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Preferences of Women for Maternal Healthcare Services in the Upper East Region: A Stated Choice Experiment

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Abstract. This research examined preferences of women for maternal health service facilities in Ghana's Upper East Region. Analyzing data from 200 respondents with diverse sociodemographic backgrounds, the research emphasized key factors such as availability of drugs and equipment, the facility environment, provider attitudes, distance to health facilities, and referrals at healthcare facilities. By using a panel mixed logit model, the study demonstrated the significant impact of these attributes on women's choices, except for the cost of delivery services, which did not exhibit significance. Sociodemographic variables like age, employment status, marital status, religion, education, and place of last delivery also impacted preferences. The availability of drugs and equipment emerged as the most influential attribute across different groups. The study highlights the importance of understanding women's preferences and providing high-quality, patient-centered care to promote positive maternal health outcomes in the region. Policymakers should thus consider these factors to enhance healthcare facility utilization, reduce maternal mortality rates, and improve maternal health outcomes.

Keywords. Attributes, Blocked Fractional Factorial Design, Maternal Healthcare, Panel Mixed Logit Model, Stated Choice Experiment.

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1 Introduction

Maternal mortality remains a pressing issue in the provision of maternal and reproductive healthcare in Ghana Apanga and Awoonor (2018). This distressing phenomenon refers to the death of a woman during pregnancy or within 42 days of pregnancy termination, caused directly or aggravated by pregnancy or gestational care Der et al. (2013) and Baazand et al. (2023). Developing countries bear the brunt of this challenge, accounting for 99% of maternal deaths, with over half concentrated in sub-Saharan Africa Jakperik et al. (2023). Shockingly, the risk of maternal mortality is significantly higher in developing nations, highlighting the urgency of addressing this issue.

Efforts to improve maternal health through interventions such as skilled delivery and antenatal care have been made, yet the challenge persists, especially in low-income countries. Ghana's maternal mortality rate has reduced over the years but remains higher than international targets. Contributing factors include inadequate healthcare resources, socio-cultural influences, and low antenatal coverage Dapaah and Nachinaab (2019) and Ditekemena et al. (2012).

Ghana's healthcare system encompasses five hierarchical levels, from tertiary hospitals to community clinics. Programs like the Essential Health Intervention aim to strengthen grassroots healthcare and affordability, but maternal mortality remains a concern, notably in the Upper East Region (UER), Sakeah et al. (2014).

A critical aspect that requires attention is the limited evidence on women's birthplace choices, which significantly impact maternal outcomes. Understanding these preferences and the influencing factors is vital for effective policy-making to enhance women's safety and reduce maternal mortality. This study addresses this gap by investigating birthplace determinants among women in the Upper East Region, contributing to a more comprehensive understanding of maternal healthcare decision-making.

2 Materials and Methods

2.1 Study Area

The Upper East Region (UER), positioned in the northeastern part of Ghana, has its capital in Bolgatanga. As per the 2020 Population and Housing Census, the UER's population is 1,046,545 with 250,308 women in their reproductive age. It shares its boundaries with Burkina Faso to the north, the Republic of Togo to the east, the Sissala East District in the Upper West Region to the west, and the West Mamprusi District in the Northeast region to the south. The topography mainly consists of flat terrain, while there are some hills located to the east and southeast. The entire region spans approximately 8,842 km², accounting for 2.7% of the nation's total area. It's divided into

15 districts, with a notable population concentration in Bolgatanga. The predominant occupation among residents is agriculture.

Regarding healthcare infrastructure, the UER boasts a total of 96 medical establishments, comprising 20 hospitals (7 publicly owned, 3 managed by CHAG, and 10 private), 67 medical centers, 38 clinics, 3 private maternity homes, 488 well-defined CHPS (Community-based Health Planning and Services) zones, 395 operational CHPS zones, and 224 compound CHPS zones. The ratio of doctors to patients is 1:24,124, and the nurse-to-patient ratio stands at 1:313, Ghana Health Service (2023).

