a combination of financial, sociocultural, and geographical barriers[1]. In contexts such as Nepal, geographical access can be particularly problematic due to the hilly and mountainous terrain in parts of the country. Geographical barriers to obstetric care facilities have a significant influence on women's uptake of institutional delivery care[2]. Long distances, rough terrain, lack of affordable transportation and the costs incurred are barriers that prevent women from reaching facilities on time and affect the basic decision to use these services. A review of literature suggests that there has been no systematic analysis of the effect of distance on the uptake of institutional delivery in Nepal.

This study examines the effect of distance from place of residence to birthing facilities on utilisation of birthing services. The full range of public, private and Non-governmental Organisation (NGO) birthing facilities are considered, that is: Birthing Centres (BCs), Basic Emergency Obstetric and Neonatal Care (BEONC) facilities and Comprehensive Emergency Obstetric and Neonatal Care (CEONC) facilities. The analysis generates evidence that is not available from routine information systems and periodic surveys, such as the Nepal Demographic and Health Survey (NDHS). The output of this analysis is useful for policymakers, programme managers and those involved in allocation of health sector resources in addressing 'universal health coverage' and 'leaving no-one behind'.

1.1 Objectives

The key objective of this analysis is to assess the effect of distance to birthing facilities on utilisation of delivery services. The specific objectives of this analysis are to:

- analyse the distance from the NDHS 2016 clusters to the nearest birthing facility (BC/BEONC/CEONC)
- assess the level of use of birthing services at facilities based on geographical accessibility (distance)
- examine the effect of distance to the closest birthing facility on institutional delivery
- draw policy recommendations to improve the utilisation of institutional delivery service.

2. Methodology

2.1 Sources of data

This analysis used data from NDHS 2016 and data on the geographical location of health facilities from the Ministry of Health and Population's (MoHP's) Health Management Information System (HMIS).

NDHS 2016 had employed a stratified sampling technique and selected respondents in two stages in rural areas, and in three stages in urban areas. In the rural areas, wards were selected as Primary Sampling Units (PSUs), and households were selected from the sampled PSUs. In urban areas, wards were selected as PSUs, and one Enumeration Area (EA) was selected from each PSU. Households were then selected from the sampled EAs. This resulted in a total of 244 EAs in urban areas, and 139 PSUs in rural areas, which together make up the 383 data clusters used by this study[8]. The study used service utilisation data from NDHS 2016 and the geographical location codes of the central point of each of the 383 data clusters.

2.2 Data analysis

The HMIS dataset with the health facility geolocation codes was combined with the NDHS 2016 dataset with the geolocation codes of the central point of the clusters. A separate database was created with location details of health facilities with delivery services (BC/BEONC/CEONC). A new variable was generated in the combined dataset to identify the distance in kilometres for each facility from the central point of the NDHS 2016 clusters.

Equitable access and utilisation were assessed from two perspectives:

(1) availability of birthing facilities in different distance categories from the central point of the NDHS 2016 clusters. In this analysis, availability means that institutional delivery care is provided at the birthing facility and access is measured in terms of the distance between the central point of the NDHS 2016 and the facility measured in kilometres (km).
(2) effect of distance on utilisation of delivery services in different settings.

Delivery at health facilities is a dependent variable taken from the NDHS 2016 dataset. Delivery at any place outside of a health facility including the home and on the way to a health facility is taken as a reference group. The main independent

variable is the distance to the nearest birthing facility from the central point of the NDHS 2016 cluster. The distance to the facility is measured in kilometres as per the availability of information of geographical distance from Geographic Information System (GIS) coordinates. The distance is categorised as less than 2km, 2–4km and 5km or more. The data was analysed to estimate an independent effect of each distance category on the probability of institutional delivery. Sociodemographic, wealth status, exposure to mass media and maternity-related variables as listed in Box 1 below were used as potential explanatory variables as presented in NDHS 2016 report and other related literature[9–11].

Box 1: Variables and categories

Distance: <2km, 2–4km and 5km +
Mother's age at birth: <20 years, 20–34 years and 35–49 years
Residence: Urban, rural
Education: No education, primary, secondary and higher
Wealth quintile: Poorest, poorer, middle, richer, richest
Household size: 4 or less and more than 4
Caste/ethnicity: Bhramin/Chhetri, Terai other caste, Dalit, Newar, Janajati and Muslim
Province: Province 1, Province 2, Province 3, Gandaki Province, Province 5, Karnali Province and Sudurpashchim Province
Ecological: Mountain, hill and Terai zone:
Exposure to mass media: Low, medium and high
Use of internet: No, yes
Owns a mobile phone: No, yes
Types of nearest birthing facility: BC, BEONC and CEONC

Descriptive and adjusted regression analysis was performed to measure the effect of distance to the closest birthing facility on use of delivery service. Binary association between explanatory variables and the outcome variable was examined using a chi-squared test. A logistic regression model was used to estimate the probability of institutional delivery based on the distance category and the values of the other explanatory variables. Logistic regression was used to analyse the association of distance with institutional delivery together with all variables by avoiding confounding effects.

Separate independent regression models were developed for wealth, province, caste/ethnicity/religion and education to explore the effect of distance on utilisation of institutional delivery services for each of these variables respectively. Categories for each of these variables were developed as shown in Box 2 below. Some categories required some regrouping of the NDHS 2016 data.

Box 2: Variables and categories used for the analysis

Wealth status: Poor and non-poor
Ecological zone: Mountain/Hill, Terai
Provinces: Province 1, Province 2, Province 3, Gandaki Province, Province 5, Karnali Province and Sudurpashchim Province
Caste/ethnicity: Brahmin/Chhettri/Newar, Janajati, Dalit, Muslim/other Terai caste
Education: No education/primary and secondary/higher

Socioeconomic factors were controlled to examine the effect of distance on the outcome variable. We present the Odds Ratio (OR) – a common way of measuring the association between each explanatory variable and the outcome from logistic regression – and the Confidence Interval (CI). P-value is presented for each explanatory variable at a 5 percent significance level to interpret the statistical significance of the association. NDHS 2016 sampling weights were used in the analysis to account for sampling design.

This piece of work is the outcome of the joint efforts of the MoHP Policy, Planning and Monitoring Division, Family Welfare Division, Integrated Health Information Management Section and the UK Department of International Development (DFID) and the Nepal Health Sector Support Programme (NHSSP). Key findings of this analysis have also been included in the MoHP's Health Sector Annual Progress Report, 2019, prepared as part of the National Joint Annual Review (NJAR), 2075/76, and have informed the ongoing Aama programme review led by the Family Welfare Division. The final products will be shared with wider audiences through the MoHP and NHSSP websites.

The findings of this analysis are useful for policymakers and programme managers in designing targeted programme interventions to improve utilisation of maternal health services by women living far from birthing facilities.

2.3 Limitation

Distance was calculated based on the distance between the health facility and the central point of the NDHS 2016 cluster using the GIS coordinates of the facilities and the cluster. However, women surveyed in the NDHS 2016 are likely to have resided at different distances from the central point of the cluster and this was not factored into the analysis.

The analysis is limited to measuring the effect of distance (in kilometres) on utilisation of institutional delivery services. Other factors that impact geographical access in Nepal such as terrain and availability of transportation are not considered.

