BMC Pregnancy and Childbirth

RESEARCH

Open Access

Trends, spatial distribution and determinants of maternal home deliveries in Zambia

Peter Mumba[1*], Thomas O. Miyoba[2], Emmanuel Musonda[1], Mwangala Mulasikwanda[1] and Samson Shumba[2]

Abstract

Background The absence of skilled care during home deliveries represents a critical public health concern, as it has a significant impact on maternal mortality rates. The World Health Organization (WHO) reports that approximately 287,000 women worldwide died in 2020 due to maternal causes, equating to more than 800 maternal deaths each day. The study aimed at analyzing trends, spatial distribution and determinants of maternal home deliveries in Zambia between 1992 and 2018.

Method The study used data from six rounds of the Zambia Demographic and Health Survey (ZDHS). A weighted sample of 6,230 women in 1992, 7,136 in 1996, 6,594 in 2001/02, 13,211 in 2013/14 and 9,731 in 2018 who delivered at home or health facility five years preceding the survey. Univariate and bivariate analyses were employed to examine trends in maternal home deliveries based on selected individual and community-level factors from 1992 to 2018.Spatial analysis was used to highlight regional disparities in maternal home births. The multilevel logistic regression model was used to analyze the potential predictors of maternal home deliveries using STATA version 15.

Results The prevalence of maternal home deliveries in Zambia decreased from 49% in 1992 to 15% in 2018. Spatial analysis showed regional variations, with the Northern province consistently having the highest prevalence of home births. Multilevel logistic regression highlighted the influence of individual and selected community factors of home deliveries. The results show that women with primary, secondary, and higher education had significantly reduced odds of delivering at home compared to women with no education from 1992 to 2018. In 2018, women with primary, secondary, and higher education had a 35%, 62%, and 96% reduction in the odds of delivering at home compared to women with no education [aOR = 0.65, 95% CI: 0.49–0.88; aOR = 0.38, 95% CI: 0.26–0.56; aOR = 0.04, 95% CI: 0.01–0.74]. Women in middle and rich quintile, attending at least one antenatal care reduced the likelihood of delivering at home. In terms of selected community factors, women from rural residence had increased odds of home delivery across all the survey years.

Conclusion Despite a decline in maternal home deliveries, rural women continue to choose this option due to factors such as lack of education, higher parity, limited media exposure, and inadequate antenatal care. Regional and community variations also influence these choices. These findings can guide health policy by targeting interventions in rural areas, improving education, and enhancing access to antenatal care to reduce home deliveries and improve maternal health outcomes.

Keywords Maternal home delivery, Spatial distributions, High parity, Contextual factors, Trends

*Correspondence:
Peter Mumba
petmumba50@gmail.com

[1]Department of Population Studies, School of Humanities and Social Sciences, University of Zambia, Lusaka, Zambia
[2]Department of Epidemiology & Biostatistics, School of Public Health, University of Zambia, Lusaka, Zambia

Background

Home delivery without skilled care at birth significantly contributes to the severity of maternal death, making it a critical public health concern. In the absence of skilled health professionals, the risks associated with childbirth increase substantially, leading to adverse outcomes and loss of maternal lives [1, 2]. Ensuring safe deliveries and promoting maternal health are critical priorities for global healthcare systems [1]. The World Health Organisation (WHO) estimated that approximately 287,000 women worldwide lost their lives due to maternal causes in 2020. This distressing statistic translates to over 800 maternal deaths occurring every day, equivalent to a tragic loss every two minutes [3].

Despite notable progress in recent years, a significant number of women in sub-Saharan African (SSA) countries continue to give birth at home [4]. Research conducted in selected SSA countries revealed that 22% of births occur at home, often without the presence of skilled birth attendants or access to appropriate medical interventions [5]. Similarly, a study conducted in Eastern Africa reported a 24% prevalence of home deliveries [6]. This practice poses substantial risks to maternal and neonatal health, contributing to persistently high maternal and infant mortality rates in the region. According to the 2019 Mini Ethiopian Demographic and Health Survey report (EDHS), the prevalence of home delivery in Ethiopia was 51% [7].

The motivation behind home deliveries may vary, but the absence of skilled birth attendants and essential obstetric care significantly compromises the well-being of mothers and infants. Complications arising during childbirth, such as postpartum hemorrhage, sepsis, or obstructed labor, require immediate medical attention to prevent adverse outcomes [1]. In the absence of skilled assistance, delays in recognizing and managing obstetric emergencies contribute to increased morbidity and mortality rates. Studies conducted in Africa have demonstrated that women who did not have at least one Antenatal Care (ANC) visit were more likely to deliver at home [8–11]. Unplanned pregnancies, financial constraints, lack of health insurance coverage and non-accessibility of health care facilities have emerged as substantial barriers to accessing delivery care. These factors impede an individual's ability to seek essential maternal healthcare services, potentially exacerbating maternal health disparities and hindering positive pregnancy outcomes [12].

In Zambia, approximately 15% of births occurred at home in 2018 [13]. However, this indicates that a substantial proportion of women in Zambia still deliver their babies at home, hindering the progress made towards achieving universal health coverage [14]. The Copperbelt and Muchinga provinces have the lowest proportions of home births, while the Northern Province reports 28% of births occurring at home. A study conducted in rural Zambia found that older women, never married women, and those who had not attended at least one ANC visit were significant predictors of home deliveries. Although there have been studies on predictors of home deliveries [14–17], no research has used nationally representative data to examine trends, spatial distribution and predictors of home deliveries at national level in Zambia. Therefore, the study aims to provide an in-depth analysis on trends, spatial distribution and determinants of home deliveries in Zambia between 1992 and 2018.

Methods

Source of data

The study used six rounds of the Zambia Demographic and Health Surveys (ZDHS) conducted in 1992, 1996, 2001-2, 2007, 2013-14 and 2018 in Zambia. The sampling frame utilized for the 1992 to 2018 ZDHS were based on the Census of Population and Housing (CPH) conducted in 1990, 2000 and 2010 by Zambia Statistical Agency (Zamstats). The surveys employed a stratified two-stage sample design. In the first stage, sample points (clusters) were selected, which consisted of enumeration areas (EAs). The selection of EAs within each sampling was conducted with a probability proportional to their size. This ensured that larger EAs had a higher chance of being included in the sample. The second stage involved systematic sampling of households. A household listing operation was carried out in all selected clusters. On average, each cluster contained 133 households. From each cluster, a fixed number of 25 households were systematically selected using an equal probability selection process. This process resulted in a total sample size of 50,125 households from 1992 to 2018. The results obtained from this sample are representative at various levels, including the national level, urban and rural areas and provincial levels [14]. Only women with the recent births were added for the analysis. The sampling methodology was employed to ensure the collection of data that accurately represents the Zambian population and allows for the analysis and reporting of various demographic and health indicators.

Dependent and individual level independent variables

In this study, the outcome variable of interest was the occurrence of home delivery as shown in Table 1. The response variable was derived from a question posed to women who had given birth within the five years preceding the survey. The response was categorized into two groups: home delivery and controlled for institutional delivery. Home delivery encompassed responses indicating that the birth took place at the respondent's own home or at another person's home, as indicated in the survey question. On the other hand, institutional

Table 1 Outcome and selected explanatory factors for home deliveries

Outcome	Label definition	Measurement
Home deliveries	0 = Institutional delivery, 1 = Home delivery	Nominal
Individual level factors	**Label Definition**	
Age	15–24, 25–34, 34–49	Ordinal
Marital status	0.Single, 1. Married and 3. Widowed/Divorced/Seperated	Nominal
Education status	0 = No education, 1 = Primary, 2 = Secondary, 3 = Higher	Ordinal
Wealth index	1 = Poor, 2 = Middle, 3 Rich	Ordinal
Access to media	0 = No, 1 = Yes	Nominal
Religious denomination	1 = Catholic, 2 Protestants,3 Muslims, 4 Other	Nominal
Parity	1= 1 Child, 2 = 2–4 children, 3 = 5 or More children	Ordinal
ANC visit	0 = No, 1 = Yes	Nominal
Employment status	0 = Not working, 1 = Working	Nominal
Selected community level factors	**Label Definition**	
Place of residence	1 = Urban, 2 = Rural	Nominal
Region	1 = Central, 2 = Copperbelt, 3 = Eastern, 4 = Luapuala,5 = Lusaka,6 = Muchinga,7 = Northern,8 = Northwestern,9 = Southern,10 = Muchinga	Nominal
Community education	1 = Low, 2 = Middle, 3 = High	Ordinal
Community access to media	1 = Low, 2 = Middle, 3 = High	Ordinal
Community employment	1 = Low, 2 = Middle, 3 = High	Ordinal

delivery included births that took place at health facilities. By dichotomizing the responses into home delivery and institutional delivery, the study aimed at analyzing the trends of home delivery since 1992, map their distribution and examine the predictors. This information can provide insights into the utilization of institutional delivery services and potentially inform interventions to improve maternal and newborn health outcomes. Independent variable selected in the study are based on evidence from other studies conducted on the predictors of home deliveries [15, 18–20].

