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Mobile Phone Ownership and Utilization of Quality ANC Services in Nepal

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Abstract: This study explores the link between the mobile phone ownership and the utilization of quality Antenatal Care (ANC) services in Nepal with reference to the cross-sectional data from the nationally representative Nepal Demographic and Health Survey 2022. In total 1878 currently married women who gave birth within two years preceding the survey has been used for this study. To analyze the impact of the mobile phone ownership on utilization of ANC, this study has used a binary logistic regression model. The findings shows having a mobile phone not only helps to connect people but also influence the number of ANC visits with skilled provider (AOR=2.36) and the timing of the first visit (AOR=1.56). Nevertheless, the importance of improving the content of ANC services had a lesser effect despite having mobile ownership. This shows there is still gap in providing comprehensive ANC services despite the Government of Nepal claims of wide spread availability of these services.

Keywords: Antenatal care, Cellphone, Ownership, Quality service.

1. Background

Mobile phones connect people and help to provide essential services, especially for vulnerable communities in rural areas, who have little access to mobility. Previous studies have also proved that mobile phones can facilitate access to health information (Rotondi et al., 2020; LeFevre et al., 2020) and improve patient-provider communication (ITU & UNDP, 2023), especially for women's health (LeFevre et al., 2020). During COVID-19 epidemic, cellphones and digital technology—particularly mobile communication—helped a lot of individuals by identifying the case, contact tracing, testing, and the provision of health services and the implementation of quarantine measures (Budd et al., 2020). It is also noteworthy as De and Pradhan (2023) shows in their review paper there is potential in using mobile technology in maternal and neonatal health care. They further state health seeker and service providers in resource constraint setting particularly use mobile phone. However, there are still digital divides that need to be addressed to ensure equitable access to these benefits. DAKA & WinDt (2022) highlights that if anyone is not in online, they are potential for being left out of work and educational

opportunities and also missed out on potentially life-saving information and services especially for pregnant women who can make their pregnancy safer themselves.

Antenatal care (ANC) is essential component of maternal health, contributing to the early detection of pregnancy related complication and its management as well. The World Health Organization (WHO) recommends timely initiation of antenatal care, with minimum of eight ANC visits during pregnancy to ensure a positive pregnancy experience (WHO, 2016). Despite improvements in the availability of maternal health services, disparities in the utilization of quality ANC still persist particularly in low resource setting. Socio-economic inequalities play an important role in shaping accessing to maternal health services (Sen, 2002). Empirical evidence further shown that factors such as education, wealth and ethnicity influence ANC utilization (Goland et al., 2012) Evidence from Bangladesh shows that mobile phone use is associated with increased utilization of maternal health services (Biswas et al., 2020). Studies from India further suggest women's phone ownership in urban areas positively associated with maternal mortality and use of modern contraceptives (Rotondi et al., 2020). These findings highlight the potential of mobile phones offer to be an affordable instrument that helps realize numerous important SDGs, such as SDG 3 "good health and well-being," if the opportunity is fully utilized. However, mobile phones are near universal in low-, middle- and high-income countries, digital divides persist. George et al. (2018) emphasizes the mobile phones accessibility among women can challenge not only the power relations and social norms but also increase their agency. This situation may obviously increase risk making mothers targets for backlash. When patriarchal ideology dominates women agency, it hampers women's decision-making capacity.

Mobile phone can connect women with people. But a woman even after having mobile phone could not get freedom to accessing health service. Technically a woman could have mobile phone but male members could control it or she could use it only for the household purposes. Female could only engage in informal or domestic communication through mobile phone. Benerjee (2022) also highlight such case in Indian context. They show the difference between owning and using the mobile phone. In countries like Nepal, where smarts mobile phone accessibility is high (73%) (National Statistics Office [NSO], 2024), the use of mobile technology can be very effective approach for maternal health care services especially during pregnancy. It connects people, inform them for the timely and sufficient care for the pregnant women, and help those who live particularly in remote areas with limited access to health facilities. Likewise, while making decision to health services, a female had to be dependent on male members. These underscore the importance of not only increasing access to mobile technology but also addressing the social and cultural barriers that influence how women use these tools for maternal health care.