3. Results

Socioeconomic and demographic overview of the survey population: The average age of mothers at birth was 24 years. Fifty-four percent of the survey population were from urban areas and 55 percent from Terai. As for mothers' education, 34 percent had no formal education and 14 percent had higher education. More than two-thirds (71 percent) of mothers were living with more than four household members. About 14 percent were Dalit, 27.7 percent were Janajatis and 27.7 percent were Bhramin/Chhetri. Less than 10 percent of the survey population reside in Karnali (6.7 percent), Gandaki (7.7 percent) or Sudurpashchim (8.6 percent) provinces and 27 percent live in Province 2. More than half of the sample had high levels of media exposure. More than three-quarters (77 percent) had their own mobile phone and 17 percent were using the Internet.

Out of the total 383 NDHS 2016 clusters, 58.5 percent had BCs, 23.8 percent had BEONC facilities and 17.8 percent had CEONC sites as the nearest birthing facility. About 36 percent of birthing facilities were located within 2km from the central point of the NDHS 2016 cluster; 48 percent were located within 2–4 km and 16 percent were located at 5km or further. The mean distance from the central point of the NDHS 2016 clusters to the nearest birthing facility was 3.2km (Table 1).

Table 1: Distribution of birthing facilities by distance from the central point of NDHS 2016 clusters

Facilities	<2km	2–4km	5km +	Mean/(SD)	Total
BC	87 (63.5%)	109 (58.9%)	28 (45.9%)	2.92/(2.3)	224 (58.5%)
BEONC	20 (14.6%)	49 (26.5%)	22 (36.1%)	3.69/(2.2)	91 (23.8%)
CEONC	30 (21.9%)	27 (14.6%)	11 (18.0%)	3.52/(4.0)	68 (17.8%)
Total	**137 (35.8%)**	**185 (48.3%)**	**61 (15.9%)**	**3.21/(2.7)**	**383 (100.0%)**

3.1 Institutional delivery and distance to the birthing facility

Less than six in every ten births (57 percent) take place at a health facility in Nepal; 43 percent take place at home or on the way to a health facility. Institutional delivery rate varies by key variables (see Table 2):

- Distance from closest birthing facility: 64.3 percent of births in clusters less than 2km from a birthing facility were delivered at the health facility compared to 50.3 percent of births in clusters 5km or further from a birthing facility.
- Urban vs rural: 68.6 percent of births in urban areas were delivered in a birthing facility compared to 44.2 percent in rural areas.
- Age: institutional delivery was higher among younger mothers (63.7 percent for women <20 years of age) than among older mothers (41.2 percent in age group 35+).
- Province: institutional deliveries were lower in Province 6 (35.6 percent) and Province 2 (44.6 percent) than the national average (57.4 percent).
- Ecological zone: only 41.7 percent of deliveries were conducted in health institutions in Mountain areas compared to 61 percent in Hill and 56.9 percent in Terai.
- Wealth: only 33.9 percent of births to mothers from the poorest wealth quintile were delivered in a birthing facility compared to 89.6 percent for the richest quintile.
- Education: 36.4 percent of women with no education delivered in a health facility compared to 89 percent of those with higher education.
- Caste/ethnicity/religion: 45.4 percent of Dalits delivered at a health institution compared to 74.6 percent among Newar.
- Houshold size: 67.1 percent of women living with fewer than five family members delivered in a birthing facility compared to 53.4 percent for women living in households with five or more members.
- Media exposure: institutional delivery was higher (69.7 percent) among women with high exposure to mass media compared to women with low exposure to mass media (37 percent).
- Internet use: Mothers who use the Internet were more likely to have institutional deliveries (85.6 percent) than non-users (51.4 percent)
- Birthing facility type: women living closest to a higher-level birthing service (BEONC or CEONC) had higher institutional delivery rates than women living closest to a BC.

Table 2: Distribution of live births in the five years preceding the survey by selected characteristics and percentage delivered in a health facility, according to selected characteristics

Characteristics	Percentage distribution of live births in the 5 years preceding the survey		Percentage of live births delivered in a health facility			N
	%	CI	%	CI	P	
Distance					.021	
<2km	29.2	[24.0–35.1]	64.3	[58.5–69.7]		1,479
2–4km	51.5	[45.0–58.0]	56.1	[51.2–60.9]		2,605
5km +	19.3	[14.3–25.4]	50.3	[42.4–58.2]		975
Mother's age at birth					.000	
<20	22.1	[20.3–24.0]	63.7	[59.5–67.8]		1,117
20–34	74.0	[72.3–75.7]	56.3	[53.0–59.6]		3,746
35–49	3.9	[3.3–4.6]	41.2	[32.5–50.4]		197
Mean age at birth	24 years (SD 5.3)					
Residence					.000	
Urban	54.0	[48.4–59.4]	68.6	[64.3–72.7]		2,730
Rural	46.0	[40.6–51.6]	44.2	[39.8–48.7]		2,330
Province					.000	
Province 1	16.2	[14.5–18.0]	62.2	[55.2–68.8]		819
Province 2	27.0	[24.0–30.2]	44.6	[38.3–51.1]		1,367
Province 3	16.1	[12.8–20.0]	70.7	[61.4–78.6]		813
Gandaki	7.7	[6.7–8.8]	68.3	[58.4–76.8]		388
Province 5	17.8	[15.6–20.2]	59.4	[52.1–66.2]		899
Karnali	6.7	[5.9–7.6]	35.6	[27.4–44.9]		338
Sudurpashchim	8.6	[7.5–9.9]	66.4	[57.9–73.9]		437
Ecological zone					.018	
Mountain	7.1	[5.0–10.2]	41.7	[29.6–54.9]		361
Hill	37.8	[32.8–43.0]	61.0	[56.0–65.8]		1,911
Terai	55.1	[50.1–60.0]	56.9	[52.6–61.0]		2,789
Wealth index					.000	
Poorest	21.4	[18.5–24.6]	33.9	[29.0–39.3]		1,082
Poorer	21.2	[19.0–23.5]	46.6	[42.1–51.2]		1,072
Middle	22.2	[19.9–24.6]	57.6	[52.7–62.3]		1,121
Richer	20.5	[18.3–22.9]	69.5	[64.1–74.4]		1,036
Richest	14.8	[12.7–17.2]	89.6	[85.1–92.8]		748
Educational					.000	
No education	34.3	[31.5–37.1]	36.4	[32.4–40.5]		1,733
Primary	20.1	[18.0–22.4]	49.2	[44.4–54.0]		1,019
Secondary	32.0	[29.5–34.5]	71.5	[67.9–74.8]		1,617
Higher	13.7	[12.0–15.6]	89.0	[85.7–91.6]		691
HH size					.000	
4 or less	29.2	[27.1–31.4]	67.1	[63.1–70.8]		1,479
More than 4	70.8	[68.6–72.9]	53.4	[50.0–56.7]		3,581
Caste/Ethnicity					.000	
Bhramin/Chhetri	27.7	[24.8–30.8]	68.4	[63.5–73.0]		1,396
Terai Other Caste	20.2	[16.7–24.4]	48.1	[41.5–54.7]		1,021
Dalit	13.8	[11.7–16.2]	45.4	[39.6–51.3]		695
Newar	3.5	[2.3–5.4]	74.6	[62.4–83.9]		178
Janajati	27.7	[24.4–31.2]	57.9	[52.5–63.1]		1,395
Muslim	7.1	[4.6–10.7]	51.6	[41.0–62.1]		358
Exposure to mass media					.000	
Low	23.7	[21.1–26.5]	37.0	[32.8–41.4]		1,199
Medium	22.9	[21.0–24.9]	49.6	[45.2–54.1]		1,157
High	53.4	[50.4–56.4]	69.7	[66.4–72.8]		2,704
Use of Internet					.000	
No	82.6	[80.5–84.5]	51.4	[48.2–54.6]		4,179
Yes	17.4	[15.519.5]	85.6	[81.7–88.7]		881
Mobile telephone ownership					.000	
No	23.0	[20.6–25.5]	43.9	[39.0–48.9]		1,163
Yes	77.0	[74.5–79.4]	61.4	[58.2–64.5]		3,897
Types of nearest birthing					.001	

