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Understanding what women want: eliciting preference for delivery health facility in a rural sub-County in Kenya, A Discrete Choice Experiment.

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Abstract

Objective: To identify what women want in a delivery health facility and how they rank the attributes of a health facility when choosing where to deliver using a Discrete Choice Experiment.

Design: We conducted a Discrete Choice Experiment to elicit rural women's quality of care preferences for their choice of a health facility in which to deliver. Facility attributes were systematically identified through both a comprehensive literature review and a qualitative study. The DCE utilized a hypothetical stated preference methodology to establish preferences. We ran both a multinomial logit model to identify relative ranking of attributes and a mixed multinomial logit model to establish the sociodemographic variables that influence women's preferred attributes.

Setting: Six health facilities that presented a mix of public and private health facilities within Naivasha sub-County a semi-rural area with populations drawn from agriculturalist, pastoralist and peri-urban settings.

Participants: women aged 18-49 years who had recently delivered within six weeks were recruited from child welfare clinics at six health facilities.

Primary and secondary outcomes: The DCE required women to select hypothetical health facility A or health facility B or opt-out alternative (representing a home delivery). These were presented as repeated hypothetical scenarios. Data were analyzed using both a multinomial (conditional) logit model to evaluate average preferences and relative importance of the selected attributes and a mixed multinomial model to evaluate how interactions with sociodemographic variables influence the selected attributes.

Results: A total of 474 participants were sampled, 466 participants completed the survey (response rate 95%). 8 individuals were dropped because of incomplete data on key attributes. All the attributes identified were found to be important to the women by the level of statistical significance showing internal validity. The attribute with the greatest association with health facility preference was having a kind and supportive attitude of healthcare worker, followed by availability of medical equipment and drugs, and thirdly quality of clinical services during the delivery. Distance to the health facility, availability of referral services, cost of delivery services were ranked 4th, 5th and 6th respectively. The opt-out alternative was negative and ranked last suggesting a disutility for home delivery.

Conclusion: The most highly valued attribute was a process indicator of quality of care; kind and supportive care by health care workers followed by other technical indicators of quality of care such as

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availability of equipment for cesarean sections and clinical quality of care. Policy makers charged with implementing the free maternity services should take into account women's preferences when designing interventions at health facility level. These factors can help inform strategies that are patient-centered as part of the initiative to increase quality of care during delivery service at the county level.

Strengths and limitations of the study

- The study reports the use of a discrete choice experiment in maternal health services within the context of the newly implemented free maternity services policy in Kenya.
- The findings of this study will inform the contextual aspects of quality of care valued by women based on their experience of care during delivery services in a rural setting with low income populations.
- The hypothetical nature of the DCE might results in biased results as respondents might make inaccurate choices while being aspirational regarding the quality of services, they expect at a health facility during delivery.
- Bias might also be introduced by the fact that the hypothetical choices might not be representative of women's choices because decision making around delivery place in real life may be made in a social context with other key family members involved in such rural contexts.

Key words

Discrete choice experiment preferences delivery health facility rural women Kenya

Word Count

 6059

Background

Globally, maternal mortality estimates show that there were 295,000 maternal deaths in 2017, representing a general reduction in maternal deaths. (1) Strategies to reduce the high burden of maternal mortality in low and middle-income countries have included increasing coverage for high quality facility-based delivery. (2), (3) Facility-based delivery is increasing in sub Saharan Africa due to the growing attention on efforts to reduce maternal mortality resulting in substantial declines in mortality over the last few decades. (4),(5) This has been facilitated in part by overcoming barriers to access such as cost and distance. However there remains the challenge of growing inequities in maternal health outcomes within countries and this demands that we pay attention to the barriers to access to high-quality facility-based delivery.

Kenya is one of the countries exhibiting insufficient progress in reducing preventable maternal deaths, the reported maternal mortality ratio is currently estimated at 362 deaths per 100,000 live births.(6) In a major move to eliminate barriers such as cost, the Government initiated the free delivery policy in 2013. (7) The government's free maternity policy together with access to private delivery care financed by the National Health Insurance Fund (NHIF) expanded the options for delivery health facilities available for women to choose from. This resulted in positive trends in access to facility-based delivery particularly in rural areas where investments in the health system and physical infrastructure such as road network had resulted in increased access. The total numbers of health care facilities in Kenya has grown to 3965 over the last 10 years. (8) All these strategies increased women's choices available for delivery health facilities.

However, inequities in maternal health outcomes still exist in Kenya particularly at the county level, a recent UNFPA report in Kenya identified 15 counties that contribute to 98.7 % of the maternal deaths with most of them been rural counties.(9) Quality of care provided also differs substantively across regions in Kenya with one study identifying a 25 percentage point gap between Nairobi and Coast region. (10) Additionally, higher volume facilities and those with caesarean section capacity seemed to receive high quality of care. (10) There have also been recent reports of increased utilization of county level hospitals for deliveries. (11) Other national assessments of quality of care at health facilities in Kenya

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suggest that poorer women, have a higher likelihood of encountering poor quality of maternal health services in Kenya. (12) Assessments targeting primary health facilities have shown that these facilities offer poorer quality of services, with gaps with regard to basic infrastructure, medical equipment and supplies a, diagnostic accuracy and adherence to clinical guidelines.(13),(14) The Government in recent times introduced the Kenya Quality Model for Health (KQMH) to improve quality of care at health facilities. This strategy aimed to identify quality improvement in healthcare by improving adherence to standards and guidelines, improving the structure-process-outcome of health services by applying the principles and tools of quality management and meeting the needs of patients in a cultural acceptable way. However, several implementation challenges were identified such as sub-standard health facilities, professional misconduct amongst nonprofessionals offering health facilities and lack of pharmaceutical supplies. (15)

The WHO framework on quality of health services during facility-based delivery proposes that a high-quality health system is safe, effective, patient centered, timely, efficient, and equitable. (16) These frameworks assume knowledge on the end-users. However, it is likely that Kenyan women in rural areas may be incapable of assessing the clinical quality from a technical standpoint. However, they are able to assess the quality of the care and choose delivery health facilities based on the experience of care such as respectful care by health care workers. There is limited knowledge in Kenya on what women value in the care they receive from the health facilities. Most strategies for assessing quality of care during delivery in Kenya have previously focused only on either the health system inputs required, satisfaction levels at the end of the continuum of care and are based on national level assessments such as service provision assessment and demographic health surveys. (6),(8) These studies while useful and nationally representative, however fail to identify and provide a ranking for demand side barriers. As a consequence, they are unable to fully explain why women prefer certain health facilities over others. Hence there is limited contextual information on what women value when making decisions on choice of a health facility. This information is particularly useful in resource constrained settings where prioritization guides use of few health resources.

Discrete Choice Experiments (DCE) can be particularly helpful in eliciting preferences. DCE's allow health services users to state individual preferences when offered different hypothetical choices. (17) They are based on the assumption that services can be described by their attributes, and that the value of a service depends on the nature and level of these attributes. (18) DCE's have been used to examine a broad range of health system challenges in sub-Saharan Africa patient preferences for hospital services in South Africa and maternal health services in rural areas of Ethiopia and Tanzania. (20), (21), (22) We intend to address these questions with an eye toward the examination of quality of care within the context of the

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Kenya Quality Model for Health (KQMH). The main objective of this study was to use a DCE to elicit women's preferences with regard to the characteristics of a delivery health facility based on their delivery experiences in a rural sub-County. We aim to provide insights on what women's view of quality of care is based on their experience of care. We hope these preferences will present the patient perspective to complement the needed technical quality improvement to support the development of a quality health system, so women can get what they want and deserve from the health system.

Methods

Study Setting

Naivasha Sub-County is a semi-rural setting 50km to the northwest of Nairobi. It is composed of peri-urban settlements, and includes agriculturalist and pastoralist populations within Nakuru County. It has a population of roughly 181,966 people. Primary Health facilities include government health facilities; several private health facilities; and a County Referral Hospital in Naivasha town. The population is also served by a faith-based private tertiary hospital, about 20 km away from Naivasha in neighboring Kiambu County. Naivasha was selected as a study site because recent evidence from a UNFPA report rank ordered counties by contribution to the burden of maternal deaths and Nakuru County was ranked fourth. (9)

Discrete Choice Experiments

DCE's are an attribute driven technique used to elicit stated preferences and interventions(18) and are based on the assumption that health care interventions services and policies can be described by their attributes. (23) The attributes of the interventions and their assigned levels are usually combined using experimental designs produce a set of hypothetical choice alternatives. Respondents are then asked to choose which alternatives they prefer the attribute levels determine the utility respondents attached to a particular characteristic of an intervention and hence their preferences. (24) DCE's belong to a family of techniques called conjoint analysis which is a rigorous method of eliciting preferences and have been identified for analyzing stated preferences. The advantage of DCE's over other methods of economic evaluation is that they permit estimation of a range of healthcare elements including structural components, process components, health outcomes and non-health outcomes and are useful in understanding what users' value in health care. (18)

Identification of attributes and attribute levels

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The first stage in the development of a DCE is the identification of attributes and attribute levels. The literature recommends a careful selection of attribute and their levels. Previous studies suggest a review of the literature and qualitative work to aid in the identification of relevant attributes. (25) We undertook a comprehensive literature review of the key literature of facility-based delivery and skilled birth attendance in sub-Saharan Africa to gain an in depth understanding of the factors influencing place of delivery. We also conducted a qualitative study with 6 focus group discussions with 50 women at a mix of public and private health facilities with maternity wards. We also conducted -in-depth interviews with 12 health care workers serving as in- charges at the maternities. We used an interview guide. See supplementary file 1. The participants were purposively selected women were aged 18 to 49 and had just delivered their babies within 6 weeks and were attending child welfare clinics at the different health facilities. Table 1. Shows the final attributes and attribute levels selected for the DCE.

Experimental design

We designed the DCE as an unlabeled one with sixteen choice set presented under three alternatives: health facility A, health facility B, and an opt-out alternative where the woman would choose none of the two facilities, presented as preference for home delivery. See Table 1 for the final attributes and attribute levels included in the DCE. All attributes in the choice experiment had two levels each except cost, which had three levels. This resulted in a design of $(2^5 \times 1^3 = 96)$ choices in the full fractional design. This number of choices would have been too tedious for the respondents to handle. We opted to use a fractional factorial design to reduce the choices from 35 to 16, making it manageable for the respondents. This was done using a D-efficient design using Ngene software to generate the original experimental design (Choice Metrics, 2012). All the attributes were dummy coded to allow comparison against a reference category. The D-efficient design also allowed for favorable design such as orthogonality, level balance, minimum balance and overlap. (26) The 16 choice-set questions were generated from the design. The choice-sets were grouped into two sets, and each respondent was presented with a choice card with eight questions in a single block.

Table 1. Final list of attributes and attribute levels included for the DCE.

Attribute	Attribute level
Quality of clinical services at the health facility	Good quality treatment
	Bad quality treatment

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Attitude of healthcare workers	Kind and supportive healthcare worker
	Unkind and unsupportive healthcare worker
Availability of medical equipment and supplies	Medical equipment and supplies available
	Medical equipment and supplies not available
Distance to the health facility	Health facility is close to residence
	Health facility is far from residence
Referral to the health facility	Clean health facility
	Dirty health facility
Cost of delivery service (Kenyan Shillings/ Ksh)	3000; 5000; 8000

DCE Study sample

The choice-sets were reviewed for content by a team of policy makers from the county headquarters during a one-day meeting at the main referral hospital at the county. The meeting confirmed and validated the choice of attributes as important to both women and healthcare workers. This was followed by a pilot study with 30 women in a neighboring sub-County to test the attributes. The women who participated in the pilot were not included in the main study. The pilot resulted in minor revisions to the wording of certain attributes for example the attribute 'treatment at the health facility' was changed to 'quality of clinical care during delivery' to provide a distinction between interpersonal and clinical aspects of quality of care. The final DCE scenario with the final attributes can be seen in Table 2. These questions were then loaded into Open Data Kit (ODK) and incorporated into a questionnaire consisting of items on sociodemographic and maternal health utilization variables. The questionnaire contained question adapted from the Kenya Demographic Health Survey 2014.9 (8) See supplementary file 2. We used the rule by Johnson and Orme (2003) to suggest the sample size required for main effects. This depended on the number of choice tasks (t) the number of alternatives (A) and the number of analysis cells (C). We had 16 choice-tasks (t) with 3 alternatives (a) and 3*2 analysis cells (c). N >500*c/t*a=N>500*6/16*3 = N>62.5. (27). Using this formula we derived a mimimum sample size of 62.5. We however collected a larger random sample of 477 women from six health facilities that would enable appropriate estimation of both main and interaction effects. Lancsar and Louiviere (2006) in an earlier study recommend a sample of 20 respondents per questionnaire version as sufficient to estimate reliable DCE models.

Table 2. Example of a scenario in a choice-set card that was presented to the women

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THE DISCRETE CHOICE EXPERIMENT ON ATTRIBUTES FOR PLACE OF DELIVERY IN RURAL SUB COUNTY IN KENYA

Our objective is to conduct a DCE experiment to explore the relative importance of attributes of place of delivery to Kenyan women living in Naivasha sub-County to try and elucidate what women's value and their preferences are when they are making choices on place of delivery. You will be provided with a script on a mobile phone and you will be asked to imagine that you are pregnant and you are given a choice between the following two health facilities to deliver your baby in. Which one would you prefer? Facility A or Facility B? You also have an option of choosing none of the two health facilities as Option C. This implies delivering your baby at home. There are no right or wrong answers

SAMPLE CHOICE CARD

Attribute	Health Facility A	Health Facility B	Option C
Quality of clinical care during delivery	Good quality	Bad quality	(None of the two health facilities- home delivery)
Attitude of healthcare workers	Kind and supportive attitude	Unkind attitude	
Cost of delivery services	3000Ksh	5000Ksh	
Availability of equipment and supplies	Equipment supplies not available	Equipment & supplies available	
Distance to health facility	Facility is close to home	Facility is far from home	
Availability of referral health services	Referral services available	Referral services unavailable	
Your choice (tick only one)	☐	☐	☐

Data collection

A team of six research assistants along with their two supervisors received a five data training on data collection and study tools by the first author. Women were randomly recruited during postpartum immunization clinics from six health facilities representing a mix of public and private health facilities. We randomly sampled 474 women. After the women gave informed consent, we then interviewed them using the Open Data Kit (ODK) Platform.

Patient and public involvement statement

During the pilot phase the women aged between 18 and 49 who were the main respondents provided feedback on the survey instruments. They also reviewed and provided feedback during the qualitative phase on the selection of the attributes.

Ethics

Permission to conduct the research was provided by the National Commission for science research and technology and innovation (NACOSTI). Ethical approval was provided by AMREF ERSC and permission to conduct interviews at the health facilities was provided by the County Government of Nakuru.

Model specification

The data were imported and analyzed in Stata 15 (StataCorp LP, College Station, USA). Descriptive statistics were calculated for the non-DCE variables. The DCE data was analyzed using the Random Utility model.(28)A model that expresses the utility 'U' in of an alternative i in a choice set C_n (perceived by individual n) as two parts: 1) An explainable component specified as a function of the attributes of the alternatives $V(X_{in}, \beta)$; and 2) an unexplainable component (random variation) ε_{in}.

$U_{in} = V(X_{in}, \beta) + \varepsilon_{in}$

The individual n will choose alternative i over other alternatives in a choice set C if and only if this alternative gives the maximized utility. The relationship between the utility function and the observed k attributes of the alternatives can be assumed under a linear-in-parameter function (19). Therefore, the utility the respondents attach is related to the attribute and attribute levels within the choice-sets, meaning that if alternative i is chosen within a choice set, i will yield the maximum utility compared to j alternatives. A is the alternative specific constant, x are the attributes in the DCE and β are the coefficients describing the marginal utility of the attribute. The standard conditional logit model is below:

$V_{in} = \alpha_i + \beta_i x_{i1} + \ldots + \beta_k x_{i+e}$

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A base conditional model was used to estimate the mean change in utility, preference which respondent placed on attributes (19). α i is a constant term that represents the general preference for place of delivery at a health facility compared to the alternative of opting out and having a home delivery. Dummy coding was used for the data, each attribute level was assigned a value of 1 whenever it was retained and 0 when omitted. The utility model makes the assumption that women will trade-off between the different attribute levels and choose the alternative that gives the greatest utility. The conditional model is suitable for estimating average preferences across respondents. The utility function was estimated for the following model:

$U_i = α_i + β1QualityClinicalcare + β2kattitudeofhealthworkers + β3Medicalequipmentandsuppliesavailable + β4distance + β5cleanliness + β6Costs + ε$ *(error term)*

$α_i$ is the alternative specific constant (ASC) term that shows the preference for place of delivery (either a health facility or home), $β$'s 1-6 are the parameters for each of the attribute levels and $ε$ is the error term.

Data Analysis and model estimation

The Discrete Choice models' responses were analyzed according to the random utility theory framework (28). This framework assumes that women seek to maximize their utility according to the perceived benefit associated with the different attributes and attribute levels.

The aim of the base multinomial logit model estimation is to determine whether the attributes are important (statistically significant, as shown by the significance level of the $β$) and the direction of importance (shown by the sign of the estimated $(β)$ and relative importance (size of the estimated parameter). The main hypothesis test was whether the parameter estimates were significantly different from zero for all attributes.

Due to the assumption of irrelevant independent alternatives, the presence of heterogeneity in choices we estimated a generalized mixed multinomial logit model to assess for preference heterogeneity amongst the women. (29) The mixed multinomial logit model overcomes some of the limitations of the base multinomial logit by allowing for random taste variation, unrestricted substitution patterns, and correlation in unobserved factors over time. The Mixed multinomial logit can also utilize any distribution for the random coefficients, unlike probit which is limited to the normal distribution assumes that some of the parameters are random following a certain probability distribution. (29) It allows for the estimation of both main and interaction effects. This was done by extending the generalized mixed multinomial model and testing interactions between the sociodemographic and the women's attributes in order to investigate how preferences may vary according to observed individual characteristics. The sociodemographic characteristics included such as maternal age, marital status, education and income status have been known to influence place of delivery in Kenya. (30),(31),(32),(33)

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The output of the mixed multinomial logit model includes the mean and the standard deviations of the random parameter estimates with confidence levels. The mean parameter estimate represents the relative utility of each attribute while the standard deviations for a random parameter suggest the existence of heterogeneity in the parameter estimates over the sampled population around the mean parameter estimate i.e., different individuals possess individual-specific parameter estimates that may be different from the sample population mean parameter estimates. (29) The p-value of the interactions shows statistical significance for an interaction between sociodemographic variables and attributes hence signifying the influence of the woman's characteristics. The theoretical validity of the design will be explored by examining the signs and significance levels of parameter estimates.

To address bias, we tested for choice monotonicity, this is the assumption that a respondent will choose an alternative in the choice task that is superior to the other alternative on all choice attributes. (24), (23)We included a choice-task with dominated alternatives within the choice-sets. We included these responses in the analysis because Lancsar and Louviere (2006) noted that such respondents with dominant choices should not be deleted. This is because deleting them may result in the removal of valid preferences and hence reduce statistical efficiency and result in sample selection bias.

Results

Participant characteristics

474 women were invited to participate in the DCE experiment. There was incomplete data for eight respondents. The DCE survey was successfully administered to 466 representing a 98% response rate. The average age of the respondents was 26 years, 32% were primiparous.   88% of the women reported themselves as married and 86% had attained a secondary school education. About 60% of the heads of household had attained up to a secondary education. Only 18% of the rural a woman were heads of household, however 95% respectively claimed to have influence over household-level decisions. Approximately 83%, reported that they were not the main source of household income Finally, about 67% of the women reported having moved to the study setting from elsewhere within the last five years. See Table 3 below for details on the sociodemographic characteristics.

