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Original Article

### Assessing the Effectiveness of Information and Technology on Maternal Health Care Access: Evidence from Uganda DHS 2016

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**Background:** The growing importance of information and technology in improving healthcare access, though increasingly stressed, is not adequately researched. Seventy-five percent of maternal deaths in Uganda still arise from preventable diseases, partly due to a lack of awareness. The current study sought to establish the role of information and technology; and other demographic factors that affect maternal healthcare access. **Methods:** We estimate an ordered logistic regression on the UDHS 2016 data set. The study sample consisted of 11311 mothers aged 15-49. The study model distance and money to measure the severity of accessing health care services. **Results:** Information and technology play significant roles in improving access to healthcare. The significance increases the higher the frequency. Those who listen to the radio or watch television at least once a week are less likely to report severe problems in accessing health care than those who do not listen or watch at all (-0.11; -0.30) respectively. Reading newspapers or magazines less than once a week significantly affects healthcare access (-0.09). Possession of a mobile phone improves health care access (-0.60). Aging limits health access while urban residence (0.12), wealth (-0.42), education (-0.26) and partner's occupation (-0.30) improve maternal health access. **Conclusion:** Information and technology play an essential role in improving maternal access to health care services and the frequency with which the information is provided matters. Access to maternal health care is positively related to urban residence, more education, a higher level of wealth index, and the partner's occupation and negatively related to aging.

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## INTRODUCTION

The sustainable development goals (SDG 3) relate good health to work performance. On this basis, it is aimed that access to safe and effective medicines and vaccines should be the ultimate goal for countries to attain for their citizenry. It is hoped that universal access to health care will help halve the number of children dying from preventable diseases and the scourge of alarming maternal mortality rates (Atuhaire, Ekirapa & Mutenyo, 2023). It is a desired goal of SDG 3 to put an end to all preventable maternal and infant diseases by 2030 (Agiraembabazi et al., 2019). Worryingly in Uganda, seventy-five percent of maternal deaths still arise from preventable diseases, partly due to a lack of awareness. The four aspects of healthcare access often mentioned in the literature include timeliness, coverage, workforce and services. The literature surveyed reveals inequities in healthcare access (Dawkins et al., 2021) both in developed (Spooner et al., 2021) and developing countries (Atuhaire, Ekirapa, & Mutenyo, 2023; Amare & Zemenu, 2020).

The issue of maternal health care access is pertinent, especially in sub-Saharan Africa where of the recorded global maternal deaths, 66% are said to occur on this part of the continent. Women tend to have more difficulties in accessing health services compared to men (Topriceanu et al., 2021). In East

Africa, the number of mothers who receive health care from skilled birth attendants is below 50%, and the likelihood of these mothers dying is 1 in 31 (Amare & Zemenu, 2020). Uganda has recorded a declining trend in maternal mortality ratio from 336 to 189 deaths per 100,000 live births from 2009-2016 to 2015-2022 respectively (Alobo et al., 2022). Similar declines are also reported under pregnancy-related deaths from 438 to 228 per 100,000 live births for the period 2004-2011 to 2015-2022 respectively (UBOS, 2022; Agiraembabazi et al., 2019). These ratios are still higher than the target maternal mortality ratio of 70 per 100,000 as set in the sustainable development goals. The need to identify appropriate interventions to improve healthcare access based on empirical evidence is a contribution that this paper aims to make.

Researchers have identified several factors influencing access to health care which include age, education, ethnicity, race, employment status, health insurance coverage, income, sex, residence, transport, and comorbidities (Topriceanu et al., 2021; Garrod et al., 2020; Graves et al., 2022; Chowdhury & Ravi, 2022). Spooner et al., (2021) classify the determinants of health access into demand-side and supply side factors. The demand-side factors include the patient's abilities to perceive, seek, reach and pay, while the supply-side factors include approachability, affordability, availability

(Amare & Zemenu, 2020), acceptability, and appropriateness of the health services. The literature surveyed mentions little about how information and technology affect healthcare access, especially among mothers.

