Determinants of Utilization of Institutional Delivery Services in Zambia: An Analytical Cross-sectional Study

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Abstract

Introduction

Institutional delivery at birth is an important indicator of improvements in maternal health, which remains one of the targets of sustainable development goals intended to reduce the maternal mortality ratio. Despite the importance of delivering at institutions with skilled attendants, approximately 15% of women prefer to give birth at home, according to the 2018 Zambia Demographic and Health Survey (ZDHS). Therefore, the aim of the present study was to identify determinants of utilization of institutional delivery in Zambia.

Methods

A population based cross-sectional study design was used to examine 9841 women between 15 and 49 years of age from the 2018 ZDHS. Both descriptive and inferential statistics were used. Logistic regression was applied to calculate crude odds ratio (OR), adjusted OR, 95% confidence interval (CI). The level of significance was set at $p \leq 0.05$ for all analyses.

Results

The proportions of institutional and home delivery were 93.6% and 6.2%, respectively, in urban areas. The corresponding figures were 80.2% and 19.8% in rural areas. Sociodemographic factors – woman's (OR 1.76; 95% CI: 1.04–2.99) and husband's secondary/higher education (OR 1.83; 95% CI: 1.09–3.05), higher wealth index (OR 2.31; 95% CI: 1.27–4.22) and rural place of residence (OR 0.55; 95% CI: 0.30–0.98) – were significantly associated with institutional delivery. Healthcare-related factors – 5-12 visits to antenatal care (ANC) (OR 2.33; 95% CI: 1.66–3.26), measuring blood pressure (OR 1.65; 95% CI: 1.02–2.66) and testing blood samples (OR 2.01; 95% CI: 1.04–3.88) during pregnancy – were found to be significantly associated with institutional delivery.

Conclusions

The present study shows that sociodemographic factors such as women's and husband's secondary or higher education, higher wealth index, place of residence as well as healthcare-related factors such as 5-12 ANC visits, measuring blood pressure and testing blood samples during pregnancy were found to be significantly associated with institutional delivery. To improve institutional delivery and reduce maternal and newborn mortality, policymakers and public health planners should design an effective intervention program targeting these factors.

Introduction

Despite an extensive reduction in maternal mortality, maternal deaths remain high globally, particularly in low- and middle-income countries. Worldwide, maternal mortality has dropped by 35% from 2000 to 2017 (i.e., estimated 451,000 maternal deaths in 2000 and 295,000 in 2017) [1]. However, the highest mortality

or morbidity due to pregnancy-related complication or reproductive ill health among pregnant women has been found in Sub-Saharan Africa [2]. The maternal mortality ratio (MMR) in Sub-Saharan Africa in 2017 was very high, estimated at 542 per 100,000 live births [1]. In Zambia, the estimated MMR dropped to 213 in 2017, from 528 in 2000 [1], and maternal mortality accounts for 10% of all deaths among women between 15 and 49 years of age [3]. According to the Sustainable Development Goal (SDG) 3 – Target 3.1, which is to reduce global MMR to less than 70 per 100,000 live births by 2030 [4], the estimated MMR still remains relatively high in Zambia.

Most of the maternal mortality in the developing countries, including Zambia, has occurred because of low levels of maternal healthcare-seeking behavior. There are evidences to suggest that inadequate antenatal care (ANC) utilization and the extremely few deliveries assisted by a skilled attendant are related to maternal mortality [5–7]. The utilization of maternal healthcare services, such as antenatal and prenatal care, and family planning have been shown to significantly reduce maternal mortality [8,9]. To ensure women's physical and mental wellbeing, the World Health Organization [10] has recommended at least eight ANC visits during pregnancy as well as postnatal care visits at six hours, six days, six weeks, and six months.