Characteristics	Percentage distribution of live births in the 5 years preceding the survey		Percentage of live births delivered in a health facility			N
	%	CI	%	CI	P	
center						
BC	61.2	[55.9–66.3]	53.5	[49.2–57.8]		3,097
BEONC	26.5	[22.2–31.3]	58.9	[52.4–65.1]		1,341
CEONC	12.3	[9.3–16.0]	73.2	[65.3–79.9]		622
Total	**100**		**57.4**	**[54.2–60.4]**		**5,060**

Multivariable logistic regression analysis showed that the distance to the nearest birthing facility is inversely associated with institutional delivery: i.e. as the distance from the cluster to the birthing facility increases, the odds of institutional delivery decreases. Women living in a cluster 2–4km from the closest birthing facility were 26 percent less likely to deliver at a health facility compared to the women who lived within 2km (OR: 0.74 (CI 0.56–0.97, P=0.031). When the distance to the birthing facility increases to 5km or more, women are 43 percent less likely to deliver at a health facility (OR: 0.57, CI 0.38–0.84, p=0.005) (Table 3).

The multivariable logistic regression analysis showed that:

- Age: women who gave birth at 20–34 years of age were 37 percent less likely (OR: 0.63, CI 0.52–0.78, p<0.001) to deliver at a health institution than women in the adolescent (15–19) age group who gave birth.
- Location: rural women were 31 percent less likely (OR: 0.59, CI 0.45–0.77, p<0.001) to deliver at a health institution than urban women.
- Province: women from Province 2 were at decreased odds (OR: 0.47, CI 0.28–0.78; p=0.003), whereas women from Province 7 were at increased odds (OR: 1.77, CI 1.02–3.08; p=0.041) of delivering at a health facility in comparison with Province 1.
- Wealth: wealth status is positively associated with institutional delivery. Women from the poorer quintile were 1.4 times (CI 1.05–1.98; p=0.023), middle quintile were 3.2 times (CI 2.2–4.7; p<0.001), richer quintile were 3.7 times (CI 2.53–5.47; p<0.001) and richest quintile were 6.9 times (CI 3.9–12.0; p<0.001) more likely to deliver at a health facility compared to the women in the poorest quintile.
- Education: the odds of institutional delivery increased with women's level of education. Women who had primary, secondary or higher levels of education were respectively 1.39 times (CI 1.08–1.80; p=0.011), 2.34 times (CI 1.87–2.94; p<0.001) and 4.75 times (CI 3.30–6.83; p<0.001) more likely to have an institutional delivery compared to women with no education.
- Household size: women who lived in a household with >4 members had 31 percent less chance (OR: 0.69 CI 0.57–0.84; p<0.001) of delivering at a health institution than those who lived in households with four members or fewer.
- Caste/ethnicity/religion: women from Terai other (OR: 0.66 CI 0.44–0.98; p=0.041) and Janajati (OR: 0.75, CI 0.57–0.98; p=0.003) castes were less likely to deliver at a health facility compared to women from Brahmin/Chhetri castes.

- Media exposure: women with high media exposure had increased odds (OR 1.29, CI 1.04–1.61, p<0.05) of having an institutional delivery compared with women with low media exposure.
- Internet: women who used the Internet had 1.7 times (CI 1.27–2.28, p<0.001) increased likelihood of delivering at a health institution than women who did not use the Internet.

Table 3: Odds ratio (and 95% confidence intervals) from binary logistic regression of distance from NDHS 2016 clusters to nearest birthing facilities and potential risk factors with institutional delivery in Nepal

Variables	Institutional delivery		
	Odds ratio	[95% CI]	P value
Distance			
<2km (ref)	1		
2–4km	0.74	0.56–0.97	0.031
5km +	0.57	0.38–0.84	0.005
Mother's age at birth			
<20 years (ref)	1		
20–34	0.63	0.52–0.78	0.000
35–49	0.74	0.49–1.13	0.163
Place of residence			
Urban (ref)	1		
Rural	0.59	0.45–0.77	0.000
Provinces			
Province 1(ref)	1		
Province 2	0.47	0.28–0.78	0.003
Province 3	1.08	0.63–1.86	0.784
Gandaki	0.91	0.52–1.61	0.749
Province 5	0.72	0.44–1.18	0.189
Karnali	0.58	0.32–1.06	0.075
Sudurpashchim	1.77	1.02–3.08	0.041
Ecological zone			
Mountain (ref)	1		
Hill	1.3	0.81–2.09	0.281
Terai	1.76	0.98–3.15	0.058
Wealth quintile			
Poorest (ref)	1		
Poorer	1.44	1.05–1.98	0.025
Middle	3.21	2.20–4.70	0.000
Richer	3.72	2.53–5.47	0.000
Richest	6.88	3.94–12.03	0.000
Women's education			
No education (ref)	1		
Primary	1.39	1.08–1.80	0.011
Secondary	2.34	1.87–2.94	0.000
Higher	4.75	3.3–6.83	0.000

Variables	Institutional delivery		
	Odds ratio	[95% CI]	P value
HH size			
4 or fewer (ref)	1		
More than 4	0.69	0.57–0.84	0.000
Caste/ethnicity			
Bhramin/Chhetri (ref)	1		
Terai Other Caste	0.66	0.44–0.98	0.041
Dalit	0.76	0.55–1.05	0.092
Newar	0.78	0.47–1.30	0.342
Janajati	0.75	0.57–0.98	0.033
Muslim	0.8	0.52–1.23	0.305
Media exposure			
Low (not at all) (ref)	1		
Medium (exposure to media less than once a week)	1.1	0.88–1.37	0.419
High (exposure to media at least once a week)	1.29	1.04–1.61	0.022
Internet use by women			
No (ref)	1		
Yes	1.7	1.27–2.28	0.000
Woman owns a mobile phone			
No (ref)	1		
Yes	0.94	0.75–1.19	0.630
Level of nearest birthing facility			
BC (ref)	1		
BEONC	0.96	0.66–1.4	0.834
CEONC	0.84	0.56–1.24	0.375

Distance is a categorical (<2, 2–4 and 5+) variable and is measured in kilometers. Utilisation of health facility delivery service (yes/no) is a dependent variable. Results are weighted by using the pre-calculated variables in the NDHS data set.