The literature further identifies several barriers to healthcare access like old age, household poverty, the lack of ownership of transport means like a bicycle and sociocultural issues (Wandera et al., 2015; Dawkins et al., 2021). Other barriers include distance to the health facility, inadequate social support and the inadequacies in health infrastructure. The Uganda government has tried to improve access to the nearest health facility to a distance of at least 5 kilometres though the complementary health infrastructure like staff and drugs are still below the target.

Several researchers have investigated the issue of healthcare access from varying dimensions. Wandera et al., (2015) investigated the determinants of access to health care among older persons in Uganda aged 50 years and above. The study missed out on the population below 50 years. Topriceanu, et al., (2021) and studies were conducted in a European setting. Chowdhury & Ravi (2022) study investigated disparities in healthcare accessibility in developing countries while Dawkins et al., (2021) employed a systematic review to synthesize factors affecting healthcare access, and variations across low- and middle-income countries (LMICs) versus high-income countries (HICs). Amare & Zemenu (2020) investigated the determinants of women to maternal health care in 12 East African countries using the DHS secondary data from 2008 to 2017. The focus was on maternal health care and aspects of information access were not handled. From the reviewed literature, we have found no specific study focussing on the role of information and technology in improving maternal healthcare access, specifically, in the context of a developing country.

The Uganda Vision 2040 in alignment with SDG 3, and as reflected in the health sector strategic plan underscores access to health care as a key pillar of

Uganda's goal to nurture a productive population that positively contributes to the country's development agenda. The Ministry of Health strategic plan 2020/21-2024/25 aims to achieve universal health coverage with a focus on access and quality. Previous studies on Uganda examined the effect of socioeconomic and demographic factors on the use of maternal healthcare but did not explore how information and technology affect maternal access to healthcare services (Amwonya et al., 2022; Ndugga et al., 2020; Kakama & Basaza, 2022). We hypothesize that the high numbers of maternal and child mortality in developing countries may be attributable to limitations in information access. Mothers still die during delivery due to lack of attention from qualified health practitioners that may not be readily available or efficiently utilised. Information and technology would improve awareness, access and utilization of health services.

In this paper, we attempted to establish the role of information and technology as an essential intervention required in improving maternal access to health care services. The research paper also examines how age, residence, wealth, education and the partner's occupation may be appropriate interventions to help Uganda reduce the current high maternal mortality ratio to the target set by the sustainable development goals.

## MATERIALS AND METHODS

### Data Source

This study utilised data from the 2016 Uganda Demographic and Health Survey (UDHS), which was instrumental in evaluating health and nutrition programs with a focus on maternal and child health, fertility, and domestic violence. The survey employed a two-stage sampling approach: initially selecting 697 Enumeration Areas (EAs)—162 urban and 535 rural—excluding one EA due to land disputes. In the second stage, households within these EAs were listed from April to October 2016, with institutions like hospitals and schools excluded.

Large EAs were segmented, and data were collected from one segment per EA

From each of the 696 EA, 30 households were selected leading to a sample of 20,880 households. The 20,880 households resulted in successful interviews with **18,506** women aged 15-49. The reduction is due to some households lacking eligible women or eligible respondents being unavailable during fieldwork. For this analysis, data from 11,311 women were used after adjusting for relevant covariates. Additionally, one-third of the households provided male data and biomarker samples, including tests for anaemia and malaria, and measurements of height and weight.

### Model Specification

The dependent variable, "access to healthcare," was derived from survey responses and is an ordinal categorical variable with three levels: "no problem" (coded as "1"), "moderate problem" (coded as "2"), and "severe problem" (coded as "3"). Given the ordinal nature of this outcome, an ordered probit model was employed, as outlined by . The model is specified as follows:

$$y^* = x'\beta + \varepsilon$$

Where,  $y^*$  represents the latent variable for healthcare access. The vector  $x$  includes covariates related to the respondent's personal characteristics,  $\beta$  is the vector of coefficients to be estimated, and  $\varepsilon$  denotes the normally distributed error term. The primary independent variable is mobile phone ownership, serving as a proxy for technological access, coded as a binary variable (0 for "no" and 1 for "yes"). Additional covariates include the respondent's age group (adolescent, youth, or adult), residence (urban or rural), educational attainment, literacy level, employment status, household wealth index, partner's occupation, and frequency of media consumption (newspapers, radio, and television).

