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Use of Delivery Care in Tanzania: The Importance of Poverty, Empowerment and Emergency

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Abstract

Maternal mortality rates remain high because of low use of delivery care. While governments implement exemption schemes to reduce 'barriers to access' to delivery care, little is known about women's actual preferences. This study combines data from a survey and a choice experiment in Tanzania to compare women's preferences with real choices of delivery care. We find that poor and lowly empowered women attach lower weights to the quality of delivery care, which indicates their lower use of delivery care is partly induced by their preferences. Barriers to access for poor women are particularly severe in case of delivery complications.

1. Introduction

One of the Millennium Development Goals where least progress has been made is MDG5, according to which maternal mortality rates are to be reduced by 75% between 1990 and 2015 and universal access to reproductive health is achieved (Rosenfield et al. 2006; Simwaka et al. 2005). Despite the launch of many initiatives, the progress required to meet these goals lags far behind, especially in Sub-Saharan Africa, where maternal mortality rates have only declined by 26% between 1990 and 2008. Currently, every 2½ minutes a woman dies in Sub-Saharan Africa, due to complications arising during pregnancy and childbirth (WHO 2010).

There is, however, widespread consensus on what must be done to reduce maternal mortality. Since more than a decade ago, it is recognized that every pregnant woman should have access to skilled care during delivery, as every pregnancy is a potential risk (WHO 1999). Especially access to and utilization of high-quality emergency obstetric care is of crucial importance (Mavalankar and Rosenfield 2005). However, the proportion of deliveries attended by skilled health personnel in Sub-Saharan Africa has only marginally improved from a 41% in 1990 to 46% in 2008 (UN-DESA 2010). Many women give birth at home without any skilled assistance and where referral to higher level of care is often difficult or impossible in case of complications (Worell 2001).[1] Given these conditions, one of the central questions is why not more women decide to deliver at health facilities and hospitals, where skilled care is available.

Several studies have associated low rates of delivery at health facilities with poverty and lack of empowerment (Abadian 1996; Bloom et al. 2001; Furuta and Salway 2006; Glick et al. 2000; Mrisho et al., 2007; Stephenson et al. 2006; Woldemicael and Tenkorang 2010). It is often assumed that these lead to important *barriers to access.* In response to the little progress in the fight against maternal mortality, several governments in Sub-Saharan Africa (Uganda, Ghana, Tanzania, among others) have

[1] Undesirable outcomes of home delivery in developing countries have been documented by several studies (Koblinsky et al. 1999; Wagle et al. 2004).

implemented exemption schemes (Ensor and Ronoh 2005) assuming these lower *barriers to access* and hence increase the use of obstetric care.

However, the success of such policies is not guaranteed, and the following two considerations require special attention. First, it is uncertain whether women would automatically choose for high-quality obstetric care if this option is made equally as reachable as other options. To understand women's choices we need to make a distinction between what they *want* to choose and what they are *able* to choose. Women may be willing to use high-quality obstetric care but often do not have the means for this; equally possible, they may not be willing to use high-quality obstetric care even if they are able to do so. Several studies have highlighted the importance of traditional beliefs and cultural aspects as contributing factors for not seeking delivery care at health facilities. Sargent (1990), for example, found in rural Benin that the ideals of courage and stoicism at delivery are underscored to young girls and pregnant women. Especially women who manage to deliver without calling for assistance are esteemed. Some women may also have an aversion to delivering in health facilities. This was found by Kyomuhendo (2003), when interviewing a Ugandan mother with both traditional and hospital birth experiences: "Once you go to deliver in hospital you are treated like a child or a fool, in total disregard of your age, experience and status."

Second, a distinction needs to be made between delivery in normal conditions and delivery with complications.[2] Normal delivery could be perfectly handled at home or at the primary care level, but when complications occur obstetric care at the secondary or tertiary level is needed (WHO 2004). However, many women deliver at home and when complications occur they end up in life threatening conditions if they are not taken to a higher level of care in time. It is, therefore, not surprising that most cases of maternal death occur because of obstetric complications (WHO 1999). While delivery complications is the most important causal factor of maternal death, little is known about the influence of complications and emergency on women's use of and preferences for maternal healthcare (Gabrysch and Campbell 2009). It is most likely that constraints and preferences under complicated delivery differ substantially from those under normal delivery.