Institutional delivery has been found to be one of the key predictors of preventing neonatal mortality and a recognized intervention mechanism for decreasing maternal death [11,12]. Timely institutional delivery assisted by skilled attendants can significantly reduce maternal and neonatal mortality by preventing delivery complications [13,14]. Nonetheless, a large number of women in the developing countries, particularly in rural areas, lack access to institutional delivery settings, meaning that birth occurs in unsafe and unhygienic situations [15]. Although Sub-Saharan Africa has increased its rate of child birth with skilled medical attendance, it is still below half (46.5%), compared to the observed rate of 99.5% in the developed countries [16]. According to the latest 2018 Zambia Demographic and Health Survey (ZDHS 2018), the percentage of deliveries assisted by skilled birth attendants in Zambia increased from 44% in 2002 to 84% in 2018 [3]. Even if the rate of births with skilled attendants at delivery has increased over the years in Zambia, considering the SDG 3 target level, more needs to be done [4]. Access to healthcare services and utilization of available skilled birth attendance can contribute to minimizing the risk of delivery complications and to preventing maternal and neonatal mortality [17].

Utilization of healthcare facilities by women and its association with institutional delivery is influenced by several factors. Previous studies worldwide have found that multilevel factors, such as personal and sociodemographic conditions, affect the decision to seek out institutional delivery with skilled birth attendants [18–23]. A recent study conducted in Southwest Ethiopia by Yoseph et al. [24] found that high wealth index, primary and above education level for the husband, women's age below 40 years and number of ANC visits were positively associated with institutional delivery. A study conducted in Eritrea demonstrated that the factors low education level for both women and husbands, early initiation of ANC visits, women having given birth in healthcare facility before the most recent pregnancy and women having had complications during the most recent pregnancy were associated with a significantly increased rate of institutional delivery service utilization [20]. Another study found that several

socioeconomic and demographic factors among both women and husbands as well as health-facility-related factors, such as quality of care, were determinants of choice of place of delivery [25]. However, earlier studies in Sub-Saharan Africa have mainly focused on socioeconomic and demographic factors in relation to institutional delivery, thus more studies are needed to investigate healthcare-related factors for institutional delivery. Further, evidence-based knowledge regarding potential determinants of delivery healthcare utilization in Zambia is lacking. A representative population-based study, reflecting both rural and urban areas and focusing on sociodemographic and healthcare-related determinants, would help policymakers design a specific intervention approach in this regard. Therefore, the present study aims to address this knowledge gap regarding the situation in Zambia by identifying sociodemographic and healthcare-related determinants associated with institutional delivery assisted by skilled birth attendants.

Methods

Study setting

Zambia is a landlocked tropical country in Southern-Central Africa. The ten provinces of Zambia are divided into 117 districts. The vast majority of the population are Christian (96%), followed by other religions (3%) [26,27]. The per capita income of Zambia was 1,307 U.S. dollars in 2019, and the country achieved lower-middle income country status in 2011. The annual gross domestic product growth rate was on average 6.8% between 2000 and 2014, but economic growth declined significantly, from 4% in 2018 to 1.4% in 2019 [28,29]. In Zambia, the Ministry of Health and the Ministry of Community Development, Mother and Child Health are responsible for delivery of healthcare services. The healthcare system is divided into three main levels: the primary level – consisting of healthcare centers and healthcare posts; secondary level – comprising provincial/general hospitals and district hospitals; and tertiary level – comprising tertiary teaching hospitals. Just as in many other countries, Zambia has recognized the importance of equal distribution of healthcare services and has developed public policies aimed at reducing poverty and fostering development. There is a recurrent chronic shortage of healthcare workers. Moreover, they are unequally distributed, with more healthcare workers living and working in urban areas than in rural areas.

Data source

The present study used secondary, cross-sectional data extracted from the 2018 Zambia Demographic and Health Survey (ZDHS) [3], which was implemented by the Zambia Statistics Agency (ZamStats) in collaboration with the Ministry of Health. The survey is nationally representative and was conducted from 18 July 2018 to 24 January 2019 under the auspices of the United States Agency for International Development together with the technical assistance of ICF International, USA. Four types of questionnaires were used in the 2018 ZDHS – the Household Questionnaire, the Woman's Questionnaire, the Man's Questionnaire, and the Biomarker Questionnaire [3]. The women's questionnaires were used to

collect information from all eligible ever-married women 15-49 years of age. Trained field workers collected the information through interviews.