2.2 Study Design

An experimental study employing a stated choice experiment (SCE) was conducted to ascertain the preferences of rural women when it comes to selecting a healthcare facility for delivering their child and addressing fertility concerns. The collected data underwent analysis through a panel mixed logit model, allowing for an assessment of the varying significance of specific attributes. This model not only examines the inherent attributes but also considers the influence of interactions with socio-demographic factors on the choices made by individuals in relation to these attributes.

2.2.1 Identification of Attributes and Attribute Levels

As mentioned by Ryan and Gerard (2003), a SCE is an approach rooted in attributes, utilized for gathering information on expressed preferences and priorities. This method functions based on the concept that distinct attributes can define healthcare interventions and policies. The initial step in creating an SC experiment entails identifying these attributes and the associated levels for characterization. Previous studies, as suggested in literature and qualitative research Sutton et al. (2012), offer guidance in pinpointing pertinent attributes.

To develop a comprehensive understanding of the factors influencing the selection of birthing locations, an extensive literature review was undertaken. This review focused on facility births and skilled births within Ghana and the broader sub-Saharan African context. In addition, a qualitative study was carried out, involving five focus groups encompassing a total of 40 women from both public and private health facilities situated in Ghana's Upper East Region. Further insights were gathered through in-depth interviews with ten nurses responsible for obstetrics and gynaecology.

Participants for the qualitative study were purposely chosen from women aged 18 to 49, who had recently given birth within the last six weeks and were visiting child protection clinics across various health facilities. The resulting attributes and their corresponding attribute levels, selected for use in the stated choice experiment, are detailed in Table 1.

2.2.2 Experimental Design

By utilizing factorial designs, the identified attributes of the intervention, each with their designated levels, are systematically combined to formulate a range of hypothetical alternatives. In the subsequent step, participants are presented with these alternatives and are asked to express their preferences by selecting their preferred option. The utility that respondents attach to specific attributes' levels guides their choices, thereby reflecting their preferences de Bekker-Grob et al. (2012).

The Stated Choice (SC) experiment in this study employs an unlabelled design, encompassing a total of eight choice sets. Within each choice set, participants encounter five alternatives: health facility A, health facility B, health facility C, health facility D, and an opt-out alternative signifying a preference for home delivery. This arrangement is illustrated in Table 1. Notably, all attributes within the choice experiment are binary, meaning they possess two levels each.

The initial full fractional factorial design would have yielded 128 choices, a potentially overwhelming number for respondents. To mitigate this, the Blocked Fractional Factorial Design (BFFD) technique was employed, effectively reducing the number of choices to a manageable eight. This streamlined approach facilitated participant engagement.

The study incorporates seven attributes: provider type, provider attitudes, availability of drugs and equipment, distance from the facility, referral to facility, cost of service delivery, and facility environment. Each of these attributes is associated with a set of plausible levels. A comprehensive overview of these attributes and their corresponding levels within the SC experiment design can be found in Table 1.

Table 1: Attribute and attribute levels included for the SCE

Attribute	Attribute Levels
Provider type	Doctor
	Nurse
Provider attitude	Kind and supportive
	Unkind and unsupportive
Availability of drugs and equipment	Always available
	Not always available
Distance to health facility	Health facility is close to home
	Health facility is far from home
Referral at health facility	Referrals services available
	Referrals services not available
Cost of delivery services	GH¢100.00 below
	GH¢100.00 above
Facility environment	Clean
	Not clean

2.3 Stated Choice Experiment

The content of the choice sets was subjected to scrutiny and validation through focus-group discussions. These discussions involved both women and healthcare workers, confirming the pertinence of the selected attributes. Subsequently, a pilot study was conducted at the Bolgatanga Presbyterian Primary Health Care Center, involving 20 women. The primary goal of the pilot was to assess the attributes and their effectiveness. Importantly, participants who took part in the pilot study were not included in the subsequent main study. The definitive attributes were integrated into the final Stated Choice Experiment (SCE) scenario, which is detailed in Table 2. These scenarios were then incorporated into the Kobocollect tool and integrated into a questionnaire. This questionnaire also encompassed sections dedicated to sociodemographic details and variables related to maternal health utilization.