### Data Analysis

All analyses were conducted using Stata 16. Descriptive statistics were generated, and models

were estimated to account for the complex survey design and weighting, ensuring accurate and representative results. A survey-weighted chi-square test was used to assess the associations between the independent and dependent variables. Ordinal probit regression was applied to both models, with the estimated coefficients interpreted accordingly.

### Outcome Variable

The variable "access to healthcare" is derived from responses to questions about barriers to obtaining medical advice or treatment. Specifically, four core DHS questions assess whether the following are considered major problems: obtaining permission to go to a health facility, the distance to the health facility, getting the money needed for treatment, and not wanting to go alone. Respondents answered each question with either "big problem" or "not a big problem." The outcome variable "access to healthcare" is constructed as an ordinal categorical variable with values of 1, 2, and 3. In the first model, respondents who answered, "not a big problem" to all four questions are classified as having "no problem" (coded as 1). Those who indicated that either the distance to the health facility or the cost of treatment was a "big problem," regardless of their answers to other questions, are classified as having a "severe problem" (coded as 3). All other responses are categorized as a "moderate problem" (coded as 2). In the second model, the criteria for the "severe problem" category is narrowed to those who reported a "big problem" with getting the money needed for treatment. Respondents who indicated distance to the health facility as a "big problem" are now categorized under the "moderate problem" group. This adjustment is made because, while distance may be an issue, individuals might still be able to arrange transport from family or friends, as long as they can afford the medical bills.

### Distance

The long distances that patients have to travel to access health services is listed among the barriers to



health access (Geleto et al., 2018; Lufumpa et al., 2018; Chowdhury & Ravi, 2022; Graves et al., 2022; Cyr et al., 2019; Kirby & Yabroff, 2020). This is often worsened by delays in receiving the needed healthcare attention once at the health facility (Arroyave & Moreno, 2018; Olivera et al., 2018; Cassim et al., 2019; Cyr et al., 2019). The delays in providing the much-desired health care to patients is not only explained by the attitude of health care providers, but also the inadequate health infrastructure (Khatri & Karkee, 2018; Graves et al., 2021). Distance is identified among the barriers to health care access in Uganda.

### Exposure variables

This study investigated the influence of information and technology on maternal healthcare access in Uganda. The primary independent variables are mobile phone ownership and the frequency of media consumption—specifically, watching television, listening to the radio, and reading newspapers. These variables serve as proxies for access to information and technology. Mobile phone ownership is a binary variable, with "0" indicating no ownership and "1" indicating ownership. The frequency of media consumption is measured with three categories: "not at all" (coded as 0), "less than once a week" (coded as 1), and "at least once a week" (coded as 2).

### Information access

Access to information is essential if the country is to attain the goal of universal health access. The role of information in improving health outcomes is stressed in . The possession of information on immunization programmes is credited with preventing child mortality, especially from immunizable diseases. To the adult population, adequate health education may greatly improve the quality of people's lives through adopting healthy living habits. A positive relationship between access to information, ability to read and health access is reported in (Tsawe & Susuman, 2014). The Quebec intervention is a classic example of how information

access can stimulate healthcare access and improve the quality of people's lives (Spooner et al., 2021). This is supported by who observe the tendency for people to seek the services of a qualified medical practitioner at the stage of deteriorating health. The rural population possess limited health education, which exposes them to poor health outcomes.