Women were asked questions on the following topics: socioeconomic and demographic factors (e.g., age, education, occupation, place of residence, religion), healthcare-related matters such as breastfeeding, maternal and childcare (antenatal, delivery and postnatal), reproductive history, family planning methods, immunizations and illnesses, fertility preferences, and awareness of AIDS, other sexual transmitted infections, domestic violence, and women's empowerment [3].

Study design and sample

A community-based cross-sectional study was conducted to assess determinants of the preference for institutional delivery and was based on the women's entire birth file in the 2018 ZDHS data.

The 2018 ZDHS employed a two-stage stratified sampling method covering the demographics of women across the country. In the first stage, the survey used sample clusters from the list of enumeration areas. The clusters were selected based on their population size within each sampling stratum. A total of 545 clusters were selected in the survey. Systematic sampling was used in the second stage to obtain households from each enumeration area. An average of 133 households were found in each cluster. Of the 133, a fixed number of 25 households were selected from each cluster using a systematic selection process; thus, the 2018 ZDHS covered 13,625 households in total. The sample size is representative at the national, urban, rural and provincial level.

Of the initially selected 13,625 households, 12,831 households were successfully interviewed. From the 12,831 households, a total of 14,189 eligible women were identified for an individual interview. Finally, out of the 14,189 women, 13,683 ever-married women 15-49 years of age were interviewed, yielding a response rate of 96%. A similar response rate was observed in rural and urban areas. The women who were interviewed had experienced 38,446 births in total. For the present study, the last birth within the past five years was considered, resulting in 9841 deliveries within this period being included in the analyses.

Variable measurement

Outcome variable

The outcome variable of institutional delivery was dichotomized as yes or no. If women gave birth in any healthcare facility (i.e., deliveries occurring at a government hospital, private hospital and/or any healthcare and family welfare center) and the birth was assisted by skilled attendants, this was categorized as an institutional delivery, otherwise births were categorized as non-institutional deliveries (i.e., deliveries occurring at respondents' home or in other non-professional facilities).

Explanatory variables

The following explanatory variables were selected based on previous studies [19–21,30,31] and the availability of relevant data. The categorization of each variable was made based on previous evidence and distribution of sample size in each category. Sociodemographic variables were categorized as follows: *age* into four groups in years (15-24, 25-30, 31-39, 40-49); *place of residence* (urban, rural); *women's education* (no education, primary, secondary/higher); *religion* (catholic, protestant, other); *wealth index* (poor, middle, high); *husbands' education* (no education, primary, secondary/higher); *women's current working status* (yes, no); *number of children* (1, 2, 3 or more). Healthcare-related variables were coded as number of *antenatal care visits* (ANC) (1-3, 4, 5-12); *healthcare facility* (yes, no); measured *blood pressure* (yes, no); given *blood sample* (yes, no); *anemia* (yes, no); *decision-maker regarding contraception use* (women's decision, husbands' decision, joint decision).

Statistical analyses

Because the DHS data were not randomly collected, the dataset was weighted using the sample weight variable provided in the dataset to normalize the data at the national level and to minimize the standard errors. First, a descriptive analysis was used to present the basic characteristics of the sample. Prior to performing chi-squared tests, univariate and multivariate logistic regressions, complex survey modules for the analyses were used to adjust for the cluster sampling technique of the survey by accounting for primary sampling units, sample strata and sample weight. Pearson's chi-squared test was used to check for determinants associated with the choice of institutional delivery. Variables that were found to be significantly associated with the choice of institutional delivery using chi-squared tests were entered into regression models. Both univariate and multivariate logistic regression analyses were conducted to identify the association between explanatory variables and institutional delivery.