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Table 3. Sociodemographic characteristics of women in Naivasha sub-County (N=466).

Naivasha sub-County		
Sociodemographic variables	N	(%)
Age n (mean (SD))	26(5.1)	
Marital status		
Single	57	12
Married	409	88
Education		
Primary school	175	38
Secondary school	221	48
University/tertiary	66	14
Parity		
1	151	32
> 2	215	68
Head of household status		
Woman not HH	381	82
Woman head of HH	85	18
Head of household education		
Primary school	100	27
Secondary school	196	53
University/Tertiary	72	20
Woman's influence on decision making within HH		
Woman had no influence	18	5
Woman had influence	363	95
Main-earner status		
Is not the main earner	386	83
Is main earner	79	17
Residence (moves)		
Moved in 5 years	226	67
Moved over 5 years	112	33

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To enable the estimation of main and interaction effects each respondent was given a survey with 3 unlabeled alternatives (health facility A, health facility B and an opt-out option) with 16 choice-sets to choose from, resulting into 48 observations per respondent. The number of observations analyzed within the rural site were 22,368 out of 22,566. 198 observations were dropped by STATA automatically because of dominant choices.

In the rural setting, the variable with the greatest association with choice of health facility was attitude of the health care workers, followed by availability of medical equipment and drugs and thirdly the quality of clinical services during delivery The distance to the health facility, availability of referral health facility, cost of delivery were ranked 4th, 5th, 6th. The opt-out alternative had a negative sign and was ranked 7th . See Table 4 below.

The direction of the coefficient signs provides a check on the theoretical validity of the DCE model, that is, whether the coefficients move as economic theory or a priori expectation would predict. All the attributes with the exception of the opt-out had the expected positive signs showing utility with the exception of the cost attributes. The cost attribute was positive, however economic theory expects them to be negative showing that women have a disutility for high costs.

Table 4. The base multinomial logit model with for a DCE on preferences for place of delivery amongst women in a rural sub-County.

	Rural sub-County		
Attribute	β	P value	C.I
Attitude.	1.184***	<0.001	(1.11-1.25)
Medequip.	1.073***	<0.001	(1.01-1.13)
Qualclin.	0.826***	<0.001	(0.76-0.89)
Distance.	0.457***	<0.001	(0.39-0.52)
Referral.	0.266***	<0.001	(0.20-0.33)
Costs.	0.000018***	<0.001	(2.55e-06-0.00033)
ASC.	-0.849***	<0.001	(-0.97-0.73)

Legend Attitude: attitude of healthcare workers, medequip: medical equipment and drug, Qualclin: quality of the clinical delivery services, Distance- Distance to the health facility, Referral: referral service availability, Clean: cleanliness of the health facility, ASC: Alternative Specific Constant.

* Significance at the 90% level ** significance at the 95% level *** significance at the 99% level

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For the generalized mixed multinomial logit model with no interactions, we found out that all the mean coefficients values for all the attributes, were statistically significant at the 99% level with the exception of the opt-out attribute which showed significance at a lower level 90%. See Table 5. This meant that we could reject the null hypothesis and conclude that all the selected attributes selected were important to the women respondents. The low significance value for the opt-out suggested that women had a low value for home deliveries. All the attributes had strong statistically significant parameter estimates for the standard deviation, except the cost attribute which had significance at the 90% level. This suggested weak preference heterogeneity meaning that was very little variation around the mean, with very few women possessed individual-specific parameter estimates that might be different from the sample population mean.

Table 5. Generalized mixed logit model showing means and standard deviations to explain preference heterogeneity in choices made by women in rural setting

	Mean Coefficient values		Standard Deviations (SD)	
	β	P- value	B	P- value
Attitude.	1.972***	<0.0001	1.582***	<0.0001
Medequip.	1.764***	<0.0001	0.778***	<0.0001
QualClin.	1.316***	<0.0001	1.577***	<0.0001
Distance.	0.759***	<0.0001	0.374***	<0.0001
Referral.	0.436***	<0.0001	0.535***	<0.0001
ASC.	0.289*	0.377	3.202***	<0.0001
Cost.	-10.089***	<0.0001	0.112*	0.639
No. of Observ.	22, 368			
Wald Chi	2173.84			
Prob >chi2	0.0000			
Log likelihood	-4400.93			

Legend

*Attitude: attitude of healthcare workers, Medequip: medical equipment and drugs, ASC: Alternative Specific Constant, Qualclin: quality of clinical delivery services, Distance: distance to the health facilities, * Significance at the 90% level ** significance at the 95% level *** significance at the 99% level*

Table 6. The mixed multinomial logit model showing interactions between sociodemographic variables and attributes to explain preference heterogeneity in choices made by women in a rural sub-County.

	Interaction terms (Mean Parameter)							
	w/Sec educ		w/ age		w/ marital status		w/main earner	
Attribute	β[a]	p-value	β[a]	p-value	β[a]	p-value	β[a]	p-value
Attitude.	-0.05*	0.771	0.004*	0.753	0.286*	0.082	1.38***	<0.0001
Medequip.	-0.15*	0.917	0.07***	<0.0001	1.61***	<0.0001	1.51***	<0.0001
QualClin.	0.04*	0.328	0.05***	<0.0001	1.19***	<0.0001	1.11***	<0.0001
Distance.	0.149*	0.099	0.0005*	0.938	0.17**	0.033	-0.12*	0.110
Referral.	-0.0268*	0.787	0.02***	<0.0001	0.45***	<0.0001	0.22*	0.077
Cost, (Ksh)[b]	0.00008***	<0.0001	-13.41***	<0.0001	-10.31***	<0.0001	0.00003*	0.386
Interaction terms (SDs)								
Attitude x covariate	0.27*	0.105	-0.02***	0.004	0.86***	<0.0001	1.11***	<0.0001
Medequip x covariate	0.36*	0.179	-0.03***	<0.0001	1.61***	<0.0001	1.51***	<0.0001
Qualclin x covariate	0.289*	0.345	0.06***	<0.0001	1.43***	<0.0001	1.14***	<0.0001
Distance x covariate	-0.13*	0.410	-0.0002*	0.751	0.008*	0.804	-0.008*	0.910
Referral x covariate	0.52***	0.001	-0.02***	<0.0001	0.55***	<0.0001	-0.49**	0.007
Cost X covariate	0.00007***	0.026	0.321*	0.238	0.447*	0.224	0.00001*	0.800
No. of respondents	466	466	466	466	466	466	466	466
No. of observations	22,272		22,368		22,368		22,320	
Log-likelihood	-4493.82		-4399.34		-4473.60		-4472.99	
Prob> χ2	0.0000		0.0000		0.0000		0.0000	
Likelihood ratio χ2	1462.88		3256.14		1052.72		909.59	

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Preference Heterogeneity

The influence of sociodemographic characteristics on the preferences suggested variation in preferences for the attributes for place of delivery. See Table 6. Younger married women who identified themselves as main earners were more likely to show strong and significant preferences for the top three valued attributes of having a kind and supportive healthcare worker, availability of medical equipment and good quality clinical services. Referral services were highly valued by younger married women with a secondary education who were not the main earners within their households. Costs of delivery services was highly valued by women with a secondary school education but the rest of the sociodemographic had a weak preference for cost of delivery services. The women showed weak preferences for the attribute of distance to the delivery health facility suggesting that there was no variation in the characteristics of women who valued this attribute.

Discussion

This study explored women's preferences for characteristics for delivery health facilities in a rural sub-County in Kenya. The main finding was that all the attributes had an impact on the probability of choosing a health facility for delivery over a home delivery. To our knowledge, this is the first report of using a DCE to address attributes valued by women in a rural setting in Kenya within the context of a free maternity services policy. The most highly valued attribute for women when making a choice of a delivery service was the attitude of health care workers, this was followed closely by the availability of medical equipment and quality of clinical services. Lowly valued attributes were the availability of referral services and the cost of delivery service. The opt-out alternative that signified home delivery was ranked last and was negative signifying women had a disutility for home deliveries in this setting.

Based on the magnitude of the estimated attribute-level coefficients we found out that the attitude of healthcare workers providing delivery services was valued above all other attributes. Quality of care standards require that women be treated in a respectful manner and in a way that upholds their dignity. (16) Global literature has identified that the attitude of health workers managing women during labor and delivery presents a huge challenge with reports of mistreatment of women as evidenced in a recent systematic literature review covering low- and middle-income countries. (34) This has also been reported in diverse settings within sub-Saharan African such as Guinea (35), Nigeria (36) and South Africa. (37)

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The high value for attitude of health care workers as an attribute has been reflected in other DCE studies set in rural settings in sub-Saharan Africa. (21),(22),(38) Mistreatment has increasingly been recognized as a barrier to women accessing facility-based delivery in Kenya. (39), (40) Across certain Kenyan context, some studies have placing prevalence of disrespect and abuse at 20%. (41) Urgent international calls have been made for accountability for the mistreatment of women during labor and delivery because it is a compelling human rights issues. (42),(43) Mistreatment should be addressed during regular supervision in all facilities, and quality assessments should ensure that a functioning feedback mechanism for respectful care during delivery is in place.

The second most valued attribute was the availability of medical equipment and supplies at the health facility. This was corroborated by the qualitative study where women specifically identifying theatre for caesarean sections and neonatal resuscitation equipment. Studies evaluating the state of obstetric care coverage often compare the provision of care to the physical infrastructure available without assessing the care provided at health facilities. For example, a recent study that evaluated emergency obstetric services (EMOC) across health facilities in rural Kenya found that EMOC capabilities were not being met. (44) The study confirmed that only two of the five health centers assessed had acceptable EMOC capabilities illustrating the state of rural health facilities for obstetric care. Additionally, recent assessments of quality of care at Kenyan health facilities have shown that medical equipment and drug supplies for mothers were only available at only 41% of health facilities (both public and private). (13) Therefore, health policy makers need to focus in availing EMOC availabilities because women's preferences suggest that they value the availability of equipment as a way of judging the quality of care at a health facility.

The women showed a high preference for quality of clinical care by ranking it third. Women heard from their friends and family about the quality of delivery care. One DCE study in sub-Saharan Africa focused on attributes of respectful care ranked women's preference for good health system conditions such as having a qualified birth attendant amongst other conditions. (45) This suggests that women can ascertain to a certain degree what quality of care is from assessing their delivery experience including the necessity of cesarean sections. This calls for skilled birth attendants to provide better quality clinical care that is based on WHO evidenced based guidelines. (16)

Referrals though lowly ranked by women was still valued in this setting. This finding suggests that referral options at are weak. Women mentioned that they were referred by health care workers to the sub-County hospital that is a referral health facility. They were also afraid of having to get complications because of the unavailability of ambulances .WHO standards advocate for referrals that are conducted in a timely fashion with a pre-established plan for delivery care and with relevant sharing of information between the concerned staff at the receiving health facilities. (16)

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An unexpected finding was the coefficient of the cost attribute had a positive sign, signifying a disutility for lower costs. This finding suggests that the women had a value for pay higher amounts of money for better quality of delivery services. We hypothesize that the women were making a trade-off by selecting higher amounts and signaling that they were willing to pay higher amounts for obtaining services that they perceived as being of higher quality. This finding is critical given that abound only half of all women (55%) of women in this setting had access to any health insurance coverage of any type. This implies that the women would have to pay for the delivery service using out-of-pocket funds at private health facilities. Such payments have been associated with putting patients at significant financial risk. Additional evidence points that there has been challenges with the implementation of the free maternity services with women reporting that they have been asked to pay for some items. (46) The women also described situations where public health facilities were "free," but they were exposed to hidden and indirect costs during billing and were sometimes asked to pay extra fees. Costs, both direct and indirect, have been previously identified in studies assessing factors influencing place of delivery in Kenya. (47)

In assessing the sociodemographic influencing attributes, we recognized a trend of younger married women been concerned with the three most valued attributes mentioned above as attitude of health care workers, availability of medical equipment and the clinical quality of delivery services. This suggests that younger women are more knowledgeable and aware of their expectations of the health system and might exercise their rights to demand better quality health care. Studies suggest that decisions on health care are done in a social context with women often consulting their families and friends. (48),(49) There have been recent reports of young mothers in rural areas in Kenya receiving poor quality services. (50) Hence strategies that are specific to certain demographics within the population can help the health system be more responsive to women's needs.

This study had some limitations. We mostly sampled women who were attending postnatal child welfare clinics so we are likely to have received hypothetical views of women who are users of the health system and represent some satisfaction with the health system. Hence it is hard to generalize the findings to a wider group of women. In future community sampling of women who delivered at home might help assist with eliciting preferences of women who are not users of the health system to assess what is most valued amongst such groups to inform policy makers.

Conclusion

This study showed that women's experience of care during delivery, attributes such as attitude of healthcare workers, availability of equipment and supplies, access to good quality delivery care are highly

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valued by women and may affect the utilization of health facilities during the free maternity services. The women's choices indicate their preferences for both structural and process aspects of quality of care. As countries like Kenya implement policies such as the free maternity services and the Kenya Quality Model for Health as strategies to reduce inequities to access to maternal health services. It is critical to for policy makers to understand women's preferences and what drives them to seek delivery services at health facilities. Ensuring high quality care that is patient-centered we can reduce inequities and improve maternal health outcomes for the future.

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Author Contributions

JOA and MA conceptualized the study. JOA conducted the data analysis and drafted the manuscript. JOA, MA, FW and GK revised the manuscript and provided critically important feedback on the manuscript, all authors read and approved the final manuscript

Patient and public involvement

Women were involved in the design, conduct reporting and dissemination of this research refer to the methods section

Patient content for publication.

Not required

Ethical approval.

Permission to conduct this research was provided by the National Commission for Science Technology and Innovation (NACOSTI) through a research permit No. P17/34367/2013 and an institutional research ethical approval form AMREF ESRC Approval No. P388/2017.

Conflicts of interests

None declared

Data availability statement

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

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<u>APPENDIX 1</u>

<u>FGD guide and in-depth interview guide for women and healthcare workers in Naivasha sub-counties</u>

Purpose of the FGD and in-depth interview

The purpose of this Individual in-depth Interview is to try and understand where women residing within Embakasi North sub-County deliver their babies and why they prefer these specific facilities or places**.** The study intends to specifically elucidate the following;

1)   What women's preferences are with regard to place of delivery
2)   Why they choose certain places over the other places
3)   To determine attributes of the health facilities that they deliver in and which of the attributes they deem important
4)   Possible attribute levels of the attributes identified

Logistical arrangements

I would like to go over a few logistical arrangements before we begin the interview:

My names are Jackline Aridi and I am registered as a PhD student at Strathmore University's Institute of Healthcare Management. The interview will last approximately 30 minutes. I have obtained Ethical clearance to conduct this research from Strathmore University's Institutional Review Board and permission to conduct research within Nairobi County from the National Science and Technology Research Institute (NACOSTI)

Everything we discuss during this interview will be kept in strict confidence and your real name will not appear in any of our results. As such, please make every effort to be open and honest when responding to the questions. If at any time you feel uncomfortable and want to stop the interview, please feel free to. I will provide you with a consent form which you will read and sign if you find it agreeable with you. For data capture purposes, this interview will be recorded using a mobile phone device.

Sociodemographic characteristics of healthcare workers.

Characteristic	
Age in years	
20-29	
30-39	
40-49	
50+	
Marital Status	
Single	
Married	
Divorced /Widowed	
Years of Work Experience	
0-4	
5-9	
10-15	
15+	
Type of Health Facility	
Public Health Centre	
Private Health Centre	

Referral Hospital	
Maternity	
Other	

Questions for women, healthcare workers and policy makers

Key questions	Probes
1. Birthing Experience- What are the things that make for a good birthing experience?	Describe your dream birthing experience. Who do you think needs to be present? What do you think needs to be present? What do you think are worries or concerns of the mothers? Are there cultural traditions that need to be followed judiciously? What makes a mother feel safe during the process? What would absolutely make it a bad experience?
2. Place to deliver- How did mothers and their families decide where to deliver?	**Facility staff** What are the hours of operation of the maternity ward? How many staff are working in your maternity ward? Is there electricity and water at your facility at all times? If not, explain Do you have a placenta pit? Are staff trained in: Newborn resuscitation? Emergency obstetric care? (placing IVs and dispensing Misoprostol for haemorrhage) Is your services completely free? Or do patients have to pay for some supplies (ex. gloves), use of an equipment, etc.? Is there periodic upgrade in capacity for maternity staff? When was the last upgrade and how many staff participated?

		Do you feel that mothers in your area deliver at your health centre if available? If not, where do they deliver? Why?
		Are mothers treated nicely and with respect? Give examples.
		Who do you think is involved in the decision making process as to where a mother delivers?
		Community leaders/Fathers:
		What are the options for places to deliver?
		Who were involved in the decision making process as to where to deliver?
		Are you usually involved in deciding where to deliver? If so, what did you have to consider in making that decision? (cost, distance, risks, benefits)
		What makes the delivery place a good or bad experience? Were you treated nicely and with respect? Give examples
3.	Recommendation to friends- What would you tell your friends about where they should deliver and why	Is it culturally appropriate to share your family's birthing experiences with your friends?
		Does your opinion have an impact on where your friends deliver their babies?
		Community leaders: Do you recommend/suggest pregnant mothers to deliver at certain places?
		Fathers: Does the Chief/leaders in your community recommend/suggest that your family deliver at certain places?
		Community leaders: If you hear something negative about a place to deliver, does it affect where you would recommend/suggest a family to deliver?
		Fathers: If you hear something negative about a place to deliver, does it affect where your family choose to deliver?

Attribute Level development Questions

1. What do you think women accessing services from the health facilities where you work value most when they go to the facility for delivery?
2. What do you think is the most important characteristic of the health facility for women when they go to deliver?
   a. *Probe (cost of delivery services, distance to facility, equipment and supplies, attitude of healthcare worker, qualifications of health care workers)*
3. What do you think are barriers to health facilities from providing good quality delivery services?
   a. What do you think health facility in charges should do to promote good facility based experiences for delivery services for women?
4. What is your opinion on the current free maternal health services policy under implementation since 2013? Is it encouraging utilization of health facilities for delivery services?
5. What do you think are the challenges that the Government and policy makers experiencing with respect to health policies concerned with delivery services in public health facilities? Private facilities? Tertiary facilities? And what should they do about the challenges?
6. *What specific health policies do you think the Government should promote to improve access to high quality delivery services in public and private health facilities? Probe (free ANC, increase access through NHIF, early focused ANC?)*

Field	**WOMEN'S HEALTH AND HOUSEHOLD QUESTIONAIRE**
	DEMOGRAPHIC QUESTIONS
Age	1. What is your age?
Residence	2. How long have you lived in Embakasi North/Naivasha sub county? A. I have lived here my whole life B. I just moved to Embakasi North/Naivasha C. Other
MovedWhen	3. How many years ago did you move here? A. 0-5 years B. 5-10 years C.11-20 years D. Over 20 years
ResidenceWhy	4. Why did you move to Embakasi North**?** A. I have family or friends here B. I heard there were business opportunities here C. To be close to Nairobi City Centre D. To look for work E. Other
Schooling	5. What is your level of education? A. Did not attend primary school B. Primary School C. Secondary School D. Tertiary E. University
Married	6. Are you married? A. No B. Yes
MarriedDuration	7. How long have you been married? A. 0-5 years B. 5-10 years C. 10-15 years D. 15-20 years
HOUSEHOLD MODULE	
HeadofHousehold(HoH)	8. Are you the head of the household?(If an important decision is to be made in the Household are you the one who gets to decide A. No B. Yes
Main Earner	9. Are you the main earner in your household? Do you contribute the most to household expenditures? A. No B. Yes
MainEarnerNo	10. How are you related to the person who earns most in your household? A. My Father/ My Husband/Boyfriend's father

	B. My grandfather/ My Husband/Boyfriend's grandfather C. My husband/Boyfriend D. My mother/My Husband/boyfriend's mother E. Another family member/ relative/ aunt/uncle F. Other

HOUSEHOLD MODULE : SOCIOECONOMIC STATUS

HoHMESame	11. Are the head of the household and the main earner the same person in your household? A. No B. Yes
adults	12. How many people over the age of 18 live in your household?
adultswomen	13. How many of these are women?
adolescents	14. How many people aged between 14 and 18 live in the household
adolescentwomen	15. How many of these people are women?
children	16. How many people under 13 live in your household?
childWomen	17. How many of these children are women?
employedadults	18. How many members of your household contributed to your household expenses last month? *(this includes things like rent, food, water, electricity fuel, cooking fuel)*
totalpublicexpenditure	19. How much did the employed adults contribute to your household expenses last month
	HOUSEHOLD ASSETS
Refrigerators	20. How many refrigerators does your household own?
Bicycles	21. How many bicycles does your household own?
Motorbikes	22. How many motorbikes does your household own?
Cars	23. How many cars does your household own?
Televisions	24. How many Televisions does your household own?
Radios	25. How many radios does your household own?
Stereos	26. How many stereos does your household own?
Mobiles	27. How many mobiles does your household own?
Mattresses	28. How many mattresses does your household own?
waterExp	29. How much did your household spend on water last month?
electricityExp	30. How much did your household spend on electricity last month?
fuelExp	31. How much did your household spend on fuel last month?