Individual level factors

The wealth index was categorized into three groups by combining the poorest and poor, and the rich and richest, like in previous studies in Ethiopia and Nigeria [21, 22]. Access to media was defined as exposure in the past week to TV, newspapers or magazines, and radio. Parity was measured only among women who had given birth at least once, excluding those with zero parity, as the study focused on women who had given birth.

Selected community level factors

To create community level variables, individual level variables such as education, media access and employment status were aggregated into clusters. Percentiles were used to determine whether they fell in the low, middle or high category. Place of residence and region took their original categorization as shown in Table 1.

Statistical analysis

The analysis was done using STATA version 15, Microsoft Excel and Quantum Geographic Information System (GIS) version 2.18.1. Survey weights were applied to ensure that the results accurately represented the population. Various types of statistical analysis were conducted, including univariate, trend, spatial, and multilevel logistic regression. In the univariate analysis, frequency and percent distribution were utilized to present the background characteristics of women from 1992 to 2018. Trends in maternal home deliveries were examined based on selected individual and community-level factors. The overall trend graph of maternal home deliveries from 1992 to 2018 was generated using Microsoft Excel. To explore the clustering and spatial distribution of maternal home births, GIS was employed. This GIS software allowed the creation of choropleth maps to visually represent the distribution patterns. The spatial analysis focused on individual provinces, using geo-coordinate data from the ZDHS to link each home birth to its respective province of residence. The unit of spatial analysis in this study was a cluster of sample households as designated by the ZDHS, representing groups of households within specific geographic areas. To examine the determinants of home deliveries, a two-level multivariate logistic regression was utilized. This approach accounted for the hierarchical structure of the data, with women nested within households and households nested within clusters. The measure of association was the odds ratios, with statistical significance set at a threshold of $p < 0.05$. Multilevel logistic regression recognized that women with similar characteristics in different communities may have different outcomes. The multilevel regression model follows this equation:

$$\begin{aligned}\text{logit}(=1)) = \alpha_0 + \alpha_{0j} + \alpha_1 x_{1ij} + \ldots + \alpha_k x_{kij} \\ + \beta_1 z_{1j} + \ldots + \beta_m z_{mj}\end{aligned}$$

The assumption is made that the random effects are independent of the model covariates (X, Z) [23]. The Akaike information criterion (AIC) and Bayesian information criterion (BIC) were used for postestimation to select the best model, with the model having the lowest values chosen. The Inter cluster correlation (ICC) was used to assess the variability attributed to clusters. All methods were carried out in accordance with relevant guidelines.

Using the Akaike Information Criterion (AIC) to assess model fit across survey years, Model 2 consistently showed lower AIC values than Model 1, suggesting a better fit overall. This makes Model 2 the preferred choice for analyzing predictors over time as indicated in Table 2.

Ethics

This study was conducted by utilizing available data from the ZDHS upon request from DHS measure evaluation, which can be easily accessed at (https://dhsprogram.com/). The dataset used in this research contained no personally identifiable information, ensuring complete anonymity of the participants. It is worth noting that the original ZDHS Biomarker and survey protocols underwent a rigorous approval process, receiving authorization from both the Tropical Disease and Research Center as well as the Research Ethics Review Board of the Centers for Disease Control and Prevention.

Results

Demographic and socioeconomic characteristics of women

Table 3 presents the background characteristics of women who gave birth either at home or in a health facility between the years 1992 and 2018. A total weighted sample of 6,230 women in 1992, 7,136 in 1996, 6,594 in 2001/02, 13,211 in 2013/14, and 9,731 in 2018. The age distribution shows a slight shift, with the youngest group (15–24 years) decreasing from 37.7% in 1992 to 34.6% in 2018. Single women increased from 5.0% in 1996 to 11.2% in 2018. Education levels improved, with secondary education completion rising from 18.3% in 1992 to 35.2% in 2018 and a corresponding decrease in women with no education. The wealth index remained stable, with 46.0% to 46.8% of women consistently classified as poor. Media access improved, reaching 60.7% in 2018, up from 55.5% in 2007. Female-headed households grew from 10.0% to 20.1%, and Protestant affiliation increased from 69.1% in 1992 to 82.3% in 2018. In terms of parity, women with 2–4 children remained the majority across survey years, while antenatal care (ANC) attendance showed strong gains, with nearly universal coverage (98.9%) by 2018. Employment among women gradually declined from 59.7% in 2001/2 to 47.3% in 2018. Urban residency rose from 29.3% in 2007 to 35.7% by 2018. Consistent regional representation was noted, with Copperbelt, Lusaka, and Eastern provinces contributing the highest proportions of women, while Western and North-Western provinces had lower numbers. Community-level factor salso showed shifts, with fewer communities in the high education category by 2018 and high-employment communities increasing to 72.8% from 60.3% in 1992.

Overall trends of maternal home deliveries in Zambia

The results presented in Fig. 1 provides evidence of a decreasing prevalence of maternal home deliveries in Zambia over the period of 1992 to 2018. The findings indicate that maternal home deliveries rose from 49% in 1992 to 56% in 2001-02, then declined steadily to 15% by 2018,

Table 4 presents the prevalence of maternal home deliveries across all six ZDHS rounds. Home deliveries were most common among older women (35–49 years), those residing in rural areas, from the poorest households, with no formal education, and with five or more children. Additionally, women who lacked ANC visits, media exposure, or employment had a higher prevalence of home deliveries.

Home deliveries were more common among married women, those with lower education levels, and those from rural areas. The highest prevalence was observed in 2001/02, particularly among women with no education (82.4%) and those from the poorest households (70.8%).

ANC attendance strongly influenced home delivery rates with women who did not attend ANC had the highest prevalence in all years (97.5% in 1992, 92.5% in 2001/02). Home deliveries among rural women declined from 73.6% in 1992 to 20.1% in 2018, while urban rates fell from 20.9% to 6.4%.

Spatial distribution

The proportion of home deliveries in Zambia varied across different regions. The highest proportion of home deliveries was observed in the Central province, where 27.5% of deliveries took place at home. This was closely followed by the Western province, where 23.8% of deliveries were at home. In Northern and Muchinga regions, 25.9% and 19.1% of deliveries, respectively, occurred at home. Other regions with notable home delivery rates included Lusaka and Luapula, where 10.7% and 11.9% of deliveries, respectively, took place at home as shown

Table 2 Model diagnostic

	1992	1996	2001/2	2007	2013/4	2018
Model 1 AIC	5883.00	6948.14	4318.15	4304.10	8544.65	4740.44
Model 2 AIC	5666.28	67,340	4136.25	4205.02	8369.67	4665.66

Table 3 Percent distribution of women aged 15–49 by background characteristics with recent births, 1992–2018 DHS, Zambia