### Mobile phone

The use of technology and internet access are vital elements in the provision of information. However, the digital divide between the rich and the poor, as well as the urban and rural residents complicate this pathway. During the COVID-19 pandemic, several countries strategized to improve health access to all by adopting telehealth. This though, was limited by digital inequalities manifest in limited internet access, lack of required equipment and general digital illiteracy (Beaunoyer et al., 2020).

The use of the telephone call to reach out to patients led to the improvement in the utilization of health services through the Quebec intervention. It is argued that the call to the patients enabled them to appreciate the need for the targeted health service intervention. This clearly demonstrates the essential role played by information and technology in stimulating and improving the access and utilization of health services. Timely access to health information can effectively be delivered to users online through the various tools integrated into the mobile phone including social media tools.

### Confounding variables

#### Education

Educated women have a higher probability of accessing health care compared to uneducated women (Atuhaire et al., 2020; Dawkins et al., 2021; Amare & Zemenu, 2020; Atuhaire et al., 2023; Amwonya et al., 2022). Education tends to empower women to make independent decisions by reducing their dependence on men. In most developing countries, women are less educated and less empowered (Arroyave & Moreno, 2018) compared

to men, which greatly limits their access to health care (Geleto et al., 2018)]. Educated women are also better placed to process available health information to inform better health decisions (Amwonya et al., 2022). Education is associated with high correlations when related to health status. This however contradicts (Garrod et al., 2020) whose study found that higher education (university educated) was associated with more likelihood of reporting difficulty in accessing health care (Garrod et al., 2020).

### Wealth

Wealth enables improved access to healthcare (Ndugga et al., 2020; Fagbamigbe & Idemudia, 2017). The literature posits that women who are wealthy tend to easily access healthcare services compared to their counterparts who are from the poor class (Atuhaire et al., 2023; Amwonya et al., 2022; Barman et al., 2020; Chowdhury & Ravi, 2022; Corscadden et al., 2018; Dawkins et al., 2021). Healthcare access tends to improve if it is considered affordable. However, in developing countries, the cost of healthcare support tends to be highly prohibitive and intertwined with both direct and hidden/informal costs (Geleto et al., 2018; Amare & Zemenu, 2020; Graves et al., 2022).

### Employment

Women are often discriminated against and employed in informal low-paying jobs that are less secure. The literature tends to associate better pay with improved ability to access health care. Where a woman's earnings are inadequate, support from a working husband tends to be very crucial. Research indicates the existence of a positive association between the married and improved access to healthcare (Wandera et al., 2015). This of course assumes an ideal situation of a supportive husband.

### Residence

Where one lives matters in terms of accessing health care. The literature depicts rural areas as characterized by inadequate health facilities and

limited skilled overworked personnel (Chowdhury & Ravi, 2022; Atuhaire et al., 2023; Arroyave & Moreno, 2018; Lufumpa et al., 2018). The rural settings were found to limit healthcare access (Amare & Zemenu, 2020; Tsawe & Susuman, 2014; Graves et al., 2022; Graves et al., 2021; Kirby & Yabroff, 2020; Kanter et al., 2020). This is often complicated by the long distances people in rural settings have to travel to access medical care (Graves et al., 2022).

### Age

The literature associates aging with reduced access to healthcare (Wandera et al., 2015). Dawkins et al., (2021) argue that the impact of age on health access is context-dependent.

### Partners' Occupation

The occupation of a partner tends to be influenced by the level of education. Educated partners are more likely to work and take up professional jobs compared to the uneducated who have no work or take up more unskilled jobs. An educated partner is more likely to offer the needed support to the mother to access health care. Amare and Zemenu (2020) study established the existence of a positive relationship between a partner's education and maternal healthcare access. The lack of social support from the immediate family may play a role in limiting access to health care. This is especially true when some patients may feel offended to ask for help (Arroyave & Moreno, 2018). It is also reported that a woman may be delayed or denied access to essential social services like transport if not accompanied by the male (Dawkins et al., 2021; Amare & Zemenu, 2020). Social support is so crucial in developing countries like Uganda where most of the household chores are left to the woman (Dawkins et al., 2021; Amare & Zemenu, 2020), leaving her with limited or no time to seek health support from qualified practitioners. The social construction of society may also lead to stigma-related effects that prevent mothers from accessing health. This seems to be revealed clearly in (Amare

& Zemenu, 2020) where research findings revealed the less likelihood of access to healthcare by mothers who had unwanted pregnancies compared to mothers with planned to become pregnant. The support received from the health facility if perceived to be friendly, will improve the demand for health care access (Geleto et al., 2018).

