RESEARCH ARTICLE

Factors associated with health facility delivery in Kitui County: a cross sectional study [version 1; peer review: 1 approved, 1 approved with reservations]

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Abstract

Background: High maternal mortality rate is a major public health concern in developing countries. Skilled birth delivery is central to reducing maternal mortality, yet health facility delivery remains low in Kitui County, Kenya. Our study estimated prevalence of unskilled delivery and identified factors associated with health facility delivery in Kitui County.

Methods: A cross-sectional study was conducted December 2017-February 2018. 245 women from five administrative wards were interviewed. A structured questionnaire was used to collect data. Variables that had p value ≤ 0.05 in bivariate analysis were included in multivariable regression model to assess for confounders. Variables with a p value of ≤ 0.05 in multivariate analysis were considered statistically significant at 95% CI.

Results: We interviewed 245 (240 analyzed) women from the five wards; the majority were 16-25 years age group (45.5%; 110/240). Mean age was 27 ± 6.6 years. Prevalence of health facility delivery was 50.4%. Distance from a health facility, number of children in a household, occupation of the respondent's partner, number of antenatal clinic (ANC) visits and means of transport were significant factors for not delivering in a health facility. On multivariate analysis, women who lived ≥ 5 km from health facility were less likely to deliver in a health facility (AOR = 0.36; 95% CI 0.15- 0.86). Women who attended ≥ 4 ANC visits were 4 times more likely to deliver in a health facility (95% CI 2.01-8.79).

Conclusions: More than half of the respondents delivered in a health facility. A long distance from the health facility is a hindrance to accessing ANC services. Inadequate ANC visits was associated with home delivery. Improving accessibility of health care services and health education on family planning would increase delivery at a health facility. We recommend Kitui County introduce five satellite

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Any reports and responses or comments on the article can be found at the end of the article.

clinics/ambulatory services for expectant women to access ANC and maternal services.

Keywords

Home delivery, Health facility delivery, skilled birth delivery, delivery practices, Kitui

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Introduction

Globally, the maternal mortality rate has continued to increase leading to failure by countries to achieve the Millennium Development Goals (MDGs) that were set in year 1990 to 2015¹. This made it impossible to achieve the MDG 5² that aimed to reduce maternal and neonatal deaths (now Sustainable Development Goal (SDG) 3). However, maternal deaths have reduced from 546,000 in 1990 to 358,000 in 2015 representing a 34% reduction. Between 2016 and 2030, as part of the SDGs, the target is to reduce the global maternal mortality ratio to less than 70 per 100 000 live births³. In order to achieve, universal health care has been recognized as one of four pillars of government policy and is therefore receiving support from many quarters.

According to Safe Motherhood Initiative (SMI) introduced by World Health Organization (WHO), hospital deliveries were fewer than home deliveries in many regions of sub-Saharan Africa (SSA). The reason for this is that the initiative lacks a clear, concise realistic strategy⁴. As a result, a high number of still births (3.2 million), 4 million neonatal deaths and more than half a million maternal deaths, continue to occur. Most of these deaths are preventable⁴, and when skilled health personnel provide delivery services within health facilities to pregnant women, maternal and neonatal health outcomes improve⁵.

In Kenya, skilled birth attendance has remained far below the international target of 90% at 44%. Skilled birth attendance during delivery is a benchmark indicator for safe motherhood⁶. Delivery by a skilled birth attendant reduces chances of maternal complications. A study by Nyongesa *et al.* found that the gender of a service provider, cost, number of antenatal visits and education level were strongly associated with client's intention to deliver with a skilled birth attendant at delivery⁷.

In Kitui county, Kenya, skilled birth attendance has equally remained very low. Moreover, Mwingi North Subcounty has recorded a low number of deliveries in the health facilities. The district health information system (DHIS2) reported 1472 normal hospital deliveries in 2015 were 1472, 1594 in 2016, and 1194 in 2017⁸.