Background Characteristics	1992 DHS	1996 DHS	2001/2 DHS	2007 DHS	2013/14 DHS	2018 DHS
	N = 6230	*N* = 7136	*N* = 6594	*N* = 6394	*N* = 13,211	*N* = 9731
Age						
15–24	2347(37.65%)	2802(39.26%)	2519(38.16%)	2023(31.63%)	4096(31.01%)	3366(34.59%)
25–34	1592(25.53%)	1744(24.44%)	1748(26.48%)	1814 (28.34%)	3421.(25.90%)	2334(23.99%)
35–49	2295(36.82%)	2590(36.29%)	2334(35.36%)	2558(40.00%)	5693(43.10%)	4032(41.43%)
Marital status						
Single	343(17.04%)	350(5.02%)	389(5.89%)	384 (6.01%)	991(7.50%)	1094(11.24%)
Married	5293(84.90%)	5926(83.06%)	5494(83.22%)	5431(84.95%)	10,870(82.29%)	7582(77.91%)
Widowed/Separated/Divorced	598(9.59%)	850(11.91%)	719(10.89%)	578(9.03%	1348(10.21%)	1856(10.85%)
Education status						
No education	1062(17.04%)	979(13.72%)	971(14.71%)	859(13.43%)	1464(11.09%)	976(10.03%)
Primary	3926(63.00%)	4587(64.30%)	4204(63.68%)	4073(63.70%)	7395(56.01%)	4938(50.74%)
Secondary	1142(18.32%)	1434(20.10%)	1325(20.07%)	1306(20.41%)	3878(29.38%)	3429.3(35.24%)
Higher	103(1.65%)	134(1.88%)	101(1.54%)	157(2.45%)	465(3.32%)	388(3.99%)
Place of residence						
Urban						
Rural						
Wealth status**						
Poor				2943(46.04%)	6195(46.90%)	4558(46.84%)
Middle				1347(21.06%)	2707(20.50%)	1800(18.50%)
Rich				2104(32.90%)	4308(32.61%)	3373(34.66%)
Sex of household head						
Male	5602(89.86%)	5975(83.73%)	5568(84.36%)	5330(83.36%)	10,662(8.71%)	7773(70.88%)
Female	632(10.14%)	1161(16.27%)	1033(15.64%)	1004(16.64%)	2548(1929%)	1959(20.13%)
Access to media **						
No				3522(44.90%)	6033(45.67%)	3821(39.26%)
Yes				3523(55.10%)	7177(54.33%)	5911(60.74%)
Religious denomination						
Catholic	1736(27.87%)	1696(23.87%)	1502(22.78%)	1214(19.02%)	2167(16.44%)	1559(16.02%)
Protestants	4308(69.14%)	5300(74.56%)	4966(75.32%)	5046(79.02%)	10,855(82.34%)	8013(82.34%)
Muslims	20(0.32%)	24(0.34%)	11(0.16%	34(0.53%)	51(0.39%)	48(0.49%)
Other	165(2.6^%)	88(1.23%)	115(1.74%)	89(1.39%)	105(0.80%)	111(1.145%)
Parity						
1 child	876(14.05%)|	955(13.38%)	944(14.30%)	773(12.09%)	1860(14.08%)	1803(18.53%)
2 to 4 children	2823(45.28%)	3494(48.97%)	3291(49.86%)	3237(50.62%)	6468(48.96%)	4893(50.28%)
5 or more children	2535(40.67%)	2687(37.65%)	2366(35.84%)	2389(37.29%)	4883*36.96%)	3036(31.19%)
ANC visit						
No	390(6.41%)	262(3.76%)	179(4.19%)	89(2.18%)	126(1.38%)	77(1.78%)
Yes	5691(93.59%)	6709(96.24%)	4094(95.81%)	3975(97.81%)	9006(98.62%)	7100(98.92%)
Employment status						
Not working	2840(45.56%)	3532(49.54%)	2658(40.29%)	3186(49.89%)	5906(44.86%)	5133(52.75%)
Working	3393(54.44%)	3597(50.45%)	3938(59.71%)	3200(50.11%)	7259(55.14%)	4598(47.25%)
Selected community factors						
Place of residence						
Urban	2906(46.62%)	2845(39.87%)	2043(30.94%)	1871(29.26%)	4554(34.47%)	3475(35.71%)
Rural	3328(53.38%)	4291(60.14%)	4559(69.06%)	4523(70.74%)	8657(65.53%)	6257(5 = 64.29%)
Region						
Central	600(9.62%)	585(8.12%)	501(7.59%)	627(9.81%)	1278(9.68%)	844(8.67%)
Copperbelt	1440(23.10%)	11,339(18.76%)	1054(15.97%)	872(13.64%)	1726(13.06%)	1198(12.32%)
Eastern	653(10.47%)	1095(15.34%)	880(13.33%)|	1011(15.89%)	1701(12.87%)	1290(13.25%)
Luapula	419(6.72%)	671(9.40%)	623(9.43%)	575(9.00%)	1181(8.94%)	945(9.71%)
Lusaka	944(15.13%)	1071(15.02%)	805(12.18%)	734(11.47%)	1953(9.58%)	1523(15.71%)
Muchinga					804(6.09%)	594(6.10%)

Table 3 (continued)

Background Characteristics	1992 DHS	1996 DHS	2001/2 DHS	2007 DHS	2013/14 DHS	2018 DHS
	N = 6230	*N* = 7136	*N* = 6594	*N* = 6394	*N* = 13,211	*N* = 9731
Northern	658(10.56%)	863(12.10%)	1003(15.19%)	1037(16.21%)	1265(9.58)	884(9.08%)
North-western	172(2.76%)	287(4.02%)	355(5.38%)	4001(6.27%)	665(5.03%)	529(5.43%)
Southern	1013(16.25%)	764(10.71%)	755(11.44%)	680(10.64%)	1787(13.53%)	1293(13.28%)
Western	337(5.40%)	460(6.44%)	626(11.41%)	458(7.14%)	849(6.43%)	627(6.44%)
Community education						
Low	209(3.35%)	263(3.68%)	328(4.97%)	413(6.46%)	1698(12.85%)	1748(17.96%)
Medium	2254(36.15)	2584(36.21%)	2151(32.59%)	2233(34.92%)	6469(48.97%)	4776(49.07%)
High	3771(60.49%)	4289(60.11%)	4121(62.43%)	3748(58.62%)	5043(38.18%)	3208(32.96%)
Community media access**						
Low				539(8.43%)	1525(11.54%)	530(5.45%)
Medium				4593(71.84%)	8855(67.03%)	6001(61.66%)
high				1262(19.74%)	2831(21.42%)	3201(32.89%)
Community employment status						
low	425(6.81%)	274(3.84%)	1342(20.32%)	245*3.83%)	1318(9.98%)	223(2.29%)
Medium	2054(32.94%)	2254(31.60%)	1934(29.28%)	1895(29.63%)	4342(32.86%)	2422(24.89)
high	3756(60.25%)	4607(64.56%)	3327(50.41%)	4254(66.54%)	7551(58.16%)	7087(72.82%)

* Wealth index and Access to Media was not collected in the 1992, 2001/2 and 2007 DHS, ** Muchinga was created in 2010

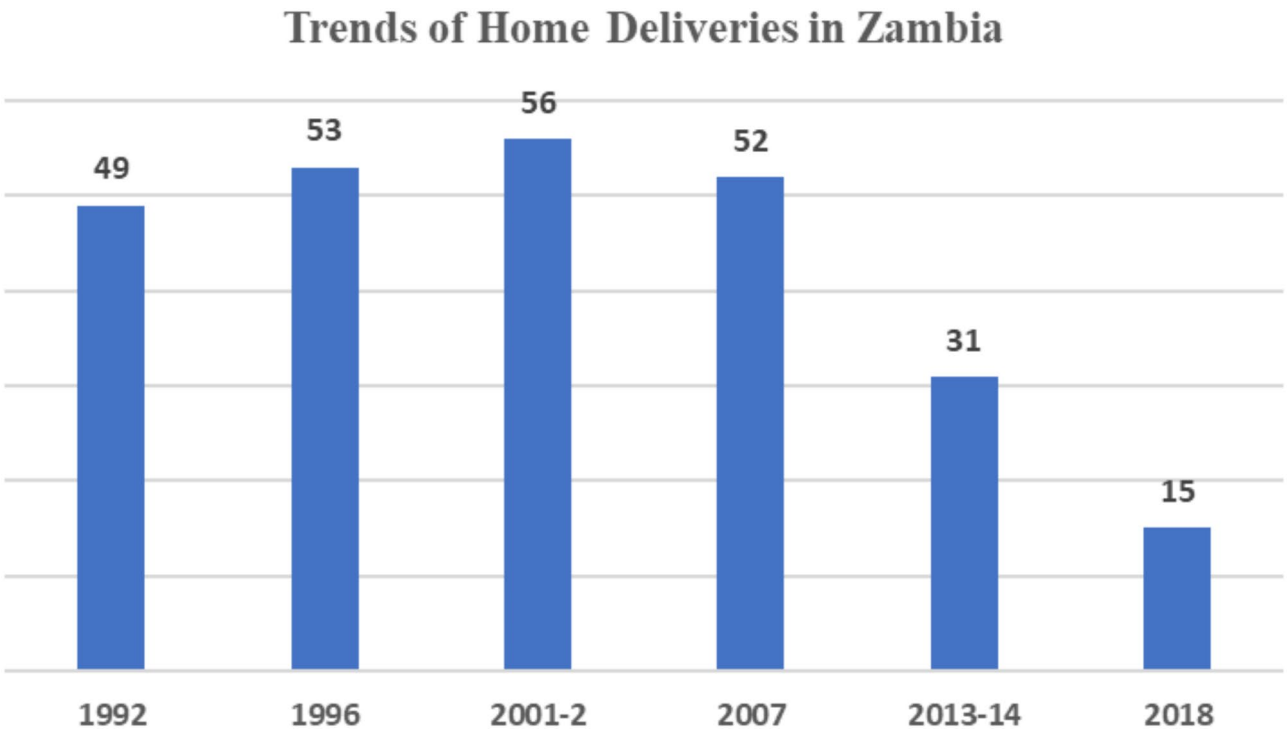

Fig. 1 Overall trends in home birth deliveries in Zambia from 1992 to 2018- ZDHS

in Fig. 2. In North-western and Southern regions, 12.0% and 19.4% of deliveries, respectively, occurred at home.

The Copperbelt and Eastern regions had the lowest percentages of home deliveries, with 10.2% and 6.7%, respectively, of deliveries taking place outside of health facilities. Overall, while the percentage of home deliveries varies across the country, the regions with more remote or less accessible healthcare facilities tend to have higher rates of home deliveries.