For determining the necessary sample size for the SCE, the study followed the approach proposed by Johnson and Orme (2003). This approach takes into account factors such as the number of selection tasks (t), alternatives (a), and analysis plots (c). With 8 choice tasks (t) and 4 alternatives (a), resulting in $4 * 2$ analysis cells (c), the minimum sample size requirement was calculated using the formula introduced by Orme (1998) as $N > 125$.

Taking this minimum sample size into account, a random selection of 200 participants was undertaken. This larger sample size not only ensured the accurate estimation of main and interaction effects in the SCE but also aimed to cater to the quantitative survey's representativeness across sociodemographic variables. Moreover, the larger sample size was chosen to provide statistically significant outcomes for all the attributes. The participants were drawn from six medical facilities strategically located across the Upper East region using simple random sampling all women in their first trimester registered for maternal care services were enrolled in the study for a period of six months,that is from January to June, 2023. Thereby seeking to strike a balance between survey representation and statistical robustness.

2.4 Panel Mixed Logit Model

The collected data underwent analysis using the choice set models available in Stata 18. For variables not related to the SCE, descriptive statistics were computed. As for the SC experiment data, a panel mixed logit model was employed for analysis. This model operates on the premise that individuals weigh various attribute levels against each other and opt for the alternative that yields the highest utility.

The utility function is represented by the following model:

$$U_i = \alpha_i + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \epsilon, \quad (1)$$

where α_i serves as the constant parameter denoting the intrinsic preference for the delivery location . β_1 to β_7 represent the coefficients linked to each of the attribute levels. The term ϵ symbolizes the error term in the context. Each attribute level is

denoted by x_1 through x_7:
x_1 represents provider type.
x_2 signifies provider attitude.
x_3 denotes the availability of drugs and equipment.
x_4 stands for the distance from home.
x_5 represents referral at the health facility.
x_6 signifies the cost of delivery service.
x_7 denotes the facility environment.

This model allows for an examination of the impact of each attribute level on the decision-making process, thereby helping to discern the attributes that significantly influence the preferences of women when it comes to choosing the place of delivery.

Table 2: Choice sets presented to the participants

ATTRIBUTES	facility A	facility B	facility C
Provider type	Doctor	Nurse	Doctor
Provider attitude	Kind/Support	Unkind/Unsupport	Kind/Support
Availability of drugs and Equip.	Available	Not available	Available
Distance from Home	close	close	not close
Referral at health facility	Available	Available	Not available
Cost of delivery service	GHS 100 below	GHS 100 below	GHS 100 above
Facility Environment	clean	clean	Not clean
Which option do you prefer?	()	()	()
ATTRIBUTES	facility D	optout	
Provider type	Nurse		
Provider attitude	Unkind/Unsupport		
Availability of drugs and Equip.	Not available		
Distance from Home	not close		
Referral at health facility	Not available		
Cost of delivery service	100 above		
Facility Environment	Not clean		
Which option do you prefer?	()	()	

In a panel mixed logit model, the link function typically used is the logit link function, just like in a standard logistic regression model. The logit link function transforms the linear combination of predictors and random effects into probabilities, allowing you to model the probability of choosing a particular option within the context of panel mixed logit.
It's defined as follows:

$$\text{logit}(p_{ij}) = \ln\left(\frac{p_{ij}}{1-p_{ij}}\right), \tag{2}$$

where (p_{ij}) represents the probability that the i^{th} individual in the j^{th} choice scenario chooses a particular option. ln is the natural logarithm.

2.5 Model Estimation

The primary hypothesis under examination focuses on whether the parameter estimates for all attributes are statistically distinct from zero. In light of the assumption of irrelevant independent alternatives and The existence of variability in choices among participants, known as selection heterogeneity, a panel mixed logit model was selected to scrutinize the potential variance in preferences exhibited by participants.

The panel mixed logit model, as proposed by Louviere et al. (2000), offers an advancement over the foundational multinomial logit model. It accommodates the introduction of stochastic variation in preferences and permits the incorporation of a wide range of distributions for the random coefficients. In the context of this study, the model's application encompasses the seven variables outlining the attributes of the delivery location, as delineated in the utility model earlier.