3.2 Effect of distance to birthing facility on institutional delivery by wealth status

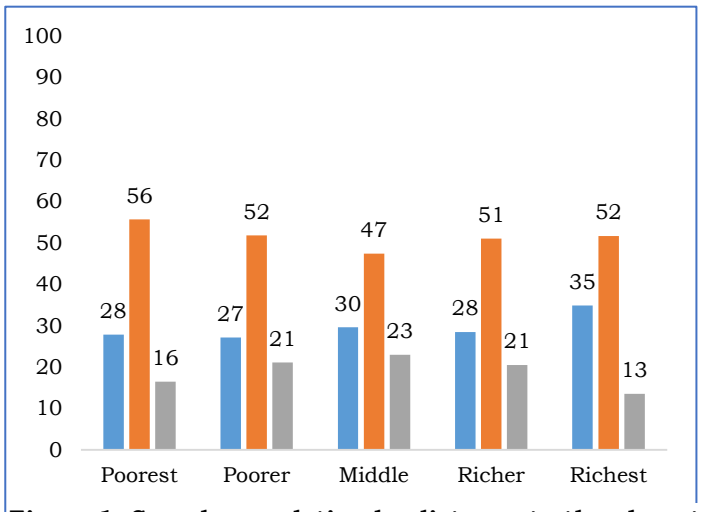


Figure 1: Sample population by distance to the closest birthing facility and wealth quintile (%)

NDHS 2016 uses principal component analysis to measure the wealth status of households and puts them into five categories: poorest, poorer, middle, richer and richest. Households are given a score based on the number of consumer goods they own, ranging from a television to a bicycle or car, and on housing characteristics, such as source of drinking water, toilet facilities and flooring materials.

As Figure 1 shows, there is not a major variation in the distribution of sample households by distance to the closest birthing facility according to wealth. However, the richest quintile were living comparatively nearer to the birthing facility than other wealth categories.

Figure 2 suggests that the relationship between institutional delivery and distance to the closest birthing facility varies for poorer and better-off populations. Distance appears to deter institutional delivery more strongly for the poorest and poorer quintiles than others. Institutional delivery is 187 percent higher among poorest who are living <2km from the closest birthing facility (43 percent) compared to women living 5km or more (15 percent). There is no significant difference in institutional delivery rate for the richest quintile regardless of their distance from the facility.

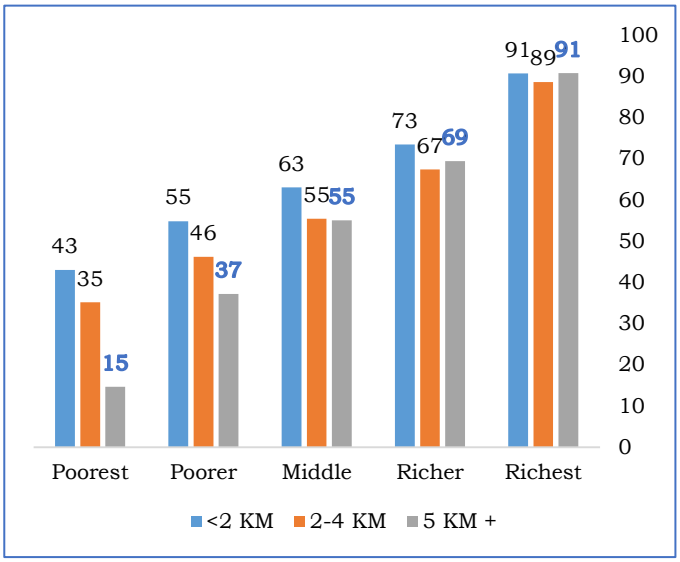


Figure 80: Institutional delivery by distance and wealth quintile (%)

Table 4 presents two separate independent regression models for poor (made up of poorest and poorer quintile) and non-poor (made up of richer and richest quintiles) groups. Controlling for all other confounding factors (mother's age, education, caste/ethnicity/religion, province, ecological zone, household size, media exposure and level of nearest birthing facility), the effect of distance from the closest birthing facility for the poor and non-poor groups respectively was calculated. Compared to poor women who lived within 2km from the birthing facility, poor women living between 2–4 km were 28 percent (OR, 0.72, CI, 0.52, 1.00, P=0.052) less likely to deliver at a birthing facility and poor women who lived 5km or more were 63 percent (OR, 0.37, CI, 0.20, 0.66, P=0.001) less likely to deliver at a birthing facility. In contrast, there was no statistical association between distance and institutional delivery for the non-poor group.

The findings indicate that poor women experience distance-related barriers to institutional delivery but non-poor women do not. This suggests that interventions in remoter areas that seek to overcome distance barriers are better targeted to poor populations than aiming to cover all populations.

Table 4: Effect of distance to birthing facility on utilisation of institutional delivery by wealth/poverty status

	OR (95% CI , P value)	
	Poor (Poorest/Poorer)	**Non-poor (Fourth/highest)**
Distance from cluster to nearest birthing facility		
<2km (ref)	1	1
2–4km	OR: 0.72, CI: 0.52–1.00, p = 0.052	OR: 0.82, CI:0.53–1.27, P=0.377
5km +	OR: 0.37, CI :0.20–0.66, P=0.001	OR=0.82, CI:0.48–1.42, P=0.487

The two separate regression models for poor and non-poor groups adjusted for mother's age at birth of child, place of residence, province, ecological zone, women's education, household size, caste/ethnicity/religion, media exposure, internet use mobile phone ownership and level of nearest BC

3.3 Effect of distance to birthing facility on institutional delivery by province

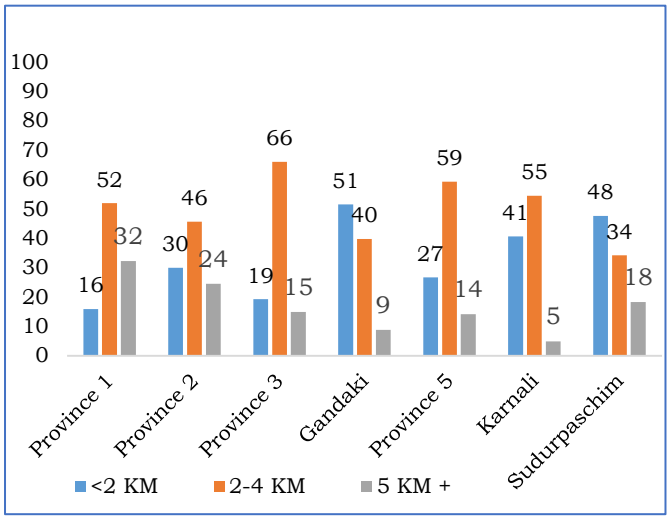
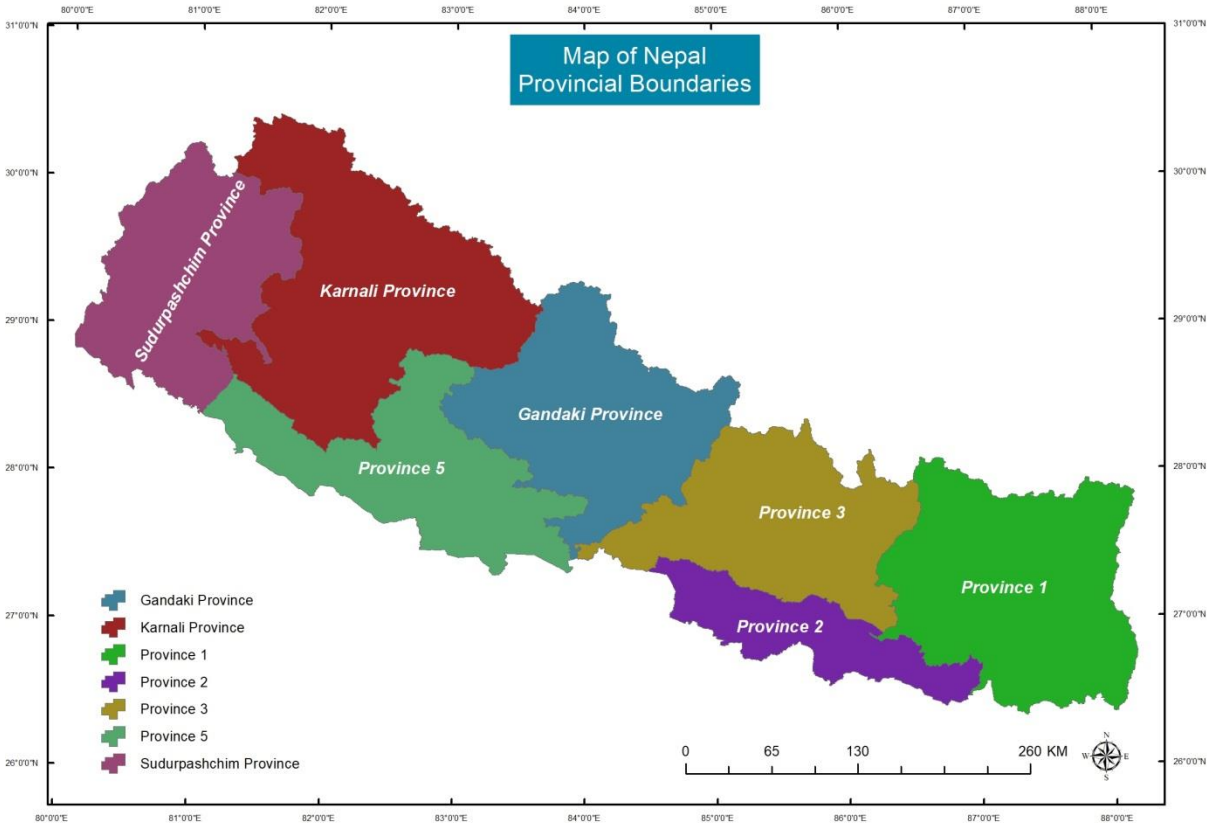