Using a secondary data from the recent 2022 Nepal Demographic and Health Survey (NDHS) the study highlights the potential of mobile phone ownership to bridge the gap in access to maternal health care services.

2. Methods

Data source and study population

This study utilized data from the nationally representative Nepal Demographic Health Survey (NDHS) 2022. The study population comprised 1,878 currently married women aged 15-49 who had a most recent birth within the two years preceding the survey. This reference period was selected to provide more current measures compared to the standard five years, as it reduces the likelihood of recall error among respondents and improves the accuracy of reported ANC services. It is a cross-sectional survey, which is conducted in every 5 years in Nepal. Its main strength is the availability of comprehensive data on women and children's health.

Sampling

This study has employed NDHS 2022, an updated sampling frame, based on the 2011 Nepal Population and Housing Census (NPHC) provided by the National Statistics Office. A two stage stratified sampling method was used. Stratification was performed by dividing each of the seven provinces into urban and rural areas, subsequent in a total of 14 sampling strata. In the first stage, 476 primary sampling units (PSU) were used. The PSU were selected with probability proportional to PSU size and with independent selection in each sampling stratum within the sample allocation. Altogether 14,243 households were selected and among them 13,786 were interviewed. A total of 14, 845 women aged 15-149 years were interviewed. The detail of sampling is freely available on the Measure DHS website (https://dhsprogram.com).

Study variables

Dependent variables

This study has utilization of quality ANC services as the dependent variable dependent variable, which is measured through three dimensions: attendance at four or more ANC visits with skilled providers, ANC visits at first trimester and received essential care component (WHO, 2016). A detailed description of each of the dependent variables considered in this study is as follows:

a. ANC visit with skilled providers: This is the most important component for ANC. ANC visits with skilled providers were defined by combining information on the number of ANC visits and the visit with skilled providers- doctors, nurses and midwives-were considered. The number of skilled ANC visits was categorized as no visit, one visit, two to three visits and four or more visits. Although WHO recommends minimum eight antenatal care contacts between conception and birth (WHO, 2016), this study uses. on four or more visits as the Government of Nepal (GoN) health protocol.

b. The next outcome of interest is visit at first trimesters. It is very essential to access the potential risk if any. Furthermore, the first visit has to be completed

during the first trimester of pregnancy (not less than 12 weeks). In NDHS surveys, the question for this measure was, "How many months pregnant were you when you first received antenatal care for this pregnancy?" Responses were in numbers ranging from 0 to 10. These responses were categorized into four i.e. No ANC, ANC in the first trimester, ANC in the second trimester and ANC in the third trimester.

c. Essential content of care includes the services received during the ANC contact. The service contains weighted, blood pressure taken, urine test, blood sample taken, listen baby's heartbeat, talk about food to eat, talk about breastfeeding, ask about vaginal bleeding, weight gain, and given or brought iron tablet/syrup. Each component is first made dichotomous, where 1 indicates that the service was received and 0 indicates that it was not received. A composite score was then created by summing all ten components, resulting in total score ranging from 0-10. Based on this score, ANC content was categorized as follows: a score of 0 indicates that no ANC content was received, a score of 10 indicates that complete ANC content was received, and score ranging from 1-9 were categorized as incomplete content of care.

d. Utilization of ANC: Utilization of ANC is measured based on all these three components that is four or mover ANC visits with skilled provider, first trimester visit and receipt of complete ANC content. Each component was coded as 1 if the recommended criterion was met and 0 otherwise. These components were summed to generate a composite score ranging from 0-3. A score of 0 indicates "received no adequate quality ANC" and 3 indicates "received adequate ANC services". Score of 1 and 2 represent partial utilization of ANC services.