In sum, to optimize government's policies it is necessary to know to which extent the low use of delivery care by poor and lowly empowered women is the result of *barriers to access*, or the result of women's *preferences* (Question 1); and to analyze how emergency conditions play a role in this equation (Question 2). In this study, we address these questions by comparing women's preferences with real choices of

[2] It is estimated that 15% of all pregnant women in developing countries experience life-threatening obstetric complications that require emergence care (WHO 1999).

delivery care. For this, we combine observational data on delivery care with the data from a choice experiment of a sample of 518 women in Tanzania.

2. Related literature

In this section, we embed our research questions into the existing literature. For this, we make use of Figure 1. One of the central elements in this Figure is 'use of obstetric care', which is closely related to the place where women give birth. Some women deliver at home, mostly without any obstetric care (Worell 2001). Other women deliver at local health centres, such as dispensaries or village health posts where medical staff is available but where equipment and medicines are often lacking. Still other women deliver at hospital, where qualified staff, equipment and medicines are available (NBS 2007). The distinction between different places of delivery is especially important in case of complications when obstetric care at higher levels is needed (WHO 2004).

Many studies have investigated factors that influence pregnant women's use of obstetric care in developing countries. Most of them are based on choice models that conceptualize individual choice as an optimization problem in which women choose the option from an 'alternative set' (i.e. the set of available alternatives) that maximizes their utility. Choice modelling studies can be broadly classified into two main classes, based on the methodological approach used. A first group of studies look at individual choices, making use of observational data on service use (e.g. Addai 2000; Gage 2007; Magadi et al. 2000), the arrow at the top in Figure 1. A second group of studies use 'stated preferences', which are obtained by choice experiments in which people are asked *directly* about their preferences for particular services (e.g. Duong et al. 2004; Kruk et al. 2009), the lower left arrow.[3]

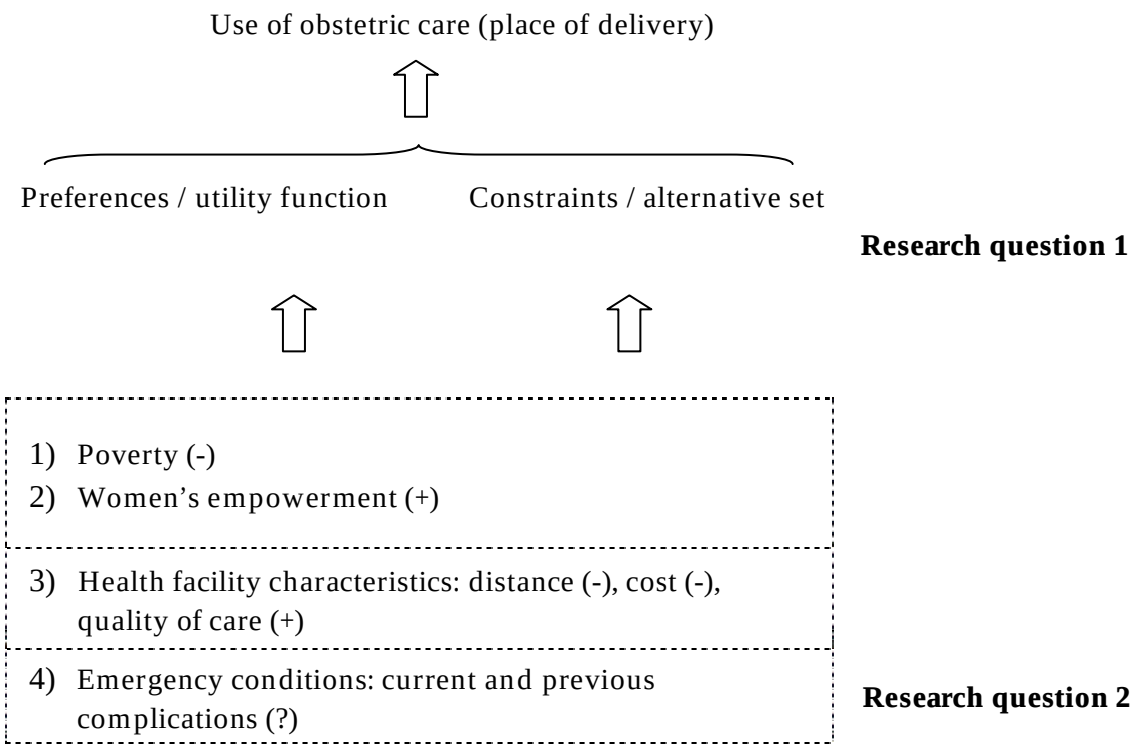
Applying both approaches to the same sample of respondents and comparing results (as we will do in this study), can provide interesting insights.[4] It allows us to make a distinction between what women *want* to choose and what they *eventually choose*. Translated to our study, comparing women's preferences with their actual choices allows us to assess to which extent women's low use of high-quality obstetric care is