Figure 81: Distribution of sample population by distance and province (%)

The Constitution of Nepal (2072 BS) restructured the country into a federal democratic republic with three levels of government: federal level, seven provinces and 753 local governments. The seven provinces are (starting from the east): Province 1, Province 2, Province 3, Gandaki Province, Province 5, Karnali province and Sudurpashchim Province (See the map below).

Figure 3 shows how distribution of the sample population by their distance from a birthing facility varies by province. For example, 16 percent of the population are living <2km from a birthing facility in Province 1 and 51 percent of the population are living <2km from a birthing facility in Gandaki Province.



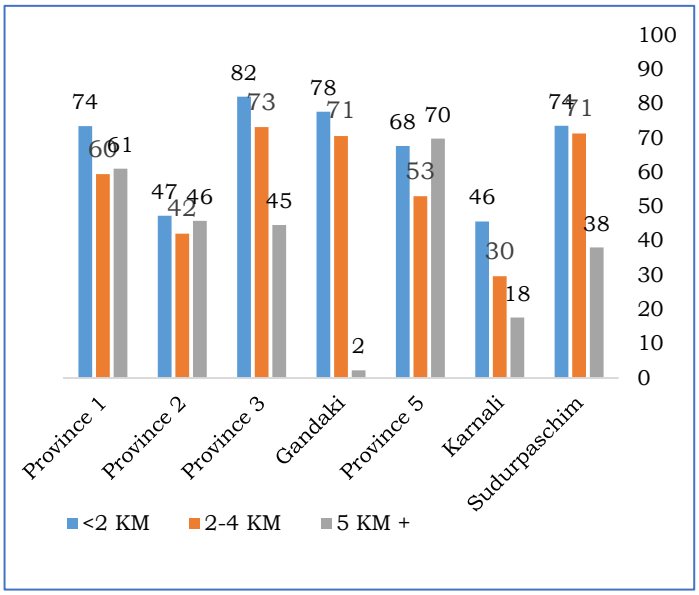


Figure 82: Institutional delivery by distance and province (%)

Figure 4 shows how institutional delivery rate for clusters at different distances from a birthing facility varies by province. Institutional delivery for women living within 2km of a birthing facility is low in Province 2 (47 percent) and Karnali Province (46 percent) in comparison with others provinces. Institutional delivery is lower among women living 5km or more from a birthing facility in Karnali Province (18 percent) and Gandaki Province (2 percent) than other provinces.

With all confounding variables controlled, a separate independent analysis on the effect of distance from birthing facility on institutional delivery for all provinces was undertaken. The distance of <2km from the birthing facility was taken as the reference. Table 5 shows that the effect of distance from birthing facility on institutional delivery varies by province.

- In Province 1 and Province 2, distance to birthing facilities has no significant effect on institutional delivery.

- In Province 3, women living 2–4 km from a birthing facility were 78 percent (OR: 0.22, CI, 0.11, 0.47, P<0.001) less likely to deliver at a health institution than those women living <2km from one, and women living 5km or more were 94 percent (OR: 0.06, CI, 0.02, 0.18; p<0.001) less likely to deliver at a health institution.
- In Gandaki Province, women living more than 5km from the closest birthing facility were more than 99 percent (OR: 0.002, CI, 0.00, 0.01; p<0.001) less likely to deliver at a health facility.
- In Province 5, distance from the birthing facility is not significantly associated with institutional delivery.
- In Karnali Province, distance to the birthing facility reduces the probability of institutional delivery. Women who lived 2–4 km from a facility were 66 percent (OR: 0.34, CI, 0.14, 0.85; p<0.05) less likely to deliver at a birthing facility and those who lived 5km or more were 93 percent (OR: 0.07, CI, 0.02, 0.24; p<0.001) less likely to deliver at birthing facility in comparison with the women living within 2km.
- In Sudurpashchim Province, women living 5km or more from a birthing facility were 75 percent (OR: 0.25, CI, 0.11, 0.56; p<0.001) less likely to deliver at a health institution than women who were living within 2km.

Table 5: Effect of distance to birthing facility on institutional delivery by province

Provinces (ref =<2km)	2–4km	5km +
Province 1	OR: 1.23, CI: 0.65–2.32, P=0.522	OR: 0.67, CI: 0.34–1.33, P=0.248
Province 2	OR: 0.83, CI: 0.49–1.40, P=0.473	OR: 0.88, CI: 0.46–1.65, P=0.676
Province 3	OR: 0.22, CI: 0.11–0.47, P=0.000	OR: 0.06, CI: 0.02–0.18, P=0.000
Gandaki	OR: 0.49, CI: 0.24–1.01, P=0.053	OR: 0.002, CI: 0.00–0.01, P=0.000
Province 5	OR: 0.56, CI: 0.35–0.91, P=0.020	OR: 0.56, CI: 0.26–1.22, P=0.142
Karnali	OR: 0.34, CI: 0.14–0.85, P=0.021	OR: 0.07, CI: 0.02–0.24, P=0.000
Sudurpashchim	OR: 1.31, CI: 0.68–2.54, P=0.409	OR: 0.25, CI: 0.11–0.56, P=0.001

The seven separate regression models for each province adjusted for mother's age at birth, place of residence, ecological zone, wealth quintile, women's education, household size, caste/ethnicity, media exposure, internet use, mobile phone ownership and level of nearest birthing center.