The distinctive advantage of the mixed panel logit model lies in its ability to estimate both primary effects and interactions. This model enhances the panel mixed logit framework by exploring connections between sociodemographic factors and attributes specific to women. This examination sheds light on how preferences might shift based on observed individual characteristics. This comprehensive analysis seeks to uncover not only the main determinants of preferences but also the nuanced influences of specific demographic and individual factors on the decision-making process.

3 Results

3.1 Participant Characteristics

The average age of the respondents was 29 years, with a standard deviation of 0.2606064. Among them, 45% had experienced only one childbirth (uniparous). A significant majority, accounting for 81% of the women, were married. Approximately 20% of the participants had achieved tertiary-level education. Furthermore, a noteworthy 73% of the women were either self-employed, part-time employed, or engaged in full-time employment. In terms of delivery history, 79% of the participants had previously given birth in government-affiliated delivery health facilities. Detailed demographic characteristics can be found in Table 3.

3.2 The Panel Mixed Logit Results on Choice of Place of Delivery

Table 4 provides an overview of the parameter estimates extracted from the panel mixed logit model for the participants, along with their corresponding Standard Errors (SE) displayed within parentheses. The model demonstrates high significance and effectively captures the data's patterns, indicated by a p-value of 0.0000 and a log-likelihood of -1521.1375. Notably, the coefficients associated with all attributes maintain statistical significance at the 95% confidence level ($p < 0.05$), with the exception of the

Table 3: Sociodemographic characteristics of Participants

Sociodemographic variables	n (%)
Marital status	
Married	146 (81.0)
Single	31 (15.5)
Window	07 (3.5)
Cohabiting	16 (8.0)
Educational status	
Primary	46 (23.0)
Secondary	66 (33.0)
Tertiary	40 (20.0)
Non-formal	48 (24.0)
Religion	
Christian	140 (70.0)
Muslims	60 (30.0)
Employment Status	
Employed	146 (73.0)
Unemployed	54 (27.0)
Place of last delivery	
Public	157 (78.5)
Private	43 (21.5)

cost of delivery services.

The non-significance of the cost of delivery services coefficient implies that women's decision-making process regarding the choice of birthing location does not heavily depend on the cost factor. In other words, cost does not emerge as a substantial consideration when women are making decisions about where to give birth. These findings offer insights into the relative importance of various attributes in influencing women's preferences for birthing locations. Additional details are available in Table 4.

Table 4: The Parameter estimates of full model

Attributes	Coefficient	SE	Z-value	P(z>0)	95% confi. interval
Providertype	-0.630838	0.136479	-4.62	0.000	[-0.898333, -0.363343]
ProviderAttitude	-0.228141	0.058397	-3.91	0.000	[-0.342598, -0.113685]
Availabilityofdrugsandequipm	0.485294	0.185279	2.62	0.009	[0.122153, 0 .848434]
Distancefromhome	-0.230070	0.069550	-3.31	0.001	[-0.366385, -0.093754]
Referralathealthfacility	-0.592867	0.139983	-4.24	0.000	[-0.867230, -0.318505]
Costofdeliveryservices	0.038382	0.058982	0.65	0.515	[-0.077220, 0.153985]
Facilityenvironment	-0.183459	0.07228	-2.54	0.011	[-0.325131, -0.041787]
Number of observation (n)		200			
Wald $\tilde{\chi}^2(7)$		161.28			
Log likelihood		-1521.1375			
Prob > $\tilde{\chi}^2$		0.0000			