[3] While very common in health economics and environmental economics, choice experiments have not been commonly used in development studies. For interesting applications in development studies see: Asfaw et al. (2004) on user fees for health care; Hope (2006) to evaluate water policies against the priorities of the poor; Baltussen et al. (2006) for priority setting by health policymakers; van Kempen et al. (2009) on preferences for firewood in rural Guatemala.

[4] As studies of stated preferences use hypothetical scenarios, they are not restricted to alternatives that fall within the alternative set, i.e. the alternatives that are reachable given one's constraints.

the result of *barriers to access*, or the result of their preferences. With this analysis we address our first research question.[5]

Figure 1. Conceptual framework



The list of studies that use either of both approaches to investigate determinants of the use of delivery care is long, and it is not our intention to review all of them in this section. We will look at those of most relevance for the purpose of our study. As indicated in Figure 1, we focus on the effect of *poverty* and *female empowerment*, which several studies showed to influence the use of delivery care in a negative and positive way, respectively (Glick et al. 2000; Bloom et al. 2001; Furuta and Salway 2006; Mrisho et al. 2007; Stephenson et al. 2006; Woldemicael and Tenkorang 2010). There is also abundant evidence on the importance of *health facility characteristics*, such as distance to the health centre (Dor et al. 1987; Frederickx 1998; Thaddeus and Maine 1994) and costs of delivery (Gage 2007; Graham et al. 2004), which make services less attractive, and 'quality of care' which has a positive effect on the use of delivery care (Kruk et al. 2009; Leonard et al. 2002).

An important missing factor in the literature, however, is the influence of *emergency* conditions. As explained before, most cases of maternal death occur in case of

[5] It should also be noted that the combination of both approaches requires that they are used on the same sample of respondents, so that the socio-economic variation is the same for both analyses.

complications, so that it is of paramount relevance to study how complications influence women's use of and preferences for obstetric care, which is the second research question of our study. Whereas the effects of health facility attributes, wealth and empowerment are clear, the influence of emergency conditions is less straightforward. Complications (and consequent emergency) at the moment of delivery may influence choice in at least two different ways. First, individual choice may be influenced by *current* emergency conditions. The existing evidence is mixed on this, however. On one hand, there is evidence that suggests that women do not change their behaviour when facing emergency conditions. According to Jahn et al. (1998), despite frequently occurring complications, there is a reluctance to change the pre-selected delivery setting in case of severe complications. Others, however, assume it more likely that emergency conditions influence health-seeking behaviour (Thaddeus and Maine 1994). Second, women's preferences may also be influenced by *prior experience* with complications (Jahn et al. 1998; Pang et al. 2008; Thaddeus and Maine 1994). Such experience is often very intense and may have long-lasting effects on women's preferences for health facilities.

3. Data and methods

As explained before, we will compare two analyses that investigate the influence of wealth, empowerment and emergency conditions on 1) women's *use* of health care facilities and 2) women's *preferences* for health care facilities. In this section, we explain how we apply the previously described framework (Figure 1) to each of the two analyses.