For regression analysis, all these outcome variables were dichotomized to facilitate binary logistic regression. Women who met the recommended criteria were coded as 1, while all others were coded as 0. Women who had four or more visits with skilled providers were coded as 1, while others were coded as 0. Who made the first ANC visit in their first trimester and receiving complete ANC content were coded as 1, while all other categories were coded as 0. Similarly, the composite ANC utilization variable was dichotomized into adequate (score=3), coded as 1, and inadequate utilization (score=0, 1, and 2), coded as 0.

Independent variable

Mobile phone ownership is the main independent variable in this study, which is assessed through a binary (yes/no) question on ownership of mobile telephone. Other factors that may influence antenatal care disparities include ethnicity, place of residence, province level, educational level, wealth index and problem in access health care. These factors are previously identified (Goland et al., 2012) and can influence a woman's ability to seek and receive adequate antenatal care, leading to

disparities in maternal and infant health outcomes as Sen (2002) highlights health among the most important conditions of human life showing a critically important component of human capabilities. It concerns that preventable deaths are occurring among women; it also highlights the need to address disparities in maternal and infant health outcomes.

Furthermore, this study operationalizes ethnicity into two categories-marginalized and non-marginalized women based on previous study (KC et al., 2021). Dalit, Janajati, Muslim and Madhesi were grouped in marginalized, while other ethnic groups including Hill Brahmin, Hill Chhetri, Terai Brahmin/Chhetri and Newar were categorized as non-marginalized. The wealth index was constructed based on principle component analysis using variety of consumer goods the respondent owns, like televisions, bicycles, or cars as well as housing characteristics such as drinking water sources, toilet facilities and flooring materials. In the NDHS wealth score was distributed into five equal categories, each comprising 20% of the population-wealthiest, fourth, middle, second, and poorest (MoHP, New ERA, ICF, 2023). However, for this study purpose this index was further categorized into three groups-poor, middle and rich.

Problems in accessing health care services were measured using four indicators: difficulty in obtaining permission to seek care, getting money needed for treatment, distance to health facility and not wanting to go alone. These indicators were combined to construct a composite variable categorized into no problem, some problem, and big problem, reflecting the level of barriers faced by women in accessing health services. All these variables were included in the analysis; however, place of residence was excluded from the final regression model to avoid conceptual overlap, as provincial differences already reflect variations in infrastructure, service availability, and urban-rural disparities.

3. Statistical analysis

To ensure the representativeness of findings at the national level, sampling weights provided by the NDHS 2022 were applied in all analysis. Cross-tabulation were used to describe the distribution of utilization of ANC across the explanatory variables, and statistical significance was assessed using Pearson's chi-square test of independence at a *p*-value of less than 0.05. Binary logistic regression analysis was used to examine the association between mobile phone ownership and utilization of quality ANC services. Two models were used: Model 1(crude model) assessed the unadjusted association between mobile phone ownership and ANC utilization, while Model 2 (adjusted model) controlled for confounding variables, including age, education, wealth index, place of residence, province and caste/ethnicity. Independent variables included in the multivariable analysis were selected based on statistical significance in bivariate analysis ($p<0.05$). The strength of association was reported

using crude odds ratios (COR) and adjusted odds ratios (AOR) with 95% Confidence Interval (CI).

4. Results

This table provides an overview of the sample characteristics from the NDHS 2022 survey. It shows that almost 82% of women own a mobile phone (Table 1). This ownership varies across different social groups, educational status, places of residence, provinces, and wealth indices. For example, mobile phone ownership is found higher among non-marginalized groups (94.9%) compared to marginalized groups (76.4%). In the same way, ownership increases with the women's education level, from 61.5% among those with no education to 92.3% among those with secondary and above education. Urban women (83.6%) are more likely to own mobile phones than their counterpart-rural residents (78.2%). Likewise, women from Bagmati province own highest (90.1%) mobile phone and lowest from Madhesh (73%). More wealthier women own mobile phones (90.7%) than poor women (74 %).