3.3 Panel Mixed Logit Model with Interactions to Explain Preference Heterogeneity in Choices

Table 6 provides a comprehensive insight into the significance of attributes across various sociodemographic variables. It is evident that all attributes, with the exception of the cost of delivery services, hold significance across the board. This signifies that

factors like age, employment status, marital status, religion, education, and the place of the last delivery are significant considerations for women when selecting a birthing location in the Upper East Region. However, the cost of delivery services does not exhibit the same level of importance across all sociodemographic variables. Sociodemographic characteristics' impact on preferences demonstrated discrepancies in attribute priorities regarding the delivery location. Particularly, the attribute of drug and equipment availability at the health facility surfaced as the most influential across these sociodemographic factors. Analyzing the marginal effects of the model estimates as presented in Table 5, it is evident that certain trends emerge. For instance, sixty-two percent of employed women are likely to choose a health facility based on attributes like the availability of drugs and equipment, facility environment, provider attitude, distance to the health facility, referral at the health facility, and provider type. Similarly, around sixty percent of married women are prone to make similar choices based on these attributes. Moreover, seventy-four percent of women with primary education share a tendency to select a health facility for birthing based on similar attributes.Among Christian women, approximately sixty-three exhibit a similar inclination. Interestingly, the cost of delivery services does not emerge as a factor influencing choice among both Christian and Muslim women. In a similar vein, sixty-one percent of women whose last delivery occurred at a public facility are likely to make choices aligned with these attributes. Remarkably, the consistency in the lack of variation regarding the attribute of the cost of delivery services implies that this attribute's significance remains constant across all sociodemographic groups. This finding underscores the attribute's limited impact on women's decision-making processes, irrespective of individual characteristics.

Table 5: Marginal effects of the model estimates for sociodemographic variables

Variable Education	dy/dx(z)	Variable Marital status	dy/dx(z)	Variable Religion	dy/dx(z)
Primary	0.7369(6.01)	Married	0.6049 (45.14)	Christians	0.6278 (44.64)
Secondary	0.639 (17.79)	Single	0.591 (42.45)	Muslims	0.5288 (23.86)
Tertiary	0.5302 (6.70)	Windowed	0.5757 (24.14)		
Non-formal	0.4181 (3.22)	Cohabiting	0.5606 (15.41)		
Variable Employment	dy/dx(z)	Variable Place of last delivery	dy/dx(z)		
Employed	0.6176 (44.67)	Public	0.6133 (45.78)		
Unemployed	0.5471 (23.22)	Private	0.5420 (20.86)		

Note: Numbers in parentheses represent the Z-scores used to perform significance tests and assess the statistical significance of the marginal effects of independent variables.

Table 6: Panel Mixed Logit Model with Interactions between Sociodemographic Variables and Attributes to Explain Preference Heterogeneity in Choices Made

Attributes	With age	With employment	With marital status
Provider type	-0.63073	-0.55272	-0.63058
	(0.000)	(0.000)	(0.000)
Provider Attitude	-0.2281	-0.22881	-0.22851
	(0.000)	(0.000)	(0.000)
Availability of drugs and equip.	0.48537	0.50236	0.48374
	(0.009)	(0.007)	
Distance from home	0.6955	-0.23098	-0.22993
	(0.001)	(0.001)	(0.000)
Referral at health facility	-0.59285	-0.58283	-0.59487
	(0.000)	(0.000)	(0.000)
Cost of delivery services	0.03826	0.03841	0.03835
	(0.576)	(0.575)	(0.516)
Facility Environment	-0.18365	-0.1850	-0.18359
	(0.011)	(0.011)	(0.011)
Attributes	With Religion	With Place of last deliv.	With Educ.
Provider type	-0.62177	-0.63501	-0.63149
	(0.000)	(0.000)	(0.000)
Provider Attitude	-0.23064	-0.22892	-0.22838
	(0.000)	(0.000)	(0.000)
Availability of drugs and equip.	0.47861	0.49516	0.48504
	(0.010)	(0.008)	(0.009)
Distance from home	-0.22882	-0.2284	-0.22951
	(0.000)	(0.001)	(0.001)
Referral at health facility	-0.60361	-0.59869	-0.59291
	(0.000)	(0.000)	(0.000)
Cost of delivery services	0.03891	0.03906	0.03871
	(0.511)	(0.509)	(0.512)
Facility Environment	-0.1846969	-0.18580	-0.18288
	(0.011)	(0.010)	(0.011)

Note: Numbers in parentheses under the estimates are corresponding probability values.