Even though delivery by skilled birth attendants have remained low, the immunization coverage at a country and county level have remained above the national government rate, showing that immunization coverage is not proportional to the number of skilled birth attendants. According to the Kenya health information system (KHIS), the number of Bacillus Calmette Guillen (BCG) antigen doses administered in Mwingi north Subcounty in 2017 was 3268, while the number of deliveries recorded by skilled birth attendants was 1154⁸. This means that over 65% of babies were delivered at home without the help of a skilled birth attendant, as BCG vaccines are administered within 6 weeks of birth.

Improving maternal delivery care is an essential element of attaining improved maternal health. In order to achieve this

agenda, information about the rates and trends in maternal mortality is essential for resource mobilization, monitoring and evaluation of progress towards the SDGs. However, for this to be attained, maternal health programs should be based on quality evidence. Therefore, this cross-sectional study aimed to identify factors affecting health facility deliveries in Mwingi North Subcounty, Kenya.

Methods

Study setting

The study was carried out in five administrative wards of Mwingi North Subcounty, which has a catchment population of 160,938. Within the Subcounty, there are two Subcounty hospitals, six health centres, 20 dispensaries, two private nursing homes, and one level 4 hospital. Cadres of staff include medical officers (n=2), pharmacists (1), nursing officers (60), clinical officers (14), public health officers (10), nutritionists (2), and medical laboratory technologists (13). Approximately 34,800 women of reproductive age reside in the Subcounty (KDHS, 2014).

Study population

The study population included women of reproductive age (14–49 years) who had delivered within the preceding two years (1st January 2016 to 31st January 2018). Women who were below the age of 18 years who were not accompanied by a guardian or a parent, those with psychiatric problems and very ill women were excluded from the study.

Women who were attending the clinics for routine appointments and who met the inclusion criteria were requested to spare about 15 minutes after their appointment to participate in the interview. The respondents were picked on first come basis, whereby the first 5 attendees of maternal child health services were picked every day until the proportionate sample for each health facility was achieved.

Sample size and sampling technique

Sample size was determined using proportion of home deliveries to proportion of hospital deliveries. This data was collected from DHIS; home deliveries (80%) and in hospitals (20%) in the study area. The standard error was set at 5% and Z score value of 1.96 for 95% confidence interval (CI) multistage and proportionate sampling techniques were applied. The sample size required was 245. Purposively, we selected Mwingi North Subcounty among the eight sub counties of Kitui County. Secondly proportionate sampling was done among the five wards of Mwingi north Subcounty according to their catchment population and the number of health facility deliveries reported.

Data collection and instruments

A structured questionnaire was administered by five research assistants between 1st December 2017 and 31st January 2018. The questionnaire was administered face to face at the health facilities as the respondents were coming to seek maternal child health services. The questionnaire had the following: demographic information, social economic and facility related questions (see *Extended data*⁹).

Data analysis

Study variables were classified as either dependent (outcome) variables or independent (exposure) variables. These included age, marital status, level of education, parity, occupation, number of people living in a house and distance from health facilities,

We carried out descriptive statistics, Chi square test and calculated odds ratios.

The data was collected using paper questionnaire, which was later entered into Epi Info™ (CDC) and Microsoft Excel 2010. Analysis was based on the specific objectives of identifying factors affecting delivery, respondents' characteristics and calculation of prevalence of skilled birth attendant. We ran bivariate and multivariate models using binary logistic regression to assess any relationship between independent variables and health facility delivery. Data was analyzed using Statistical Package for Social Sciences (SPSS) v.25.

We calculated crude and adjusted odds ratios to ascertain effect sizes for any association between the outcome and predictor variables. The significance of these factors was determined using 95% confidence interval (CI). Variables (independent) found to be significant with p value less than 0.05 on bivariate analysis were included in a multivariate logistic regression model to control for any potential confounding variables.