Table 1.
Background characteristics of sample population, NDHS 2022

	Owns a mobile telephone		
Background characteristics	**No**	**Yes**	**Total**
Social group			
Marginalized	23.6	76.4	1335
Non marginalized	5.1	94.9	543
Educational status			
No education	38.5	61.5	346
Basic education (1-8)	22.1	77.9	636
Secondary and above education (8+)	7.7	92.3	896
Type of place of residence			
Urban	16.4	83.6	1231
Rural	21.8	78.2	647
Province			
Koshi	19.4	80.6	350
Madhesh	27	73.0	483
Bagmati	9.9	90.1	288
Gandaki	8.1	91.9	115
Lumbini	18.8	81.2	317
Karnali	12.1	87.9	142
Sudurpashchim	16.4	83.6	182
Wealth index of women			
Poor	25.7	74.3	845

Middle	17.4	82.6	367
Rich	9.3	90.7	666
Problem in accessing health care			
None	29.5	70.5	251
Some of them	19.3	80.7	1025
All four	11.7	88.3	602
Number of ANC visit			
No visit	46.1	53.9	51
1	28.8	71.2	40
2-3	36.1	63.9	272
4+	13.8	86.2	1514
Do not know/missing	48.1	51.9	2
Assistance by skilled health professional during ANC			
Skilled health professional	17.1	82.9	1771
Others	29.5	70.5	57
No ANC care	46.1	53.9	51
Timing of 1st ANC visit			
No antenatal care visit	46.1	53.9	51
First trimester	14.6	85.4	1367
Second trimester	25.9	74.1	431
Third trimester	22.0	78.0	27
Do not know/missing	81.3	18.7	3
Care component received during ANC visit			
None	53.1	46.9	30
Incomplete	18.5	81.5	1265
Complete	15.9	84.1	583
Total respondents	**343**	**1535**	**1878**
Proportion of respondents (%)	**18.3**	**81.7**	**100.0**

Women who owned mobile phones had higher utilization of antenatal care services compared to those who did not own a mobile phones, Particularly, 68% of women with mobile phones had four or more ANC visits with skilled providers (67.7%) compared to only about 11% of women without mobile. Likewise, about 62% of women with mobile phones received their first ANC visit in the first trimester. However, only about 30% received complete ANC content (30.1%) and only 19% received adequate quality ANC services. In contrast, only about 3% of women who did not own mobile phones received adequate quality ANC service (Table 2).

The data also shows variations across different socio-demographic groups. Among marginalized groups, about 60% of women with mobile phones had four or

more ANC visits compared to 13.8% among those without mobile phones. Among non-marginalized groups, the difference is more pronounced, with 86.4% of non-marginalized women with mobile phones having four or more ANC visits compared to only 2.9% without mobile phone. Educational attainment showed a positive relationship with the utilization of ANC services particularly when they owned mobile phones. For example, women with higher level of education uses the higher ANC services if they own a mobile phone.

Table 2.

Distribution of women who had utilized antenatal care service according to mobile ownership and background characteristic (n=1878)

	>=4 ANC visit with skilled providers		ANC first visit at first trimester		Received ANC content		Adequate quality ANC	
	With mobile	Without mobile	With mobile	Without mobile	With mobile	Without mobile	With mobile	Without mobile
Ethnicity								
Marginalized	60.1	13.8	55.5	14.0	26.9	7.6	15.5	3.5
Non-marginalized	86.4	2.9	78.5	2.4	36.9	1.6	28.3	0.8
Educational status								
No education	44.4	21.8	38.4	21.9	17.0	12.9	8.3	6.0
Basic education	60.2	12.9	55.3	12.4	26.8	7.1	15.3	2.3
Secondary and above education	82.0	4.7	76.2	5.0	36.1	2.7	26.2	1.7
Type of place of residence								
Urban	68.2	9.1	65.3	9.2	29.5	5.3	19.5	2.6
Rural	66.6	13.4	56.3	13.5	31.3	6.5	18.6	3.0
Province								
Koshi	63.8	11.1	61.6	11.5	20.1	6.1	11.1	2.1
Madhesh	54.2	13.2	49.8	14.0	19.9	8.7	11.2	3.6
Bagmati	81.7	4.9	79.5	6.1	24.4	0.6	19.5	0.3
Gandaki	79.2	4.5	73.2	5.7	39.7	2.2	27.4	2.1
Lumbini	70.5	14.1	65.5	12.8	39.8	6.0	27.6	3.3
Karnali	69.8	6.6	60.0	6.0	36.6	3.1	20.5	1.8
Sudurpashchim	74.8	12.9	57.6	10.4	53.4	9.7	34.7	5.3
Wealth index of women								
Poor	58.8	14.1	52.3	13.7	27.0	8.0	14.5	3.2