For our study, we take a sample of women in the reproductive age (20-55 years old), who gave birth to at least one child in the last 5 years. These women are interviewed by a team of female enumerators. We collect data on demographic characteristics, household characteristics, birth history and use of delivery care. We also let these women participate in a ranking exercise to capture their individual preferences for delivery care.

3.1. Analysis of obstetric care use

In the first analysis, we investigate the influence of wealth, women's empowerment and emergency conditions on the likelihood of delivery at different health facilities. For this, we ask respondents in the sample where they delivered their last pregnancy. This information is classified into three categories: 1. delivery at home, 2. delivery at a local health facility (dispensary, health centre or village health post) and 3. delivery at a hospital. This variable is used as dependent variable in a multinomial probit (MNP) regression. In particular, we associate the outcome $y_i \in \{1,2,3\}$ of every

woman i to three latent variables $v_{i,j}$ for j = 1, 2, 3 through the following link function:

$$y_i = j \text{ with } v_{i,j} = \max\{v_{i,1}, v_{i,2}, v_{i,3}\} \text{ and } v_{i,1} = 0 \qquad (1)$$

The outcome corresponds to whichever latent variable is greatest, the idea being that we do not observe the latent values, but only the outcome (y_i). This is equivalent to observing the largest element of $v_{i,j}$ for j = 1, 2, 3. This leads to the following latent utility model:

$$v_{i,j} = \beta_j x_{i,j} + \varepsilon_{i,j} \text{ for } j = 2, 3 \qquad (2)$$

for j = 2,3, with β_j being the parameter vector to be estimated, x a vector of independent variables and $\varepsilon_{i,j}$ the error for outcome j. We assume a bivariate normal distribution with zero mean for both dimensions.

The following explanatory variables will be used. To look at the effect of wealth and empowerment we create two indices. To construct these indices we use the first factor of a factor analysis of a list of indicator variables. For the wealth index we use variables on housing conditions, livestock, land and economic assets.[6] For the empowerment index, we use a list of variables that covers the most important dimensions of empowerment mentioned in the literature (Alsop and Heinsohn 2005; Kabeer 1999; Malhotra et al. 2002). We use information on whether women have an income-generating activity, their knowledge about programs that offer loans in the area and whether they have ever received or given a loan. We also include variables measuring literacy, education, mobility and attitudes towards use of contraceptive methods. Finally, we use variables that look at intrahousehold agency, such as domestic decision-making, women's control over money, control over sexual relations and domestic violence, couple communication and whether the household is female headed. Both indices are standardized so that their mean equals 0 and their standard deviation is equal to 1.

[6] We follow the procedure as elaborated by Rutstein and Johnson (2004). The complete list of indicator variables is: housing conditions (main material of the soil, roof and walls of the house; the number of bedrooms, source of drinking water, time to fetch water, type of toilet facilities, sharing of toilet facilities, type of cooking fuel and main source of energy for lighting and the presence of mosquito nets), number of animals owned, amount of arable land, amount of land used for grazing and economic assets (radio, television, an iron, refrigerator, bed with mattress, a sofa, a table, chair, running watch or clock, a cupboard, a fan, computer, internet access at home, land line, mobile phones, bicycle, motorcycle/scooter, car/truck, bank account and jewellery).

Table 1. Descriptive Statistics

Continuous variables	Mean	SD
Age	31.60	6.87
Education	5.00	3.37
Number of children (given birth to)	4.95	2.59
Wealth index	0.00	1.00
Empowerment index	0.00	1.00
Categorical variables	Percentage	
Rural	82.24%	
Currently pregnant	16.60%	
Had complications at last birth	38.03%	
Place of last delivery		
Not in facility [a]	50.58%	
Local health facility [b]	26.06%	
Hospital	23.36%	

[a] At home (47.10%) or on the way (3.48%);
[b] Dispensary (9.65%) or health centre/village health post (16.41%); N = 518.

In addition to the wealth and empowerment indices, we construct a variable 'complications' from a series of questions regarding the last birth that look at the four major obstetric complications requiring assessment and care: haemorrhage (severe blood loss), obstructed labour, eclampsia (pregnancy-induced hypertensive disorder), and puerperal sepsis (childbed fever).[7] These problems have been consistently ranked as the most common causes of maternal death in communities where maternal mortality is high (NSOP 1994). A binary variable is constructed, which is equal to 1 if the respondent experienced one of the four complications. Table 1 shows the descriptive statistics of the variables used.