Ethical considerations

Our study tools and protocol were approved by the Meru University of Science and Technology Ethical Review Committee (approval number: MIRERC/923/2017), while permission to carry out the study was granted by Kitui county government. Respondents provided both written and verbal informed consents following introduction and explanation on the purpose of study being done. Those who could write, appended a signature to the consent form while others left their thumb prints on the form. They were informed about their right to interrupt the interview at any time or even decline to be interviewed without any future prejudice or facing consequence.

Results

Demographic characteristics

We interviewed a total of 245 women; the data from 240 women were analyzed as 5 records were removed from analysis as most variables were not captured. In a further 8 records, respondents did not know their years or date of birth.

The mean age of the respondents was 27.6 years ($\pm$ standard deviation (SD) 6.5). The mean age of respondents reporting a previous health facility delivery was 27.4 ± 6.6 , while respondents reporting previous home deliveries had a mean age of 27.5 ± 6.5 . Most respondents were in the age group of 16–25 years (110; 45.8%), followed by the age groups 26–35 years (94; 39.2%) and >35 years (28; 11.7%). A small proportion of respondents did not know their age (8; 3.3%).

Among respondents reporting hospital deliveries, Kyuso ward had the majority of deliveries (91; 37.9%) while Tharaka ward had only 32 (13.3%) ($\chi^2=12.8$, $df=4$, $p=0.01$). Overall, Ngomeni ward had the highest proportion of home deliveries (22; 9.2%) (Table 1).

In terms of education level, most of the women (149; 62.7%) were primary school leavers. Out these women, 32.1% (77) delivered at home. Very few (10; 4.2%) of the respondents did not have any form of education. There was no significant association between level of education and delivery in a health facility ($\chi^2=4.64$, $df=4$, $p=0.33$).

Socio-demographic factors associated with health facility delivery

The majority of respondents were housewives, for both those reporting deliveries in health facilities and at home (51; 21.3% and 53; 22.1%, respectively). All (3; 100%) respondent who had formal jobs delivered in a health facility, while the majority of women who were farmers/livestock keepers (40; 16.7%) delivered at home and 22 (9.2%) delivered in a health facility.

On bivariate analysis, occupation of the mother ($\chi^2=13.42$, $df=4$, $p=0.01$), partner occupation ($\chi^2=18.7$, $df=4$, $p=0.001$), distance from health facility ($\chi^2=19.7$, $df=2$, $p=0.0001$) and residence ($\chi^2=12.8$, $df=4$, $p=0.01$) were factors found to be significantly associated with health facility delivery in Mwingi north Subcounty (Table 1).

On multivariate analysis, women who lived >5 kilometers away from health facilities were 38% less likely to deliver in a health facility (adjusted odds ratio (AOR) = 0.38, 95% CI 0.15–0.86). Partner occupation was also significant for delivery in a health facility (AOR = 0.67, 95% CI 0.26–1.71) (Table 2).

Reproductive health-related determinants for place of delivery

Regarding the number of antenatal clinic (ANC) visits, 58% (139) of respondents attended less than four visits. Among these, 21.3% delivered in a health facility while the rest delivered in their homes. The majority of those who attended more than four ANC visits (70; 29.2%) delivered in a health facility as opposed to 12.9% (31) who delivered in their homes. When we carried out bivariate analysis, number of ANC visits was significant for giving birth in a health facility ($\chi^2=23.6$, $df=1$, $p=0.001$).

A quarter of the respondents (65; 21.1%) had a parity of 1+0, among them 64.6% (42) delivered in a health facility while the rest delivered in their homes. There were 31 respondents who had a parity of >5 (12.9%), of these the majority (24; 10%) delivered in their homes.

Regarding family size (number of children) in household most of the respondents 48.8% (117) had 1–2 children. Of these 64.9% (76) delivered at a health facility while the rest delivered in their homes, however respondents who had more than

Table 1. Social demographic characteristics of women of reproductive age in Mwingi North Subcounty in 2018. ANC, antenatal care.