Middle	66.2	10.3	62.5	11.5	32.2	4.6	22.1	2.6
Rich	79.7	6.5	74.6	6.2	32.5	3.7	23.5	2.2
Problem in accessing health care								
None	50.7	17.4	42.1	16.9	30.7	8.4	13.1	4.6
Some of them	65.9	10.7	60.9	10.7	28.3	6.8	18.2	2.8
All four	77.7	7.7	72.6	8.0	32.9	3.0	19.2	2.7
Total	**67.7**	**10.6**	**62.2**	**10.6**	**30.1**	**5.7**	**19.2**	**2.7**

The effect of mobile phone ownership on the utilization of quality ANC services was described in Table 3 with crude and adjusted odds ratio. Ownership of, mobile phone shows a significant association with the utilization of certain component of ANC, however, its effect varies across different socio-demographic characteristics. The crude odds ratio indicates that women with mobile phones were 3.45 times more likely to have four or more ANC visits with skilled providers compared to those without mobile phones. After adjusting for socio-demographic factors, this association remained significant, with women who owned mobile phones being 2.36 times more likely to have four or more ANC visits with skilled providers. Likewise, the odds ratios for receiving the first ANC visit in the first trimester was higher among women with mobile phones, with crude and adjusted odds ratios of 2.27 and 1.56 respectively.

However, mobile phone ownership did not show statistically significant association with utilization of quality ANC services (AOR=1.28). Similarly, no significant association was observed between ownership of mobile phone and their receiving ANC content (AOR=0.98). These finding suggest that mobile phones may improve the utilization of ANC in timely initiation and visits, but do not ensure the completeness or quality of services received during ANC.

While, contextual factors show stronger association with quality ANC. For example, women with secondary or higher education were statistically significant and more likely to receive quality ANC services. Likewise, women from richer households have high odds of receiving quality ANC than women from poorer households. These disparities were also evident in province level such as Sudurpaschim and Lumbini have high odds ratio of receiving quality of ANC compared to those in Koshi.

Problem related with health accessibility showed mix effects. Findings shows that financial or physical barriers alone may not be sufficient to receive quality ANC. This suggests that other structural and services-related barriers may play a vital role in determining the utilization of quality of ANC services.

Table 3.

Effect of mobile ownership on quality antenatal care service utilization (n = 1,878)

Characteristics	>=4 ANC visit with skilled providers		ANC first visit at first trimester		Received ANC content		Quality ANC	
Mobile ownership	COR	AOR	COR	AOR	COR	AOR	COR	AOR
No	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Yes	3.45 (2.68-4.45)**	2.36 (1.80-3.11)**	2.27 (1.78-2.90)**	1.56 (1.20-2.04)**	1.27 (0.98-1.65)	0.98 (0.73-1.31)	1.76 (1.28-2.42)**	1.28 (0.91-1.82)
Ethnicity								
Marginalized	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Non-marginalized	2.96 (2.20-3.99)**	1.62 (1.14-2.30)**	1.85 (1.45-2.35)**	1.31 (0.97-1.76)	1.48 (1.20-1.82)**	0.99 (0.77-1.28)	1.75 (1.39-2.20)**	1.17 (0.89-1.55)
Educational status								
No education	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Basic education	1.39 (1.05-1.85)*	0.94 (0.69-1.29)	1.38 (1.05-1.82)*	1.06 (0.79-1.42)	1.49 (1.09=2.03)*	1.31 (0.94-1.83)	1.28 (0.89-1.84)	1.02 (0.69-1.51)
Secondary and above education	3.33 (2.48-4.47(**	1.50 (1.05-2.12)*	2.84 (2.16-3.73)**	1.56 (1.13-2.15)**	2.18 (1.63-2.91)**	1.95 (1.38-2.75)**	2.31 (1.66-3.23)**	1.63 (1.10-2.40)*
Province								
Koshi	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Madhesh	0.69 (0.51-0.94)*	0.81 (0.58-1.14)	0.65 (0.48-0.87)*	0.70 (0.51-0.97)*	1.03 (0.74-1.43)	1.19 (0.85-1.69)	1.14 (0.77-1.70)	1.29 (0.85-1.95)
Bagmati	2.16 (1.43-3.38)**	1.59 (1.02-2.47)*	2.17 (1.43-3.38)**	1.71 (1.12-2.60)*	1.01 (0.69-1.46)	0.93 (0.63-1.36)	1.62 (1.06-2.47)*	1.36 (0.88-2.11)
Gandaki	1.73 (1.00-3.00)	1.38 (0.77-2.45)	1.37 (0.83-2.28)	1.12 (0.66-1.89)	2.24 (1.43-3.51)**	2.14 (1.35-3.37)**	2.74 (1,65-4.55)**	2,46 (1.47-4.12)**