3.4 Effect of distance to birthing facility on institutional delivery by education

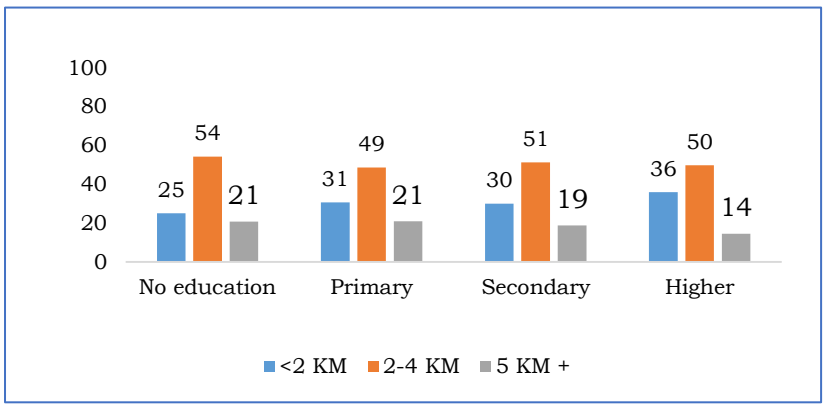


Figure 5: Distribution of sample population by distance and educational status (%)

Studies have shown that women's education contributes to institutional delivery in Nepal[12,13]. This study also shows that education is associated with institutional delivery. Nine in every ten women with a higher level of education delivered at a health facility whereas one in

every three women with no education delivered at a facility (Figure 5).

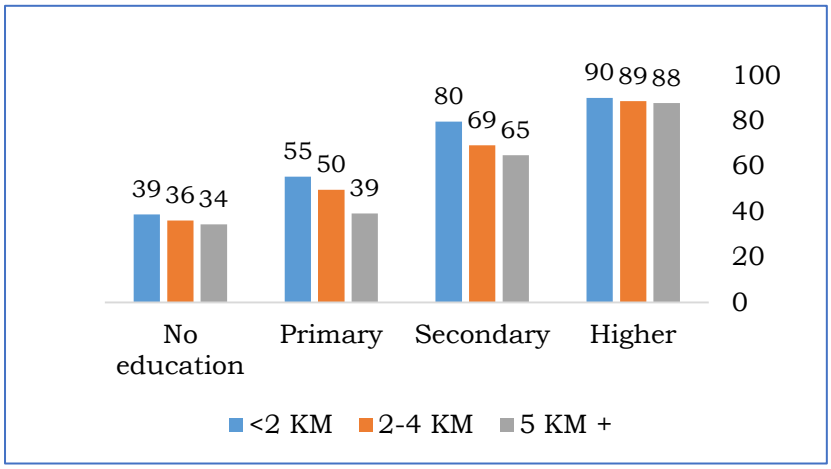


Figure 6 suggests that distance to a birthing facility has little effect on institutional delivery among women with no education and higher education. In contrast it has a greater effect for women with primary and secondary education.

Figure 6: Institutional delivery by distance and educational status (%)

Table 6 presents results from two separate analyses for women with no education/primary education and secondary/higher education. The results show that the probability of institutional delivery decreases when the distance to the birthing facilities increases for the secondary/higher educated group. Women living 2–4 km from a birthing facility who had secondary/higher education were 29 percent (OR: 0.71, CI: 0.51–0.98), P<0.05) less likely to deliver at a health institution, and those who lived 5km or further were 50 percent (OR: 0.50, CI:0.31–0.80), P<0.05) less likely, when compared to women with secondary/higher education living less than 2km from the closest birthing facility. Women with no education/primary education living 2–4km from their closest birthing facility were 26 percent less likely to deliver at a health facility compared to the reference group living under 2km from a facility, and women living 5km or further away were 41 percent less likely to deliver at a health institution (OR: 0.59, CI: 0.36–0.96, P<0.05).

Table 6: Effect of distance to birthing facility on institutional delivery by education

	OR (95% CI , P value)	
	No education/primary	**Secondary/higher**
Distance from cluster to nearest birthing facility		
<2km (ref)	1	1
2–4km	OR:0.74, CI: 0.53–1.04), P=0.086	OR: 0.71, CI: 0.51–0.98), P=0.035
5km +	OR: 0.59, CI: 0.36–0.96), P=0.034	OR: 0.50, CI:0.31–0.80), P=0.004

The two separate regression models for education adjusted for mother's age at birth of child, place of residence, ecological zone, wealth quintile, province, household size, caste/ethnicity/religion, media exposure, internet use, mobile phone ownership and level of nearest BC

3.5 Effect of distance to birthing facility on institutional delivery by caste/ethnicity/religion

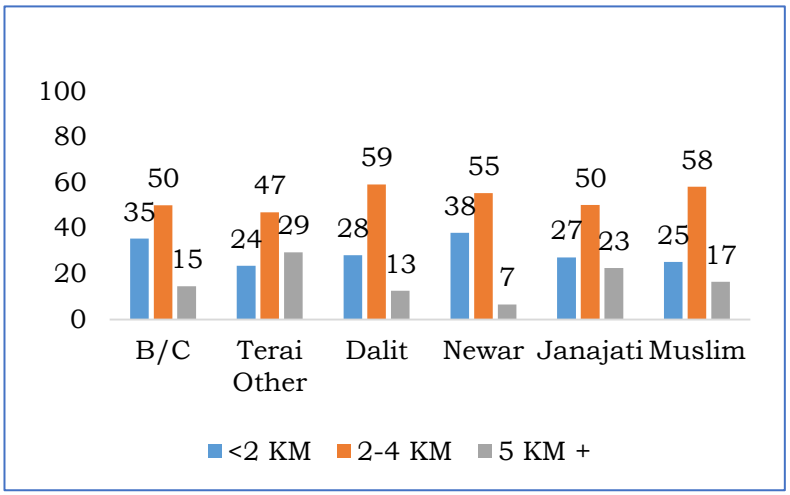


Figure 7: Distribution of sample population by distance and caste/ethnicity/religion status (%)

Figure 7 shows some variation in the distribution of caste/ethnic/religious groups vis-à-vis distance to a birthing facility. For example, 93 percent of Newar caste lived less than 5km from the nearest birthing facility compared to 71 percent of Terai other caste and 77 percent of Janajati.