REPRODUCTION AND PREGNANCY MODULE

insurance	32. Do you currently have health insurance?
	    A. No
	    B. Yes

insuranceType	33. What kind of insurance do you have?
	    A. NHIF
	    B. OBA
	    C. Private Insurance
	    D. Other

insuranceOther	34. The private insurance policy you have, what is the name of the company that provides it? specify
insurancePrice	35. How much do you pay per month for insurance? (if the respondent doesn't pay monthly help them approximate the monthly rate)

generalHospital	36. Have you visited a clinic, hospital, or doctor in the last year to receive medical care unrelated to a pregnancy?
	    A. No
	    B. Yes

generalHospitalWhy	37. During the most expensive visit to a clinic, hospital, or doctor in the last year, what was the visit for? A. I was hurt in an accident and needed urgent care (example broken bones, stitches, allergic actions) B. I was very sick and needed to get medicine or another kind of treatment example malaria, pneumonia) C. I developed a condition and needed to sneak
generalHospitalPaid	38. How much did you spend in total on medical care received in the last year unrelated to pregnancy**?**

generalHospitalStill	39. Are you still seeking treatment for health conditions unrelated to pregnancy?
	    A. No
	    B. Yes

anaemia	40. Do you suffer from anemia?
pregnantEver	41. Have you ever been pregnant?
pregnantAvoid	42. Have you ever used anything or tried in any way to delay or avoid getting pregnant?
timesPregnant	43. How many times have you been pregnant?
livebirths	44. How many livebirths have you had?
deaths	45. Sometimes it happens that children die. It may be painful to talk about and I am sorry to ask you about such memories, but it is important to get correct information. Have you ever given birth to a son or daughter who was born alive but later died?
deathsBoys	46. How many of those were boys?
miscarriages	47. How many times have you had a pregnancy result in a miscarriage?

stillbirths	48. How many times have you had a pregnancy result in a stillbirth?
yearPreg	49. In what year did this pregnancy occur?
embakasinorthPreg	50. Were you living in Embakasi North sub County during this pregnancy?
nairobiPreg	51. Were you living in Nairobi during this pregnancy?
intended	52. Was this pregnancy planned?
marriedThen	53. Were you married to the father at the time?
monthsPreg	54. How many months were you pregnant before you gave birth?
antenatalcare	55. How many ante natal visits did you attend?
anc_first	56. How many months pregnant were you when you first went for an ante natal care visit?
ancSame	57. Did you get ante natal care at the same facility where you planned to give birth? A. No B. Yes
ancElseWhy	58. Why did you go somewhere different for ante natal care than the place you planned to give birth?
ancElseWhyMain	59. What was the main reason you when somewhere different for ante natal care than the place you planned to give birth? A. I was saving up to give birth in a nicer hospital than where I received ante natal care B. I could afford ante natal care at that hospital, but not a birth there C. Convenience: it was easier to go to the place where I received ante natal care than where I gave birth D. Complications: I needed to go to a special hospital like Kenyatta because of complications
insurancePr	60. Did you have health insurance during this pregnancy?
insuranceTypePr	61. What kind of insurance did you have?
insurancePricePr	62. How much did you pay per month for insurance?
talkPrice	63. Did anyone talk to you about how expensive it would be to give birth during ante-natal care?
contactHospital	64. Did you contact hospitals about prices before giving birth?
savingMonths	65. How many months before you gave birth did you begin putting aside money to pay for it?
iron	66. During this pregnancy, did you take any iron tablets or iron syrup?
Folic acid	67. During this pregnancy, did you take any folic acid?
malarial	68. During this pregnancy, did you take any anti-malarial medication?
tetanus	69. During this pregnancy, did you receive a shot in the arm to prevent the baby from getting tetanus (convulsions after birth)?
vitA	70. Did you experience any problems seeing during the daytime or at night?
specialist	71. Did you visit an OB/GNY or specialist before giving birth?

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	A. No B. Yes
referral	72. Were you referred to a larger hospital like Kenyatta National because a doctor determined that there might be complications with your pregnancy? A. No B. Yes
complicationExpected	73. What complication where you referred for? A. Sepsis B. Hemorrhage C. High blood pressure D. Other
whereBirth	74. Where did you give birth on this occasion? A. Hospital B. Home
plannedFacility	75. Is this where you originally planned to give birth, or did you have to change your plans? A. No B. Yes
whyChangePlans	76. Why did you change your plans? A. The baby came early and I had to go to the nearest facility B. I wasn't able to afford the facility I originally planned on C. I had more money that I expected when the baby was born so I could go to a nicer facility D. Other
outsideFacility	77. Why didn't you deliver in a health facility? A. It was too expensive B. I couldn't get to one in time once I went into labor C. I don't trust the Doctor and nurses at the facilities I can afford D. I don't trust health facilities E. Other
whyHere	78. What qualities of the Health Facility did you find important in making the choice of delivering there? A. Cost B. Cleanliness C. Distance from home D. Availability of supplies and equipment E. Qualification of health worker(nurse or doctor) F. Waiting time G. Staff attitude H. Referral by relative I. Other
whyHereMost	79. What was the most important quality of the Health Facility in making the choice of delivering there? A. Cost B. Cleanliness C. Distance from home D. Availability of supplies and equipment E. Qualification of health worker(nurse or doctor) F. Waiting time G. Staff attitude

	H. Referral by relative I. Other
birthTime	80. About how many hours did it take to deliver the baby, starting from when you first experienced contraction pains?
ceaserean	81. Was this a normal birth, or was the baby delivered by cesarean section? A. Normal birth B. Ceaserean
ceasereanEmergency	82. Was the cesarean planned or unexpected? A. Planned B. Unexpected
doctorAtAll	83. After you arrived at the hospital to give birth, did you see a doctor, or only nurses and birth attendants? A. No B. Yes
	Thank you for participating in our survey. We really appreciate your time, and are grateful for meeting with us today.

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Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1

Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2

Introduction

Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3,4,5
Objectives	#3	State specific objectives, including any prespecified hypotheses	5

Methods

Study design	#4	Present key elements of study design early in the paper	5,6
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,9
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	9
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	N/A

Bias	#9	Describe any efforts to address potential sources of bias	11
Study size	#10	Explain how the study size was arrived at	8
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	10,11
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	10,11
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	11
Statistical methods	#12c	Explain how missing data were addressed	N/A
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	10
Statistical methods	#12e	Describe any sensitivity analyses	N/A
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	9
Participants	#13b	Give reasons for non-participation at each stage	N/A

Participants	#13c	Consider use of a flow diagram	N/A
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	11,12
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	N/A
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11,12,13
Main results	#16b	Report category boundaries when continuous variables were categorized	11,12
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	16

Discussion

| Key results | #18 | Summarise key results with reference to study objectives | 16 |

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Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	18
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	18
Generalisability	#21	Discuss the generalisability (external validity) of the study results	18

Other Information

Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	20

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Understanding what women want: eliciting preference for delivery health facility in a rural sub-County in Kenya, A Discrete Choice Experiment.

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Understanding what women want: eliciting preference for delivery health facility in a rural sub-County in Kenya, A Discrete Choice Experiment.

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Abstract

Objective: To identify what women want in a delivery health facility and how they rank the attributes of a health facility when choosing where to deliver using a Discrete Choice Experiment.

We conducted a Discrete Choice Experiment to elicit rural women's quality of care preferences for choice of delivery health facility. Facility attributes were systematically identified through both a comprehensive literature review and a qualitative study. The DCE utilized a hypothetical stated preference methodology to establish preferences. We ran both a multinomial logit model to identify relative ranking of attributes and a mixed multinomial logit model to establish the sociodemographic variables that influence women's preferred attributes. Six health facilities that presented a mix of public and private health facilities within Naivasha sub-County a semi-rural area with populations drawn from agriculturalist, pastoralist and peri-urban settings. Women aged 18-49 years who had recently delivered within six weeks were recruited from child welfare clinics at six health facilities.

Primary outcome: The DCE required women to select hypothetical health facility A or health facility B or opt-out alternative (representing a home delivery). These were presented as repeated hypothetical scenarios. Data were analyzed using both a multinomial (conditional) logit model to evaluate average preferences and relative importance of the selected attributes and a mixed multinomial model to evaluate how interactions with sociodemographic variables influence the selected attributes.

Results: A total of 474 participants were sampled, 466 participants completed the survey (response rate 98%). 8 individuals were dropped because of incomplete data on key attributes. All the attributes identified were found to be important to the women by the level of statistical significance showing internal validity. The attribute with the greatest association with health facility preference was having a kind and supportive healthcare worker (β=1.184, p<0.001), followed by availability of medical equipment and drugs (β=1.073, p<0.001) and third quality of clinical services (β=0.826, p<0.001), during the delivery. Distance to the health facility, availability of referral services, cost of delivery services were ranked 4th, 5th and 6th respectively(β=0.457, p<0.001), (β=0.266 p<0.001), and (β=0.000018, p<0.001), The opt-out alternative was negative and ranked last suggesting a disutility for home delivery. (β=-0.849, p<0.001).

Conclusion: The most highly valued attribute was a process indicator of quality of care; kind and supportive care by health care workers followed by other technical indicators of quality of care such as availability of equipment for cesarean sections and clinical quality of care. Policy makers charged with

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implementing the free maternity services should take into account women's preferences when designing interventions at health facility level. These factors can help inform strategies that are patient-centered as part of the initiative to increase quality of care during delivery service at the county level.

Strengths and limitations of the study

- The study reports the use of a discrete choice experiment in maternal health services within the context of the newly implemented free maternity services policy in Kenya.
- The findings of this study will inform the contextual aspects of quality of care valued by women based on their experience of care during delivery services in a rural setting with low income populations.
- The hypothetical nature of the DCE might results in biased results as respondents might make inaccurate choices while being aspirational regarding the quality of services, they expect at a health facility during delivery.
- Bias might also be introduced by the fact that the hypothetical choices might not be representative of women's choices because decision making around delivery place in real life may be made in a social context with other key family members involved in such rural contexts.

Key words

Discrete choice experiment preferences delivery health facility rural women Kenya

Word Count

8893 words

2

Background

In 2017, an estimated 295,000 women died while giving birth. While this represents a 35% improvement from 451,000 maternal deaths in 2000, the vast majority of these deaths are preventable (1). Strategies to reduce the high burden of maternal mortality in low and middle-income countries have included increasing coverage for high quality facility-based delivery (2),(3). Facility-based delivery is increasing in sub Saharan Africa due to the growing attention to efforts to reduce maternal mortality resulting in substantial declines in mortality over the last few decades (4),(5). This has been facilitated in part by overcoming barriers to access such as cost and distance. However there remains the challenge of growing inequities in maternal health outcomes within countries and this demands that we pay attention to the barriers to access to high quality facility-based delivery.

Kenya is one of the countries exhibiting insufficient progress in reducing preventable maternal deaths, the reported maternal mortality ratio is currently estimated at 362 deaths per 100,000 live births (6). In a major move to eliminate barriers such as cost, the Government initiated the free delivery policy in 2013 (7). The government's free maternity policy together with access to private delivery care financed by the National Health Insurance Fund (NHIF) expanded the options for delivery health facilities available for women to choose from. This resulted in positive trends in access to facility-based delivery particularly in rural areas where investments in the health system and physical infrastructure such as road network had resulted in increased access. The total numbers of health care facilities in Kenya has grown to 3965 over the last 10 years (8). All these strategies increased women's choices available for delivery health facilities.

However, inequities in maternal health outcomes still exist in Kenya particularly at the county level. A recent UNFPA report in Kenya identified 15 counties that contribute to 98.7 % of the maternal deaths with most of the deaths in rural counties (9). The quality of care provided also differs substantively across regions in Kenya with one study identifying a 25-percentage point gap between Nairobi and Coast region (10). Additionally, higher volume facilities and those with caesarean section capacity seemed to offer a high quality of care (10). There have also been recent reports of increased utilization of county level (referral) hospitals for deliveries (11). National assessments of quality of care at health facilities in Kenya suggest that poorer women, have a higher likelihood of encountering poor quality of maternal health services in Kenya (12),(13). Assessments targeting primary health facilities have shown that these facilities offer poorer quality of services, with gaps with regard to basic infrastructure, medical equipment and supplies a, diagnostic accuracy and adherence to clinical guidelines (14),(15). Within this context

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there is significant overlap between primary health facilities and delivery health facilities. With the free maternity services policy, health centers and dispensaries at the primary level of care were upgraded in order to be able to provide uncomplicated childbirth services. The Government in recent times introduced the Kenya Quality Model for Health (KQMH) to improve the quality of care at health facilities (16). This strategy aimed to support quality improvement by providing minimum standards and guidelines, and support the structure-process-outcome of health services by applying the principles and tools of quality management. The KQMH goals included meeting the needs of patients in a cultural acceptable way. However, several implementation challenges were identified such as sub-standard structures at health facilities and lack of pharmaceutical supplies at health facilities.

The WHO framework on quality of health services during facility-based delivery proposes that a high-quality health system is safe, effective, patient centered, timely, efficient, and equitable (17). These frameworks assume knowledge of the end-users. However, it is likely that Kenyan women in rural areas may be incapable of assessing the clinical quality from a technical standpoint. They are able to assess the quality of the care and choose delivery health facilities based on their experience of care such as respectful treatment by health care workers. They are also able to assess other aspects of provision of care, such as the availability of medical equipment like theatre for caesarean section during an emergency, accessing drug supplies within the facility versus an outside pharmacy, and referral services that includes transportation to a higher-level facility.

There is limited knowledge in Kenya on the specific elements women value most in the care they receive from the health facilities. Most strategies available for assessing quality of care received during childbirth in Kenya have focused only on either the health system inputs required, or satisfaction levels at the end of the continuum of care. Strategies are also based on national level assessments of quality of care such as service provision assessment and demographic health surveys (6),(8). These studies while useful and nationally representative, fail to identify and provide a ranking for demand side barriers. As a consequence, national data at present are unable to fully explain why women prefer certain health facilities over others. Contextual information on what women value when making decisions on choice of a health facility become increasingly important as women's choices increase. This information is particularly useful in resource constrained settings where prioritization guides allocation of scarce health resources.

Discrete Choice Experiments (DCE) can be particularly helpful in eliciting preferences. DCE's allow health services users to state individual preferences when offered different hypothetical choices (18). They are based on the assumption that services can be described by their attributes, and that the value of a

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service depends on the nature and level of these attributes (19). DCE's have been used to examine a broad range of health system challenges in sub-Saharan Africa including patient preferences for hospital services in South Africa (20) and maternal health services in rural areas of Ethiopia and Tanzania (21),(22). The main objective of this study was to use a DCE to elicit women's preferences with regard to the characteristics of a delivery health facility based on their delivery experiences in a rural sub-County. We aim to provide insights on what a women's view of quality of care is, based on their experience of care. We hope these preferences will present the patient perspective to complement the needed technical quality improvement to support the development of a quality health system, so women can get what they want and deserve from the health system.

Methods

Study Setting

Naivasha Sub-County is a semi-rural setting 50km to the northwest of Nairobi. It is composed of peri-urban settlements, and includes agriculturalist and pastoralist populations within Nakuru County. It has a population of roughly 181,966 people. Primary Health facilities include government health facilities; several private health facilities; and a County Referral Hospital in Naivasha town. The population is also served by a faith-based private tertiary hospital, about 20 km away from Naivasha in neighboring Kiambu County. Naivasha was selected as a study site because recent evidence from a UNFPA report rank ordered counties by contribution to the burden of maternal deaths and Nakuru County was ranked fourth (9).

Discrete Choice Experiments

Identification of attributes and attribute levels

DCE's are an attribute driven technique used to elicit stated preferences and interventions and are based on the assumption that health care interventions services and policies can be described by their attributes (18). The first stage in the development of a DCE is the identification of attributes and attribute levels. Previous studies suggest a review of the literature and qualitative work to aid in the identification of relevant attributes (23). We undertook a comprehensive literature review of the key literature of facility-based delivery and skilled birth attendance in sub-Saharan Africa to gain an in depth understanding of the factors influencing place of delivery. We also conducted a qualitative study with 6 focus group discussions with 50 women at a mix of public and private health facilities with maternity wards. We also conducted -in-depth interviews with 12 health care workers serving as in- charges at the maternities. We used an interview guide. See supplementary file 1. The participants were purposively selected women

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were aged 18 to 49 and had just delivered their babies within 6 weeks and were attending child welfare clinics at the different health facilities. Table 1. Shows the final attributes and attribute levels selected for the DCE.

Experimental design

The attributes of the interventions and their assigned levels are usually combined using experimental designs produce a set of hypothetical choice alternatives. Respondents are then asked to choose which alternatives they prefer the attribute levels determine the utility of respondents attached to a particular characteristic of an intervention and hence their preferences (24). The DCE was designed as an unlabeled one with sixteen choice set presented under three alternatives: health facility A, health facility B, and an opt-out alternative where the woman would choose none of the two facilities, presented as preference for home delivery. See Table 1 for the final attributes and attribute levels included in the DCE. All attributes in the choice experiment had two levels each except cost, which had three levels. This resulted in a design of (2^5 x 3^1 =96) choices in the full fractional design. This number of choices would have been too tedious for the respondents to handle. We opted to use a fractional factorial design to reduce the choices from 36 to 16, making it manageable for the respondents. This was done using a D-efficient design using Ngene software to generate the original experimental design (25). All the attributes were dummy coded to allow comparison against a reference category. The reference categories were those that were the dominant choice for example good quality of clinical services, kind and supportive health care workers, availability of medical equipment, availability of referral services. Short distance to the health facility and the lowest price of delivery service, 3000Ksh.The D-efficient design also allowed for favorable design such as orthogonality, level balance, minimum balance and overlap (26). The 16 choice-set questions were generated from the design. Each choice-sets contained 16 questions. We then divided each choice set into two sets with 8 questions each and each respondent was presented with a single choice-set from a single block.