3.2. Ranking experiment

In the second analysis, we study women's preferences for delivery services. To capture such preferences, we let the women in the sample participate in a ranking exercise of hypothetical options of obstetric care providers. To examine these ranking data we use conjoint analysis techniques. Conjoint analysis is based on the assumption that any service can be described by its characteristics (attributes) all

[7] A control question about convulsions when the woman was not pregnant was also included to check whether the eclampsia was not related to pre-existing brain condition not related to her pregnancy.

with their own levels. The extent to which an individual values a service is assumed to depend on the levels of these attributes. This technique has been successfully used in several fields of research, including the elicitation of patients' preferences in health service delivery (Ryan and Farrar 2000).

Table 2. Attributes and levels used in the ranking exercise

Attribute	Levels	
Type of health care worker	1	Nurse/Midwife
	2	Doctor
Health care worker attitude	1	Does not smile and listen carefully
	2	Smiles and listens carefully
Distance	1	0 hours by foot
	2	2 hours by foot
Cost	1	0000 TZS
	2	3000 TZS
	3	6000 TZS
	4	9000 TZS
Technical Quality	1	Equipment and drugs not always available
	2	Equipment and drugs always available

The design of the ranking exercise focuses on attributes of health facilities that women take into consideration when deciding where to deliver their next child. The facility attributes and their levels are selected by reviewing the data of the 2004 Tanzanian Demographic and Health Survey, recent literature on women's decisions regarding delivery in sub-Saharan African countries and interviews with Tanzanian women. We select five attributes: costs, distance and three attributes of 'quality of care' (availability of equipment and drugs, provider attitude/responsiveness and type of provider).[8] We assign levels to the attributes that are realistic for the study region. For example, costs range between 0 and 9000 Tanzanian shilling (with four levels).[9] To the other attributes we assign two levels, as shown in Table 2.

We expect that costs and distance have a negative effect on preferences for obstetric care facilities, and that women prefer facilities that are well stocked with equipment

[8] The ranking exercise did not include an explicit home delivery option. We did so to avoid an 'easy way out' bias (Kontoleon and Yabe 2003).

[9] It should be noted that despite the exemption policy in place costs remain important as many facilities still charge delivery fees (NBS 2007).

and drugs. We also look at the type of health care worker and the health care worker's attitude/responsiveness. We expect women to prefer facilities where health care workers are more responsive[10] and facilities with higher qualified staff (facilities staffed with doctors instead of facilities with nurses/midwifes only). Making all possible combinations of the different levels of attributes we obtain a total of 64 possible scenarios (4×2^4). As this set is too large for an individual to rank, we reduce them to a subset of eight scenarios, which are selected through an orthogonal design[11]. The eight selected scenarios are presented in Table 3.

Table 3. Scenarios used in the ranking exercise

Card	Provider available	Provider attitude	Distance	Costs of service	Drugs and equipment always available
A	Doctor	Smiles and listens carefully	2 hours by foot	6000 shilling	no
B	Nurse/Midwife	Does not smile or listen carefully	2 hours by foot	0 shilling	no
C	Doctor	Does not smile or listen carefully	2 hours by foot	3000 shilling	yes
D	Nurse/Midwife	Smiles and listens carefully	0 hours by foot	3000 shilling	no
E	Nurse/Midwife	Does not smile or listen carefully	0 hours by foot	6000 shilling	yes
H	Doctor	Does not smile or listen carefully	0 hours by foot	9000 shilling	no
K	Doctor	Smiles and listens carefully	0 hours by foot	0 shilling	yes
M	Nurse/Midwife	Smiles and listens carefully	2 hours by foot	9000 shilling	yes

Each of these scenarios is depicted on a vignette. Two examples of such a ranking vignette are shown in Figure 2. Before ranking the vignettes we present and explain each of the eight vignettes in a random order, in an attempt to avoid order bias. We then let the respondent rank the scenarios in order of preference. For this, we put all the vignettes on a table (or on the floor) and ask the respondent to select the most preferred among the vignettes, after which this one is removed from the set. Thereafter, the respondent selects the most preferred among the remaining cards. We repeated this procedure until all vignettes receive a rank.