Variables	Categories	Delivery location, n (%)		P value
		Health facility	Home	
Age, years	15–19	10 (4.3)	9 (3.9)	0.99
	20–24	39 (16.8)	37 (16.0)	
	25–29	26 (11.3)	24 (10.4)	
	30–34	28 (12.1)	30 (12.9)	
	35–49	14 (6.1)	14 (6.1)	
	Mean age	27.4±6.6	27.5± 6.5	
Marital status	Divorced	2 (0.8)	4 (1.7)	0.36
	Married	89 (37.1)	92 (38.3)	
	Single	28 (11.7)	23 (9.6)	
	Widow	2 (0.8)	0 (0)	
Occupation	Business	26 (10.8)	14 (5.8)	0.01
	Casual Jobs	19 (7.9)	12 (5.0)	
	Farming/Livestock	22 (9.2)	40 (16.7)	
	Formal Jobs	3 (1.3)	0	
	Housewife	51 (21.3)	53 (22.1)	
Education	Adult education	0 (0)	3 (1.3)	0.33
	College/University	11 (4.6)	7 (2.9)	
	No Education	5 (2.1)	5 (2.1)	
	Primary	72 (30.0)	77 (32.1)	
	Secondary	33 (13.8)	27 (11.3)	
Ward	Kyuso	49 (20.4)	42 (17.5)	0.01
	Mumoni	16 (6.6)	17 (7)	
	Ngomeni	18 (7.5)	26 (10.8)	
	Tharaka	10 (4.2)	22 (9.2)	
	Tseikuru	28 (11.7)	12 (5)	
Attended ANC	Attended	71 (29.6)	31 (12.9)	0.001
	Not Attended	50 (20.8)	87 (36.25)	
No of ANC attended	Less than 4	51 (21.3)	88 (36.7)	0.0001
	4 or More	70 (29.2)	31 (12.9)	
Means of transport	Ambulance	55 (22.9)	59 (24.6)	0.02
	Own transport	33 (13.8)	16 (6.7)	
	Public transport	33 (13.8)	44 (18.3)	
Distance	<5km	51 (21.3)	21 (8.8)	0.00001
	6 to 10 km	41 (17.1)	45 (18.8)	
	Above 10 km	29 (12.1)	53 (22.1)	

Variables	Categories	Delivery location, n (%)		P value
		Health facility	Home	
Parity	1+0	42 (17.5)	23 (9.6)	0.001
	2+0	33 (13.8)	18 (7.5)	
	3+0	22 (9.2)	29 (12.1)	
	4+0	15 (6.3)	25 (10.4)	
	5+0	2 (0.8)	0 (0)	
	>5+0	7 (2.9)	24 (10.0)	
Partner occupation	Business	36 (15.0)	21 (8.8)	0.001
	Casual Jobs	9 (3.8)	9 (3.8)	
	Farming/Livestock	31 (12.9)	58 (24.2)	
	Formal Jobs	11 (4.6)	2 (0.8)	
	Missing	34 (14.1)	29 (12.1)	
Cost of transport	Affordable	64 (26.7)	43 (17.9)	0.001
	Not affordable	56 (23.3)	70 (29.2)	
	Don't know	1 (0.42)	6 (2.5)	
No of children	1 to 2	76 (31.7)	41 (17.1)	7.6e-05
	3 to 4	31 (12.9)	47 (19.6)	
	5 to 6	11 (4.6)	18 (7.5)	
	>7	3 (1.3)	13 (5.4)	
People living in the household	0 to 3	20 (8.3)	10 (4.2)	0.079
	4 to 5	50 (20.8)	41 (17.1)	
	6 to 7	31 (12.9)	39 (16.3)	
	>8	20 (8.3)	29 (12.1)	
Any practices that hinder delivery of health facility delivery	Present	94 (39.2)	27 (11.3)	0.03
	Absent	106 (44.2)	13 (5.4)	

7 children were few 6.7% (16) of which 81.1% (13) delivered in their homes $\chi^2=21.6, df=3, p=0.00007$ (Table 2).