Determinants of maternal home deliveries in Zambia between 1992 and 2018

A multilevel multivariate logistic regression analysis was applied to identify individual and selected community that are associated with maternal home deliveries in

Table 4 Prevalence of materanl home deliveries among women aged 15–49 by background characteristics, 1992–2018 DHS, Zambia

Background Characteristics	1992 DHS	1996 DHS	2001/2 DHS	2007 DHS	2013/14 DHS	2018 DHS
	N = 6230 %(Freq)	*N* = 7136 %(Freq)	*N* = 6594 %(Freq)	*N* = 6394 %(Freq)	*N* = 13,211 %(Freq)	*N* = 9731 %(Freq)
Age			**	***	***	***
15–24	49.74(1168)	51.59(1445)	54.82(1381)	46.99(950)	26.61(1089)	11.77(396)
25–34	46.46(739)	51.51(898)	52.26(914)	51.05(926)	30.59(1046)	15.27(356)
35–49	50.10(1150)	56.34(14559)	60.23(1405)	56.62(1148)	36.00(2050)	18.08(728)
Marital status	***	*	***	***	***	***
Single	31.44(108)	42.87(153)	35.79(140)	30.76(118)	6.52(163)	7.33(80.18)
Married	49.93(2643)	54.17(3210)	57.43(3155)	53.84(2925)	32.71(3556)	15.90(1205)
Widowed/Seperated/Divorced	51(306)	51.49(437)	56.51(406)	48.80(282)	34.62(467)	18.58(196)
Education status	***	***	***	***	***	***
No education	77.33(821)	75.89(743)	82.44(801)	74.50(639)	48.69(713)	32.26(315)
Primary	51.59(2025)	59.12(2711)	61.60(2589)	56.83(2315)	38.77(2867)	18.33(905)
Secondary	18.05(206)	23.66(339)	23.20(307)	28.24(369)	15.23(590)	7.52(258)
Higher	4.28(4)	5.98(8)	2.86(3)	0.83(1)	2.25(10)	0.86(3.37)
Wealth status**				***	***	***
Poor				70.84(2085)	45.59(2824)	22.65(1032)
Middle				62.06(835)	33.68(912)	13.92(198)
Rich				19.19(404)	10.45(450)	5.89(198)
Sex of household head						***
Male	49.26(2759)	53.38(3189)	56.16(3127	52.24(2784)	31.73(3383)	14.98(1164)
Female	47.03(297)	52.86(614))	55.52(573)	50.79(540)	31.51(803)	16.19(317)
Access to media **				***	***	***
No				57.48(2025)	36.43(2615)	17.78(1051)
Yes				45.27(1300)	26.05(1572)	11.26(430)
Religious denomination	***	*	***	*	***	***
Catholic	45.59(792)	50.84(863)	55.72(836)	50.86(617)	27.55(597)	14.49(225)
Protestants	49.51(2133)	53.86(2855)	55.58(2760)	51.88(2618)	32.45(3522)	15.39(1233)
Muslims	76.71(127)	33.17(8)	40.31(4)	39.36(13)	6.27(3.21)	15.72(8)
Other	76.71(123)	76.06(67)	84.65(97)	75.90(67)	48.82(51)	13.53(15)
Parity	***	***	***	***	***	***
1 child	40.08(351)	42.95(410)	41.26(389)	30.89(239)	13.92(259)	6.00(100)
2 to 4 children	49.34(1393)	50.13(1752)	54.96(1809)	49.97(1617)	28.13(1819)	13.77(673)
5 or more children	51.79(1313)	61.08(1641)	63.48(1502)	61.59(1468)	43.18(2108)	23.05(699)
ANC vist	***	***	***	***	***	***
No	97.48(380)	96.04(252)	92.54(166)	96.02(85)	86.22*109)	78.27(61)
Yes	45(2607)	52.06(3493)	52.11(2134)	48.35(1922)	26.59(2395)	12.45(884)
Employment status	***		***		***	
Not working	48.87(1388)	51.62(1823)	48.86(1298)	50.92(1623)	28.22(1666)	15.44(792)
Working	49.13(1667)	54.97(1977)	60.88(2398)	53.04(1697)	34.54(2506)	14.98(689)
Selected community factors						
Place of residence						
Urban	20.94(609)	22.96(653)	20.72(423)	15.82(296)	10.68(487)	6.41(223)
Rural	73.57(2445)	73.41(3150)	71.89(3277)	66.66(3028)	42.74(3700)	20.12(1250)
Region	***	***	***	***	***	***
Central	61.08(366)	62.87(368)	66.25(332)	66.71(418)	50.95(651)	27.02(228)
Copperbelt	20.00(288)	24.40(326)	27.46(289)	23.64(206)	17.21(296)	8.69(104)
Eastern	62.43(407)	66.43(728)	68.43(602)	54.75(553)	27.79(472(	7.54(97.)
Luapula	63.60(267)	72.30(485)	70.81(441)	64.42(371)	31.22(368)	11.44(108)
Lusaka	23.50(221)	25.85(277)	24.65(198)	21.64(159)	9.75(190)	8.66(132)
Muchinga					38.45(309)	22.50(134)
Northern	81.00(533)	75.70(653)	72.28(724)	68.79(713)	51.82(656)	27.38(242)
North-westen	45.57(78)	43.42(125)	52.77(724)	57.84(231)	24.71(164)	11.77(62.20)

Table 4 (continued)

Background Characteristics	1992 DHS	1996 DHS	2001/2 DHS	2007 DHS	2013/14 DHS	2018 DHS
	N = 6230 %(Freq)	*N* = 7136 %(Freq)	*N* = 6594 %(Freq)	*N* = 6394 %(Freq)	*N* = 13,211 %(Freq)	*N* = 9731 %(Freq)
Southern	66.08(669)	72.31(553)	67.52(510)	62.27(424)	42.40((758)	16.95(219)
Western	67.16(226)	62.67(288)	66.40(416)	54.42(249)	37.57(319)	24.70(154)
Community education	***	***	***	***	***	***
Low	7.77(16)	7.97(21)	6.37(21)	9.44(39)	4.18(71)	4.33(76)
Medium	22(503)	30.12(778)	29.81(641)	33.93(758)	27.07(1751)	14.26(681)
High	67(2537)	70.03(3003)	73.72(3038)	67.45(2528)	46.88(2363)	22.60(724)
Community media access**				***	***	***
Low				21.77(117)	14.86(227)	***
Medium				52.67(2419)	30.41(2693)	7.23(38.34)
high				62.47(788)	44.74(1267)	20.57(658)
Community employment status	***	*	***	**	***	***
low	78.78(335)	68.32(187)	78.26(1050)	67.05(164)	52.00(685)	19.40(43.24)
Medium	42.86(880)	58.08(1309)	1115(57.71)	59.11(1120)	32.71(1420)	14.00(339)
high	49.05(1842)	50.06(3803)	46.14(1535)	47.96(2040)	27.56(2081)	15.51(1099)

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$* Wealth index and Acces to Media was not collected in the 1992, 2001/2 and 2007 DHS, ** Muchinga was created in 2010

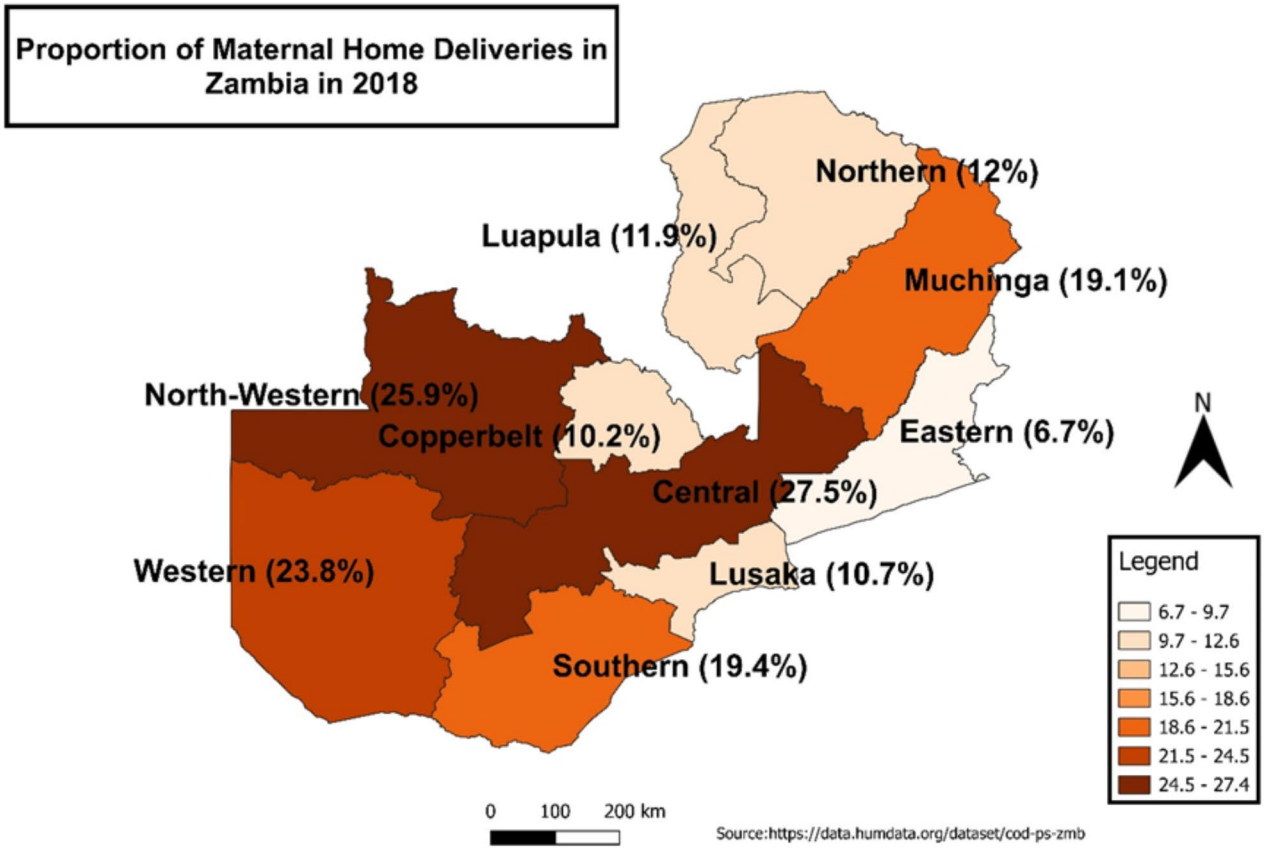

Fig. 2 Shows the spatial distribution of maternal home births in 2018

Zambia. Three models were developed for all the survey years. The null model had no individual and community factors. Table 5 shows that in 1991 and 2018 the ICC was 17.7% and 27.1% respectively. This entails that 17.7% and 27.1% of the variations on maternal home deliveries were attributed to clusters in 1991 and 2018. An ICC greater than zero and significant chi-square test of independence in the null model of the all the survey years facilitated