## RESULTS

**Table 1: Descriptive statistics**

Variable	None	Moderate	Severe	Chi-square	P-value
Age					
Adolescent	0.44	0.05	0.51	66.01	0.000
Youths	0.42	0.04	0.54		
Adults	0.38	0.02	0.6		
Average	0.41	0.04	0.55		
Residence					
Urban	0.58	0.04	0.38	428.28	0.000
Rural	0.36	0.03	0.61		
Average	0.41	0.04	0.55		
Literacy					
Cannot read	0.31	0.03	0.66	308.77	0.000
Can read	0.47	0.04	0.49		
Average	0.41	0.04	0.55		
Occupation					
Unemployed	0.42	0.03	0.55	1.96	0.580
Employed	0.41	0.04	0.55		
Average	0.41	0.04	0.55		
Wealth index					
Poor	0.27	0.03	0.7	914.89	0.000
Middle	0.37	0.04	0.59		
Rich	0.56	0.04	0.39		
Average	0.41	0.04	0.55		
Owns a mobile phone					
No	0.31	0.03	0.65	536.13	0.000
Yes	0.52	0.04	0.44		
Average	0.41	0.04	0.55		
Frequency of listening to Radio					
Not at all	0.32	0.02	0.66	193.42	0.000
Less than once a week	0.38	0.04	0.58		
At least once a week	0.46	0.04	0.5		
Average	0.41	0.04	0.55		

In this section, we present the descriptive statistics (Table 1) and the estimated results in Table 2.

This table shows the summary statistics of our dataset. It breaks down the variables by their values and demonstrates the health level distribution of each group. For example, 65% of non-mobile owners had severe health issues while 44% of mobile owners had severe health issues.

<b>Frequency of reading newspaper or magazine</b>					
Not at all	0.37	0.03	0.6	417.12	0.000
Less than once a week	0.56	0.04	0.4		
At least once a week	0.62	0.06	0.32		
<b>Average</b>	0.41	0.04	0.55		
<b>Frequency of watching television</b>					
Not at all	0.34	0.03	0.62	691.97	0.000
Less than once a week	0.46	0.03	0.51		
At least once a week	0.64	0.05	0.31		
<b>Average</b>	0.41	0.04	0.55		
<b>Partner's occupation</b>					
Not working	0.26	0.01	0.72	395.69	0.000
Professional work	0.48	0.04	0.48		
Unskilled work	0.32	0.03	0.66		
<b>Average</b>	0.41	0.04	0.55		

Table 1 results depicts the important role information and technology play in improving access to health care among the respondents. The respondents, who more frequently listen to the radio (50%), read newspapers (32%) or watch television (31%) reported less severity in accessing health care. This is in contrast to those who do not at all listen to radio (66%), read newspapers (60%) or watch television (62%). This implies that the severity of accessing health care reduces the more one is exposed to information. This result is further strengthened by the findings on literacy, where those who cannot read face more severe access problems (66%) compared to their counterparts who can read (49%).

In terms of technology, significant differences were reported in the severity of accessing health care. Those who lack mobile phones reported higher severe problems (63%) in accessing health care while respondents in possession of a mobile phone reported relatively lower severe problems (45%) in accessing health care. This signifies the crucial role technology plays in improving maternal health care access in a developing country like Uganda.

The results indicate the existence of significant differences in the access of health care in terms of

age group. The adults reported the highest percentage of severity (60%), followed by the youths (54%) and the adolescents (51%). This result implies that the severity in accessing health care increases with age. In terms of where one resides, the rural residents (61%) face more severe problems in accessing health care compared to the rural residents (38%).