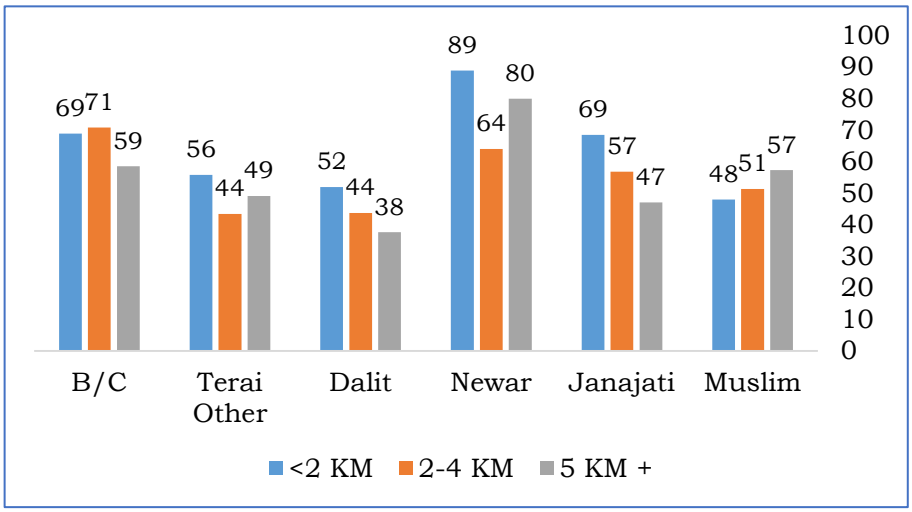


Figure 8: Institutional delivery by distance and caste/ethnicity/ religion (%)

Figure 8 shows that institutional delivery rate was lowest among Dalits compared with other caste/ethnic/religious groups. Among Dalit women, 38 percent of those living 5km or further had an institutional delivery compared to 52 percent of Dalit women living within 2km. The prevalence of institutional delivery was low in the Terai other caste group and for Muslim women but with less statistical variation by distance as per Dalits.

Four different regression analyses examined the association of distance with institutional delivery for different caste/ethnic/religious groups. All confounding factors were controlled. For the purpose of this analysis the caste/ethnicity/religious groups used by NDHS 2016 have been regrouped into Brahmin/Chhetri/Newar (institutional delivery range: 68.4 percent to 74.6 percent), Janajati (institutional delivery 57.9 percent), Terai other/Muslim (institutional delivery range: 48.1 percent to 51.6 percent) and Dalit (institutional delivery 45.4 percent).

Table 7 shows that the probability of institutional delivery decreases as distance to the birthing facility increases for all caste/ethnic/religious groups. However, the magnitude of probability varies by group. The prevalence of institutional delivery is comparatively low in Dalit and in the Terai other/Muslim group. For these two groups, women living 5km or further have significantly less chance (Dalits: OR: 0.48, CI, 0.25, 0.93; p<0.029; and Terai other/Muslim: OR: 0.65, CI, 0.43, 0.99; p<0.042) of delivering at a facility in comparison with reference to women who live less than 2km from a birthing facility. Bhramin/Chhetri/Newar have institutional delivery rates higher than the national average. For this group there is little difference in institutional delivery rates for those living less that 2km from a birthing facility and those living between 2 and 4km. However, the likelihood of an institutional delivery drops by 70 percent for women living 5km or more from a birthing facility compared to the reference group. Janajati women living 5km or more from a birthing facility are 65 percent less likely to have an institutional delivery than Janajati women living within 2km of a facility.

Table 7: Effect of distance to birthing facility on institutional delivery by caste/ethnicity/religious group

	OR (95% CI , P value)			
	Bhramin/Chhetri/ Newar	**Janajati**	**Dalit***	**Other Terai/Muslim***
Distance from cluster to nearest birthing facility				
<2km (ref)	1	1	1	1
2–4km	OR: 0.97, CI:0.66–1.43, P=0.878	OR: 0.63, CI:0.38–1.03, P=0.063	OR: 0.75, CI: 0.50–1.10, P=0.138	OR: 0.72, CI: 0.51–1.01, P=0.061
5km +	OR: 0.30, CI:0.16–0.55, P=0.000	OR: 0.35, CI: 0.20–0.61, P=0.000	OR: 0.48, CI:0.25–0.93, P=0.029	OR: 0.65, CI:0.43–0.99, P=0.042

The four separate regression models adjusted for mother's age at birth of child, place of residence, ecological zone, wealth quintile, province, household size, caste/ethnicity/religion, media exposure, internet use, mobile phone ownership and level of nearest BC. * = unweighted

3.6 Effect of distance to birthing facility on institutional delivery by ecological region

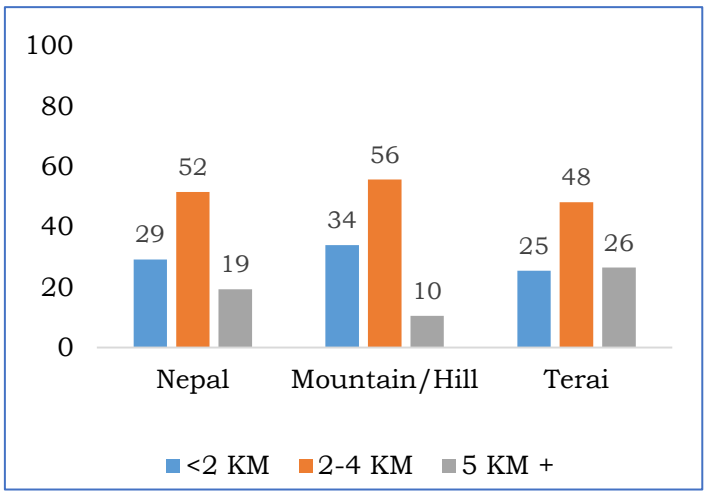


Figure 9: Distribution of sample population by distance and ecological zone (%)

Ecologically, Nepal is divided into three zones: Mountain, Hill and Terai.

Figure 9 shows that 10 percent of the sample population live 5km or further from the closest birthing facility in Mountain/Hill areas compared to 26 percent in the Terai.

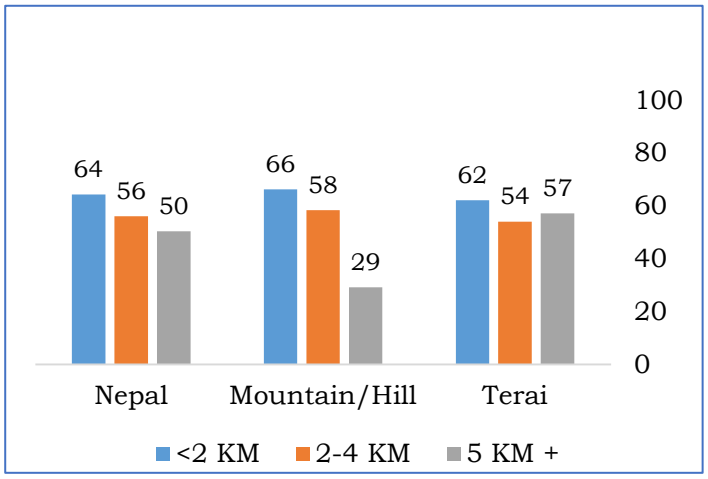


Figure 10: Institutional delivery by distance and ecological zone (%)

In Mountain/Hill ecological zones the institutional delivery rate is 128 percent higher among women who live less than 2km from the closest birthing facility compared to women who live over 5km from a facility. In contrast, in the Terai region there is only 9 percent difference in the institutional delivery rate between women living less than 2km from the closest birthing facility and women living 5km or further (data not shown).

Two different regression analyses examined the association of distance with institutional delivery for different ecological zones. For the purpose of this analysis, Mountain and Hill are regrouped into a group 'Mountain/Hill'. All confounding factors were controlled. See Table 8.

Using women living less than 2km from the closest birthing facility as the reference group, distance is associated with institutional delivery in both ecological zones. Women from Mountain/Hill who were living 2–4km distance from the closest birthing facility were 27 percent (OR: 0.73, CI, 0.59, 0.90; p<0.01) less likely to deliver at a health institution than women living <2km, and women living at 5km or further were 84 percent (OR: 0.16, CI, 0.11, 0.24; p<0.001) less likely. Likewise, women from Terai living 2–4km from the closest birthing facility were 30 percent (OR: 0.70, CI, 0.54, 0.90; p<0.01) less likely to deliver at a health institution and women living 5km or further were 39 percent (OR: 0.61, CI, 0.46, 0.81; p<0.001) less likely to deliver at a health facility than women living less than 2km from the closest birthing facility.