Table 5 Multilevel determinants of home deliveries in Zambia, ZDHS 1992–2018

Background Characteristics	1992 DHS (aOR)	1996 DHS (aOR)	2001/2 DHS (aOR)	2007 DHS (aOR)	2013/14 DHS (aOR)	2018 DHS (aOR)
Intercept	6.88 (2.09–26.33) **	5.58(1.15–26.89) *	2.97 (0.80–11.12)	28.21 (4.75–167.54) ***	3.00(1.08–8.29) *	5.23(1.33–20.60) *
Individual Factors						
Age						
15–24	1.00	1.00	1.00	1.00	1.00	1.00
25–34	0.81 (0.66–1.00)	1.02 (0.83–1.26)	0.77 (0.61–0.98) *	0.95 (0.75–1.22)	0.82(0.66–1.01)	1.02(0.76–1.37)
35–49	0.76 (0.56–1.04)	0.88 (0.68–1.13)	0.78 (0.55–1.12)	1.01 (0.76–1.33)	0.80(0.63–1.01)	0.88(0.63-1,01)
Marital status						
Single	1.00	1.00	1.00	1.00	1.00	1.00
Married	1.14 (0.73–1.76)	0.68 (0.46–1.02)	1.03 (0.68–1.54)	1.34 (0.87–2.06)	0.73(0.54–0.98) *	0.81(0.57–1.15)
Divorced/Widowed/Seperated	1.489(0.96–2.30)	0.71 (0.48–1.05)	1.23 (0.78–1.95)	0.96 (0.57–1.60)	1.00(0.71–1.43)	1.30(0.83–2.03)
Education status						
No education	1.00	1.00	1.00	1.00	1.00	
Primary	0.60 (0.47–0.76) ***	0.60 (0.47–0.78) ***	0.49 (0.37–0.64) ***	0.61 (0.45–0.83) **	0.76(0.62–0.94) **	0.65(0.49–0.88) **
Secondary	0.23 (0.17–0.31) ***	0.22 (0.16–0.30) ***	0.18 (0.13–0.25) ***	0.39 (0.27–0.56) ***	0.45(0.35–0.58) ***	0.38(0.26–0.56) ***
Higher	0.06 (0.01–0.25) ***	0.07 (0.02–0.21) ***	0.06 (0.01–0.37) ***	0.04 (0.01–0.20) ***	0.17(0.07–0.41) ***	0.037(0.01–0.17) ***
Wealth index						
Poor	1.00	1.00	1.00	1.00	1.00	1.00
Middle	na	na	na	0.76 (0.61–0.94) *	0.86(0.74–1.02)	0.71(0.55–0.91) **
Rich	na	na	na	0.37 (0.26–0.53) ***	0.50(0.38–0.66) ***	0.48(0.31–0.74) ***
Access to media						
No				1.00	1.00	1.00
Yes				0.91 (0.76–1.09)	0.90(0.78–1.04)	0.89(0.71–1.11)
Sex of household head						
Male	1.00	1.00	1.00	1.00	1.00	1.00
Female	0.86(0.63–1.17)	0.95(0.76–1.20)	0.97(0.74–1.26)	1,04((0.78–1.37)	0.90(0.74–1.08)	1.03(0.80–1.33)
Religious denomination						
Catholic	1.00	1.00	1.00	1.00	1.00	1.00
Protestants	1.04 (0.84–1.30)	1.07 (0.88–1.30)	1.14 (0.90–1.44)	0.97 (0.75–1.25)	1.23(1.01–1.50) *	1.01(0.77–1.29)
Muslims	0.32 (0.12–0.87) *	0.56 (0.15–2.05)	0.08 (0.00–4.23)	0.83 (0.26–2.63)	0.18(0.03–1.07)	4.04(0.78–22.45)
Other	1.67 (1.00–2.78)	1.70 (0.94–3.05)	2.16 (1.00–4.76) *	1.50 (0.76–2.99)	0.98(0.45–2.12)	1.17(0.55–2.47)
Parity						
1 child	1.00	1.00	1.00	1.00	1.00	1.00
2 to 4 children	1.77 (1.38–2.27) ***	1.59 (1.27–2.01) ***	1.67 (1.29–2.16) ***	1.83 (1.33–2.52) ***	2.37(1.83–3.04) ***	2.48(1.83–3.33) ***
5 or children	1.80 (1.27–2.58) ***	2.08 (1.48–2.99) ***	1.69 (1.17–2.42) ***	2,02 (1.40–2.91) ***	3.26(2.36–4.49) ***	3.07(2.06–4.58) ***
ANC						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.04 (0.02–0.08) ***	0.09 (0.04–0.21) ***	0.09 (0.05–0.17) ***	0.02 (0.01–0.08) ***	0.05(0.05–0.08) ***	0.04(0.02–0.08) ***
Employment status						
Not working	1.00	1.00	1.00	1.00	1.00	1.00
Working	1.04 (0.85–1.27)	1.10 (0.92–1.31)	1.12 (0.90–1.40)	0.87 (0.72–1.07)	0.96(0.08–1.13)	1.07(0.88–1.31)
Selected contextual factors						
Place of residence						

Table 5 (continued)

Background Characteristics	1992 DHS (aOR)	1996 DHS (aOR)	2001/2 DHS (aOR)	2007 DHS (aOR)	2013/14 DHS (aOR)	2018 DHS (aOR)
Urban	1.00	1.00	1.00	1.00	1.00	1.00
Rural	4.18 (2.72–6.40) ***	4.91 (3.21–7.53) ***	3.07 (1.98–4.75) ***	3.79 (2.53–5.67) ***	2.25(1.72–2.96) ***	2.04(1.19–3.51) **
Region						
Central	1.00	1.00	1.00	1.00	1.00	1.00
Copperbelt	0.38 (0.21–0.72) **	0.32 (0.17–0.63) ***	0.51 (0.27–0.96)	0.45 (0.23–0.87) *	0.48(0.30–0.76) **	0.62(0.33–1.16)
Eastern	0.54 (0.31–0.93) *	0.47 (0.26–0.85) *	0.82 (0.43–1.55)	0.29 (0.16–0.51) ***	0.19((0.12–0.31) ***	1.00(0.05–0.18) ***
Luapula	0.96 (0.50–1.82)	0.78 (0.41–1.50)	0.87 (0.47–1.61)	0.71 (0.42–1.20)	0.28(0.17–0.46) ***	0.20(0.05–0.19) ***
Lusaka	0.41 (0.23–0.75) **	0.31 (0.17–0.58) ***	0.42 (0.25–0.75) ***	0.39 (0.22–0.69) ***	0.33(0.21–0.53) ***	0.76(0.43–1.34)
Muchinga	na	na	na	na	0.43(0.26–0.71) **	0.40(0.21–0.76) **
Northern	1.84 (0.99–3.41)	1.00 (0.55–1.81)	1.18 (0.69–2.00)	0.86 (0.47–1.57)	0.72(0.44–1.17)	0.65(0.32–1.31)
North-westen	0.30 (0.14–0.64) **	0.16 (0.07–0.34) ***	0.45 (0.21–0.96)	0.37 (0.20–0.70) **	0.24(0.15–0.39) ***	0.30(0.14–0.61) ***
Southern	0.95 (0.54–1.67)	0.86 (0.47–1.60)	1.36 (0.67–2.76)	0.81 (0.49–1.33)	0.74(0.48–1.13)	0.62(0.33–1.19)
Western	0.67 (0.35–1.28)	0.45 (0.24–0.86) *	0.72 (0.40–1.32)	0.36 (0.19–0.70) **	0.46(0.28–0.75) **	0.60(0.34–1.07)
Community education						
Low	1.00	1.00	1.00	1.00	1.00	1.00
Medium	1.56 (0.80–3.02)	3.47(1.45–8.33) ***	3.50 (1.38–8.88) *	1.38 (0.60–3.16)	2.87(1.80–4.31) ***	1.58(0.89–2.80) *
High	3.24 (0.59-2.93-2.78) ***	5.66 (2.33–13.73) ***	9.74 (3.72–25.51) ***	2.03 (0.84–4.90)	4.05(2.49–6.57) ***	0.50(0.22–1.17)
Community media access						
Low	1.00	1.00	1.00	1.00	1.00	1.00
Medium	na	na	na	1.25 (0.73–2.15)	1.18(0.79–1.77)	0.98(0.46–2.08)
high	na	na	na	1.001(0.51–2.50)	1.33(0.84–2.09)	0.99(0.45–2.16)
Community employment status						
low	1.00	1.00	1.00	1.00	1.00	1.00
Medium	1.01 (0.53–1.95)	0.62 (0.27–1.46)	0.62 (0.38–1.00*)	0.79 (0.40–1.57)	0.62(0.42–0.91) *	0.37(0.15–0.91)
high	1.01 (0.50–2.03)	0.55 (0.23–1.33)	0.55 (0.29–1.03)	0.77 (0.38–1.58)	0.77(0.52–1.14)	0.50(0.22–1.17)
ICC	0.1766	0.1766	0.2481	0.1656	0.2146	0.2710
Variance						
AIC	5824.77	6861.74	4223.49	4241.57	8369.67	4665.66
BIC	6033.68	7075.00	4421.99	4469.17	8625.87	4913.48