Lumbini	1.84 (1.24-2.71)**	1.76 (1.17-2.64)**	1.32 (0.92-1.88)	1.21 (0.84-1.75)	2.27 (1.62-3.17)**	2.33 (1.65-3.28)**	2.94 (1.99-4.34)**	2.95 (1.98-4.39)**
Karnali	1.09 (0.69-1.71)	0.95 (0.58-1.55)	0.71 (0.53-1.15)	0.71 (0.45-1.12)	1.95 (1.27-2.97)**	2.11 (1.35-3.31)**	1.89 (1.14-3.11)*	2.00 (1.18-3.40)*
Sudurpashchim	2.39 (1.44-3.95)**	2.01 (1.18-3.44)**	0.78 (0.53-1.15)	0.65 (0.42-0.98)*	4.87 (3.31-7.17)**	5.53 (3.67-832)**	4.37 (2.85-6.71)**	4.59 (2.92-7.21)**
Wealth index								
Poor	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Middle	1.53 (1.13-2.08)**	1.08 (0.79-1.47)	1.47 (1.12-1.93)*	1.27 (0.94-1.70)	1.18 (0.91-1.54)	1.32 (0.99-1.77)	1.53 (1.14-2.05)*	1.61 (1.17-2.23)*
Rich	2.32 (1.78-3.03)**	1.47 (1.08-2.00)*	2.17 (1.70-2.75)**	1.35 (1.03-1.77)*	1.31 (1.05-1.63)*	1.37 (1.05-1.77)*	1.61 (1.26-2.07)**	1.45 (1.08-1.94)*
Problem in health care access								
None	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Some of them	1.53 (1.13-2.08)**	1.21 (0.87-1.69)	1.75 (1.32-2.33)**	1.57 (1.16-2.13)**	1.01 (0.75-1.37)	0.80 (0.58-1.11)	1.24 (0.86-1.77)	0.94 (0.64-1.37)
All four	2.74 (1.93-3.88)**	1.59 (1.08-2.33)*	2.89 (2.09-3.99)**	2.03 (1.43-2.89)**	1.13 (0.82-1.55)	0.75 (0.53-1.07)	1.85 (1.09-2.30)*	0.95 (0.63-1.43)

Note. COR=Crude Odds Ratio; AOR=Adjusted Odds Ratios; *p<0.05, **p<0.01

Discussions

This study examined the effect of mobile phone ownership on the utilization of quality ANC services among women in Nepal. The findings depict that mobile phone ownership significantly improves the utilization of ANC services, however, its effect of quality ANC services remained limited.