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Table 1. **Final list of attributes and attribute levels included for the DCE.**

Attribute	Attribute level
Quality of clinical services at the health facility	Good quality treatment
	Bad quality treatment
Attitude of healthcare workers	Kind and supportive healthcare worker
	Unkind and unsupportive healthcare worker
Availability of medical equipment and supplies	Medical equipment and supplies available
	Medical equipment and supplies not available
Distance to the health facility	Health facility is close to residence
	Health facility is far from residence
Referral at the health facility	Referral services available at the health facility
	Referral services unavailable at the health facility
Cost of delivery service (Kenyan Shillings/ Ksh)	3000; 5000; 8000

DCE Study sample

The choice-sets were reviewed for content by a team of policy makers from the county headquarters during a one-day meeting at the main referral hospital at the county. The meeting confirmed and validated the choice of attributes as important to both women and healthcare workers. This was followed by a pilot study with 30 women in a neighboring sub-County to test the attributes. The women who participated in the pilot were not included in the main study. The pilot resulted in minor revisions to the wording of certain attributes for example the attribute 'treatment at the health facility' was changed to 'quality of clinical care during delivery' to provide a distinction between interpersonal and clinical aspects of quality of care. The availability of medical equipment and drug supplies was defined as easily observable equipment important to women such as the theatre, for cesarean sections and incubators for premature babies. Women could easily determine availability of drugs at the health facility when they are sent outside of the hospital to buy essential drugs. Knowledge on both these attributes were also determined by conversations with other women from their social network. The availability of referral services was defined as the availability of a means of emergency referral transport to move the women from primary to

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tertiary level of care that could handle obstetric complications. The final DCE scenario with the final attributes can be seen in Table 2.

These questions were then loaded into Open Data Kit (ODK) and incorporated into a questionnaire consisting of items on sociodemographic and maternal health utilization variables. The questionnaire contained question adapted from the Kenya Demographic Health Survey 2014. See supplementary file 2.

To obtain the sample size for the DCE We used the rule by Johnson and Orme (2003) to suggest the sample size required for main effects. This depended on the number of choice tasks (t) the number of alternatives (A) and the number of analysis cells (C). We had 16 choice-tasks (t) with 3 alternatives (a) and 3*2 analysis cells (c). N >500*c/t*a=N>500*6/16*3 = N>62.5 (27). Using this formula we derived a mimimum sample size of 62.5. We however collected a larger random sample of 474 women that would enable appropriate estimation of both main and interaction effects for the DCE. Our eventual sample size targeted sample size was 474 from six health facilities to satisfy the representativeness for the quantitative survey for the sociodemographic variables but also large enough power to provide results that were statistically significant for all relevant attributes. Lancsar and Louiviere (2006) in an earlier study recommend a sample of 20 respondents per questionnaire version as sufficient to estimate reliable DCE models (28).

Table 2. Example of a scenario in a choice-set card that was presented to the women

THE DISCRETE CHOICE EXPERIMENT ON ATTRIBUTES FOR PLACE OF DELIVERY IN RURAL SUB COUNTY IN KENYA

Our objective is to conduct a DCE experiment to explore the relative importance of attributes of place of delivery to Kenyan women living in Naivasha sub-County to try and elucidate what women's value and their preferences are when they are making choices on place of delivery. You will be provided with a script on a mobile phone and you will be asked to imagine that you are pregnant and you are given a choice between the following two health facilities to deliver your baby in. Which one would you prefer? Facility A or Facility B? You also have an option of choosing none of the two health facilities as Option C. This implies delivering your baby at home. There are no right or wrong answers

SAMPLE CHOICE CARD

Attribute	Health Facility A	Health Facility B	Option C
Quality of clinical care during delivery	Good quality	Bad quality	(None of the two health facilities- home delivery)
Attitude of healthcare workers	Kind and supportive attitude	Unkind attitude	
Cost of delivery services	3000Ksh	5000Ksh	
Availability of equipment and supplies	Equipment supplies not available	Equipment & supplies available	
Distance to health facility	Facility is close to home	Facility is far from home	
Availability of referral health services	Referral services available	Referral services unavailable	
Your choice (tick only one)	□	□	□

Data collection

A team of six research assistants along with their two supervisors received a five data training on data collection and study tools by the first author. Women were randomly recruited during postpartum immunization clinics from six health facilities representing a mix of public and private health facilities. We randomly sampled 474 women. After the women gave informed consent, we then interviewed them using the Open Data Kit (ODK) Platform.

Patient and public involvement statement

During the pilot phase the women aged between 18 and 49 who were the main respondents provided feedback on the survey instruments. They also reviewed and provided feedback during the qualitative phase on the selection of the attributes.

Ethics

Permission to conduct the research was provided by the National Commission for science research and technology and innovation (NACOSTI). Ethical approval was provided by AMREF ERSC and permission to conduct interviews at the health facilities was provided by the County Government of Nakuru.

Model specification

The data were imported and analyzed in Stata 15 (StataCorp LP, College Station, USA). Descriptive statistics were calculated for the non-DCE variables. The DCE data was analyzed using the Random Utility model (29). A model that expresses the utility 'U' in of an alternative i in a choice set C_n (perceived by individual n) as two parts: 1) An explainable component specified as a function of the attributes of the alternatives $V (X_{in}, \beta)$; and 2) an unexplainable component (random variation) ε_{in}.

$U_{in} = V (X_{in}, \beta) + \varepsilon_{in}$

The individual n will choose alternative i over other alternatives in a choice set C if and only if this alternative gives the maximized utility. The relationship between the utility function and the observed k attributes of the alternatives can be assumed under a linear-in-parameter function (19). Therefore, the utility the respondents attach is related to the attribute and attribute levels within the choice-sets, meaning that if alternative i is chosen within a choice set, i will yield the maximum utility compared to j alternatives. A is the alternative specific constant, x are the attributes in the DCE and β are the coefficients describing the marginal utility of the attribute. The standard conditional logit model is below:

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$V_{in} = \alpha_i + \beta_i x_{i1} + \ldots + \beta_k x_{i+e}$

A base conditional model was used to estimate the mean change in utility, preference which respondent placed on attributes. α_i is a constant term that represents the general preference for place of delivery at a health facility compared to the alternative of opting out and having a home delivery. The reference group was the choice of health facility A or health facility B. Dummy coding was used for the data, each attribute level was assigned a value of 1 whenever it was retained and 0 when omitted. The utility model makes the assumption that women will trade-off between the different attribute levels and choose the alternative that gives the greatest utility. The conditional model is suitable for estimating average preferences across respondents. The utility function was estimated for the following model:

$U_i = \alpha_i + \beta1 QualityClinicalcare + \beta2 attitudeofhealthworkers + \beta3 Medicalequipmentandsupplies +\beta4 distance + \beta5 referral\ services + \beta6 Costs + \varepsilon\ (error\ term)$

α_i is the alternative specific constant (ASC) term that shows the preference for place of delivery (either a health facility or home), β's 1-6 are the parameters for each of the attribute levels and ε is the error term.

Data Analysis and model estimation

The Discrete Choice models' responses were analyzed according to the random utility theory framework (29). This framework assumes that women seek to maximize their utility according to the perceived benefit associated with the different attributes and attribute levels.

The aim of the base multinomial logit model estimation is to determine whether the attributes are important (statistically significant, as shown by the significance level of the β) and the direction of importance (shown by the sign of the estimated (β) and relative importance (size of the estimated parameter). The main hypothesis test was whether the parameter estimates were significantly different from zero for all attributes.

Due to the assumption of irrelevant independent alternatives, the presence of heterogeneity in choices we estimated a generalized mixed multinomial logit model to assess for preference heterogeneity amongst the women (30). The mixed multinomial logit model overcomes some of the limitations of the base multinomial logit by allowing for random taste variation, unrestricted substitution patterns, and correlation in unobserved factors over time. The Mixed multinomial logit can also utilize any distribution for the random coefficients, unlike probit which is limited to the normal distribution assumes that some of the parameters are random following a certain probability distribution (30). The five variables that described the attributes of place of delivery in the utility model above were entered into the model as random parameters whereas the cost variable was entered as a fixed variable.

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The mixed multinomial logit model allows for the estimation of both main and interaction effects. This was done by extending the mixed multinomial model and testing interactions between the sociodemographic and the women's attributes in order to investigate how preferences may vary according to observed individual characteristics. The sociodemographic characteristics included such as maternal age, marital status, education and income status have been known to influence place of delivery in Kenya (31),(32),(33)(34). Education was measured in three categories, primary, secondary and tertiary education. We formed two dummy variables s1 and s2 representing a comparison between primary and secondary education to tertiary education. We categorized age into three categories: 18-24 years, 25-34 years and 35-45 years. We then formed two dummy variables a1 and a2 to represent the first two age categories. marital status and main earner had one dummy variable each that were interacted with the attributes.

The output of the mixed multinomial logit model includes the mean and the standard deviations of the random parameter estimates with confidence levels. The mean parameter estimate represents the relative utility of each attribute while the standard deviations for a random parameter suggest the existence of heterogeneity in the parameter estimates over the sampled population around the mean parameter estimate i.e., different individuals possess individual-specific parameter estimates that may be different from the sample population mean parameter estimates. The p-value of the interactions shows statistical significance for an interaction between sociodemographic variables and attributes hence signifying the influence of the woman's characteristics. The Robust Standard Errors shows the level of error. These have been shown in tables 4,5 and 6. The theoretical validity of the design will be explored by examining the signs and significance levels of parameter estimates. To address bias, we tested for choice monotonicity, this is the assumption that a respondent will choose an alternative in the choice task that is superior to the other alternative on all choice attributes (28).

Results

Participant characteristics

474 women were invited to participate in the DCE experiment. There was incomplete data for eight respondents. The DCE survey was successfully administered to 466 representing a 98% response rate. The average age of the respondents was 26 years, 32% were primiparous. 88% of the women reported themselves as married and 48% had attained a secondary school education. About 53% of the heads of household had attained up to a secondary education. Only 18% of the rural a woman were heads of household, however 95% respectively claimed to have influence over household-level decisions. Approximately 83%, reported that they were not the main source of household income Finally, about 67%

of the women reported having moved to the study setting from elsewhere within the last five years. See Table 3 below for details on the sociodemographic characteristics.

Table 3. Sociodemographic characteristics of women in Naivasha sub-County (N=466).

Sociodemographic variables	Naivasha sub-County	
	N	(%)
Age n (mean (SD))	26(5.1)	
Marital status		
Single	57	12
Married	409	88
Education		
Primary school	175	38
Secondary school	221	48
University/tertiary	66	14
Parity		
1	151	32
> =2	215	68
Head of household status		
Woman not HH	381	82
Woman head of HH	85	18
Head of household education		
Primary school	100	27
Secondary school	196	53
University/Tertiary	72	20
Woman's influence on decision making within HH		
Woman had no influence	18	5
Woman had influence	363	95
Main-earner status		
Is not the main earner	386	83
Is main earner	79	17
Residence (moves)		
Moved in 5 years	226	67
Moved over 5 years	112	33
Delivery health facility		
Public facility	346	74
Private facility	91	19
Home delivery	29	6

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To enable the estimation of main and interaction effects each respondent was given a survey with 3 unlabeled alternatives (health facility A, health facility B and an opt-out option) with 16 choice-sets to choose from, resulting into 48 observations per respondent. The number of observations analyzed within the rural site were 22,368 out of 22,566. 198 observations were dropped by STATA automatically because of dominant choices.

In the rural setting, the variable with the greatest association with choice of health facility was attitude of the health care workers, followed by availability of medical equipment and drugs and thirdly the quality of clinical services during delivery The distance to the health facility, availability of referral health facility, cost of delivery were ranked 4th, 5th, 6th. (p<0.001). The opt-out alternative had a negative sign and was ranked 7th. (p<0.001).   See Table 4 below.

The direction of the coefficient signs provides a check on the theoretical validity of the DCE model, that is, whether the coefficients move as economic theory or a priori expectation would predict. All the attributes with the exception of the opt-out had the expected positive signs showing utility with the exception of the cost attributes. The cost attribute was positive, however economic theory expects them to be negative showing that women have a disutility for high costs.

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Table 4. The base multinomial logit model with for a DCE on preferences for place of delivery amongst women in a rural sub-County.

	Rural sub-County		
Attribute	β	Robust S. E	C.I
Attitude.			
Kind (Reference)	1.184***	0.037	(1.11-1.25)
Medequip.			
Available (Reference)	1.073***	<0.035	(1.01-1.13)
Qualclin.	0.826***	0.034	(0.76-0.89)
Good (Reference)			
Distance. (Reference. Short)	0.457***	0.031	(0.39-0.52)
Referral.	0.266***	0.033	(0.20-0.33)
available (Reference)			
Costs.	0.000018***	9.40e-06	(2.55e-06-0.00033)
ASC.	-0.849***	0.082	(-0.97-0.73)

Legend Attitude: attitude of healthcare workers, medequip: medical equipment and drug, Qualclin: quality of the clinical delivery services, Distance- Distance to the health facility, Referral: referral service availability, Clean: cleanliness of the health facility, ASC: Alternative Specific Constant.

* Significance at the 90% level ** significance at the 95% level *** significance at the 99% level

Robust S.E- Robust Standard Errors

For the mixed multinomial logit model with no interactions, we found out that all the mean coefficients values for all the attributes, were statistically significant at the 99% level (p <0.0001) with the exception of the opt-out attribute (p=0.377). See Table 5. This meant that we could reject the null hypothesis and conclude that all the selected attributes selected were important to the women respondents. The low significance value for the opt-out suggested that women had a low value for home deliveries. All the attributes had strong statistically significant parameter estimates for the standard deviation, except the cost attribute which had significance at the 90% level (p=0.639). This suggested weak preference heterogeneity meaning that was very little variation around the mean, with very few women possessed individual-specific parameter estimates that might be different from the sample population mean. Upon analyzing the

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differences between primiparous and multiparous women with regard to choose of the opt-out. We found out that women who were multiparous were more likely to choose the opt-out suggesting a dissatisfaction with their experience at the health facility.

Table 5. The mixed multinomial logit model showing means and standard deviations to explain preference heterogeneity in choices made by women in rural setting

Attribute	Mean Coefficient values		Standard Deviations (SD)	
	β	Robust S. E	β	Robust S.E
Attitude.				
Kind (Reference)	1.972***	0.123	1.582***	0.108
Medequip				
Available (Reference)	1.764***	0.076	0.778***	0.702
Qualclin	1.316***	0.106	1.577***	0.126
Good (Reference)				
Distance				
Short (Reference)	0.759***	0.052	0.374***	0.091
Referral services				
Available (Reference)	0.436***	0.054	0.535***	0.085
ASC.	0.289*	0.327	3.202***	0.179
Cost.	-10.089***	0.302	0.112*	0.239
No. of Observ.	22, 368			
Wald Chi	2173.84			
Prob >chi2	0.0000			

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| Log likelihood | -4400.9 |

Legend

Attitude: attitude of healthcare workers, Medequip: medical equipment and drugs, ASC: Alternative Specific Constant, Qualclin: quality of clinical services, Distance: distance to the health facilities, * Significance at the 90% level ** significance at the 95% level *** significance at the 99% level

Table 6. *The mixed multinomial logit model showing interactions between sociodemographic variables and attributes to explain preference heterogeneity in choices made by women in a rural sub-County.*

	Interactions (Mean parameters)							
	w/sec educ(ref)$		w/age category2$$(ref)		w/married (ref)		w/main earner (ref)	
Attribute	βa	RSE	βa	RSE	βa	RSE	βa	RSE
Attitude.								
Kind (Reference)	0.118	0.143	0.205	0.141	0.218	0.187	-0.198	0.184
Medequip.								
Available (Reference)	-0.124	0.09	-0.131	0.092	-0.419**	0.144	0.172	0.125
QualClin.								
Good quality (Reference)	0.355**	0.141	0.279**	0.131	-0.352	0.226	0.092	0.191
Distance. Short (Reference)	-0.109	0.077	-0.176**	0.08	0.199*	0.116	-0.206**	0.103
Referral.								
Available (Reference)	0.007	0.082**	0.027	0.083	0.109	0.121	-0.300**	0.114
Cost, (Ksh)b	0.00008	0.00002	-0.00003	0.00002	-0.00002	0.00003	-0.00006**	0.00003

Interactions (Standard deviations)

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Attitude x covariate	-0.347	0. 225	0.549***	0.167	0.886***	0.137	-0.817***	0.244
Medequip x covariate	-0.483***	0.090	-0.416***	0.116	0.398***	0.125	0.153	0.185
Qualclin x covariate	0.996***	0.220	0.920***	0.122	0.680***	0.131	-0.232	0.158
Distance x covariate	-0.093*	0.093	-0.026	0.086	- 0.133	0.099	0.018	0.142
Referral x covariate	-0.379***	0.102	0.317**	0.131	0.382***	0.085	0.379***	0.118
Cost X covariate	0.0000297	0.00004	5.31e-06	-0.00002	0.00002	0.00002	0.00002	0.00003
No. of respondents	466	466	466	466	466	466	466	466
No. of observations	22,272		22,368		22,368		22,320	
Log-likelihood	-4493.82		-4458.93		-4473.60		-4472.99	
Prob> χ2	0.0000		0.0000		0.0000		0.0000	
Likelihood ratio χ2	1462.88		2298.41		1052.72		909.59	

$ The level of education had two dummy variables so we present the referent category(secondary) compared to women with tertiary education. We have included the full results showing the primary education in Appendix 6

$$ The age was also categorized into three age categories; we only present the results for the second age category (a2) here. The rest are included in the table 6 and included in appendix 6

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Preference Heterogeneity

The influence of sociodemographic characteristics on the preferences suggested variation in preferences for the attributes for place of delivery. See Table 6. For the mean parameters women with a secondary education had a moderate strong preference for quality of clinical care (p=0.012). Women aged between 25 and 34 years had a moderately strong preference for good clinical quality (p=0.034) and a short distance to the health facility (p=0.024). Married women had a moderate preference for a health facility with available medical equipment and drugs (p=0.004) and a weak preference for a short distance to the health facility (p=0.085). Women who were main earners had a moderate strong preference for availability of referral services at a health facility (p=0.009), a short distance to the health facility (p=0.045) and a cost of delivery services (p=0.035).

The standard deviation shows the variation around the mean, parameters showing heterogeneity in the preferences amongst the women. There was strong variation in preferences for the following three attributes; availability of medical equipment and drugs (p<0.0001), good quality clinical care (p<0.0001), and the availability of referral services at the health facility (p<0.0001) amongst women with secondary education. This finding suggests that several women in this category possessed individual-specific parameter estimates that are different from the sample population mean for the attributes. Women who were aged between 25 and 34 years showed strong preference heterogeneity for the attributes on kind and supportive health worker (p=0.001), availability of medical equipment and drug supplies (p<0.0001), good quality clinical care (p<0.0001). Married women showed strong preference heterogeneity for four attributes; kind and supportive attitude of health care workers (p<0.0001), availability of medical equipment and drug supplies and drugs (p=0.001), good quality clinical care (p<0.0001) and the availability of referral services at the health facility (p<0.0001). Lastly women who reported themselves as main earners showed strong preference heterogeneity for the attributes of kind and supportive attitude of health care workers (p=0.001) and availability of referral services only (p=0.001).

All women across the four sociodemographic groups showed no variation for the for the attribute of costs of delivery and distance to the delivery health facility with the exception of women with secondary

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education (p<0.0001) suggesting that there was no variation in the individual characteristics of women who valued these two attributes

Discussion

This study explored women's preferences for characteristics for delivery health facilities in a rural sub-County in Kenya. The most highly valued attribute for women when making a choice of a delivery service was the attitude of health care workers, this was followed closely by the availability of medical equipment and quality of clinical services. Lowly valued attributes were the availability of referral services and the cost of delivery service. The opt-out alternative that signified home delivery was ranked last and was negative signifying women had a disutility for home deliveries in this setting. All the attributes had an impact on the probability of choosing a health facility for delivery over a home delivery. To our knowledge, this is the first report of using a DCE to address attributes valued by women in a rural setting in Kenya within the context of a free maternity services policy.

Based on the magnitude of the estimated attribute-level coefficients we found out that the attitude of healthcare workers providing delivery services was valued above all other attributes. Quality of care standards require that women be treated in a respectful manner and in a way that upholds their dignity (17).