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$; CI = Confidence Intervals, 1 = Reference Categories; PVC = Proportional Variance Change; ICC = Inter Cluster Correlation; BIC = Bayesian information criterion; AIC = Akaike information criterion

the use of multilevel logistic regression. Model 2, with both individual and selected community level factors explained better maternal home deliveries compared to model 1 and the null hypothesis, noted from the values of AIC in Table 2.

The findings in the study showed that women who were aged 25–34 and 35–49 years had reduced odds of delivering at home across all the years. Nonetheless, this association was only significant in the 2001/2 survey were women aged 25–34 years had 23% reduction in odds of delivering at home compared to women aged 15–24 years [95% CI, aOR = 0.77, 0.61–0.98]. There was no significant association between women's marital status and delivering at home except in the 2013/14 survey were married women had 27% reduction in odds of delivering at home compared single women [95% CI, aOR = 0.73, 0.54–0.98]. The results showed that women with primary, secondary and tertiary education were less likely to deliver at home than those with no formal education between 1992 and 2018. For instance, in the 2018 survey women with primary, secondary and higher education had a reduction in odds of delivering at home of 35%, 62% and 96% [95% CI, aOR = 0.35,0.49–0.88; aOR = 0.62, 0.26–0.56; aOR = 0.04, 0.01–0.17] respectively. Being from middle

and rich households, and attending at least one ANC visit decreased the odds of home delivery. However, there was no significant association between middle class women compared to poor women in 2007. The results show that women with 2–4 and 5 or more children had significantly increased odds of delivering at home compared to women with 1 child across all the years. In 2018 women with 2–4 and 5 or more children were 2 times and 3 times more likely to deliver at home compared to women with 1 child [95% CI, aOR = 2.48, 1.83–3.33; aOR = 3.07, 2.06–4.58] respectively. Furthermore, women who had at least one ANC visit had over 90% reduction in delivering at home compared to women who had no ANC visit [aOR = 0.04, 0.02–0.06].

In terms of selected of community factors, the study revealed that women in rural setting had 4 times higher odds of delivering at home in 1992 compared to women in urban areas [95% CI, aOR = 4.02, 2.72–6.40] and it reduced 2 in 2018 compared to women in urban setting [95% CI, aOR = 2.04, 1.19–3.51]. Further regions such as Copperbelt, Eastern, Lusaka, Northwestern, and Western consistently show lower odds of home deliveries compared to women Central region, especially in later years. Higher community education levels are associated with increased odds of home deliveries in 1991, 1996 and 2013.

Discussion

The study investigated the trends, spatial distribution and predictors of maternal home deliveries between 1992 and 2018 in Zambia using the ZDHS data. The findings in the study show that the prevalence of maternal home deliveries has exhibited a notable decline over time, from 49% in 1992 to 15% in 2018 [13]. However, a significant proportion of women residing in rural areas of Zambia continue to opt for home births [15]. Similar patterns have been observed in Malawi, Ethiopia and Zimbabwe, where the prevalence of home deliveries has been showing a downward trend [24–26]. In a recent study conducted in East Africa, the prevalence of home deliveries was 24% based on data from the DHS [6]. Additionally, various studies conducted in SSA countries have reported alarmingly high rates of home deliveries. For instance, prevalence rates of 47%, 83%, 91%, and 47% were found in Bosomtwe-Atwima-Kwanwoma (Ghana), East Badawacho District (Ethiopia), and Margibi County (Liberia), respectively [22, 27–29]. It should be noted that even though the prevalence of maternal home deliveries has been declining overtime it remains worryingly high.

The findings in various studies highlight the concern on the prevalence of maternal home deliveries in specific regions within SSA. The high rates suggest that a significant proportion of women in these areas give birth at home rather than utilizing institutional delivery services. This poses potential risks to maternal and newborn health, as home deliveries may lack the necessary medical support and emergence care available in healthcare facilities. Several influential factors have been linked to home deliveries. These factors encompass the place of residence, with a particular emphasis on rural areas, as well as lack of formal education, higher parity (Number of previous births), limited exposure to media, and inadequate utilization of antenatal care ANC services [6, 9, 15, 30].

This study has provided evidence of rural-urban disparities in maternal home deliveries within Zambia. Both rural and urban areas exhibit a declining trend in home deliveries, although the rate of reduction is more pronounced in rural areas (74 – 19%) with a decrease of 10.5% annually compared to 3% in urban areas (21 to 6%), from 1992 to 2018. This finding is consistent with other studies that have identified rural-urban differentials in women's delivery choices [6, 10, 31]. The disparity in home deliveries between rural and urban areas can be attributed to several factors. Firstly, the unavailability of nearby healthcare facilities in rural areas and the long distances that women must travel contribute to the higher likelihood of giving birth at home [5, 22, 32]. Additionally, these circumstances adversely impact the number of ANC visits women are able to make before delivery, thereby increasing the chances of opting for a home birth due to limited access to health talks and education on safe delivery practices [33]. Home deliveries were lower in the more urbanized and developed Copperbelt and Lusaka provinces, which have the highest and second-highest GDPs in the country, and where health facilities are more accessible than in rural areas like Northern Province [34].

Maternal home deliveries exhibited a general downward trend overtime across all age groups, indicating a positive shift towards utilizing health services during childbirth. However, it is worth noting that there were reported increases in maternal home deliveries from 1992 to 2001/02, followed by a subsequent decline. These fluctuations in trends are consistent with previous research, which consistently emphasizes the importance of demographic factors, particularly younger maternal age, influencing the likelihood of utilizing health services during childbirth. Research findings consistently highlight that younger maternal age is associated with a higher propensity to seek and access health services. This relationship suggests that younger mothers are more inclined to engage with healthcare providers and utilize available resources during pregnancy and childbirth [35–38]. However, in the multivariate analysis, older women were found to be less likely to deliver at home compared to younger women. This discrepancy could be attributed to other variables controlled in multivariate analysis

which may influence delivery location differently across age groups.

We applied a two-level multivariate logistic regression to examine the predictors of home deliveries in Zambia from 1992 to 2018, only variable that were significant at 0.25 were added to model 2 which was the best model with the lowest AIC and BIC after adding selected community factors. Our study has identified several factors that significantly influence maternal home deliveries in Zambia, including individual characteristics such as young age though inconsistent, lack of formal education, middle and rich quintiles, and higher parity, as well as community factors such as residence, region and community education. We found that older women between the ages of 25 and 34 years had lower odds of delivering at home though only significant in 2001/02 survey year, in the other survey years it showed older women had a lower likelihood of delivering at home though not significant, this aligns with findings from previous studies [6, 39–41]. Older women, particularly those over 35 years, are at an increased risk of developing health issues and experiencing challenges during pregnancy and childbirth. Conditions like high blood pressure, gestational diabetes, placenta previa, and other age-related disorders may contribute to these risks. As a result, healthcare providers often advise delivering in a hospital or medical facility where specialized care is easily accessible [42]. However, studies in Ghana and rural Kenya suggest a different pattern, where older women are less likely to deliver in a health facility [8, 27]. These studies, however, had limited representativeness, focusing on a single district and a rural area, which may explain the different findings. Such regional variations highlight the influence of geographic and cultural factors on delivery location choices.

Research has shown a clear association between education and the location of delivery, as well as the influence of education on access to health services [43, 44]. Our study revealed that women with primary, secondary, and higher education had a reduced risk of delivering at home across all the survey years. This finding is supported by previous research conducted in Ethiopia, Nigeria and Eritrea [19, 30, 31, 45]. This indicates that educated women have better access to healthcare knowledge and are more aware of potential childbirth risks and complications [46, 47]. They also understand the advantages of delivering in a medical facility with skilled healthcare providers. Additionally, educated women are more likely to be covered by health insurance, increasing their access to maternal health services [48].