The type of occupation a mother does did not reveal any significant differences in terms of accessing health care. However, the partner's occupation does matter. Partners/husbands who are not working are the most affected at 72%, followed by the unskilled (66%), then the professionals at 48%. There is a significant difference in the severity of accessing health care depending on the wealth status. The severity reduces the higher the level of one's wealth index. The severity for the poor is 70%, the middle 59% and the rich 39%.

We estimated two models, model 1 has both distance and ability to pay (money) rated as severe barriers to health access and coded as 3; while model 2 takes distance to be a moderate problem coded as 2, and only money taken to be severe coded as 3.



**Table 2: Estimated results using the ordered logit model**

Number of observations	11311	Number of obs	1131
Design df	667	Design df	667
F (19, Prob > F)	32.26 0.000	F (19, Prob > F)	39.24 0.000
<b>Model 1</b>			
Linearized			
	Coef.	Std. Err.	[95% Conf. Interval]
<b>Age</b>			
Youths	0.225	0.054	(0.12,0.33) ***
Adults	0.289	0.057	(0.18,0.40) ***
<b>Residence</b>			
Rural	0.115	0.057	(0.00, 0.23) **
<b>Education</b>			
Primary	-0.069	0.053	(-0.17,0.04)
Secondary	-0.189	0.068	(-0.32,-0.06)***
Higher	-0.220	0.088	(-0.39,-0.05)**
<b>Literacy</b>			
Can read	-0.013	0.039	(-0.09,0.06)
Employment	-0.077	0.047	(-0.17,0.01)*
<b>Wealth index</b>			
Middle	-0.207	0.043	(-0.29,-0.12)***
Rich	-0.404	0.046	(-0.49,-0.31) ***
<b>Owns a mobile phone</b>			
Yes	-0.137	0.036	(-0.21,-0.07)***
<b>Frequency of listening to radio</b>			
Less than once a week	-0.003	0.053	(-0.11,0.10)
At least once a week	-0.078	0.045	(-0.17,0.01)*
<b>Frequency of watching TV</b>			
Less than once a week	-0.076	0.056	(-0.19,0.03)
At least once a week	-0.293	0.057	(-0.41,-0.18)***
<b>Frequency of reading newspaper or magazine</b>			
Less than once a week	-0.105	0.050	(-0.20,-0.01)**
At least once a week	-0.111	0.069	(-0.25,0.02)
<b>Partner's occupation</b>			
Professional	-0.280	0.089	(-0.46,-0.11)
Unskilled	-0.127	0.089	(-0.30,0.05)
/cut1	-0.710	0.130	(-0.97,-0.45)***
/cut2	-0.612	0.129	(-0.87,-0.36)***

Standard errors in parentheses \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

The results shown in Table 2 exemplify the essential role of the provision of information in improving access to health care among the population, more specifically the mothers. Those who listen to the radio are less likely to report severe problems in accessing health care than those who do not listen to the radio at all. The log-odds of this result is not significant for those who listen to radios less than once a week (-0.003) but is highly significant for those who listen to radios at least once a week (-0.08). The effect of listening to the radio on health access is even more pronounced in model 2, though highly significant log-odds only for those who listen to the radio for at least once a week (-0.11).

In regard to watching television, the results revealed that it does matter in terms of accessing health care. For those who watch television for less than a week, the results were not significant in both model 1 (-0.08) and model 2 (-0.07). People who watch television at least once a week were significantly less likely to report difficulties in accessing health (-0.29) under model 1, and (-0.30) under model 2.

The results revealed that it matters how often one reads newspapers or magazines. It was revealed that those who read newspapers or magazines for less than once a week are significantly less likely to report difficulties in accessing health care compared to those who do not read at all (-0.11) in model 1, and (-0.09) in model 2. The results were not significant for those who read newspapers or magazines at least once a week. The ability to read though associated with less difficulty in accessing health care is not significant in both models.