In a multivariate model, four or more ANC visits (AOR=2.914, 95% CI 1.105-7.682), parity of the woman (AOR=0.12, 95% CI 0.01-3.44) and the number of children in the homestead (AOR=1.96, 95% CI 0.06-35.02) did not significantly influence place of delivery (Table 2).

Facility and cultural-related factors affecting delivery in a health facility

Most of the respondents (86; 35.9%) lived approximately 6 to 10 km away from a health facility. Among these 18.8% (45) delivered at home, while only 17.1% (41) delivered in a health

facility. Very few respondents lived a distance less than 5km from a health facility (71; 30.1%) ($\chi^2=19.7, df=2, p=0.0001$).

Distance from a nearby health institution, means of transport, cost of transport and presence of traditional practices were factors that were statistically significantly determined place of delivery (Table 1).

In a multivariate model, only distance that was associated factor for delivery in a health facility. Those who lived over 5km from a health facility were less likely to deliver in a health facility (AOR=0.37, 95% CI 0.19-0.72), presence of traditional practice (AOR=0.36, 95% CI 0.15-0.86) and means of transport (AOR=0.001, 95% CI 2.38-9.56). Those who used

Table 2. Factors associated with delivery in health facilities among women of reproductive age in Mwingi North Subcounty in 2018. OR, odds ratio.

Variables	Categories	Delivery location, n (%)		Crude OR (95%CI)	Adjusted OR (95%CI)
		Health facility	Home		
Parity					
	1+0	42 (17.5)	23 (9.6)	1	1
	2+0	33 (13.8)	18 (7.5)	1 (4.6e-01 - 2.1)	0.84 (0.28-2.52)
	3+0	22 (9.2)	29 (12.1)	0.4 (1.9e-01- 0.87)	0.12 (0.01-3.44)
	4+0	15 (6.3)	25 (10.4)	0.33 (1.42e-01 0.7)	0.07 (0.00-2.60)
	>5+0	7 (2.9)	24 (10.0)	0.16 (5.61e-02 - 0.41)	0.05 (0.01-2.60)
Partner occupation					
	Business	36 (15.0)	21 (8.8)	1	1
	Casual Jobs	9 (3.8)	9 (3.8)	0.583 (0.197- 1.713)	0.42 (0.10-1.73)
	Farming/Livestock	31 (12.9)	58 (24.2)	0.31 (0.15- 0.62)	0.67 (0.26-1.71)
	Formal Jobs	11 (4.6)	2 (0.8)	3.21 (0.76-22.04)	0.49 (0.07-4.89)
	Missing	34 (14.1)	29 (12.1)	0.684 (0.33- 1.43)	0.52 (0.15-1.67)
Number of children					
	1 to 2	76 (31.7)	41 (17.1)	1	1
	3 to 4	31 (12.9)	47 (19.6)	0.35 (0.19-0.64)	1.96 (0.06-35.02)
	5 to 6	11 (4.6)	18 (7.5)	0.33 (0.14 -0.75)	5.16 (0.11-18.71)
	7 or more	3 (1.3)	13 (5.4)	0.124 (0.027-0.412)	2.81 (0.04-125)
Practices that hinder delivery in a health facility delivery					
	Absent	106 (44.2)	13 (5.4)	1	1
	Present	94 (39.2)	27 (11.3)	2.34 (1.16 -4.93)	1.92 (0.75-5.13)
Means of transport					
	Ambulance	55 (22.9)	59 (24.6)	1	1
	Own transport	33 (13.8)	16 (6.7)	2.21 (1.11-4.54)	4.20 (1.5-12.16)
	Public transport	33 (13.8)	44 (18.3)	0.80 (0.45-1.44)	0.9 (0.42-1.94)
Distance					
	<5km	51 (21.3)	21 (8.8)	1	1
	6 to 10 km	41 (17.1)	45 (18.8)	0.37 (0.19- 0.72)	0.36 (0.15-0.86)
	Above 10 km	29 (12.1)	53 (22.1)	0.22 (0.11-0.44)	0.32 (0.13-0.74)

an ambulance on referral were more likely to deliver in a health facility than those who used other means of transport (Crude odds ratio (COR)=2.21, CI 95% 1.11-4.54) (Table 2).