Global literature has identified that the attitude of health workers managing women during labor and delivery presents a huge challenge with reports of mistreatment of women as evidenced in a recent systematic literature review covering low- and middle-income countries (35). This has also been reported in diverse settings within sub-Saharan African such as Guinea (36), Nigeria (37) and South Africa (38). The high value for attitude of health care workers as an attribute has been reflected in other DCE studies set in rural settings in sub-Saharan Africa (21),(39). Mistreatment has increasingly been recognized as a barrier to women accessing facility-based delivery in Kenya. Across certain Kenyan context, some studies have placing prevalence of disrespect and abuse at 20% (40). Urgent international calls have been made for accountability for the mistreatment of women during labor and delivery because it is a compelling human rights issue (41),(42). Mistreatment should be addressed during regular supervision in all facilities, and quality assessments should ensure that a functioning feedback mechanism for respectful care during delivery is in place (43).

The second most valued attribute was the availability of medical equipment and supplies at the health facility. This was corroborated by the qualitative study where women specifically identifying theatre for caesarean sections and neonatal resuscitation equipment. These were easily observable aspects of the health

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facilities that women saw during their ANC visits. They were also informed by friends and family who had prior visits to the health facilities. Studies evaluating the state of obstetric care coverage often compare the provision of care to the physical infrastructure available without assessing the care provided at health facilities. For example, a recent study that evaluated emergency obstetric services (EMOC) across health facilities in rural Kenya found that EMOC capabilities were not being met and confirmed that only two of the five health centers assessed had acceptable EMOC capabilities illustrating the state of rural health facilities for obstetric care (44). Additionally, recent assessments of quality of care at Kenyan health facilities have shown that medical equipment and drug supplies for mothers were only available at only 41% of health facilities (both public and private)(15). Therefore, health policy makers need to focus in availing EMOC capabilities because women's preferences suggest that they value the availability of equipment as a way of judging the quality of care at a health facility.

The women showed a high preference for quality of clinical care by ranking it third. Women heard from their friends and family about the quality of delivery care. One DCE study in sub-Saharan Africa focused on attributes of respectful care ranked women's preference for good health system conditions such as having a qualified birth attendant amongst other conditions (45). This suggests that women can ascertain to a certain degree what quality of care is from assessing their delivery experience including the necessity of cesarean sections. This calls for skilled birth attendants to provide better quality clinical care that is based on WHO evidenced based guidelines (17).

Referral availability at the health facility was defined as transportation of women from the health facility where they first sought care to a higher-level health facility in the case of complications. Though ranked by women lower this attribute was still valued. This finding suggests that referral options at health facilities in this setting are weak. Women mentioned that if they were referred by health care workers to the sub-County hospital. They were afraid of complications because of the unavailability of ambulances at the lower level health facilities. WHO standards advocate for referrals that are conducted in a timely fashion with a pre-established plan for delivery care and with relevant sharing of information between the concerned staff at the receiving health facilities (17).

An unexpected finding was the coefficient of the cost attribute had a positive sign, signifying a disutility for lower costs. This finding suggests that the women had a value for pay higher amounts of money for better quality of delivery services. We hypothesize that the women were making a trade-off by selecting higher amounts and signaling that they were willing to pay higher amounts for obtaining services that they perceived as being of higher quality. This finding is critical given that approximately half of all women (55%) of women in this setting had access to any health insurance coverage of any type. This implies that the women would have to pay for the delivery service using out-of-pocket funds at private health facilities.

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Such payments have been associated with putting patients at significant financial risk. Additional evidence points out challenges with the implementation of the free maternity services with women reporting that they have been asked to pay for key birthing items sometimes including pharmaceuticals. (46), (47) The women also described situations where public health facilities were "free", but they were exposed to hidden indirect costs during billing and were sometimes asked to pay extra fees for services. Costs, both direct and indirect, have been previously identified in studies assessing factors influencing place of delivery in Kenya and requires more attention particularly in rural settings (48)(49).

Our findings also indicate that multiparous women were more likely to choose a home delivery over primiparous women suggesting some evidence of dissatisfactory experiences during delivery that would deter them from a repeat visit to the health facility. Recent studies in certain rural settings in Kenya suggest cultural values that promote home deliveries especially because of fear of health workers at health facilities (32), (50).

In assessing the relationship between sociodemographic and how they influence choice of attributes we found out that women with secondary education had a strong preference for clinical quality suggesting that highly educated women in this setting were able to discern certain elements of clinical quality either through their own experiences during antenatal care or the experiences of other women in their social network. Other DCE studies also had similar findings suggesting changing demographics with rural areas having more educated women (22).

We also recognized that young women in the age group between 25 and 34 years were concerned with the clinical quality of delivery services and distance. This suggests that younger women are more knowledgeable and aware of their expectations of the health system and might exercise their rights to demand better quality health care. Studies suggest that decisions on health care are done in a social context with women often consulting their families and friends (51), (52). There have been recent reports of young mothers in rural areas in Kenya receiving poor quality services at health facilities (53). Married women had more experience with the health system probably gleaned from previous deliveries and were able to know what to expect with regard to medical equipment and drugs. Lastly women who were main earners had strong preferences for costs which was expected. Thus targeting strategies specific to certain demographics within the population can help the health system be more responsive to women's needs.

This study had some strengths and limitations. The mains strength of the study lies in the use of a discrete choice experiment methodology in maternal health services within the context of the newly implemented free maternity services policy in Kenya. The findings of this study can inform the contextual aspects of

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quality of care valued by women based on their experience of care during delivery services in a rural setting with low income populations.

The main limitation of the study was the hypothetical nature of the DCE might results in biased results. Respondents might make inaccurate choices while being aspirational regarding the quality of services, they expect at a health facility during delivery. Bias might also be introduced by the fact that the hypothetical choices might not be representative of women's choices because decision making around delivery place in real life may be made in a social context with other key family members involved in such rural contexts.

We sampled women who were attending postnatal child welfare clinics so we are likely to have received hypothetical views of women who are users of the health system and represent some positive bias towards the utilization of health services. These findings might not generalize the findings to the minority of women who eschew health services induced immunization. In future community sampling of women who delivered at home might help assist with eliciting preferences of women who are not users of facility-based delivery services to assess what is most valued amongst such groups so as to further inform policy makers.

Conclusion

This study showed that women's experience of care during delivery, attributes such as attitude of healthcare workers, availability of equipment and supplies, access to good quality delivery care are highly valued by women and may affect the utilization of health facilities during the free maternity services. The women's choices indicate their preferences for both structural and process aspects of quality of care. It is critical to for policy makers to understand women's preferences and what drives them to seek delivery services at health facilities. Ensuring high quality care that is patient-centered we can reduce inequities and improve maternal health outcomes for the future.

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Author Contributions

JOA and MA conceptualized the study. JOA conducted the data analysis and drafted the manuscript. JOA, MA, FW and GK revised the manuscript and provided critically important feedback on the manuscript, all authors read and approved the final manuscript

Patient and public involvement

During the pilot phase the women aged between 18 and 49 who were the main respondents provided feedback on the survey instruments. They also reviewed and provided feedback during the qualitative phase on the selection of the attributes.

Patient content for publication.

Not required

Ethical approval.

Permission to conduct this research was provided by the National Commission for Science Technology and Innovation (NACOSTI) through a research permit No. P17/34367/2013 and an institutional research ethical approval form AMREF ESRC Approval No. P388/2017.

Conflicts of interests

None declared

Data availability statement

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

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APPENDIX 1

FGD guide and in-depth interview guide for women and healthcare workers in Naivasha sub-counties

Purpose of the FGD and in-depth interview

The purpose of this Individual in-depth Interview is to try and understand where women residing within Embakasi North sub-County deliver their babies and why they prefer these specific facilities or places**.** The study intends to specifically elucidate the following;

1) What women's preferences are with regard to place of delivery
2) Why they choose certain places over the other places
3) To determine attributes of the health facilities that they deliver in and which of the attributes they deem important
4) Possible attribute levels of the attributes identified

Logistical arrangements

I would like to go over a few logistical arrangements before we begin the interview:

My names are Jackline Aridi and I am registered as a PhD student at Strathmore University's Institute of Healthcare Management. The interview will last approximately 30 minutes. I have obtained Ethical clearance to conduct this research from Strathmore University's Institutional Review Board and permission to conduct research within Nairobi County from the National Science and Technology Research Institute (NACOSTI)

Everything we discuss during this interview will be kept in strict confidence and your real name will not appear in any of our results. As such, please make every effort to be open and honest when responding to the questions. If at any time you feel uncomfortable and want to stop the interview, please feel free to. I will provide you with a consent form which you will read and sign if you find it agreeable with you. For data capture purposes, this interview will be recorded using a mobile phone device.

Sociodemographic characteristics of healthcare workers.

Characteristic	
Age in years	
20-29	
30-39	
40-49	
50+	
Marital Status	
Single	
Married	
Divorced /Widowed	
Years of Work Experience	
0-4	
5-9	
10-15	
15+	
Type of Health Facility	
Public Health Centre	
Private Health Centre	
Referral Hospital	

Maternity	
Other	

Questions for women, healthcare workers and policy makers

Key questions	Probes
1. Birthing Experience- What are the things that make for a good birthing experience?	Describe your dream birthing experience. Who do you think needs to be present? What do you think needs to be present? What do you think are worries or concerns of the mothers? Are there cultural traditions that need to be followed judiciously? What makes a mother feel safe during the process? What would absolutely make it a bad experience?
2. Place to deliver- How did mothers and their families decide where to deliver?	**Facility staff** What are the hours of operation of the maternity ward? How many staff are working in your maternity ward? Is there electricity and water at your facility at all times? If not, explain Do you have a placenta pit? Are staff trained in: Newborn resuscitation? Emergency obstetric care? (placing IVs and dispensing Misoprostol for haemorrhage) Is your services completely free? Or do patients have to pay for some supplies (ex. gloves), use of an equipment, etc.? Is there periodic upgrade in capacity for maternity staff? When was the last upgrade and how many staff participated?

	Do you feel that mothers in your area deliver at your health centre if available? If not, where do they deliver? Why?
	Are mothers treated nicely and with respect? Give examples.
	Who do you think is involved in the decision making process as to where a mother delivers?
	Community leaders/Fathers:
	What are the options for places to deliver?
	Who were involved in the decision making process as to where to deliver?
	Are you usually involved in deciding where to deliver? If so, what did you have to consider in making that decision? (cost, distance, risks, benefits)
	What makes the delivery place a good or bad experience? Were you treated nicely and with respect? Give examples
3. Recommendation to friends- What would you tell your friends about where they should deliver and why	Is it culturally appropriate to share your family's birthing experiences with your friends?
	Does your opinion have an impact on where your friends deliver their babies?
	Community leaders: Do you recommend/suggest pregnant mothers to deliver at certain places?
	Fathers: Does the Chief/leaders in your community recommend/suggest that your family deliver at certain places?
	Community leaders: If you hear something negative about a place to deliver, does it affect where you would recommend/suggest a family to deliver?
	Fathers: If you hear something negative about a place to deliver, does it affect where your family choose to deliver?

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Attribute Level development Questions

1. What do you think women accessing services from the health facilities where you work value most when they go to the facility for delivery?
2. What do you think is the most important characteristic of the health facility for women when they go to deliver?
   a. *Probe (cost of delivery services, distance to facility, equipment and supplies, attitude of healthcare worker, qualifications of health care workers)*
3. What do you think are barriers to health facilities from providing good quality delivery services?
   a. What do you think health facility in charges should do to promote good facility based experiences for delivery services for women?
4. What is your opinion on the current free maternal health services policy under implementation since 2013? Is it encouraging utilization of health facilities for delivery services?
5. What do you think are the challenges that the Government and policy makers experiencing with respect to health policies concerned with delivery services in public health facilities? Private facilities? Tertiary facilities? And what should they do about the challenges?
6. What specific health policies do you think the Government should promote to improve access to high quality delivery services in public and private health facilities? Probe *(free ANC, increase access through NHIF, early focused ANC?)*

Field	WOMEN'S HEALTH AND HOUSEHOLD QUESTIONAIRE
	DEMOGRAPHIC QUESTIONS
Age	1. What is your age?
Residence	2. How long have you lived in Embakasi North/Naivasha sub county? A. I have lived here my whole life B. I just moved to Embakasi North/Naivasha C. Other
MovedWhen	3. How many years ago did you move here? A. 0-5 years B. 5-10 years C.11-20 years D. Over 20 years
ResidenceWhy	4. Why did you move to Embakasi North**?** A. I have family or friends here B. I heard there were business opportunities here C. To be close to Nairobi City Centre D. To look for work E. Other
Schooling	5. What is your level of education? A. Did not attend primary school B. Primary School C. Secondary School D. Tertiary E. University
Married	6. Are you married? A. No B. Yes
MarriedDuration	7. How long have you been married? A. 0-5 years B. 5-10 years C. 10-15 years D. 15-20 years
HOUSEHOLD MODULE	
HeadofHousehold(HoH)	8. Are you the head of the household?(If an important decision is to be made in the Household are you the one who gets to decide A. No B. Yes
Main Earner	9. Are you the main earner in your household? Do you contribute the most to household expenditures? A. No B. Yes
MainEarnerNo	10. How are you related to the person who earns most in your household? A. My Father/ My Husband/Boyfriend's father B. My grandfather/ My Husband/Boyfriend's grandfather C. My husband/Boyfriend

	D. My mother/My Husband/boyfriend's mother E. Another family member/ relative/ aunt/uncle F. Other

HOUSEHOLD MODULE : SOCIOECONOMIC STATUS

HoHMESame	11. Are the head of the household and the main earner the same person in your household? A. No B. Yes
adults	12. How many people over the age of 18 live in your household?
adultswomen	13. How many of these are women?
adolescents	14. How many people aged between 14 and 18 live in the household
adolescentwomen	15. How many of these people are women?
children	16. How many people under 13 live in your household?
childWomen	17. How many of these children are women?
employedadults	18. How many members of your household contributed to your household expenses last month? *(this includes things like rent, food, water, electricity fuel, cooking fuel)*
totalpublicexpenditure	19. How much did the employed adults contribute to your household expenses last month
	HOUSEHOLD ASSETS
Refrigerators	20. How many refrigerators does your household own?
Bicycles	21. How many bicycles does your household own?
Motorbikes	22. How many motorbikes does your household own?
Cars	23. How many cars does your household own?
Televisions	24. How many Televisions does your household own?
Radios	25. How many radios does your household own?
Stereos	26. How many stereos does your household own?
Mobiles	27. How many mobiles does your household own?
Mattresses	28. How many mattresses does your household own?
waterExp	29. How much did your household spend on water last month?
electricityExp	30. How much did your household spend on electricity last month?
fuelExp	31. How much did your household spend on fuel last month?
REPRODUCTION AND PREGNANCY MODULE	

insurance	32. Do you currently have health insurance?
	    A. No
	    B. Yes

insuranceType	33. What kind of insurance do you have?
	    A. NHIF
	    B. OBA
	    C. Private Insurance
	    D. Other

insuranceOther	34. The private insurance policy you have, what is the name of the company that provides it? specify
insurancePrice	35. How much do you pay per month for insurance? (if the respondent doesn't pay monthly help them approximate the monthly rate)

generalHospital	36. Have you visited a clinic, hospital, or doctor in the last year to receive medical care unrelated to a pregnancy?
	    A. No
	    B. Yes

generalHospitalWhy	37. During the most expensive visit to a clinic, hospital, or doctor in the last year, what was the visit for?
	    A. I was hurt in an accident and needed urgent care (example broken bones, stitches, allergic actions)
	    B. I was very sick and needed to get medicine or another kind of treatment example malaria, pneumonia)
	    C. I developed a condition and needed to sneak

generalHospitalPaid	38. How much did you spend in total on medical care received in the last year unrelated to pregnancy**?**

generalHospitalStill	39. Are you still seeking treatment for health conditions unrelated to pregnancy?
	    A. No
	    B. Yes

anaemia	40. Do you suffer from anemia?
pregnantEver	41. Have you ever been pregnant?
pregnantAvoid	42. Have you ever used anything or tried in any way to delay or avoid getting pregnant?
timesPregnant	43. How many times have you been pregnant?
livebirths	44. How many livebirths have you had?
deaths	45. Sometimes it happens that children die. It may be painful to talk about and I am sorry to ask you about such memories, but it is important to get correct information. Have you ever given birth to a son or daughter who was born alive but later died?
deathsBoys	46. How many of those were boys?
miscarriages	47. How many times have you had a pregnancy result in a miscarriage?
stillbirths	48. How many times have you had a pregnancy result in a stillbirth?

yearPreg	49. In what year did this pregnancy occur?
embakasinorthPreg	50. Were you living in Embakasi North sub County during this pregnancy?
nairobiPreg	51. Were you living in Nairobi during this pregnancy?
intended	52. Was this pregnancy planned?
marriedThen	53. Were you married to the father at the time?
monthsPreg	54. How many months were you pregnant before you gave birth?
antenatalcare	55. How many ante natal visits did you attend?
anc_first	56. How many months pregnant were you when you first went for an ante natal care visit?
ancSame	57. Did you get ante natal care at the same facility where you planned to give birth? A. No B. Yes
ancElseWhy	58. Why did you go somewhere different for ante natal care than the place you planned to give birth?
ancElseWhyMain	59. What was the main reason you when somewhere different for ante natal care than the place you planned to give birth? A. I was saving up to give birth in a nicer hospital than where I received ante natal care B. I could afford ante natal care at that hospital, but not a birth there C. Convenience: it was easier to go to the place where I received ante natal care than where I gave birth D. Complications: I needed to go to a special hospital like Kenyatta because of complications
insurancePr	60. Did you have health insurance during this pregnancy?
insuranceTypePr	61. What kind of insurance did you have?
insurancePricePr	62. How much did you pay per month for insurance?
talkPrice	63. Did anyone talk to you about how expensive it would be to give birth during ante-natal care?
contactHospital	64. Did you contact hospitals about prices before giving birth?
savingMonths	65. How many months before you gave birth did you begin putting aside money to pay for it?
iron	66. During this pregnancy, did you take any iron tablets or iron syrup?
Folic acid	67. During this pregnancy, did you take any folic acid?
malarial	68. During this pregnancy, did you take any anti-malarial medication?
tetanus	69. During this pregnancy, did you receive a shot in the arm to prevent the baby from getting tetanus (convulsions after birth)?
vitA	70. Did you experience any problems seeing during the daytime or at night?
specialist	71. Did you visit an OB/GNY or specialist before giving birth? A. No B. Yes

referral	72. Were you referred to a larger hospital like Kenyatta National because a doctor determined that there might be complications with your pregnancy? A. No B. Yes
complicationExpected	73. What complication where you referred for? A. Sepsis B. Hemorrhage C. High blood pressure D. Other
whereBirth	74. Where did you give birth on this occasion? A. Hospital B. Home
plannedFacility	75. Is this where you originally planned to give birth, A. No B. Yes
whyChangePlans	76. Did you have to change plans ? If yes, Why did you change your plans? A. The baby came early and I had to go to the nearest facility B. I wasn't able to afford the facility I originally planned on C. I had more money that I expected when the baby was born so I could go to a nicer facility D. No, didn't change plans E. Other
outsideFacility	77. Why didn't you deliver in a health facility? A. It was too expensive B. I couldn't get to one in time once I went into labor C. I don't trust the Doctor and nurses at the facilities I can afford D. I don't trust health facilities E. Other
whyHere	78. What qualities of the Health Facility did you find important in making the choice of delivering there? A. Cost B. Cleanliness C. Distance from home D. Availability of supplies and equipment E. Qualification of health worker(nurse or doctor) F. Waiting time G. Staff attitude H. Referral by relative I. Other
whyHereMost	79. What was the most important quality of the Health Facility in making the choice of delivering there? A. Cost B. Cleanliness C. Distance from home D. Availability of supplies and equipment E. Qualification of health worker(nurse or doctor) F. Waiting time G. Staff attitude H. Referral by relative

	I. Other
birthTime	80. About how many hours did it take to deliver the baby, starting from when you first experienced contraction pains?
ceaserean	81. Was this a normal birth, or was the baby delivered by cesarean section? A. Normal birth B. Ceaserean
ceasereanEmergency	82. Was the cesarean planned or unexpected? A. Planned B. Unexpected
doctorAtAll	83. After you arrived at the hospital to give birth, who of the following did you see? A. Doctor B. Only nurses C. Birth attendants
	Thank you for participating in our survey. We really appreciate your time, and are grateful for meeting with us today.