Four models were considered in the regression analysis containing sociodemographic and healthcare-related variables. Model 1 contained a univariate analysis between the selected variables and utilization of institutional delivery. Sociodemographic variables (women's age, place of residence, women's education, wealth index, husbands' education, number of children) were included in Model 2, and healthcare-related variables (ANC, healthcare facility, blood pressure, blood sample and contraception use) were added in Model 3. Finally, Model 4 consists of both sociodemographic and healthcare-related variables. Odds ratios (ORs), with their corresponding 95% confidence intervals (CIs), were applied for all models. The level of significance for all analyses was set at $p \leq 0.05$.

In order to check collinearity between explanatory variables, variance inflation factors (VIF) were estimated. A VIF value greater than 10 was assumed to indicate high collinearity. A measure of the model goodness fit test was also checked using the Nagelkerke Pseudo R^2 . Data analyses were performed using IBM SPSS Statistics for Windows, Version 27 (SPSS Inc. Chicago, IL, USA).

Ethics approval and consent to participants

The present analyses were performed using publicly available data from the demographic health surveys, for which all participants had given their informed consent. In order to conduct the present study, an ethical approval was obtained for using the data from ICF International Rockville, Maryland, USA in October 2020.

Results

Among the 9,841 women, 84.9% had an institutional delivery attended by skilled healthcare professionals. Approximately three-fourths of the women were between 15 and 34 years of age, and more than 60% were of rural origin. The literacy rate was higher among husbands (93.3%) than among the women (89.9%). Regarding wealth index, 47.1% of the women were classified as economically poor, and 18.5% and 34.4% of the women as middle and rich, respectively. More than 60% of women had received 4-12 ANC visits, whereas 35.2% had received 1-3 visits only during pregnancy. Most of the women were Protestant (82.4%), not currently working (52.8%), had two children (44.7%), had access to a healthcare facility (73.3%), had measured blood pressure (95.2%), had given blood samples for different tests (96.0%) and had tested for anemia (28.2%) during pregnancy. (Table 1). The number of deliveries at home and at an institution by place of residence – urban and rural – are presented in Figure 1.

Table 1**Background characteristics of the study population (n= 9841).**

Variable	Category	Frequency	Percentage
Women's age (years)			
	15-24	3405	34.6
	25-34	4224	42.9
	35-39	1421	14.4
	40-49	791	8.0
Place of residence			
	Urban	3489	35.5
	Rural	6352	64.5
Women's education			
	No education	996	10.1
	Primary	5008	50.9
	Secondary/higher	3837	39.0
Religion			
	Catholic	1569	15.9
	Protestant	8111	82.4
	Other	161	1.6
Wealth index			
	Poor	4634	47.1
	Middle	1823	18.5
	Rich	3385	34.4
Husband's education			
	No education	491	6.7
	Primary	2909	39.4
	Secondary/higher	3978	53.9
Working status¹			
	No	5193	52.8

	Yes	4648	47.2
Number of children²			
	1 child	3672	38.9
	2 children	4209	44.7
	3 or more	1545	16.4
ANC³			
	1-3 visits	2531	35.2
	4 visits	2358	32.8
	5-12 visits	2293	31.9
Healthcare facility⁴			
	No	2632	26.7
	Yes	7209	73.3
Blood pressure⁵			
	No	348	4.8
	Yes	6897	95.2
Blood sample⁶			
	No	290	4.0
	Yes	6955	96.0
Anemia⁷			
	No	6875	71.8
	Yes	2706	28.2
Contraception use⁸			
	Women's decision	609	14.8
	Husband's decision	475	11.5
	Joint decision	3038	73.7
Institutional delivery			
	No	1482	15.1
	Yes	8359	84.9

¹Women's current working status (yes= working; no= not working); ²Number of children ever born of all women; ³ANC= Number of antenatal care visits during pregnancy. ⁴Healthcare facilities during last 12 months; ⁵Blood pressure was tested during pregnancy; ⁶Blood sample was given for different tests, i.e. anemia, HIV, during pregnancy; ⁷Anaemia during pregnancy; ⁸Decision maker for contraception use.