The respondents who own a mobile phone are significantly less likely to report severe problems in accessing health care compared to those with no mobile phone (-0.14). In model 2, the likelihood of reporting severe problems in accessing health care reduces significantly even further with the possession of a mobile phone (-0.60). These results underline the key role technology can play in creating awareness and improving access to healthcare services among the population.

The results indicate that the probability of mothers reporting severe problems in accessing health care reduces with the higher the level of education attained. In model 1, the mothers with primary education are less likely to report severe problems in accessing health care compared to mothers with no education (-0.07) though this is not significant. The mothers with a secondary level of education are significantly less likely (-0.19) to report severe problems in accessing health care compared to mothers with no education. In the same line, the mothers with higher education are significantly less likely (-0.22) to report severe problems in accessing health care compared to mothers with no education. The results in model 2 reveal a more reduced difficulty in accessing health care the more education one attains, and significant at secondary (-0.20) and higher education (-0.26).

The respondents in the middle-income group are significantly less likely to report severe problems in accessing health care compared to the poor (-0.21). The rich are even significantly far less likely to report severe problems in accessing health care compared to the poor (-0.40). In model 2, the likelihood of reporting severe problems in accessing health care reduces even further and significantly with the middle income (-0.24) and the rich (-0.42). Similarly, mothers who are employed significantly face less difficulty in accessing health care compared to their counterparts who are not employed.

The partner's occupation matters in maternal health care access though only significant in model 2. Having a partner with some form of employment is associated with fewer reported difficulties in accessing health care. The mothers with partners employed in professional occupations significantly face less difficulty in accessing health care compared to those whose partners are not working (-0.301). In the same line, mothers with unskilled partners are slightly in a better position of accessing health care than those with partners who are not working (-0.15).

Where one resides does influence the ease of access to health care. Significant results were reported in model 1, where rural residents significantly report difficulties in accessing health care compared to their counterparts in urban areas (0.12). This disparity in the level of difficulty in accessing health care is not significant in model 2. In relation to age, the difficulty in severity of accessing health care increases with age though more pronounced in model 1 than model 2. The log odds of the youth experiencing difficulties in accessing health care are 0.23 units higher than those of an adolescent. The odds are even higher for an adult at 0.29 units higher than those of an adolescent. The severity is even more pronounced in model 2 at 0.26 units (Youths) and 0.36 units (adults) higher than those of an adolescent. This underscores the key role finances play in facilitating access to health care.

## DISCUSSION

This study sought to establish the role of information and technology as essential interventions required in improving maternal access to health care services in Uganda. The study further sought to examine other demographic factors that may be useful to inform policy in line with designing appropriate interventions to help Uganda reduce the current high maternal mortality ratio and attain the target set in the sustainable development goals. In conducting this study, we were guided by two research questions 1) How is information and technology related to maternal health care access in Uganda? 2) What other demographic factors have a significant effect on maternal healthcare access in Uganda?

### **How is information and technology related to maternal health care access in Uganda?**

The study measured information in terms of the frequency of listening to the radio, reading newspapers or magazines and watching television. The results from Table 1 showed that significant differences exist when it comes to how often one utilizes the various information in relation to health

care access. Oftentimes people fail to access health services due to a lack of awareness of the availability of the health service or its relevance to one's health. The severity in accessing health care is more felt with categories that are not in a position to access information. The odds of listening to the radio in accessing health care favour the frequent user and is more pronounced in model 2 (Table 2) which focussed on the respondents' ability to pay for the services. The same result was registered in terms of watching television and reading newspapers or magazines. The crucial role played by information in improving healthcare access revealed in the estimated results augurs well with earlier studies (Chowdhury & Ravi, 2022; Spooner, et al., 2021; Tsawe & Susuman, 2014). The surprising result is that when it comes to the frequency of reading newspapers or magazines, the odds in terms of significant results favour those who read less than once a week. Perhaps this can be explained by the poor reading culture among the population in most developing countries where Uganda also falls. This result also aligns with the non-significant results when we estimate how literacy affect health care access.