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find

each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to

include the missing information. If you are certain that an item does not apply, please write "n/a" and

provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectionalreporting guidelines, and cite

them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening

the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for

reporting observational studies.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1

| Abstract | #1b | Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |

Introduction

| Background / rationale | #2 | Explain the scientific background and rationale for the investigation being reported | 3,4,5 |
| Objectives | #3 | State specific objectives, including any prespecified hypotheses | 5 |

Methods

Study design	#4	Present key elements of study design early in the paper	5,6
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,9
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	9
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	N/A

Bias	#9	Describe any efforts to address potential sources of bias	11
Study size	#10	Explain how the study size was arrived at	8
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	10,11
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	10,11
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	11
Statistical methods	#12c	Explain how missing data were addressed	N/A
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	10
Statistical methods	#12e	Describe any sensitivity analyses	N/A

Results

Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	9
Participants	#13b	Give reasons for non-participation at each stage	N/A

| Participants | [#13c](#) | Consider use of a flow diagram | N/A |

| Descriptive data | [#14a](#) | Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable. | 11,12 |

| Descriptive data | [#14b](#) | Indicate number of participants with missing data for each variable of interest | N/A |

| Outcome data | [#15](#) | Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable. | N/A |

| Main results | [#16a](#) | Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 11,12,13 |

| Main results | [#16b](#) | Report category boundaries when continuous variables were categorized | 11,12 |

| Main results | [#16c](#) | If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | N/A |

| Other analyses | [#17](#) | Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses | 16 |

Discussion

| Key results | [#18](#) | Summarise key results with reference to study objectives | 16 |

Limitations	[#19](#)	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	18
Interpretation	[#20](#)	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	18
Generalisability	[#21](#)	Discuss the generalisability (external validity) of the study results	18

Other Information

| Funding | [#22](#) | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 20 |

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BMJ

Understanding what women want: eliciting preference for delivery health facility in a rural sub-County in Kenya, A Discrete Choice Experiment.

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Abstract

Objective: To identify what women want in a delivery health facility and how they rank the attributes that influence the choice of a place of delivery.

Design: A Discrete Choice Experiment was conducted to elicit rural women's preferences for choice of delivery health facility. Data were analyzed using both a conditional logit model to evaluate relative importance of the selected attributes. A mixed multinomial model evaluated how interactions with sociodemographic variables influence the choice of the selected attributes.

Setting: Six health facilities in a rural sub-County.

Participants: Women aged 18-49 years who had delivered within six weeks.

Primary outcome: The DCE required women to select from hypothetical health facility A or B or opt-out alternative.

Results: A total of 474 participants were sampled, 466 participants completed the survey (response rate 98%).The attribute with the strongest association with health facility preference was having a kind and supportive healthcare worker (β=1.184, p<0.001), second availability of medical equipment and drug supplies (β=1.073, p<0.001) and third quality of clinical services (β=0.826, p<0.001). Distance, availability of referral services and costs were ranked 4th, 5th and 6th respectively (β=0.457, p<0.001), (β=0.266 p<0.001), and (β=0.000018, p<0.001). The opt-out alternative ranked last suggesting a disutility for home delivery. (β=-0.849, p<0.001).

Conclusion: The most highly valued attribute was a process indicator of quality of care followed by technical indicators. Policy makers need to consider women's preferences to inform strategies that are person-centered and lead to improvements in quality of care during delivery.

Strengths and limitations of the study

- The study was done under the context of the free maternity services policy in Kenya and will inform the contextual aspects of quality of care valued by women based on their experience of care during delivery.

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- The study provided a ranking of the attributes of health facility delivery valued by women in a rural setting that can be useful to policy makers when prioritizing resources for quality of care improvements
- The hypothetical nature might result in bias as respondents might make aspirational choices regarding the attributes rather than choices that represent their preferences.
- Hypothetical choices might not be representative of women's choices because decision making around delivery place in real life may be made in a social context with other key family members involved especially in rural contexts

Key words

Discrete choice experiment preferences delivery health facility rural women Kenya

Word Count

6630 words

2

Background

In 2017, an estimated 295,000 women died while giving birth. While this represents a 35% improvement from 451,000 maternal deaths in 2000, the vast majority of these deaths are preventable (1). Strategies to reduce the high burden of maternal mortality in low and middle-income countries have included increasing coverage for high quality facility-based delivery (2),(3). Facility-based delivery is increasing in sub Saharan Africa due to the growing attention to efforts to reduce maternal mortality resulting in substantial declines in mortality over the last few decades (4),(5). This has been facilitated in part by overcoming barriers to access such as cost and distance. However there remains the challenge of growing inequities in maternal health outcomes within countries and this demands that we pay attention to the barriers to access to high quality facility-based delivery.

Kenya is one of the countries exhibiting insufficient progress in reducing preventable maternal deaths, the reported maternal mortality ratio is currently estimated at 362 deaths per 100,000 live births (6). In a major move to eliminate barriers such as cost, the Government initiated the free delivery policy in 2013 (7). The government's free maternity policy together with access to private delivery care financed by the National Health Insurance Fund (NHIF) expanded the options for delivery health facilities available for women to choose from. This resulted in positive trends in access to facility-based delivery particularly in rural areas where investments in the health system and physical infrastructure such as road network had resulted in increased access. The total numbers of health care facilities in Kenya has grown to 3965 over the last 10 years (8). All these strategies increased women's choices available for delivery health facilities.

However, inequities in maternal health outcomes still exist in Kenya particularly at the county level. A recent United Nations Population Fund (UNFPA) report in Kenya identified 15 counties that contribute to 98.7 % of the maternal deaths with most of the deaths in rural counties (9). The quality of care provided also differs substantively across regions in Kenya with one study identifying a 25-percentage point gap between Nairobi and Coast regions (10). Additionally, higher volume facilities and those with caesarean section capacity seemed to offer a high quality of care (10). There have also been recent reports of increased utilization of county level (referral) hospitals for deliveries (11). National assessments of quality of care at health facilities in Kenya suggest that poorer women, have a higher likelihood of encountering poor quality of maternal health services in Kenya (12),(13). Assessments targeting primary health facilities have shown that these facilities offer poorer quality of services, with gaps with regard to basic infrastructure, medical equipment and supplies a, diagnostic accuracy and adherence to clinical

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guidelines (14),(15). Within this context there is significant overlap between primary health facilities and delivery health facilities. With the free maternity services policy, health centers and dispensaries at the primary level of care were upgraded in order to be able to provide uncomplicated childbirth services. The Government in recent times introduced the Kenya Quality Model for Health (KQMH) to improve the quality of care at health facilities (16). This strategy aimed to support quality improvement by providing minimum standards and guidelines, and support the structure-process-outcome of health services by applying the principles and tools of quality management. However, several implementation challenges were identified such as sub-standard structures at health facilities and lack of pharmaceutical supplies at health facilities.

The WHO framework on quality of health services during facility-based delivery proposes that a high-quality health system is safe, effective, patient centered, timely, efficient, and equitable (17). These frameworks assume knowledge of the end-users. However, it is likely that Kenyan women in rural areas may be incapable of assessing the clinical quality from a technical standpoint. They are able to assess the quality of the care and choose delivery health facilities based on their experience of care such as respectful treatment by health care workers. They are also able to assess other aspects of provision of care, such as the availability of medical equipment like theatre for caesarean section during an emergency, accessing drug supplies within the facility versus an outside pharmacy, and referral services that includes transportation to a higher-level facility.

There is limited knowledge in Kenya on the specific elements women value most in the care they receive from the health facilities. Most strategies available for assessing quality of care received during childbirth in Kenya have focused only on either the health system inputs required, or satisfaction levels at the end of the continuum of care. Strategies are also based on national level assessments of quality of care such as service provision assessment and demographic health surveys (6),(8). These studies while useful and nationally representative, fail to identify and provide a ranking for demand side barriers. As a consequence, national data at present are unable to fully explain why women prefer certain health facilities over others. Contextual information on what women value when making decisions on choice of a health facility become increasingly important as women's choices increase. This information is particularly useful in resource constrained settings where prioritization guides allocation of scarce health resources.

Discrete Choice Experiments (DCE) can be particularly helpful in eliciting preferences. DCE's allow health services users to state individual preferences when offered different hypothetical choices (18). They are based on the assumption that services can be described by their attributes, and that the value of a

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service depends on the nature and level of these attributes (19). DCE's have been used to examine a broad range of health system challenges in sub-Saharan Africa including patient preferences for hospital services in South Africa (20) and maternal health services in rural areas of Ethiopia and Tanzania (21),(22). The main objective of this study was to use a DCE to elicit women's preferences with regard to the characteristics of a delivery health facility based on their delivery experiences in a rural sub-County. We aim to provide insights on what a women's view of quality of care is, based on their experience of care. We hope these preferences will present the patient perspective to complement the needed technical quality improvement to support the development of a quality health system, so women can get what they want and deserve from the health system.

Methods

Study Setting

Naivasha Sub-County is a semi-rural setting 50km to the northwest of Nairobi. It is composed of peri-urban settlements, and includes agriculturalist and pastoralist populations within Nakuru County. It has a population of roughly 181,966 people. Primary Health facilities include government health facilities; several private health facilities; and a County Referral Hospital in Naivasha town. The population is also served by a faith-based private tertiary hospital, about 20 km away from Naivasha in neighboring Kiambu County. Naivasha was selected as a study site because recent evidence from a UNFPA report rank ordered counties by contribution to the burden of maternal deaths and Nakuru County was ranked fourth (9).

Discrete Choice Experiments

Identification of attributes and attribute levels

DCE's are an attribute driven technique used to elicit stated preferences and interventions and are based on the assumption that health care interventions services and policies can be described by their attributes (18). The first stage in the development of a DCE is the identification of attributes and attribute levels. Previous studies suggest a review of the literature and qualitative work to aid in the identification of relevant attributes (23). We undertook a comprehensive literature review on the topic of facility-based delivery and skilled birth attendance in sub-Saharan Africa to gain an in depth understanding of the factors influencing place of delivery. We also conducted a qualitative study with six focus group discussions with 50 women at a mix of public and private health facilities. We also conducted -in-depth interviews with 12 health care workers serving as in-charges at the maternities. We used an interview guide. (See Appendix 1). The participants were purposively selected women were aged 18 to 49 and had

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just delivered their babies within 6 weeks and were attending child welfare clinics at the different health facilities. Table 1. Shows the final attributes and attribute levels selected for the DCE.

Experimental design

The attributes of the interventions and their assigned levels were combined using experimental designs produce a set of hypothetical choice alternatives. Respondents were asked to choose which alternatives they prefer the attribute levels determine the utility of respondents attached to a particular characteristic of an intervention and hence their preferences (24). The DCE was designed as an unlabeled one with sixteen choice set presented under three alternatives: health facility A, health facility B, and an opt-out alternative where the woman would choose none of the two facilities, presented as preference for home delivery. See Table 1 for the final attributes and attribute levels included in the DCE. All attributes in the choice experiment had two levels each except cost, which had three levels. This resulted in a design of (2^5 x 3^1 =96) choices in the full fractional design. This number of choices would have been too tedious for the respondents to handle. We opted to use a fractional factorial design to reduce the choices from 36 to 16, making it manageable for the respondents. This was done using a D-efficient design using *Ngene* software to generate the original experimental design (25) (See Appendix 2). All the attributes were dummy coded to allow comparison against a reference category. The reference categories were those that were the dominant choice for example good quality of clinical services, kind and supportive health care workers, availability of medical equipment, availability of referral services. Short distance to the health facility and the lowest price of delivery service, 3000Ksh.The D-efficient design also allowed for favorable design such as orthogonality, level balance, minimum balance and overlap (26). The 16 choice-set questions were generated from the design. Each choice-sets contained 16 questions. We then divided each choice set into two sets with 8 questions each and each respondent was presented with a single choice-set from a single block.

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Table 1. Final list of attributes and attribute levels included for the DCE.

Attribute	Attribute level
Quality of clinical services at the health facility	Good quality services
	Bad quality services
Attitude of healthcare workers	Kind and supportive healthcare worker
	Unkind and unsupportive healthcare worker
Availability of medical equipment and supplies	Medical equipment and supplies available
	Medical equipment and supplies not available
Distance to the health facility	Health facility is close to residence
	Health facility is far from residence
Referral at the health facility	Referral services available at the health facility
	Referral services unavailable at the health facility
Cost of delivery service (Kenyan Shillings/ Ksh)	3000; 5000; 8000

DCE Study sample

The choice-sets were reviewed for content by a team of policy makers from the county headquarters during a one-day meeting at the main referral hospital at the county. The meeting confirmed and validated the choice of attributes as important to both women and healthcare workers. This was followed by a pilot study with 30 women in a neighboring sub-County to test the attributes. The women who participated in the pilot were not included in the main study. The pilot resulted in minor revisions to the wording of certain attributes for example the attribute 'treatment at the health facility' was changed to 'quality of clinical care during delivery' to provide a distinction between interpersonal and clinical aspects of quality of care. The availability of medical equipment and drug supplies was defined as easily observable equipment important to women such as the theatre, for cesarean sections and incubators for premature babies. Women could easily determine availability of drugs at the health facility when they are sent outside of the hospital to buy essential drugs. Knowledge on both these attributes were also determined by conversations with other women from their social network. The availability of referral services was defined as the availability of a means of emergency referral transport to move the women from primary to tertiary level of care that could handle obstetric complications. The final DCE scenario with the final attributes can be seen in Table 2.

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These questions were then loaded into Open Data Kit (ODK) and incorporated into a questionnaire consisting of items on sociodemographic and maternal health utilization variables. The questionnaire contained question adapted from the Kenya Demographic Health Survey 2014. See Appendix 3.

To obtain the sample size for the DCE We used the rule by Johnson and Orme (2003) to suggest the sample size required for main effects. This depended on the number of choice tasks (t) the number of alternatives (A) and the number of analysis cells (C). We had 16 choice-tasks (t) with 3 alternatives (a) and 3*2 analysis cells (c). N >500*c/t*a=N>500*6/16*3 = N>62.5 (27). Using this formula we derived a mimimum sample size of 62.5. We however collected a larger random sample of 474 women that would enable appropriate estimation of both main and interaction effects for the DCE. Our eventual sample size targeted sample size was 474 from six health facilities to satisfy the representativeness for the quantitative survey for the sociodemographic variables but also large enough power to provide results that were statistically significant for all relevant attributes. Lancsar and Louiviere (2006) in an earlier study recommend a sample of 20 respondents per questionnaire version as sufficient to estimate reliable DCE models (28).

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Table 2. Example of a scenario in a choice-set card that was presented to the women

THE DISCRETE CHOICE EXPERIMENT ON ATTRIBUTES FOR PLACE OF DELIVERY IN RURAL SUB COUNTY IN KENYA

Our objective is to conduct a DCE experiment to explore the relative importance of attributes of place of delivery to Kenyan women living in Naivasha sub-County to try and elucidate what women's value and their preferences are when they are making choices on place of delivery. You will be provided with a script on a mobile phone and you will be asked to imagine that you are pregnant and you are given a choice between the following two health facilities to deliver your baby in. Which one would you prefer? Facility A or Facility B? You also have an option of choosing none of the two health facilities as Option C. There are no right or wrong answers

SAMPLE CHOICE CARD

Attribute	Health Facility A	Health Facility B	Option C
Quality of clinical care during delivery	Good quality	Bad quality	(None of the two health facilities- home delivery)
Attitude of healthcare workers	Kind and supportive attitude	Unkind attitude	
Cost of delivery services	3000Ksh	5000Ksh	
Availability of equipment and supplies	Equipment supplies not available	Equipment & supplies available	
Distance to health facility	Facility is close to home	Facility is far from home	
Availability of referral health services	Referral services available	Referral services unavailable	
Your choice (tick only one)	□	□	□

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Data collection

A team of six research assistants along with their two supervisors received a five training on data collection by the first author. Women were randomly recruited during postpartum immunization clinics from a mix of six public and private health facilities. We randomly sampled 474 women. After the women gave informed consent, we then interviewed them using the Open Data Kit (ODK) Platform.

Patient and public involvement statement

During the pilot phases the women aged between 18 and 49 who were the main respondents provided feedback on the survey instruments. They also provided feedback during the qualitative phase on the selection of the attributes.

Ethics

Permission to conduct the research was provided by the National Commission for science research and technology and innovation (NACOSTI) and by the County Government of Nakuru. Ethical approval was provided by AMREF ERSC.

Model specification

The data were analyzed in Stata 15 (StataCorp LP, College Station, USA). Descriptive statistics were calculated for the non-DCE variables. The DCE data was analyzed using the Random Utility model (29). This framework assumes that women seek to maximize their utility according to the perceived benefit associated with the different attributes and attribute levels. A model that expresses the utility 'U' in of an alternative i in a choice set C_n (perceived by individual n) as two parts: 1) An explainable component specified as a function of the attributes of the alternatives $V(X_{in}, \beta)$; and 2) an unexplainable component (random variation) ε_{in}.

$U_{in} = V(X_{in}, \beta) + \varepsilon_{in}$

The individual n will choose alternative i over other alternatives in a choice set C if and only if this alternative gives the maximized utility. The relationship between the utility function and the observed k attributes of the alternatives can be assumed under a linear-in-parameter function (19). Therefore, the utility the respondents attach is related to the attribute and attribute levels within the choice-sets, meaning that if alternative i is chosen within a choice set, i will yield the maximum utility compared to j alternatives. A is the alternative specific constant, x are the attributes in the DCE and β are the coefficients describing the marginal utility of the attribute. The standard conditional logit model is below:

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$V_{in} = \alpha_i + \beta_i x_{i1} + \ldots + \beta_k x_{i+e}$

A base conditional model was used to estimate the mean change in utility, preference which respondent placed on attributes. α i is a constant term that represents the general preference for place of delivery at a health facility compared to the alternative of opting out and having a home delivery. The reference group was the choice of health facility A or health facility B. Dummy coding was used for the data, each categorical attribute level was assigned a value of 1 whenever it was retained and 0 when omitted. The cost variable was maintained as a continuous variable. The utility model makes the assumption that women will trade-off between the different attribute levels and choose the alternative that gives the greatest utility. The conditional model is suitable for estimating average preferences across respondents. The utility function was estimated for the following model:

$U_i=$ *α_i + β1QualityClinicalcare + β2attitudeofhealthworkers + β3Medicalequipmentandsupplies +β4distance + β5referral services + β6Costs + ε (error term)*

α_i is the alternative specific constant (ASC) term that shows the preference for place of delivery (either a health facility or home), β's 1-6 are the parameters for each of the attribute levels and ε is the error term.

Data Analysis and model estimation

The aim of the base multinomial logit model estimation is to determine whether the attributes are important (statistically significant, as shown by the significance level of the β) and the direction of importance (shown by the sign of the estimated (β) and relative importance (size of the estimated parameter). The main hypothesis test was whether the parameter estimates were significantly different from zero for all attributes.