As shown in Table 2, the prevalence of women who lived in rural area was 60.6% (95% CI: 57.2–64.5). Higher prevalence of age group 25-34 and women's primary education 42.5% (95% CI: 40.9–44.1) and 49.1% (95% CI: 47.1–51.1), respectively, was observed. Women with a poor wealth index 43.1% (95% CI: 40.1–46.1) and women who had two children 44.0% (95% CI: 42.4–45.6) were higher in prevalence than women with a middle and rich wealth index and children three or more, respectively. A similar prevalence was found for receiving ANC visits in all categories. In addition, a higher prevalence of women who had access to a healthcare facility, had measured blood pressure, and had given blood samples during pregnancy was observed, compared to women who had not. The value of VIF between the independent variables was less than 1.5, indicating that no specific variables were highly collinear in the prediction models [32].

Table 2

Relative percentage of study population across the explanatory variables using institutional delivery ($n= 9841$).

	Institutional delivery		
Variable	%	(95% CI)	<i>p</i> -value
Women's age (years)			
15-24	36.0	(34.5–37.6)	< 0.001
25-34	42.5	(40.9–44.1)	
35-39	14.1	(12.7–15.6)	
40-49	7.4	(6.6–8.2)	
Place of residence			
Urban	39.1	(35.5–42.8)	< 0.001
Rural	60.9	(57.2–64.5)	
Women's education			
No education	8.2	(7.2–9.2)	< 0.001
Primary	49.1	(47.1–51.1)	
Secondary/higher	42.8	(40.8–44.8)	
Religion			
Catholic	16.1	(14.4–17.9)	0.87
Protestant	82.3	(80.3–48.1)	
Other	1.7	(1.1–2.4)	
Wealth index			
Poor	43.1	(40.1–46.1)	< 0.001
Middle	18.8	(17.2–20.5)	
Rich	38.1	(35.3–41.0)	
Husband's education			
No education	5.5	(4.7–6.5)	< 0.001
Primary	36.6	(34.7–38.6)	
Secondary/higher	57.9	(55.8–60.0)	
Working status ¹			

No	52.6	(50.6–54.7)	0.71
Yes	47.4	(45.3–49.4)	
Number of children ²			
1 child	40.9	(39.2–42.7)	< 0.001
2 children	44.0	(42.4–45.6)	
3 or more	15.1	(13.6–16.8)	
ANC ³			
1-3 visits	33.3	(31.7–35.1)	< 0.001
4 visits	33.8	(32.3–35.2)	
5-12 visits	32.9	(31.3–34.6)	
Healthcare facility ⁴			
No	25.8	(23.8–27.9)	0.002
Yes	74.2	(72.1–76.2)	
Blood pressure			
No	3.8	(3.2–4.6)	< 0.001
Yes	96.2	(95.4–96.8)	
Blood sample			
No	3.1	(2.5–3.8)	< 0.001
Yes	96.9	(96.9–97.5)	
Anaemia ⁵			
No	71.9	(70.3–73.5)	0.58
Yes	28.1	(26.5–29.7)	
Contraception use ⁶			
Women’s decision	14.6	(12.8–16.6)	0.05
Husband’s decision	11.0	(9.5–12.8)	
Joint decision	74.4	(72.0–76.7)	
¹ Women’s current working status (yes= working; no= not working); ² Number of children ever born of all women; ³ ANC= Number of antenatal care visits during pregnancy; ⁴ Healthcare facilities during last			