Multiple studies have shown a clear association between the place of delivery and the wealth index [11, 21, 49]. Similarly, we established that women from wealthier families, represented by the middle and rich wealth quintile, had a lower risk of delivering at home across the survey years. This aligns with research conducted in East Africa [6] and other Sub-Saharan African countries [4]. This could be attributed to the empowerment, education and working-class status of women from wealthier families, which makes them less susceptible to transportation and financial constraints. Further women from rich wealth quintile have more maternal utilization services than those from poor families that increases their prospects of delivering at health facilities [50].

Studies indicate that parity is a significant factor in delivery location, with mixed findings across different settings [51–53]. Our results align with those from Tanzania, where women with higher parity are more likely to deliver at home [54]. However, studies from Bangladesh, Uganda, and Ethiopia suggest the opposite, with higher-parity women more likely to choose facility-based deliveries [51, 53, 55]. The rural focus of the Ethiopian study and the private hospital data in Uganda may partly explain these differences, as these contexts influence healthcare access and delivery perceptions. Higher-parity women may view childbirth as routine, increasing their comfort with home deliveries. Tailored interventions addressing this perception could improve maternal outcomes by encouraging facility-based deliveries [56]. However, some women with higher parity still prefer to deliver at health facilities, suggesting that women who have already experienced childbirth, particularly those who faced complications or required medical assistance, are more aware of the risks and complications associated with labor and delivery. These high parity women may opt for future pregnancies in hospitals where they can receive specialized care and medical procedures if necessary [53].

Furthermore, our results indicate that women who attended at least one antenatal care (ANC) visit were less likely to deliver at home across all the survey years. This finding aligns with studies conducted in Ethiopia [18, 31]. This indicates that women who participate in antenatal care gain a greater understanding of the significance of having a professional birth attendant present during labor and delivery. They also acquire knowledge regarding the advantages of giving birth in medical facilities and exhibit a favorable perspective towards maternal healthcare services, encompassing choice of birthing location as well as pregnancy and childbirth risks [18, 57].

Regarding the influence of selected community-level factors, our study revealed that women residing in rural areas face a higher risk of delivering at home. This finding is consistent with other studies [6, 45, 50]. This suggests that women in rural areas are faced with unavailability and high costs of transport and long distance to the health facilities [8, 15, 45]. We also found significant regional variations in home deliveries, which is in line with a study conducted in Nepal and Gabon that

identified significant regional variations in home deliveries [10, 50].

Over the years, maternal home deliveries in Zambia have declined due to several government initiatives. In 2006, the government removed user fees for maternal and child health services to encourage women, especially in rural areas, to deliver at health facilities. Additionally, the introduction of Safe Motherhood Action Groups (SMAGs) in 2003 has significantly contributed to this reduction. These groups play a crucial role in promoting facility-based deliveries and educating communities on safe pregnancy and childbirth practices [58].

Despite the removal of user fees, additional strategies are required to further reduce home deliveries. Strengthening antenatal care utilization, expanding access to skilled birth attendants, enhancing maternal health education, leveraging mass media for awareness, and addressing rural-urban healthcare disparities are critical. Implementing these measures can improve maternal health service uptake and contribute to safer childbirth outcomes.

Strengths and limitations of the study

This study enhances understanding of maternal home deliveries in Zambia using nationally representative survey data, applicable to women aged 15 to 49 years. A key strength is the use of national data, ensuring a representative sample and the generalizability of the findings. Additionally, spatial distribution analysis complemented the statistical findings. However, the study has limitations. Cross-sectional design prevents causal inferences, and self-reported data may be subject to recall and social desirability biases. The analysis is constrained by the available variables in the 1996, 2001/2, 2007, 2013/14, and 2018 ZDHS datasets and essential factors like the cost of care and maternal environment were not included. Spatial analysis was limited to provincial-level accuracy.

Conclusion

This study investigated the trends, geospatial distributions, and factors influencing the maternal home deliveries among mothers in Zambia from 1992 to 2018, using data from ZDHS. The results revealed a decrease in the prevalence of maternal home deliveries over time, although a considerable number of women in rural areas still preferred giving birth at home. The high rates of home births are concerning as they are known to pose risks to the health of both mothers and newborns due to the absence of medical support available in healthcare facilities. Various factors were found to be associated with home deliveries, including living in rural areas, lacking formal education, having a high parity, lack of exposure to media, and lack of utilization of antenatal care services. Rural-urban disparities were identified, with a greater decline in home deliveries in urban areas. Younger maternal age was found to increase the likelihood delivering at home, middle and rich wealth quintile, higher parity, community-level factors also played a role in home deliveries.

What has the study found?

This study found a decline in home deliveries over time, yet rural areas still had significant rates. Factors influencing home births included rural residence, lack of formal education, higher parity, limited media exposure, and inadequate antenatal care utilization. Urban areas experienced a greater reduction in home births compared to rural areas. Education, wealth, grand multiparity, and ANC visits were linked to lower home birth risks. Regional variations and community factors also played a role.

Acknowledgements

We are grateful to DHS measure evaluation for providing us with access to publicly available datasets.

Author contributions

P.M. came up with the conception and design. P.M. acquired the data. Analysis and interpretation of the data was done by P.M.,T.O.M., E.M., M.M. and S.S. All authors were involved in drafting the article and revising it critically for important intellectual content. All authors equally read and approved the final version to be published.

Funding

No funding.

Data availability

The data used in this study is publicly available at (https://dhsprogram.com/. Data analysis files are available upon request to the corresponding Ethics approval and consent to participate.

Declarations

Ethics approval and consent to participate

This study was conducted by utilizing available data from the Zambia DHS upon request from DHS measure evaluation, which can be easily accessed at (https://dhsprogram.com/). The dataset used in this research contained no personally identifiable information, ensuring complete anonymity of the participants. It is worth noting that the original Zambia DHS Biomarker and survey protocols underwent a rigorous approval process, receiving authorization from both the Tropical Disease and Research Center as well as the Research Ethics Review Board of the Centers for Disease Control and Prevention.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 8 July 2023 / Accepted: 28 February 2025
Published online: 10 April 2025

References

1. World Health Organization (WHO). Building a Health Workforce to Meet the Needs of Women, Newborns and Adolescents Everywhere: The State of the World's Midwifery 2021. 2021; 72.