Due to the assumption of irrelevant independent alternatives, the presence of heterogeneity in choices we estimated a generalized mixed multinomial logit model to assess for preference heterogeneity amongst the women (30). The mixed multinomial logit model overcomes some of the limitations of the base multinomial logit by allowing for random taste variation, unrestricted substitution patterns, and correlation in unobserved factors over time. The Mixed multinomial logit can also utilize any distribution for the random coefficients. (30). The five variables that described the attributes of place of delivery in the utility model above were entered into the model as random parameters whereas the cost variable was entered as a fixed variable. The mixed multinomial logit model allows for the estimation of both main and interaction effects. This was done by extending the mixed multinomial model and testing interactions between the sociodemographic and the women's attributes in order to investigate how preferences may vary according to observed individual characteristics. The sociodemographic characteristics included such as maternal age, marital status, education and income status have been known to influence place of delivery in Kenya (31),(32),(33)(34). Education was measured in three categories, primary, secondary and tertiary education.

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We formed two dummy variables s1 and s2 representing a comparison between primary and secondary education to tertiary education. We categorized age into three categories: 18-24 years, 25-34 years and 35-45 years. We then formed two dummy variables a1 and a2 to represent the first two age categories. marital status and main earner had one dummy variable each that were interacted with the attributes.

The output of the mixed multinomial logit model includes the mean parameter estimate that represents the relative utility of each attribute. The standard deviations for a random parameter suggest the existence of heterogeneity in the parameter estimates over the sampled population around the mean parameter estimate i.e., different individuals possess individual-specific parameter estimates that may be different from the sample population mean parameter estimates. The p-value of the interactions shows statistical significance for an interaction between sociodemographic variables and attributes hence signifying the influence of the woman's characteristics. The Robust Standard Errors shows the level of error. The theoretical validity of the design will be explored by examining the signs and significance levels of parameter estimates. To address bias, we tested for choice monotonicity, this is the assumption that a respondent will choose an alternative in the choice task that is superior to the other alternative on all choice attributes (28).

Results

Participant characteristics

474 women were invited to participate in the DCE experiment. There was incomplete data for eight respondents. The DCE survey was successfully administered to 466 representing a 98% response rate. The average age of the respondents was 26 years, 32% were primiparous. 88% of the women reported themselves as married and 48% had attained a secondary school education. About 53% of the heads of household had attained up to a secondary education. Only 18% of the rural a woman were heads of household, however 95% respectively claimed to have influence over household-level decisions. Approximately 83%, reported that they were not the main source of household income. Finally, about 67% of the women reported having moved to the study setting from elsewhere within the last five years. See Table 3 below for details on the sociodemographic characteristics.

Table 3. Sociodemographic characteristics of women in Naivasha sub-County (N=466).

	Naivasha sub-County	
Sociodemographic variables	N	(%)
Age n (mean (SD))	26(5.1)	
Marital status		
Single	57	12
Married	409	88
Education		
Primary school	175	38
Secondary school	221	48
University/tertiary	66	14
Parity		
1	151	32
> =2	215	68
Head of household status		
Woman not HH	381	82
Woman head of HH	85	18
Head of household education		
Primary school	100	27
Secondary school	196	53
University/Tertiary	72	20
Woman's influence on decision making within HH		

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Woman had no influence	18	5
Woman had influence	363	95
Main-earner status		
Is not the main earner	386	83
Is main earner	79	17
Residence (moves)		
Moved in 5 years	226	67
Moved over 5 years	112	33
Delivery health facility		
Public facility	346	74
Private facility	91	19
Home delivery	29	6

To enable the estimation of main and interaction effects each respondent was given a survey with 3 unlabeled alternatives (health facility A, health facility B and an opt-out option) with 16 choice-sets to choose from, resulting into 48 observations per respondent. The number of observations analyzed within the rural site were 22,368 out of 22,566. 198 observations were dropped by STATA automatically because of dominant choices.

In the rural setting, the variable with the greatest association with choice of health facility was attitude of the health care workers, followed by availability of medical equipment and drugs and thirdly the quality of clinical services during delivery, the distance to the health facility, availability of referral health facility, cost of delivery were ranked 4th, 5th, 6th. (p<0.001). The opt-out alternative had a negative sign and was ranked 7th. (p<0.001).   See Table 4 below.

The direction of the coefficient signs provides a check on the theoretical validity of the DCE model, that is, whether the coefficients move as economic theory or a priori expectation would predict. All the attributes with the exception of the opt-out had the expected positive signs. The cost attribute was positive, however economic theory expects them to be negative showing that women have a disutility for high costs.

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Table 4. The base multinomial logit model with for a DCE on preferences for place of delivery amongst women in a rural sub-County.

	Rural sub-County		
Attribute	**B**	**Robust S. E**	**C.I**
Attitude.			
Kind (Reference)	1.184***	0.037	(1.11-1.25)
Medequip.			
Available (Reference)	1.073***	<0.035	(1.01-1.13)
Qualclin.	0.826***	0.034	(0.76-0.89)
Good (Reference)			
Distance. (Reference. Short)	0.457***	0.031	(0.39-0.52)
Referral.	0.266***	0.033	(0.20-0.33)
available (Reference)			
Costs.	0.000018***	9.40e-06	(2.55e-06-0.00033)
ASC.	-0.849***	0.082	(-0.97-0.73)

Legend Attitude: attitude of healthcare workers, medequip: medical equipment and drug, Qualclin: quality of the clinical delivery services, Distance- Distance to the health facility, Referral: referral service availability, Clean: cleanliness of the health facility, ASC: Alternative Specific Constant.

* Significance at the 90% level ** significance at the 95% level *** significance at the 99% level

Robust S.E- Robust Standard Errors

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For the mixed multinomial logit model with no interactions, we found out that all the mean coefficients values for all the attributes, were statistically significant at the 99% level (p <0.0001) with the exception of the opt-out attribute (p=0.377). See Table 5. This meant that we could reject the null hypothesis and conclude that all the selected attributes selected were important to the women respondents. The low significance value for the opt-out suggested that women had a low value for home deliveries. All the attributes had strong statistically significant parameter estimates for the standard deviation, except the cost attribute which had significance at the 90% level (p=0.639). This suggested weak preference heterogeneity meaning that was very little variation around the mean, with very few women possessed individual-specific parameter estimates that might be different from the sample population mean. Upon analyzing the differences between primiparous and multiparous women with regard to choose of the opt-out. We found out that women who were multiparous were more likely to choose the opt-out suggesting a dissatisfaction with their experience at the health facility.

Table 5. The mixed multinomial logit model showing means and standard deviations to explain preference heterogeneity in choices made by women in rural setting

Attribute	Mean Coefficient values		Standard Deviations (SD)	
	β	Robust S. E	β	Robust S.E
Attitude.				
Kind (Reference)	1.972***	0.123	1.582***	0.108
Medequip				
Available (Reference)	1.764***	0.076	0.778***	0.702
Qualclin	1.316***	0.106	1.577***	0.126
Good (Reference)				
Distance				
Short (Reference)	0.759***	0.052	0.374***	0.091
Referral services				
Available (Reference)	0.436***	0.054	0.535***	0.085

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ASC.	0.289*	0.327	3.202***	0.179			
Cost.	-10.089***	0.302	0.112*	0.239			
No. of Observ.	22, 368						
Wald Chi	2173.84						
Prob >chi2	0.0000						
Log likelihood	-4400.9						

Legend

Attitude: attitude of healthcare workers, Medequip: medical equipment and drugs, ASC: Alternative Specific Constant, Qualclin: quality of clinical services, Distance: distance to the health facilities, * Significance at the 90% level ** significance at the 95% level *** significance at the 99% level

Table 6. **The mixed multinomial logit model showing interactions between sociodemographic variables and attributes to explain preference heterogeneity in choices made by women in a rural sub-County.**

<table>
<tr><th colspan="9" align="center">Interactions (Mean parameters)</th></tr>
<tr><th rowspan="2">Attribute</th><th colspan="2">w/sec educ(ref)$</th><th colspan="2">w/age category2$$(ref)</th><th colspan="2">w/married (ref)</th><th colspan="2">w/main earner (ref)</th></tr>
<tr><th>β^a</th><th>RSE</th><th>β^a</th><th>RSE</th><th>β^a</th><th>RSE</th><th>β^a</th><th>RSE</th></tr>
<tr><td>**Attitude.**</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Kind (Reference)</td><td>0.118</td><td>0.143</td><td>0.205</td><td>0.141</td><td>0.218</td><td>0.187</td><td>-0.198</td><td>0.184</td></tr>
<tr><td>**Medequip.** Available (Reference)</td><td>-0.124</td><td>0.09</td><td>-0.131</td><td>0.092</td><td>-0.419**</td><td>0.144</td><td>0.172</td><td>0.125</td></tr>
<tr><td>**QualClin.** Good quality (Reference)</td><td>0.355**</td><td>0.141</td><td>0.279**</td><td>0.131</td><td>-0.352</td><td>0.226</td><td>0.092</td><td>0.191</td></tr>
</table>

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Distance. Short (Reference)	-0.109	0.077	-0.176***	0.08	0.199*	0.116	-0.206**	0.103
Referral. Available (Reference)	0.007	0.082**	0.027	0.083	0.109	0.121	-0.300**	0.114
Cost, (Ksh)[b]	0.00008	0.00002	-0.00003	0.00002	-0.00002	0.00003	-0.00006**	0.00003

Interactions (Standard deviations)

Attitude x covariate	-0.347	0. 225	0.549***	0.167	0.886***	0.137	-0.817***	0.244
Medequip x covariate	-0.483***	0.090	-0.416***	0.116	0.398***	0.125	0.153	0.185
Qualclin x covariate	0.996***	0.220	0.920***	0.122	0.680***	0.131	-0.232	0.158
Distance x covariate	-0.093*	0.093	-0.026	0.086	- 0.133	0.099	0.018	0.142
Referral x covariate	-0.379***	0.102	0.317**	0.131	0.382***	0.085	0.379***	0.118
Cost X covariate	0.0000297	0.00004	5.31e-06	-0.00002	0.00002	0.00002	0.00002	0.00003

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No. of respondents	466	466	466	466	466	466	466	466
No. of observations	22,272		22,368		22,368		22,320	
Log-likelihood	-4493.82		-4458.93		-4473.60		-4472.99	
Prob> χ2	0.0000		0.0000		0.0000		0.0000	
Likelihood ratio χ2	1462.9		2298.4		1052.7		909.6	

$ The level of education had two dummy variables so we present the referent category(secondary) compared to women with tertiary education. We have included the full results showing the primary education in Appendix 4

$$ The age was also categorized into three age categories; we only present the results for the second age category (a2) here. The rest are included in the table 6 and included in Appendix 4

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Preference Heterogeneity

The influence of sociodemographic characteristics on the preferences suggested variation in preferences for the attributes for place of delivery. See Table 6. For the mean parameters women with a secondary education had a moderate strong preference for quality of clinical care (p=0.012). Women aged between 25 and 34 years had a moderately strong preference for good clinical quality (p=0.034) and a short distance to the health facility (p=0.024). Married women had a moderate preference for a health facility with available medical equipment and drugs (p=0.004) and a weak preference for a short distance to the health facility (p=0.085). Women who were main earners had a moderate strong preference for availability of referral services at a health facility (p=0.009), a short distance to the health facility (p=0.045) and a cost of delivery services (p=0.035).

The standard deviation shows the variation around the mean, parameters showing heterogeneity in the preferences amongst the women. There was strong variation in preferences for the following three attributes; availability of medical equipment and drugs (p<0.0001), good quality clinical care (p<0.0001), and the availability of referral services at the health facility (p<0.0001) amongst women with secondary education. This finding suggests that several women in this category possessed individual-specific parameter estimates that are different from the sample population mean for the attributes. Women who were aged between 25 and 34 years showed strong preference heterogeneity for the attributes on kind and supportive health worker (p=0.001), availability of medical equipment and drug supplies (p<0.0001), good quality clinical care (p<0.0001). Married women showed strong preference heterogeneity for four attributes; kind and supportive attitude of health care workers (p<0.0001), availability of medical equipment and drug supplies and drugs (p=0.001), good quality clinical care (p<0.0001) and the availability of referral services at the health facility (p<0.0001). Lastly women who reported themselves as main earners showed strong preference heterogeneity for the attributes of kind and supportive attitude of health care workers (p=0.001) and availability of referral services only (p=0.001).

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All women across the four sociodemographic groups showed no variation for the for the attribute of costs of delivery and distance to the delivery health facility with the exception of women with secondary education (p<0.0001) suggesting that there was no variation in the individual characteristics of women who valued these two attributes

Discussion

This study explored women's preferences for characteristics for delivery health facilities in a rural sub-County in Kenya. The most highly valued attribute for women when making a choice of a delivery facility was the attitude of health care workers, this was followed by the availability of medical equipment and quality of clinical services. Lowly valued attributes were the availability of referral services and the cost of delivery service. The opt-out alternative that signified home delivery was ranked last and was negative signifying women had a disutility for home deliveries in this setting. All the attributes had an impact on the probability of choosing a health facility for delivery over a home delivery. To the best of our knowledge, this is the first DCE to address attributes valued by women in a rural setting in Kenya within the context of a free maternity services policy.

We found out that the attitude of healthcare workers providing delivery services was valued above all other attributes. Quality of care standards require that women be treated in a respectful manner and in a way that upholds their dignity (17). Recent evidence has identified that the attitude of health workers during labor and delivery presents a huge challenge with reports of mistreatment of women (35). This has also been reported in diverse settings within sub-Saharan African such as Guinea (36), Nigeria (37) and South Africa (38). The high value for attitude of health care workers has been reflected in other DCE studies in rural settings in sub-Saharan Africa (21),(39). Mistreatment has increasingly been recognized as a barrier to women accessing facility-based delivery in Kenya across contexts with one study placing prevalence of disrespect and abuse at 20% (40). Urgent international calls have been made for accountability for the mistreatment of women during labor and delivery because it is a compelling human rights issue (41), (42). Mistreatment should be addressed during regular supervision in all facilities to ensure a functioning feedback mechanism for respectful care during delivery (43).

The second most valued attribute was the availability of medical equipment and drug supplies at the health facility. These were easily observable aspects of the health facilities that women saw during their ANC visits and identifying the availability of theatres for caesarean sections and neonatal resuscitation equipment. They were also informed by friends and family who had prior visits to the health facilities. Studies evaluating the state of obstetric care coverage often compare the provision of care to the physical

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infrastructure available without assessing the care provided at health facilities. For example, a recent study that evaluated emergency obstetric services (EMOC) across health facilities in rural Kenya found that EMOC capabilities were not being met and confirmed that only two of the five health centers assessed had acceptable EMOC capabilities illustrating the state of rural health facilities for obstetric care (44). Additionally, recent assessments of quality of care at Kenyan health facilities have shown that medical equipment and drug supplies for mothers were only available at only 41% of health facilities (both public and private)(15). Health policy makers need to focus in availing EMOC capabilities because women's preferences suggest that they value the availability of equipment as a way of judging the quality of care at a health facility.

The women showed a high preference for quality of clinical care and ranked it third. One study focused on attributes of respectful care ranked women's preference for good health system conditions such as having a qualified birth attendant amongst other conditions (45). This suggests that women can ascertain to a certain degree of the quality of care is from assessing their delivery experience including the necessity of cesarean sections. This calls for skilled birth attendants to provide better quality clinical care that is based on WHO evidenced based guidelines (17).

Referral availability at the health facility was defined as transportation of women from the health facility where they first sought care to a higher-level health facility in the case of complications. Though ranked by women lower this attribute was still valued. This finding suggests that referral options at health facilities in this setting are weak. Women mentioned that they were afraid of developing complications because of the unavailability of ambulances at the lower level health facilities. WHO standards advocate for referrals that are conducted in a timely fashion with a pre-established plan for delivery care and with relevant sharing of information between the concerned staff at the receiving health facilities (17).

An unexpected finding was the disutility for lower costs. This finding suggests that the women had a value for pay higher amounts of money for better quality of delivery services. We hypothesize that the women were making a trade-off by selecting higher amounts and signaling that they were willing to pay higher amounts for obtaining services that they perceived as being of higher quality. This finding is critical given that approximately half of all women (55%) in this setting had access to any health insurance coverage of any type. This implies that the women would use out-of-pocket payments at private health facilities. Such payments have been associated with putting patients at significant financial risk. Additional evidence points out challenges with the free maternity services with women reporting paying for key birthing items including pharmaceuticals (46), (47).The women also described public health facilities advertised as were "free", but were exposed to hidden informal indirect costs during billing. Costs, both direct and indirect,

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have been previously identified in studies assessing factors influencing place of delivery in Kenya (48), (49).

Our findings also indicate that multiparous women were more likely to choose a home delivery over primiparous women suggesting some evidence of dissatisfactory experiences during delivery that would deter them from a repeat visit to the health facility. Recent studies in certain rural settings in Kenya suggest cultural values that promote home deliveries especially because of fear of health workers at health facilities (32), (50).

In assessing how sociodemographic influence choice of attributes, we found out that women with secondary education had a strong preference for clinical quality suggesting that highly educated women in this setting were able to discern certain elements of clinical quality either through their own experiences during antenatal care or the experiences of other women in their social network. Other DCE studies also had similar findings suggesting changing demographics with rural areas having more educated women (22). We also discovered that younger women are more knowledgeable about the health system and might exercise their rights to demand better quality health care. Studies suggest that decisions on health care are done in a social context in consultation with their families and friends (51), (52). There have been recent reports of young mothers in rural areas in Kenya receiving poor quality services at health facilities (53). Married women had more experience with the health system from previous deliveries and were aware of expectations with regard to medical equipment and drugs. Lastly women who were main earners had strong preferences for costs which was expected. Thus, targeting strategies specific to certain demographics within the population can help the health system be more responsive to women's needs.

The main strength of the study was that it was conducted within the context of the newly implemented free maternity services policy in Kenya. The findings of this study can inform the contextual aspects of quality of care valued by women. The main limitation of the study was the hypothetical nature of the DCE might results in biased results. Respondents might make inaccurate choices while being aspirational regarding the quality of services, they expect at a health facility during delivery. Hypothetical choices might not be representative of women's choices because decision making around delivery place in real life may be made in a social context with other key family members involved especially in rural contexts.

The study sample were likely to be users of the health system and represent some positive bias towards the utilization of health services. These findings might not generalize the findings to the minority of women who eschew health services induced immunization. In future sampling of women who delivered at home might help assist with eliciting preferences of women who are not users of facility-based delivery services

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Conclusion

This study showed that women's experience of care during delivery, attributes such as attitude of healthcare workers, availability of equipment and supplies, access to good quality delivery care are highly valued by women and may affect the utilization of health facilities during the free maternity services. The women's choices indicate their preferences for both structural and process aspects of quality of care. It is critical to for policy makers to understand women's preferences and what drives them to seek delivery services at health facilities. Ensuring high quality care that is patient-centered can reduce inequities in maternal deaths and improve maternal health outcomes.

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Author Contributions

JOA and MA conceptualized the study. JOA conducted the data analysis and drafted the manuscript. JOA, MA, FW and GK revised the manuscript and provided critically important feedback on the manuscript, all authors read and approved the final manuscript

Patient and public involvement

During the pilot phase the women aged between 18 and 49 who were the main respondents provided feedback on the survey instruments. They also reviewed and provided feedback during the qualitative phase on the selection of the attributes.

Patient content for publication.

Not required

Ethical approval.

Permission to conduct this research was provided by the National Commission for Science Technology and Innovation (NACOSTI) through a research permit No. P17/34367/2013 and an institutional research ethical approval form AMREF ESRC Approval No. P388/2017.