The results of the univariate and multivariate regression analyses are summarized in Table 3. In the present study, six sociodemographic and five healthcare-related variables were set to be assessed, out of which all of the variables, except two categories – 4 ANC visits and husbands' decision on contraception use – were found to be significant predictors of institutional delivery using univariate analysis (Model 1). Model 2 represents the adjusted ORs of six sociodemographic variables, of which four were found to be significant: women with a primary education (OR 1.43; 95% CI: 1.12–1.84) or secondary/higher education (OR 2.22; 95% CI: 1.50–3.28); husband with a primary education (OR 1.54; 95% CI: 1.28–1.86) or secondary/higher education (OR 1.86; 95% CI: 1.27–2.73); women who had two children (OR 0.73; 95% CI: 0.57–0.93) or three or more (OR 0.51; 95% CI: 0.38–0.68); women with middle economic status (OR 1.58; 95% CI: 1.06–2.33) or rich economic status (OR 1.96; 95% CI: 1.28–2.30). Model 3 indicates the adjusted ORs of five healthcare-related variables, out of which 5-12 ANC visits (OR 1.71; 95% CI: 1.24–2.36), blood pressure (OR 2.26; 95% CI: 1.44–3.54) and blood sample during pregnancy (OR 2.60; 95% CI: 1.38–4.89) were found to be significant.

Finally, both sociodemographic and healthcare-related variables were set to be assessed in Model 4. The results showed that women with a secondary/higher education (OR 1.76; 95% CI: 1.04–2.99) and belonging to the higher economic stratum (OR 2.31; 95% CI: 1.27–4.22) were more likely to have delivered at an institution with skilled attendants compared to those who had no education and belonged to the poor economic stratum. Similarly, women whose husband had a secondary or higher education had 83% higher utilization of institutional delivery compared to women whose husband had no education (OR 1.83; 95% CI: 1.09–3.05). Women from rural areas were less likely to have delivered at an institution with skilled attendants in comparison to those living in urban areas (OR 0.55; 95% CI: 0.30–0.98). Women who received 5-12 ANC visits were 2.33 times more likely to have delivered at an institution with skilled attendants (OR 2.33; 95% CI: 1.66–3.26). Women who had measured blood pressure (OR 1.65; 95% CI: 1.02–2.66) and given blood samples (OR 2.01; 95% CI: 1.04–3.88) during pregnancy had an increased likelihood of delivering at institution with skilled attendants compared to those had not measured blood pressure and given blood samples (Table 3).

Table 3

Logistic regression showing the crude and adjusted odds ratio (OR) with 95% confidence interval (CI), utilization of institutional delivery services among women in Zambia.

Variables	Model 1 ^a		Model 2 ^b		Model 3 ^c		Model 4 ^d	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<i>Sociodemographic variables</i>								
Women's age (years)								
15-24	1		1				1	
25-34	0.70	0.61-0.80	0.91	0.65-1.27			1.11	0.66-1.87
35-39	0.64	0.54-0.76	0.89	0.68-1.18			1.05	0.69-1.62
40-49	0.48	0.38-0.57	0.72	0.53-0.97			0.79	0.49-1.28
Place of residence								
Urban	1		1				1	
Rural	0.28	0.24-0.32	0.69	0.43-1.10			0.55	0.30-0.98
Women's education								
No education	1		1				1	
Primary	2.10	1.80-2.44	1.43	1.12-1.84			1.38	0.97-1.99
Secondary/higher	6.32	5.27-7.60	2.22	1.50-3.28			1.76	1.04-2.99
Wealth index								
Poor	1		1				1	
Middle	2.56	1.92-3.41	1.58	1.06-2.33			1.75	0.96-3.19
Rich	4.60	3.38-6.26	1.96	1.28-2.30			2.31	1.27-4.22
Husband's education								
No education	1		1				1	
Primary	2.66	2.17-3.28	1.54	1.28-1.86			1.29	0.93-1.78