Discussion

The percentage of women who delivered through the help of a skilled birth attendant is one indicator in meeting MDG 5 (now SDG3 – ensuring good healthy lives and promote

wellbeing for all ages). In almost all countries where health professionals attend more than 80% of deliveries, maternal mortality rate is usually below 200 per 100,000 live births.

In Kenya, delivery by skilled birth attendants (health professionals) is available at very few births⁵. This study therefore considered factors affecting delivery in a health facility. The study has shown that that only 50.4% of the respondents had a

delivery conducted by a skilled delivery attendant. Our results are slightly different from those from KDHS, whereby statistics for skilled attendants were 44% in Kenya.

Our study demonstrated that there is no significant relationship between age and delivery in a health facility. However, other studies, e.g. a study by Mrisho *et al.*¹⁰ in Tanzania, showed that a higher percentage of younger women deliver at health facilities in contrast to older women who often choose to deliver at home. A study by Bhattacharyya *et al.* on factors associated with preference of a health facility delivery indicated that older women preferred health facility delivery as opposed to younger women¹¹. The reason given for this discrepancy according to studies in Zambia and Tanzania was that younger women were inexperienced and also more afraid of birth complications than older women.

The present study showed that attendance of >4 ANC visits influenced the place of delivery. This study agrees with a study that indicated that women who attended >4 ANC visits were likely to deliver in a health facility than those who did less visits¹¹. In addition, the study by Bhattacharyya *et al.* indicated that marital status had little influence on the attendance of ANC during the mother's last pregnancy and consequently on delivery in a health facility; in this study, single and married women mostly delivered either at home or at a government health facility. A study conducted in Myanmar¹² showed similar findings. In this study, the majority of divorced women delivered at home whereas widowed women delivered at either a private or government health facility. Women who make more than 4 ANC visits may have had obstetric history or perhaps have started ANC visits at earliest gestation¹³.

In our study, the number of children (parity) had a negative impact on delivery in a hospital. We found that women with higher parity and having more than two children in the family were more likely to deliver in their homes than their counterparts with low parity and one or two children. These study findings are similar to a study in Myanmar that indicated that women who have given birth more than once are less likely to seek maternal care at a health facility because they feel they can manage the birthing process without the assistance of a health care professional¹³. It was also shown in the present study that the respondent's partners played a role in determining place of delivery; those women whose partners had formal jobs were more likely to deliver in a health facility as opposed to those whose partners' job was casual or otherwise. The findings are similar to those of a study by Okang and Kaseje in Eritrea found that partners who had formal employment were more likely to deliver in a health facility than those with non-formal employment¹⁴.

Level of education is recognized as having an influence on the place of delivery. Women with non-formal education are more likely to deliver at home as opposed to a formally educated

woman with a higher probability of delivering at a health facility¹⁵, as shown by studies carried out in Nepal, Columbia and Kenya¹⁶. Additionally a study by Feyissa and Genemo in Ethiopia showed that the level of education has a significant influence on health facility delivery¹⁵. Contrary to above, the results of this study in Mwingi North Subcounty show that education has little or no influence on the place of delivery. From the data obtained from our respondents, most of the women, irrespective of their level of education, delivered either at home or at a government health facility except for women with adult education who exclusively delivered at their own homes. This finding was in contrast to the anticipated results that would have shown a distinction in place of delivery depending on a woman's educational attainment.