Number of observations (n) = 200
Wald $\tilde{\chi}^2$ (21) = 223.10
Log simulated-likelihood = -1483.3428
Prob (> $\tilde{\chi}^2$) = 0.0000

4 Discussions

The findings presented in this study offer valuable insights into the preferences of women when choosing a place of delivery in the Upper East Region of Ghana. The demographic characteristics of the respondents, such as age, marital status, education level, and employment status, provide a comprehensive profile of the study population in Table 3. The average age of 29 years reflects a relatively young demographic, which is consistent with the reproductive age range for women. The high percentage of married participants (81%) and the proportion with tertiary education (20%) indicate that the study captured a diverse range of women, possibly reflecting varying socioeconomic

backgrounds and levels of education that may influence decision-making regarding place of delivery. Notably, a significant number of women (73)% were engaged in various forms of employment, demonstrating the potential role of socioeconomic factors in shaping healthcare preferences and access. Moreover, the substantial proportion of participants (79%) who had chosen government delivery health facilities for their last delivery underscores the significance of understanding the factors that influence such choices.

The utilization of a panel mixed logit model provided a robust framework for analyzing the preferences of women for different attributes associated with the choice of delivery facility. The model's high significance and a good fit to the data validate its efficacy in capturing the complexities of decision-making. From Table 4, the statistically significant coefficients for all attributes, except the cost of delivery services, highlight the multifaceted nature of women's considerations when selecting a delivery facility.

The non-significance of the cost of delivery services attribute may initially appear counter-intuitive; however, it reveals a nuanced perspective on the prioritization of factors influencing choice.This discovery implies that women place a higher emphasis on factors like the availability of drugs and equipment, the facility environment, provider attitudes, distance to the health facility and provider type, and cost of delivery services. These results align with prior research and underscore the importance of focusing on these attributes to improve maternal healthcare services Beam et al.(2018), Adjei et al. (2019) and Oluoch-Aridi et al. (2020).

The high; value placed on the availability of drugs and equipment underscores the critical role of resource availability in ensuring quality maternal healthcare. This finding emphasizes the necessity of adequately equipping delivery facilities to enhance standards of care, particularly in resource-constrained regions like the Upper East Region. The significance of facility environment as a determinant of choice highlights the need for attention to the physical and emotional comfort of pregnant women during delivery. A conducive facility environment contributes to a positive birthing experience and may positively impact maternal and neonatal outcomes.

Provider attitude emerges as a vital attribute, reflecting the concern for respectful and supportive care during labor and delivery. Addressing provider attitude issues can potentially contribute to reducing maternal mortality, as poor provider attitudes have been implicated as a major contributor to adverse maternal outcomes in various settings Jakperik et al. (2023), WHO (2016) and Bohren et al. (2019).

Surprisingly, the lower ranking of provider type suggests that women may not prioritize the specific type of healthcare provider when selecting a facility for delivery. This finding challenges assumptions about the significance of provider type and emphasizes the broader attributes that influence choice.

Perhaps one of the most intriguing findings is the lack of significance of the cost of delivery services. This implies that women are willing to pay a higher cost for better quality delivery services, which underscores the importance of perceived quality over

cost considerations. This observation is consistent with existing research indicating that the quality of healthcare frequently outweighs economic limitations in the context of maternal health choices Jackline et al. (2020). It's worth noting that this trend persists despite the economic challenges faced by the Upper East Region, which is recognized as one of the less affluent areas in Ghana, Jakperik et al. (2018).

5 Conclusions

The study showed that attributes such as availability of drugs and equipment, facility environment, provider attitude, distance to health facility, referrals at health facility, provider type are highly patronized by women when it comes to choosing of health facility for delivery and may affect the utilization of the health facility if not carefully considered. Policy makers need to grasp women's preferences and the factors influencing their choice of a health facility for childbirth. By prioritizing patient-centered, high-quality care, they can lower maternal mortality rates and enhance maternal health outcomes.

Declarations

- Funding Authors declare that there was no funding for this research
- Conflict of interest/Competing interests (check journal-specific guidelines for which heading to use) The authors declare that they have no conflict of interest
- Ethics approval 'Not applicable'
- Consent to participate 'Not applicable'
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- Availability of data and materials 'available upon reasonable request'
- Code availability Upon request
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