2. Dept. of Reproductive Health and Research. *WHO recommendations for the prevention and treatment of postpartum haemorrhage.* 2012.
3. WHO, UNICEF UNFPA, WORLD BANK GROUP and UNDESA/Population Division. *Trends in maternal mortality 2000 to 2020: estimates.* 2023.
4. Montagu D, Yamey G, Visconti A et al. Where Do Poor Women in Developing Countries Give Birth? A Multi-Country Analysis of Demographic and Health Survey Data. 6. Epub ahead of print 2015. https://doi.org/10.1371/journal.pone.0017155
5. Gebremichael SG, Fenta SM. Determinants of institutional delivery in Sub-Saharan Africa: findings from demographic and health survey (2013–2017) from nine countries. Trop Med Health; 49. Epub ahead of print 2021. https://doi.org/10.1186/s41182-021-00335-x
6. Regassa LD, Tola A, Weldesenbet AB et al. Prevalence and associated factors of home delivery in Eastern Africa: further analysis of data from the recent demographic and health survey data. SAGE Open Med; 10. Epub ahead of print 2022. https://doi.org/10.1177/20503121221088083
7. Ethiopian Public Health Institute (EPHI) [Ethiopia] and ICF. *Ethiopia Mini Demographic and Health Survey 2019: Final Report. Rockville, Maryland, USA: EPHI and ICF.*
8. Moindi RO, Ngari MM, Nyambati VCS, et al. Why mothers still deliver at home: Understanding factors associated with home deliveries and cultural practices in rural coastal Kenya, a cross-section study global health. BMC Public Health. 2016;16:1–8.
9. Kasaye HK, Endale ZM, Gudayu TW et al. Home delivery among antenatal care booked women in their last pregnancy and associated factors: community-based cross sectional study in Debremarkos town,. 2017; 1–12.
10. Devkota B, Maskey Id J, Pandey AR et al. Determinants of home delivery in Nepal – A disaggregated analysis of marginalised and non-marginalised women from the 2016 Nepal demographic and health survey. Epub ahead of print 2020. https://doi.org/10.1371/journal.pone.0228440
11. Kimario FF, Festo C, Shabani J, et al. Determinants of home delivery among women aged 15–24 years in Tanzania. Int J Maternal Child Health AIDS. 2020;9:192.
12. Ou CY, Yasmin M, Ussatayeva G, et al. Maternal delivery at home: issues in India. Adv Ther. 2021;38:386–98.
13. Zambia Statistics Agency, Ministry of Health (MOH) Zambia, and ICF. 2019. Zambia Demographic and Health Survey 2018. Lusaka, Zambia, and Rockville, Maryland, USA.
14. Bakyaita N, Mweemba N. Universal health coverage: A perspective of the WHO country office in Zambia. Health Press Zambia Bull. 2018;2:5–16.
15. Scott NA, Henry EG, Kaiser JL, et al. Factors affecting home delivery among women living in remote areas of rural Zambia: A cross-sectional, mixed-methods analysis. Int J Womens Health. 2018;10:589–601.
16. Sinkamba T. Women's health science journal. Women's Health Sci J. 2019;3:1–38.
17. Mulenga T, Moono M, Mwendafilumba M, et al. Home deliveries in the capital: A qualitative exploration of barriers to institutional deliveries in peri-urban areas of Lusaka, Zambia. BMC Pregnancy Childbirth. 2018;18:1–11.
18. Tsegay R, Aregay A, Kidanu K, et al. Determinant factors of home delivery among women in Northern Ethiopia: a case control study. BMC Public Health. 2017;17:1–8.
19. Nduka I, Nduka EC. Determinants of noninstitutional deliveries in an urban community in Nigeria. J Med Investigations Pract. 2014;9:102–7.
20. Ahinkorah BO, Seidu AA, Budu E et al. What influences home delivery among women who live in urban areas? Analysis of 2014 Ghana demographic and health survey data. PLoS ONE; 16. Epub ahead of print 2021. https://doi.org/10.1371/journal.pone.0244811
21. Ayalew HG, Liyew AM, Tessema ZT, et al. Spatial variation and factors associated with home delivery after ANC visit in Ethiopia; Spatial and multilevel analysis. PLoS ONE. 2022;17:1–17.
22. Adewuyi EO, Zhao Y, Auta A, et al. Prevalence and factors associated with non-utilization of healthcare facility for childbirth in rural and urban Nigeria: analysis of a National population-based survey. Scand J Public Health. 2017;45:675–82.
23. Austin PC, Merlo J. Intermediate and advanced topics in multilevel logistic regression analysis. Stat Med. 2017;36:3257–77.
24. ZNSA and IInternational. Zimbabwe Demographic and Health Survey. 2016. Epub ahead of print 2016. https://doi.org/10.1088/1751-8113/44/8/085201
25. MDHS. Malawi demographic and health survey 2015-16. Natl Stat Office DHS Program 2017; 1–658.
26. Ethiopian Public Health Institute (EPHI) [Ethiopia] and ICF. Ethiopia Mini Demographic and Health Survey 2019: Final Report. Rockville, Maryland, USA: EPHI and ICF.
27. Nanang M, Atabila A. Factors predicting home delivery among women in Bosomtwe-Atwima-Kwanwoma district of Ghana: A case control study. Int J Med Public Health. 2014;4:287.
28. Maximore LS, Mohammed AG, Issahaku GR et al. Prevalence and determinants of home delivery among reproductive age women, margibi County, Liberia. BMC Pregnancy Childbirth 2022; 1–7.
29. D et. Status of Home Delivery and Its Associated Factors among Women Who Gave Birth within the Last 12 Months in East Badawacho. 2020; 2020: 45.
30. Muluneh AG, Animut Y, Ayele TA. Spatial clustering and determinants of home birth after at least one antenatal care visit in Ethiopia: Ethiopian demographic and health survey 2016 perspective. BMC Pregnancy Childbirth. 2020;20:1–13.
31. Chernet AG, Dumga KT, Cherie KT et al. Original Article home delivery practices and associated factors in Ethiopia. 2019; 20: 102–8.
32. Hailegebreal S, Gilano G, Seboka BT, et al. Prevalence and associated factors of early sexual initiation among female youth in East Africa: further analysis of recent demographic and health survey. BMC Womens Health. 2022;22:1–9.
33. Micah AE, Hotchkiss DR. Community-level factors associated with the use of facility-based delivery assistance in Uganda: A multilevel analysis. BMC Pregnancy Childbirth. 2020;20:1–12.
34. Central Statistical Office. *Research paper on Provincial Gross Domestic Product in Zambia.* 2017.
35. Gabrysch S, Campbell O. BMC pregnancy and childbirth still too Far to walk: literature review of the determinants of delivery service use. 2009; 18: 1–18.
36. Stephenson R, Baschieri A, Clements S et al. Contextual Influences on the Use of Health Facilities for Childbirth in Africa. 2006; 96: 84–93.
37. Moyer CA, Mustafa A. Drivers and deterrents of facility delivery in sub-Saharan Africa: a systematic review.
38. Shifraw T, Berhane Y, Gulema H et al. A qualitative study on factors that influence women ' s choice of delivery in health facilities in addis Ababa, Ethiopia. BMC Pregnancy Childbirth 2016; 1–6.
39. Feyissa TR, Genemo GA. Determinants of institutional delivery among childbearing age women in Western Ethiopia, 2013: unmatched case control study. PLoS ONE. 2014;9:1–7.
40. Mgaya AH, Massawe SN, Kidanto HL et al. Grand multiparity: is it still a risk in pregnancy? BMC Pregnancy Childbirth; 13. Epub ahead of print 2013. https://doi.org/10.1186/1471-2393-13-241
41. Pranata AK, Wahyudi AS, Handoyo L, et al. Determinants of birthplace among middle-to lower-class women in Indonesia: A study using the Indonesian demographic and health survey. PLoS ONE. 2021;16:1–10.
42. Heredia-Pi I, Servan-Mori EE, Wirtz VJ, et al. Obstetric care and method of delivery in Mexico: results from the 2012 National health and nutrition survey. PLoS ONE. 2014;9:1–9.
43. Hailu D, Tadele H, Tadesse BT, et al. Home delivery practice and its predictors in South Ethiopia. PLoS ONE. 2021;16:1–11.
44. Yaya S, Bishwajit G, Uthman OA, et al. Why some women fail to give birth at health facilities: A comparative study between Ethiopia and Nigeria. PLoS ONE. 2018;13:1–11.
45. Kifle MM, Kesete HF, Gaim HT et al. Health facility or home delivery? Factors influencing the choice of delivery place among mothers living in rural communities of Eritrea. 2018; 1: 1–15.
46. Bhattacharyya S, Srivastava A, Roy R, et al. Factors influencing women's preference for health facility deliveries in Jharkhand State, India: A cross sectional analysis. BMC Pregnancy Childbirth. 2016;16:1–9.
47. Yaya S, Bishwajit G, Gunawardena N. Socioeconomic factors associated with choice of delivery place among mothers: A population-based cross-sectional study in Guinea-Bissau. BMJ Glob Health. 2019;4:1–7.
48. Ahmed S, Creanga AA, Gillespie DG et al. Economic status, education and empowerment: implications for maternal health service utilization in developing countries. PLoS ONE; 5. Epub ahead of print 2010. https://doi.org/10.1371/journal.pone.0011190
49. Birhane BM, Bayih WA, Chanie M, et al. Home based postpartum care and determinants in Ethiopia: A multilevel analysis. PLoS ONE. 2022;17:1–12.
50. Sanogo NA, Yaya S, Wealth Status. Health insurance, and maternal health care utilization in Africa: evidence from Gabon. Biomed Res Int. 2020. https://doi.org/10.1155/2020/4036830. Epub ahead of print 2020.
51. Tekelab T, Yadecha B, Melka AS. Antenatal care and women's decision making power as determinants of institutional delivery in rural area of Western Ethiopia. BMC Res Notes. 2015;8:1–8.

52. Kamil A, Perveen K, Al-Tannir MA. Factors associated with Cesarean deliveries at women specialized hospital Riyadh, King Fahd medical City, Kingdom of Saudi Arabia. J Egypt Public Health Assoc. 2011;86:73–6.
53. Mugambe RK, Yakubu H, Wafula ST, et al. Factors associated with health facility deliveries among mothers living in hospital catchment areas in Rukungiri and Kanungu districts, Uganda. BMC Pregnancy Childbirth. 2021;21:1–10.
54. Moshi FV, Mbotwa CH. Determinants for choice of home birth over health facility birth among women of reproductive age in Tanzania: an analysis of data from the 2015-16 Tanzania demographic and health survey and malaria indicator survey. BMC Pregnancy Childbirth. 2020;20:561.
55. Kabir S, Hasan MR, Hossain MI, et al. Determinants and trends of health facility delivery in Bangladesh: A hierarchical modeling approach. Biomed Res Int. 2022. https://doi.org/10.1155/2022/1359572. Epub ahead of print 2022.
56. Patel R, Marbaniang SP, Srivastava S et al. Why women choose to deliver at home in India: a study of prevalence, factors, and socio-economic inequality. *BMC Public Health*; 21. Epub ahead of print 1 December 2021. https://doi.org/10.1186/s12889-021-11779-5
57. Arogundade K, Sampson J, Boath E, et al. Predictors and utilization of health institution services for childbirth among mothers in a Southern Nigerian City. Obstet Gynecol Int. 2021. https://doi.org/10.1155/2021/6618676. Epub ahead of print 2021.
58. Mulenga T, Moono M, Mwendafilumba M et al. Home deliveries in the capital: A qualitative exploration of barriers to institutional deliveries in peri-urban areas of Lusaka, Zambia. *BMC Pregnancy Childbirth*; 18. Epub ahead of print 1 June 2018. https://doi.org/10.1186/s12884-018-1837-7

Publisher's note