Secondary/higher	4.05	2.77-5.91	1.86	1.27-2.73		1.83	1.09-3.05
Number of children ¹							
1 child	1		1			1	
2 children	0.71	0.58-0.87	0.73	0.57-0.93		0.83	0.56-1.22
3 or more	0.45	0.36-0.56	0.51	0.38-0.68		0.78	0.50-1.19
Healthcare-related variables							
ANC ²							
1-3 visits	1			1		1	
4 visits	1.02	0.82-1.27		1.06	0.76-1.47	1.20	0.85-1.71
5-12 visits	1.92	1.53-2.41		1.71	1.24-2.36	2.33	1.66-3.26
Healthcare facility ³							
No	1			1		1	
Yes	1.35	1.12-1.64		1.08	0.78-1.49	1.21	0.84-1.76
Blood pressure ⁴							
No	1			1		1	
Yes	3.37	2.24-5.08		2.26	1.44-3.54	1.65	1.02-2.66
Blood sample ⁵							
No	1			1		1	
Yes	3.71	2.17-6.32		2.60	1.38-4.89	2.01	1.04-3.88
Contraception use ⁶							
Women's decision	1			1		1	
Husbands' decision	1.20	0.90-1.61		1.08	0.81-1.55	1.11	0.83-1.67
Joint decision	1.44	1.04-1.99		1.12	0.75-1.68	1.23	0.75-1.76

¹Number of children ever born of all women; ²ANC= Number of antenatal care visits during pregnancy; ³Healthcare facilities during last 12 months; ⁴Blood pressure during pregnancy; ⁵Blood sample was given for different tests, i.e. anemia, HIV, during pregnancy; ⁶Decision maker for contraception use; 1= Reference group.

^aModel 1: Univariate analysis was performed; ^bModel 2: age, place of residence, education, wealth index, husband's education, number of children; ^cModel 3: ANC, healthcare facility, health insurance and contraception use; ^dModel 4: Model 2 + Model 3.

Discussion

The present study revealed several findings concerning the relationship between sociodemographic factors, healthcare-related factors and institutional delivery assisted by skilled birth attendants. Women's and their husbands' secondary/higher level of education and women's higher wealth index were positively associated with institutional delivery. Conversely, living in rural areas was negatively associated with institutional delivery. The study also revealed that women who attended at least five ANC visits were more likely to deliver at a healthcare facility. Similarly, women who had measured their blood pressure, e.g. for hypertension, and given blood samples for different tests, e.g. for anemia, during pregnancy were more likely to have delivered their child with the assistance of skilled birth attendants.

Education level was found to be an important determinant of institutional delivery. Women with a secondary/higher education were more likely to have delivered at a healthcare facility compared to women with no education or a primary education. Similarly, having a husband with a secondary/higher education also played an important role in determining place of delivery. This finding is supported by previous studies showing that the education level of the woman and husband had a significant effect on the choice of place of delivery [19,20,22,25,33]. The reason for this could be that education level improves access to information and health education, knowledge of service and control over resources, in this way changing people's attitudes toward a preference for delivery at a healthcare facility [7,30,34].

Consistent with previous studies [19,24,35], the present study found that women with a higher wealth index were more likely to have delivered with the assistance of skilled birth attendants than were lower privileged women. This may be due to the costs, in that having a higher wealth index may help women cover all expenses required for delivery at an institution with skilled attendants. Moreover, better economic status may increase health-seeking behavior and autonomy of healthcare decision-making, which, in turn, may have a positive influence on overall healthcare utilization. This finding, therefore, reinforces the notion that economic status affects the choice to deliver at a healthcare facility.

The present study revealed that women living in rural areas were less likely to give birth in a healthcare facility compared to women living in urban areas. The finding is similar to results from previous studies [22,31,36] and other studies conducted in Sub-Saharan Africa [7,37], including a systematic review and meta-analysis [38]. One possible explanation is that women living in rural areas have less access to antenatal obstetric and postnatal care services and poor access to transportation, whereas women living

in urban areas have greater access to maternal healthcare services near their home as well as to transportation [39]. Consequently, women in rural areas do not utilize family planning, antenatal and other services as much as women in urban areas do. Moreover, women who live in urban areas are closer to information about the health benefits of institutional delivery; conversely, rural women are sometimes affected by cultural taboos concerning the choice of place of delivery. Because inequality regarding choice of place of delivery exists between rural and urban areas, further study is warranted by stratifying the analysis between urban and rural women in this regard.