Conflicts of interests

None declared

Data availability statement

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

Extra data can be accessed via the Dryad data repository at http://datadryad.org/ with the doi: 10.5061/dryad.1vhhmgqrk

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APPENDIX 1

FGD guide and in-depth interview guide for women and healthcare workers in Naivasha sub-counties

Purpose of the FGD and in-depth interview

The purpose of this Individual in-depth Interview is to try and understand where women residing within Embakasi North sub-County deliver their babies and why they prefer these specific facilities or places**.** The study intends to specifically elucidate the following;

1) What women's preferences are with regard to place of delivery
2) Why they choose certain places over the other places
3) To determine attributes of the health facilities that they deliver in and which of the attributes they deem important
4) Possible attribute levels of the attributes identified

Logistical arrangements

I would like to go over a few logistical arrangements before we begin the interview:

My names are Jackline Aridi and I am registered as a PhD student at Strathmore University's Institute of Healthcare Management. The interview will last approximately 30 minutes. I have obtained Ethical clearance to conduct this research from Strathmore University's Institutional Review Board and permission to conduct research within Nairobi County from the National Science and Technology Research Institute (NACOSTI)

Everything we discuss during this interview will be kept in strict confidence and your real name will not appear in any of our results. As such, please make every effort to be open and honest when responding to the questions. If at any time you feel uncomfortable and want to stop the interview, please feel free to. I will provide you with a consent form which you will read and sign if you find it agreeable with you. For data capture purposes, this interview will be recorded using a mobile phone device.

Sociodemographic characteristics of healthcare workers.

Characteristic	
Age in years	
20-29	
30-39	
40-49	
50+	
Marital Status	
Single	
Married	
Divorced /Widowed	
Years of Work Experience	
0-4	
5-9	
10-15	
15+	
Type of Health Facility	
Public Health Centre	
Private Health Centre	
Referral Hospital	

Maternity	
Other	

Questions for women, healthcare workers and policy makers

Key questions	Probes
1. Birthing Experience- What are the things that make for a good birthing experience?	Describe your dream birthing experience. Who do you think needs to be present? What do you think needs to be present? What do you think are worries or concerns of the mothers? Are there cultural traditions that need to be followed judiciously? What makes a mother feel safe during the process? What would absolutely make it a bad experience?
2. Place to deliver- How did mothers and their families decide where to deliver?	**Facility staff** What are the hours of operation of the maternity ward? How many staff are working in your maternity ward? Is there electricity and water at your facility at all times? If not, explain Do you have a placenta pit? Are staff trained in: Newborn resuscitation? Emergency obstetric care? (placing IVs and dispensing Misoprostol for haemorrhage) Is your services completely free? Or do patients have to pay for some supplies (ex. gloves), use of an equipment, etc.? Is there periodic upgrade in capacity for maternity staff? When was the last upgrade and how many staff participated?

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	Do you feel that mothers in your area deliver at your health centre if available? If not, where do they deliver? Why?
	Are mothers treated nicely and with respect? Give examples.
	Who do you think is involved in the decision making process as to where a mother delivers?
	Community leaders/Fathers:
	What are the options for places to deliver?
	Who were involved in the decision making process as to where to deliver?
	Are you usually involved in deciding where to deliver? If so, what did you have to consider in making that decision? (cost, distance, risks, benefits)
	What makes the delivery place a good or bad experience? Were you treated nicely and with respect? Give examples
3. Recommendation to friends- What would you tell your friends about where they should deliver and why	Is it culturally appropriate to share your family's birthing experiences with your friends?
	Does your opinion have an impact on where your friends deliver their babies?
	Community leaders: Do you recommend/suggest pregnant mothers to deliver at certain places?
	Fathers: Does the Chief/leaders in your community recommend/suggest that your family deliver at certain places?
	Community leaders: If you hear something negative about a place to deliver, does it affect where you would recommend/suggest a family to deliver?
	Fathers: If you hear something negative about a place to deliver, does it affect where your family choose to deliver?

Attribute Level development Questions

1. What do you think women accessing services from the health facilities where you work value most when they go to the facility for delivery?
2. What do you think is the most important characteristic of the health facility for women when they go to deliver?
   a. *Probe (cost of delivery services, distance to facility, equipment and supplies, attitude of healthcare worker, qualifications of health care workers)*
3. What do you think are barriers to health facilities from providing good quality delivery services?
   a. What do you think health facility in charges should do to promote good facility based experiences for delivery services for women?
4. What is your opinion on the current free maternal health services policy under implementation since 2013? Is it encouraging utilization of health facilities for delivery services?
5. What do you think are the challenges that the Government and policy makers experiencing with respect to health policies concerned with delivery services in public health facilities? Private facilities? Tertiary facilities? And what should they do about the challenges?
6. What specific health policies do you think the Government should promote to improve access to high quality delivery services in public and private health facilities? Probe *(free ANC, increase access through NHIF, early focused ANC?)*

Respondent	Choice task	Alternatives	Altertanative Specific Constant	I.	II.	III.	IV.	V.	VI.
			A	B	C	D	E	F	G
1	1	1	1	0	0	0	1	1	3000
1	1	2	1	1	1	1	1	0	5000
1	1	3	0	0	0	0	0	0	0
1	2	1	1	1	1	0	1	1	3000
1	2	2	1	1	0	0	0	0	3000
1	2	3	0	0	0	0	0	0	0
1	3	1	1	1	0	0	0	1	3000
1	3	2	1	0	1	1	1	0	5000
1	3	3	0	0	0	0	0	0	0
1	4	1	1	0	1	1	0	0	5000
1	4	2	1	1	0	0	1	1	8000
1	4	3	0	0	0	0	0	0	0
1	5	1	1	1	1	1	1	1	8000
1	5	2	1	0	0	0	0	0	5000
1	5	3	0	0	0	0	0	0	0
1	6	1	1	0	0	1	0	0	3000
1	6	2	1	1	1	1	1	1	5000
1	6	3	0	0	0	0	0	0	0
1	7	1	1	1	0	1	1	0	8000
1	7	2	1	1	1	0	0	1	3000
1	7	3	0	0	0	0	0	0	0
1	8	1	1	1	1	1	1	1	8000
1	8	2	1	0	0	0	1	1	5000
1	8	3	0	0	0	0	0	0	0
1	9	1	1	0	1	1	1	0	8000
1	9	2	1	1	0	0	0	1	3000
1	9	3	0	0	0	0	0	0	0
1	10	1	1	1	1	0	0	0	5000
1	10	2	1	0	0	1	1	1	8000
1	10	3	0	0	0	0	0	0	0
1	11	1	1	0	1	0	1	0	3000
1	11	2	1	1	0	1	0	1	5000
1	11	3	0	0	0	0	0	0	0
1	12	1	1	0	0	1	1	1	3000
1	12	2	1	1	1	0	0	0	5000
1	12	3	0	0	0	0	0	0	0
1	13	1	1	0	1	0	1	1	8000
1	13	2	1	1	0	1	0	0	5000
1	13	3	0	0	0	0	0	0	0
1	14	1	1	0	1	0	1	0	3000
1	14	2	1	1	0	1	0	1	3000

1	14	3	0	0	0	0	0	0	0
1	15	1	1	1	1	1	1	1	3000
1	15	2	1	0	0	0	0	1	3000
1	15	3	0	0	0	0	0	0	0
1	16	1	1	1	1	0	1	1	3000
1	16	2	1	0	0	1	0	1	3000
1	16	3	0	0	0	0	0	0	0

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Field	WOMEN'S HEALTH AND HOUSEHOLD QUESTIONAIRE
	DEMOGRAPHIC QUESTIONS
Age	1. What is your age?
Residence	2. How long have you lived in Embakasi North/Naivasha sub county? A. I have lived here my whole life B. I just moved to Embakasi North/Naivasha C. Other
MovedWhen	3. How many years ago did you move here? A. 0-5 years B. 5-10 years C.11-20 years D. Over 20 years
ResidenceWhy	4. Why did you move to Embakasi North**?** A. I have family or friends here B. I heard there were business opportunities here C. To be close to Nairobi City Centre D. To look for work E. Other
Schooling	5. What is your level of education? A. Did not attend primary school B. Primary School C. Secondary School D. Tertiary E. University
Married	6. Are you married? A. No B. Yes
MarriedDuration	7. How long have you been married? A. 0-5 years B. 5-10 years C. 10-15 years D. 15-20 years
HOUSEHOLD MODULE	
HeadofHousehold(HoH)	8. Are you the head of the household?(If an important decision is to be made in the Household are you the one who gets to decide A. No B. Yes
Main Earner	9. Are you the main earner in your household? Do you contribute the most to household expenditures? A. No B. Yes
MainEarnerNo	10. How are you related to the person who earns most in your household? A. My Father/ My Husband/Boyfriend's father B. My grandfather/ My Husband/Boyfriend's grandfather C. My husband/Boyfriend

	D. My mother/My Husband/boyfriend's mother E. Another family member/ relative/ aunt/uncle F. Other

HOUSEHOLD MODULE : SOCIOECONOMIC STATUS

HoHMESame	11. Are the head of the household and the main earner the same person in your household? A. No B. Yes
adults	12. How many people over the age of 18 live in your household?
adultswomen	13. How many of these are women?
adolescents	14. How many people aged between 14 and 18 live in the household
adolescentwomen	15. How many of these people are women?
children	16. How many people under 13 live in your household?
childWomen	17. How many of these children are women?
employedadults	18. How many members of your household contributed to your household expenses last month? *(this includes things like rent, food, water, electricity fuel, cooking fuel)*
totalpublicexpenditure	19. How much did the employed adults contribute to your household expenses last month
	HOUSEHOLD ASSETS
Refrigerators	20. How many refrigerators does your household own?
Bicycles	21. How many bicycles does your household own?
Motorbikes	22. How many motorbikes does your household own?
Cars	23. How many cars does your household own?
Televisions	24. How many Televisions does your household own?
Radios	25. How many radios does your household own?
Stereos	26. How many stereos does your household own?
Mobiles	27. How many mobiles does your household own?
Mattresses	28. How many mattresses does your household own?
waterExp	29. How much did your household spend on water last month?
electricityExp	30. How much did your household spend on electricity last month?
fuelExp	31. How much did your household spend on fuel last month?
REPRODUCTION AND PREGNANCY MODULE	

insurance	32. Do you currently have health insurance?
	   A. No
	   B. Yes

insuranceType	33. What kind of insurance do you have?
	   A. NHIF
	   B. OBA
	   C. Private Insurance
	   D. Other

insuranceOther	34. The private insurance policy you have, what is the name of the company that provides it? specify
insurancePrice	35. How much do you pay per month for insurance? (if the respondent doesn't pay monthly help them approximate the monthly rate)

generalHospital	36. Have you visited a clinic, hospital, or doctor in the last year to receive medical care unrelated to a pregnancy?
	   A. No
	   B. Yes

generalHospitalWhy	37. During the most expensive visit to a clinic, hospital, or doctor in the last year, what was the visit for?
	   A. I was hurt in an accident and needed urgent care (example broken bones, stitches, allergic actions)
	   B. I was very sick and needed to get medicine or another kind of treatment example malaria, pneumonia)
	   C. I developed a condition and needed to sneak

generalHospitalPaid	38. How much did you spend in total on medical care received in the last year unrelated to pregnancy?

generalHospitalStill	39. Are you still seeking treatment for health conditions unrelated to pregnancy?
	   A. No
	   B. Yes

anaemia	40. Do you suffer from anemia?
pregnantEver	41. Have you ever been pregnant?
pregnantAvoid	42. Have you ever used anything or tried in any way to delay or avoid getting pregnant?
timesPregnant	43. How many times have you been pregnant?
livebirths	44. How many livebirths have you had?
deaths	45. Sometimes it happens that children die. It may be painful to talk about and I am sorry to ask you about such memories, but it is important to get correct information. Have you ever given birth to a son or daughter who was born alive but later died?
deathsBoys	46. How many of those were boys?
miscarriages	47. How many times have you had a pregnancy result in a miscarriage?
stillbirths	48. How many times have you had a pregnancy result in a stillbirth?

yearPreg	49. In what year did this pregnancy occur?
embakasinorthPreg	50. Were you living in Embakasi North sub County during this pregnancy?
nairobiPreg	51. Were you living in Nairobi during this pregnancy?
intended	52. Was this pregnancy planned?
marriedThen	53. Were you married to the father at the time?
monthsPreg	54. How many months were you pregnant before you gave birth?
antenatalcare	55. How many ante natal visits did you attend?
anc_first	56. How many months pregnant were you when you first went for an ante natal care visit?
ancSame	57. Did you get ante natal care at the same facility where you planned to give birth? A. No B. Yes
ancElseWhy	58. Why did you go somewhere different for ante natal care than the place you planned to give birth?
ancElseWhyMain	59. What was the main reason you when somewhere different for ante natal care than the place you planned to give birth? A. I was saving up to give birth in a nicer hospital than where I received ante natal care B. I could afford ante natal care at that hospital, but not a birth there C. Convenience: it was easier to go to the place where I received ante natal care than where I gave birth D. Complications: I needed to go to a special hospital like Kenyatta because of complications
insurancePr	60. Did you have health insurance during this pregnancy?
insuranceTypePr	61. What kind of insurance did you have?
insurancePricePr	62. How much did you pay per month for insurance?
talkPrice	63. Did anyone talk to you about how expensive it would be to give birth during ante-natal care?
contactHospital	64. Did you contact hospitals about prices before giving birth?
savingMonths	65. How many months before you gave birth did you begin putting aside money to pay for it?
iron	66. During this pregnancy, did you take any iron tablets or iron syrup?
Folic acid	67. During this pregnancy, did you take any folic acid?
malarial	68. During this pregnancy, did you take any anti-malarial medication?
tetanus	69. During this pregnancy, did you receive a shot in the arm to prevent the baby from getting tetanus (convulsions after birth)?
vitA	70. Did you experience any problems seeing during the daytime or at night?
specialist	71. Did you visit an OB/GNY or specialist before giving birth? A. No B. Yes

referral	72. Were you referred to a larger hospital like Kenyatta National because a doctor determined that there might be complications with your pregnancy? A. No B. Yes
complicationExpected	73. What complication where you referred for? A. Sepsis B. Hemorrhage C. High blood pressure D. Other

whereBirth	74. Where did you give birth on this occasion?
	   A. Hospital
	   B. Home

plannedFacility	75. Is this where you originally planned to give birth, A. No B. Yes
whyChangePlans	76. Did you have to change plans ? If yes, Why did you change your plans? A. The baby came early and I had to go to the nearest facility B. I wasn't able to afford the facility I originally planned on C. I had more money that I expected when the baby was born so I could go to a nicer facility D. No, didn't change plans E. Other
outsideFacility	77. Why didn't you deliver in a health facility? A. It was too expensive B. I couldn't get to one in time once I went into labor C. I don't trust the Doctor and nurses at the facilities I can afford D. I don't trust health facilities E. Other
whyHere	78. What qualities of the Health Facility did you find important in making the choice of delivering there? A. Cost B. Cleanliness C. Distance from home D. Availability of supplies and equipment E. Qualification of health worker(nurse or doctor) F. Waiting time G. Staff attitude H. Referral by relative I. Other
whyHereMost	79. What was the most important quality of the Health Facility in making the choice of delivering there? A. Cost B. Cleanliness C. Distance from home D. Availability of supplies and equipment E. Qualification of health worker(nurse or doctor) F. Waiting time G. Staff attitude H. Referral by relative

	I. Other
birthTime	80. About how many hours did it take to deliver the baby, starting from when you first experienced contraction pains?
ceaserean	81. Was this a normal birth, or was the baby delivered by cesarean section? A. Normal birth B. Ceaserean
ceasereanEmergency	82. Was the cesarean planned or unexpected? A. Planned B. Unexpected
doctorAtAll	83. After you arrived at the hospital to give birth, who of the following did you see? A. Doctor B. Only nurses C. Birth attendants
	Thank you for participating in our survey. We really appreciate your time, and are grateful for meeting with us today.

Table 6. The mixed multinomial logit model showing interactions between sociodemographic variables and attributes to explain preference heterogeneity in choices made by women in a rural sub-County.

Interaction terms (Mean Parameters)

Attribute	w/pri educ(ref) βᵃ	RSE	w/sec educ(ref) βᵃ	RSE	w/age category1(ref) βᵃ	RSE	w/age category 2(ref) βᵃ	RSE	w/married (ref) βᵃ	RSE	w/main earner (ref) βᵃ	RSE
Attitude. Kind (Reference)	0.009*	0.210	0.118	0.143	-0.330**	0.140	0.205	0.141	0.218	0.187	-0.198	0.184
Medequip. Available (Reference)	0.004**	0.098	-0.124	0.09	0.067	0.096	-0.131	0.092	-0.419**	0.144	0.172	0.125
QualClin. Good quality (Reference)	-0.202	0.151	0.355**	0.141	-0.200	0.131	0.279**	0.131	-0.352	0.226	0.092	0.191
Distance. Short (Reference)	0.116	0.079	-0.109	0.077	0.062	0.08	-0.176**	0.08	0.199*	0.116	-0.206**	0.103
Referral. Available (Reference	0.009	0.083	0.007	0.082	-0.064	0.083	0.027	0.083	0.109	0.121	-0.300**	0.114

Cost, (Ksh)[b]	-0.000046**	0.0000218	0.00008	0.00002	9.23e-06	0.00002	-0.00003	0.00002	-0.00002	0.00003	-0.00006**	0.00003
Interaction terms (SDs)												
Attitude x covariate	1.353***	0.334	-0.347	0. 225	-0.320**	0.143	0.549***	0.167	0.886***	0.137	-0.817***	0.244
Medequip x covariate	-0.496***	0.111	-0.483***	0.090	0.497***	0.135	-0.416***	0.116	0.398***	0.125	0.153	0.185
Qualclin x covariate	0.709***	0.175	0.996***	0.220	-0.065	0.161	0.920***	0.122	0.680***	0.131	-0.232	0.158
Distance x covariate	0.183	0.191	-0.093*	0.093	0.349***	0.098	-0.026	0.086	- 0.133	0.099	0.018	0.142
Referral x covariate	0.068	0.127	-0.379***	0.102	0.345**	0.111	0.317**	0.131	0.382***	0.085	0.379***	0.118
Cost X covariate	-0.054**	0.00002	0.0000297	0.00004	0.00006	0.00004	5.31e-06	-0.00002	0.00002	0.00002	0.00002	0.00003
No. of respondemts	466	466	466	466	466	466	466	466	466	466	466	466
No. of observations	22272		22,272		22,368				22,368		22,320	

Log-likelihood	-44442.18		-4493.82		-4399.34		-4458.93		-4473.60		-4472.99
Prob> χ2	0.0000		0.0000		0.0000				0.0000		0.0000
Likelihood ratio χ2	2301,15		1462.88		3256.14		2298.41		1052.72		909.59

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Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find

each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to

include the missing information. If you are certain that an item does not apply, please write "n/a" and

provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectionalreporting guidelines, and cite

them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening

the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for

reporting observational studies.

Reporting Item			Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1

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Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3,4,5
Objectives	#3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	#4	Present key elements of study design early in the paper	5,6
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,9
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	9
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	N/A

Bias	#9	Describe any efforts to address potential sources of bias	11
Study size	#10	Explain how the study size was arrived at	8
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	10,11
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	10,11
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	11
Statistical methods	#12c	Explain how missing data were addressed	N/A
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	10
Statistical methods	#12e	Describe any sensitivity analyses	N/A
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	9
Participants	#13b	Give reasons for non-participation at each stage	N/A

Participants	[#13c](#)	Consider use of a flow diagram	N/A
Descriptive data	[#14a](#)	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	11,12
Descriptive data	[#14b](#)	Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	[#15](#)	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	N/A
Main results	[#16a](#)	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11,12,13
Main results	[#16b](#)	Report category boundaries when continuous variables were categorized	11,12
Main results	[#16c](#)	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	[#17](#)	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	16

Discussion

Key results	[#18](#)	Summarise key results with reference to study objectives	16

Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	18
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	18
Generalisability	#21	Discuss the generalisability (external validity) of the study results	18

Other Information

| Funding | #22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 20 |

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