Women who have mobile phone were significantly more likely to visit four or more time with skilled providers and timely initiate their visit. These findings are

found similar with LeFevre et al. (2020) where mobile phone ownership was examined from 15 countries and found women's mobile phone ownership is associated with better antenatal care (ANC) utilization. Though, mobile phone ownership varied by demographics, with rural and poorer women facing greater gaps, impacting their access to reproductive maternal newborn and child health services. Likewise, findings are consistent with another study from Bangladesh (Kibria et al., 2023), and India (Gunamany & Subramanyam, 2022), which indicate mobile phone users had a higher likelihood of attending at least four ANC visits. This suggest mobile phone ownership aids better access to and utilization of ANC services, which is decisive for the improvement of maternal health outcomes

Evidence from Timor-Leste (Nie et al., 2016) highlights that while mobile phone ownership is significant association with higher socioeconomic status; it is not an independent predictor ANC utilization after adjusting for demographic factors. In many cases, women rely on male family members to access health messages due to their literacy level and less awareness on digital literacy. As Banerjee (2022) highlights, having mobile phone and using it properly are two different cases. These factors remain a barrier in Nepali women, too. For example, some women shared that although they received ANC-related messages time and again, they needed help from their either children or husband to read and interpret them. These cases insight highlight the lack of agency of the marginalized woman in proper utilization of mobile phone for accessing their health services.

Similar trend was found in Zimbabwe that highlights access to digital technologies (newspapers and mobile phones) that played contributory role to impact on antenatal care (ANC) attendance (Mbunge et al., 2023). Nevertheless, digital literacy and access to information remain uneven, i.e., with some women it may require assistance from family members, as we discussed above in the case of Nepal, to interpret ANC-related messages. These results support the importance of interventions that increases digital literacy and enable women to use digital resources on their own.

Despite these effects, mobile phone ownership was not significantly associated with receiving the complete ANC content or overall quality of ANC. This highlights the important gap between service utilization and service quality. Arroyave et al. (2021) highlights that increased contact with healthcare services does not necessarily translate into the increased quality care or complete ANC contents. The quality is largely dependents on health system factor such as provider competency, availability of services and other clinical protocols. Mobile phone ownership does not guarantee the comprehensive quality ANC services, but it can facilitate access of health services.

Socio-demographic factors demonstrated stronger and consistent associations with quality ANC service utilization. Women with secondary or higher education were significantly more likely to receive quality ANC services. This is in line with the existing literature (Raru et al., 2022) that shows education improves health

knowledge, decision making autonomy and utilize the maternal health services effectively. Efforts to increase using mobile phone in assessing health services, particularly among marginalized and less educated women, could have a substantial impact on maternal health in Nepal. Batajoo (2012) emphasized that the mother and child protection (MnCP) program supported pregnant rural women through timely health information sharing and community participation with the help of mobile. Likewise, wealth status of household also positively associated with quality ANC, women from riche household have high odds ratio of utilizing the quality ANC higher the use of quality ANC services which is aligned with evidence from South Asian countries, where wealth related inequalities remain a determining factor (Tohan et al., 2024).

Regional disparities were also found across provinces. Geographic inequalities can contribute to unequal utilization of ANC services, which is in line with previous research (Sapkota et al., 2025). As Banerjee (2022) highlights, this shows having mobile phone is not a complete solution to improve women's health during pregnancy despite residing in urban areas. Problem related in accessing health care is another important factor that have mixed results. These are not consistently associated with utilizing quality ANC services. This suggests highly accessibility of health facility and other services but that does not mean they utilize quality ANC services. These realities reflect broader social norms associated to patriarchal dominance, where male family members often mediate woman's access to technology and healthcare services.

5. Conclusions

Mobile ownership plays a supportive role in improving the utilization of ANC services. However, the findings reflect having mobile phones alone is not adequate, digital literacy is equally important. While there are gaps, true digital literacy is more essential than access to mobile ownership. Therefore, to achieve meaningful results in maternal healthcare services, digital health interventions need to be integrated with broader health system efforts. Future policies should prioritize digital literacy, community engagement, and inclusive design to bridge the gap between ownership and meaningful use focusing on disadvantaged and marginalized pregnant women. Such integrations are essential to achieve the optimal utilization of ANC services and improve maternal health outcomes in Nepal.

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