Similarly according to Addai¹³, in this study farming women were less likely to seek medical care at the time of delivery than women in other occupations. This was also influenced by the occupation of partners. This may be because partners with formal employment may be able to provide insurance cover; limitation of financial resources and poor access to health services are cited as the two reasons why farming women give birth at home¹⁷.

Regarding health facility-related factors, most of the respondents in this study lived more than 10km from a health centre and therefore delivered at home due to the long distance from their homes to the health facility. The number of ANC clinic visits were proportionately reduced; as distance increased the number of ANC visits decreased. Our study findings concur with Bhattacharyya *et al.*¹¹ whose findings in a study in India showed that women who gave birth at home would rather have delivered at a health facility but the long distance accompanied by transport challenges proved to be a hindrance. Moreover, a study in Nepal by Devkota *et al.*¹⁸ drew a similar conclusion, where they found that approximately 18% of women who had intended to deliver at a health facility ended up delivering at home. These findings are in agreement with Kenya's KDHS that showed that most of the health facilities are over 5km radius from the consumers of services¹⁹.

Conclusions

Health facilities are the preferred sites for delivery regardless of the level of education, marital status and occupation of the respondents. Multiparous women are less likely to give birth at a health facility in preference of home deliveries. Long distance from the health facility is a hindrance to accessing health services and in turn maternal health care from qualified medical practitioners in Mwingi North Subcounty, Kenya.

Data availability

Underlying data

Figshare: Factors associated with health facility delivery in Kitui County; A cross sectional study, <https://doi.org/10.6084/m9.figshare.12295466.v1>²⁰.

Extended data

Figshare: Questionnaires, <https://doi.org/10.6084/m9.figshare.12374702.v1>⁹.

This project contains the following extended data:

- Questionnaire in the language it was asked with an English translation.

Data are available under the terms of the [Creative Commons Attribution 4.0 International license \(CC-BY 4.0\)](#).

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Danish Ahmad

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The authors use cross sectional survey data collected from 245 women in a region of Kenya, Kitui county, to assess determinants of institutional delivery. The paper is set against the high rates of maternal mortality and countries having missed UN-MDG targets. The focus on institutional delivery in the study area builds on global evidence that finds reduction in maternal mortality occurs initially as rates of skilled birth attendance and institutional deliveries increase.

The original research seeks to identify socio-demographic factors associated with deliveries in health facilities compared to home deliveries using bivariate and multivariate analysis. Women were interviewed at a health facility where they had sought care using a structured questionnaire and after obtaining informed consent. The authors report descriptive statistics for an analytical sample of 240 women and initially chi-square results for bivariate analysis. The bivariate analysis identified mother and partner's occupation and distance from health facility and residence as statistically significant factors. Multivariate analysis is conducted with select variables (distance and partner occupation) arising as statistically significant. The paper builds on established maternal health research and provides information that is context specific to the study area. While the paper provides information unique to Kitui county, the generalisability of the paper is limited due to a small sample size and methodological constraints.

The authors have done well to use initial set of socio demographic factors to assess institutional delivery however, the broader maternal health literature has established a broader set of factors at individual, household, and community level that the paper could have considered. The authors may like to provide details related to the area selected, Kitui, for the study in context of Kenya's overall MMR. Readers would like to understand why this area was chosen and also understand the administrative hierarchy of the country.

The selection of mothers from health clinics for interviews affects the rigour of the paper as selection bias may impact the associations seen. Women who are likely to seek care from a health

facility would be different from those who aren't seeking care. A limitations section is required in the paper where the authors may like to provide details relevant to the paper. While multivariate analysis is used, additional details are required such as the type of multivariable analysis and the construction of the outcome variable.