The odds of institutional delivery service utilization were higher among women who had visited ANC five or more times than among women who had fewer visits. This finding is consistent with previous studies conducted in other African countries [20,30,36], including a systematic and meta-analysis [40]. This may occur because having more ANC visits creates a platform for emphasizing the importance of institutional delivery and increases women's awareness of the risks of pregnancy and childbirth. Moreover, women attending more ANC visits are more likely to be informed about complications associated with home delivery, which motivates them to deliver at an institution with skilled attendants. The present findings suggest that the WHO's new guidelines, which recommend at least 8 ANC visits for every pregnant women [10], will contribute to increasing the rate of healthcare facility delivery.

Finally, a significant association was observed between taking blood pressure, giving blood samples and institutional delivery. Women whose blood pressure was measured and who gave blood samples for different tests, such as anemia during pregnancy, had an increased likelihood of delivering at an institution with skilled attendants in comparison with women who did not measure their blood pressure or give blood samples. To the best of the authors' knowledge, no previous study has investigated the association between measuring blood pressure, giving blood samples and institutional delivery. However, an earlier study looking at high blood pressure as a complication was found to be significantly associated with healthcare facility delivery [31]. One of the possible explanations for these findings is that women who measured their blood pressure and gave blood samples for different tests may have experienced pregnancy-related complications, which, in turn, made them vigilant and encouraged them to deliver their baby at an institution with skilled attendants. Further research is recommended in this regard. Nevertheless, the present findings indicate that these two factors should be considered when designing interventions intended to increase institutional delivery and reduce maternal and neonatal mortality.

Strengths and limitations

The present study was based on a large sample. It had a high response rate (96%) and a wide range of variables, from sociodemographic and healthcare perspectives. The data were analyzed by considering cluster effects that represent the whole country, both urban and rural areas, to ensure the precision of the estimates. This increases the external validity of the findings. However, one limitation of the study is the secondary nature of the included data and that the study was cross-sectional in design, which means

that the associations do not indicate causation. Moreover, there was a possibility of recall bias, in that some of the information collected was based on events from the past.

Conclusions

Based on analyses of the 2018 ZDHS, the present study showed that sociodemographic factors (e.g., women's and husbands' secondary/higher education, higher wealth index, place of residence) as well as healthcare-related factors (e.g., 5-12 ANC visits, measuring blood pressure and testing blood samples during pregnancy) were significantly associated with institutional delivery. Therefore, policymakers and public health planners should design an effective intervention program to scale up maternal health programs, including institutional delivery, targeting the disadvantaged (poor, rural residents, and low or no education), and encouraging increased use of ANC services. In addition, implementing an initiative to measure blood pressure and take blood samples for different tests, such as anemia, during pregnancy would be useful for improving institutional delivery and reducing maternal and newborn mortality in the study areas.

Abbreviations

ZDHS: Zambia Demographic and Health Survey; ANC: Antenatal Care; MMR: Maternal Mortality Ratio; OR: Odds Ratio; CI: Confidence Interval, SDG: Sustainable Development Goal, VIF: Variance Inflation Factors

Declarations

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Authors' contributions

MR co-developed the study design, and performed data processing and analyses and drafted the manuscript. ASH reviewed the initial drafts of the manuscript. MRKC reviewed the initial drafts of the manuscript. GM co-developed the study design and reviewed the initial drafts of the manuscript. All authors have read and approved the final manuscript.

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Availability of data and materials

The datasets used and analyzed during the present study are available from the corresponding author on reasonable request.

Ethics approval and consent to participants

The present analyses were performed using publicly available data from the demographic health surveys, for which all participants had given their informed consent. In order to conduct the present study, an ethical approval was obtained for using the data from ICF International Rockville, Maryland, USA in October 2020.

Consent for publication

Not applicable.

Competing interest

The authors declare that they have no competing interests.

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Figures

Figure 1

Delivery pattern by place of residence.