The possession of a mobile phone which was our proxy for technology was found to have a significant effect on maternal health care access. Mothers who own a phone reported better access to health care than mothers without a phone. These results support the findings of the Quebec intervention, where the use of mobile to provide telehealth services to people improved their access to healthcare. Phone use also complements the timelines and coverage aspects of quality health care advocated for by . The effectiveness of the use of the mobile phone may however be limited where information is needed to be delivered through the Internet due to poor network connectivity and general digital illiteracy (Beaunoyer et al., 2020). This may be more specific to the rural population.

### **What other demographic factors have a significant effect on maternal healthcare access in Uganda?**

The study explored other factors that may play a significant role in maternal healthcare access in Uganda. It was revealed that age, residence, education, wealth index, and the partner's occupation do influence maternal healthcare access. In terms of age, the findings rhyme well with (Wandera et al., 2015) where aging complicates maternal healthcare access. Healthcare access is more of a problem to rural mothers as compared to those who live in urban areas. This result complements what is already acknowledged in the Health Sector Strategic Plan 2020/21-2024/25 of the glaring inequalities in health infrastructure between the rural and urban areas. The findings also confirm findings of earlier studies by (Chowdhury & Ravi, 2022; Graves et al., 2022; Amare & Zemenu, 2020; Kanter et al., 2020; Kirby & Yabroff, 2020).

The education level of the mother matters with level of severing in accessing health care reducing the more education one attains. This finding is in consonance with (Atuhaire et al., 2023; Amwonya et al., 2022; Dawkins et al., 2021; Amare & Zemenu, 2020; Atuhaire et al., 2020; Zajacova & Lawrence, 2018). The findings however contradict (Garrod et al., 2020) whose findings predicted more difficulties in accessing health care with increased levels of education, more specifically university education.

An individual's level of wealth matters in maternal health care access with access improving the higher the wealth quintile. These findings are in agreement with earlier findings (Amwonya et al., 2022; Chowdhury & Ravi, 2022; Graves et al., 2022). In relation to model 2, where finance plays a key role in health access, the results supports (Spooner et al., 2021). Having the means to pay for health services improves accessibility. Where hidden costs are involved in accessing health care, being in a higher wealth quintile makes healthcare access somehow more affordable. In the African setting where women are mostly employed in household chores,

the support accorded by the husband need not to be overemphasized. This support tends to be influenced by the type of occupation the partner is doing. The results revealed that partners in professional occupation are in a better position to offer support to mothers who need health care services.

### **CONCLUSION AND POLICY RECOMMENDATIONS:**

From the estimated results, we draw the following conclusions and policy recommendations. Information plays an essential role in improving maternal access to health care services and the frequency with which the information is provided matters. That is, the higher the frequency, the more likely the awareness is created leading to improved access. Information that requires reading through matters may not be as potent as the information provided through radio and television. We therefore recommend the use of integrated methods of information provision to help reach out the targeted segments. The information should be regularly provided till the set target is attained.

The possession of a mobile phone improves access to maternal health care. The effectiveness will however depend on the level of digital literacy among the population, internet connectivity, power supply and stable internet. We therefore recommend the government to reduce the cost of internet, promote digital literacy and widen internet connectivity especially in the rural areas that are severely hit with poor internet connectivity.

Access to maternal health care gets more constrained as one age. On the other hand, access to maternal health care is positively related to urban residence, more education, a higher level of wealth index, and the partner's occupation. We, therefore, recommend the designing of health interventions specifically geared toward the different age cohorts as access is significantly influenced by the age cohort one is in. To reduce the disparities between urban and rural health care access, targeted interventions meant to boost rural health

infrastructure is recommended. Interventions aimed at empowering women in terms of education and employment access are a step in the right direction. Above all, efforts aimed at improving maternal health care access need to integrate programming with the partners in context given the crucial role partners play in supporting maternal access to health care services.

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