In papers with small sample sizes, the authors can consider recategorizing variables where the sample size is minimal. Table 1 identifies various categories with only 1 or 2 women that fits these categories. It is an accepted practise to construct categories in such cases so that the analysis is performed on a larger subset of women. Similarly, the construction of the baseline variables needs to be reviewed by the authors to assess which baseline category is most meaningful for their interpretation. The authors provide a wide variety of references which make for an insightful reading. As papers from South Asia and the African context are likely to be different, the authors may like to compare studies from similar regions. The study from Myanmar, though informative, is limited in relevance to a culturally different environment such as Kenya. Overall, the results also need to be interpreted with care as the small sample size of women in the paper may be resulting in statistically insignificant findings.

The public health potential of the paper can be better articulated so that findings can lead to meaningful changes in health policy and practise in the study area.

The language used was clear and easy to understand though in some places typos and grammatical errors cropped up. References had formatting errors especially where websites were used where citation details were missed.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Global health, health system strengthening, maternal and child health, healthy aging, disaster risk reduction

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 20 Oct 2021

Mathew Mutiiria

Thank you reviewer for spending valuable time looking at this article
Find the following responses to the comments

I) The generalisability of the paper is limited due to a small sample size and methodological constraints.

Response:

Though this may be true, the authors used the formula by Cochran (1977) for sample size determination in which two proportions are available. We, therefore, feel that this sample size was sufficient for this study in this area.

ii) Readers would like to understand why this area was chosen and also understand the administrative hierarchy of the country.

Response:

Kenya has 47 administrative units called counties. Kitui county was among the counties with the lowest number of health facility delivery in the country according to the Kenya district health information system.

iii) A limitations section is required in the paper where the authors may like to provide details relevant to the paper.

Response:

We agree that this section is useful, however, according to the guide by the editors for this journal, a limitation section is not among the 18 sections of the article by this journal. However, we have minimized respondents biasness by ensuring that the persons who were interviewed were within at most 2 years from the date of last delivery and that the questions were well articulated.

iv) Similarly, the construction of the baseline variables needs to be reviewed by the authors to assess which baseline category is most meaningful for their interpretation.

Response:

Our most useful baseline variables were social demographic, social-economic and health facility and social-cultural in that order.

v) The study from Myanmar, though informative, is limited in relevance to a culturally different environment such as Kenya.

Response:

Cultural differences in the two counties are indeed different, but our study referenced Myanmar based on the number of ANC visits which is not entirely a cultural factor.

vi) The public health potential of the paper can be better articulated so that findings can lead to

meaningful changes in health policy and practice in the study area.

Response:

To make meaningful changes, we have made some of the recommendations such as The county director of health services Kitui should introduce Health education in health facilities on the importance of attending the full prescribed ANC visits. The County Government of Kitui is encouraged to provide satellite clinics or ambulatory services to ensure that expectant women have access to antenatal care services.

Conclusion

We hope that these responses will provide a better understanding of the study
We will share a version2 of the manuscript.

Competing Interests: There are no competing financial or non-financial interests in this study from the authors.

Reviewer Report 01 September 2021

<https://doi.org/10.5256/f1000research.25848.r92076>

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Ferry Efendi

Universitas Airlangga, Surabaya, Indonesia

Interesting study regarding health facility delivery and the associated factors in Kitui County. My feedback as follows:

1. On the methods section please elaborate the inclusion criteria of this study.
2. Please explain your outcome and exposure variables along with the category of each variable.
3. The explanation of Table 1 doesn't match with the number on the table itself, please kindly check.
4. I am wondering about the section titled: "Facility and cultural-related factors affecting delivery in a health facility". Did you collect the data regarding culturally related factors?
5. On the discussion section, I think the authors should rewrite the discussion in order of the variables in Table 2.
6. Please state the limitations of this study.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Community health nursing

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 18 Sep 2021

Mathew Mutiiria

Dear Reviewer,

Thank you for spending your valuable time looking at this article.

Your comments are well noted and I will consider them to appear in version two of the article

Regards

Mathew - Author

Competing Interests: No competing interests were disclosed.

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