Table 8: Effect of distance to birthing facility on institutional delivery by ecological zone

	OR (95% CI , P value)	
	Mountain/Hill*	**Terai***
Distance from cluster to nearest birthing facility		
<2km (ref)	1	1
2–4km	OR: 0.73, CI: 0.59–0.90, P=0.003	OR: 0.70, CI:0.54–0.90, P=0.005
5km +	OR: 0.16, CI: 0.11–0.24, P=0.000	OR: 0.61, CI:0.46–0.81, P=0.001

The two separate regression models adjusted for mother's age at birth, place of residence, wealth quintile, women's education, province, household size, caste/ethnicity/religion, media exposure, internet use, mobile phone ownership and level of nearest BC (Unweighted data has been used for this analysis. *=Unweighted)

4. Discussion

Distance from a birthing facility reduces institutional deliveries: This study found that about 36 percent of birthing facilities were located less than 2km from the central point of NDHS 2016 clusters, 48 percent were located within 2–4km and 16 percent were located 5km or further away. Studies have shown that the distance from the nearest birthing facility has a negative effect on the chances of institutional delivery [2,14–16]. Findings from this analysis also indicate that as the distance to birthing facilities increases the probability of institutional delivery decreases. The probability of institutional delivery is 26 percent less for women living 2–4km from the closest birthing facility and 43 percent less for women who live 5km or further away. This suggests that birthing facilities need to be made available in areas that are far from existing birthing facilities to improve the institutional delivery rate.

Socioeconomic factors interact with distance to affect institutional delivery: The study found inequality in institutional delivery among different socioeconomic population groups. Socioeconomic and contextual variables interact with distance to affect the probability of institutional delivery. Distance impacts the likelihood of poor women delivering in a facility but not the likelihood of non-poor women doing so. The effect of distance on the likelihood of institutional delivery varies by province with, for example, little or no effect in Province 1 and 2, but significant effect in other provinces. Distance to the closest health facility has little effect on women with no education, who have low take-up of institutional delivery, but affects women with primary education and above. For women from all caste/ethnic/religious groups the probability of institutional delivery decreases as distance to the birthing facility increases. However, the magnitude of probability varies by group. Finally, the distance to a birthing facility affects the likelihood of institutional delivery in Mountain/Hill and Terai zones differently. Women living 5km or further from a facility in Mountain/Hill areas have very low odds of having an institutional delivery compared to women in those areas living closer by.

Poor women experience distance-related barriers to institutional delivery: Safe Motherhood and Newborn Health (SMNH) is a priority programme of the Government of Nepal. The MoHP is in the process of finalising the strategic SMNH Road Map in line with the SDGs 2030. This roadmap focuses on ending preventable maternal and newborn deaths by building on the successes of the SMNH programme and addressing the remaining challenges of delivering quality of care in an equitable manner. This study has found that poor women experience distance-related barriers to institutional delivery that non-poor women do not. Studies in other countries have also shown that the increase in distance to a facility decreases the probability of institutional delivery for rural poor women[17,18].

The effect of distance on institutional delivery varies by province: The Constitution and the restructuring of the country into the federal system has moved Nepal towards eliminating discrimination based on gender, caste, region and religion among other identity markers and there are increasing efforts to address unequal distribution of power and services among different socioeconomic groups

and geographical areas[19]. Results from this analysis have shown that the provinces have different institutional delivery rates. Province-wise independent analysis shows the effect of distance on institutional delivery differs by province. Distance is a barrier to institutional delivery in Province 3, Gandaki Province, Karnali Province, Province 6 and Sudurpashchim Province. The hilly and mountainous terrain in these provinces may be a contributing factor. In contrast, despite the easier physical access to health facilities in Province 2, it has a very low rate of institutional delivery. This situation illustrates how other factors such as sociocultural norms and the readiness and quality of services need to be considered as well as distance to understand the barriers to institutional delivery.

Differences between ecological areas: Distance to the health facility has greater impact on utilisation of delivery services in Mountain/Hill regions compared to the Terai region. The institutional delivery rate was substantially higher among women living less than 2km from a birthing facility in Mountain/Hill areas compared to women living 5km or more from a facility. Whereas in the Terai, there was only a small difference (9 percent) in the institutional delivery rate between women living less than 2km from a birthing facility and those living 5km or more. Sixty-three percent of health facilities in Mountain/Hill regions had reported institutional delivery in fiscal year 2018/19 while only 40 percent of the facilities in the Terai region had reported institutional delivery in the same year (HMIS 2018/19). This shows that the proportion of facilities with delivery services available is higher in Mountain/Hill than Terai regions, though the distance-related equity gap is higher in Mountain/Hill.

Distance and education status: The institutional delivery rate was 59 percent less among women with no education (36.4 percent) compared to women with higher education (89 percent); this is a global pattern. This study found that the probability of institutional delivery decreased with increase in distance to birthing facilities among the educated group whereas distance to the birthing facility had no significant effect on the institutional delivery rate among non-educated women.

Living close to a birthing facility increases the likelihood of an institutional delivery for all caste/ethnic/religious groups: There are disparities in utilisation of delivery services between caste and ethnic/religious groups. In general, utilisation is higher in Newar and lower in Dalit, Muslim and Terai Other caste groups. The probability of institutional delivery increases as distance to a birthing facility decreases for all groups, although the magnitude of probability varies by group. Among Dalits and Terai other/Muslim caste groups, women living at a greater distance from the facility have significantly less chance to deliver at a facility in comparison to women who live closer.

5. Recommendations

Based on the findings of this study, the following recommendations are made to support Federal, Provincial and Local Governments fulfil their commitments.

Recommendations for Local Government:

- Act to progressively ensure availability of quality delivery services within 4 km of communities.
- Investigate the reasons behind unequal utilization of existing birthing services by population groups and make evidence-based decisions and design evidence-based interventions to increase equitable access and utilization and reduce the equity gap. Specifically,
  a. Introduce interventions that address the socio-economic barriers poor women face in accessing delivery services.
  b. In Hill/Mountain zones, expand birthing services to existing health facilities where services can be strengthened to provide quality delivery care and facilities are appropriately located to serve catchment populations.
  c. In the Terai, strengthen demand for institutional delivery by changing the social norms that deter facility births, and strengthen the referral mechanism.
  d. Focus on the most disadvantaged caste/ethnic/religious groups with low institutional delivery levels and vulnerability to poverty. Target the bottom performers that are being left behind.
  e. Design interventions to raise the institutional delivery of non-educated women.
  f. Design policies that address the drivers of inequality including the inequality created by the distance to birthing facilities.

Recommendations for Provincial and Federal Governments:

- Provide strategic guidance and collaborate with local governments to achieve an equitable distribution of health facilities which are accessible to all population groups.
- Support Local Governments to improve utilization of delivery services in Province 2 and Karnali Province on a priority basis through supply and demand side interventions.
- Undertake or commission additional research and analysis to understand the reasons for low utilization of institutional delivery among poor and excluded populations.
- Support Local level Governments to improve readiness of delivery services and overcome demand side barriers.

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