[10] To be able to visualize provider attitude/responsiveness on vignettes (see further) we defined a responsive provider as one who 'smiles and listens carefully'.

[11] The experimental plan used is an orthogonal main-effect plan, which permits the estimation of all main effects of the factorial arrangement without correlation. See Addelman (1962) for an extensive explanation of orthogonal main-effect plans.

Figure 2. Examples of ranking cards

Attributes:	**Levels:**
Provider	Doctor
Provider attitude	Smiles & listens carefully
Distance	2 hours by foot
Costs	6000 Tanzanian shilling
Equipment and drugs	Not always available

CARD A

Attributes:	**Levels:**
Provider	Nurse/Midwife
Provider attitude	Does not smile & does not listen carefully
Distance	0 hours by foot
Costs	6000 Tanzanian shilling
Equipment and drugs	Always available

CARD E

Preferences for delivery care not only depend on the specific attributes, but may also depend on specific circumstances during delivery. As explained before, one of our research questions looks at the influence of emergency conditions on women's preferences. For this purpose, we create two different versions of instructions that only differ on the presence of emergency conditions (as presented below) and assign women randomly to one of them.

1. Normal delivery frame: *I will show you eight cards. Each card describes one possible health centre. Imagine that you are to deliver your next child. Please tell me which of the eight health centres you would prefer to go to for your delivery.*

2. Emergency delivery frame: *I will show you eight cards. Each card describes one possible health centre. Imagine that you are to deliver your next child and you are in urgent need for delivery assistance because of complications. Please tell me which of the eight health centres you would prefer to go to for your delivery.*

To analyze the data we use a rank-ordered multinomial logit model (Beggs, Cardell, & Hausman, 1981; Hausman & Ruud, 1987). We assume that respondents rank the eight alternatives on the basis of the utility they derive from them. Let us denote the number of alternatives by j. The utilities of the alternatives are a set of latent variables $U_1, \ldots, U_n$, defined as:

$$U_j = V_j + \varepsilon_j , \qquad (3)$$

where j = 1 , . . . , N indexes the alternatives. The two parts of the utility function are V_j , which is the part of the utility that is determined by the observed attributes and ε_j, which is the random component of the utility of alternative *j*. The deterministic part of the utility is modelled as:

$$V_j = \beta_j x_j , \qquad (4)$$

where x_j is a multi-dimensional vector with characteristics of alternative *j* and β_j is a multi-dimensional parameter vector specific to alternative *j*. We denote the ranking of alternatives by the vector $r = (r_1 , \ldots , r_N)$, for $j = 1 , \ldots , N$. An observed ranking implies a complete ordering of the underlying utilities, formally written as

$$U_{r_1} > U_{r_2} > \ldots > U_{r_N} \qquad (5)$$

Under the utility assumption (equation 3) and the assumption of the extreme value distribution we obtain the rank ordered logit model (Beggs, et al., 1981). The probability of observing ranking *r* can be written as:

$$Pr(Ur_1 > Ur_2 > \ldots > Ur_N) = \prod_{j=1}^{8} \left[\left[\frac{exp\,(V_j)}{\sum_{k=j}^{8} exp\,(V_k)} \right]\right] \qquad (6)$$

The rank ordered logit model can be seen as a series of multinomial logit models, starting with a multinomial logit model for the most preferred item, another for the second-ranked item to be preferred over all items except the first ranked item, and so on, until the last but one (where the least preferred item is selected with certainty).

The probability of a complete ranking is then equal to the product of these separate multinomial logit probabilities.[12]

So far, we assumed that all respondents use the same valuation function. It is thus assumed that all β′s in equation 4 are constant between respondents. However, there might be important individual heterogeneity in preferences related to socio-economic variation within the respondents' pool. To study the influence of individual characteristics on facility preferences we use interactions between alternative attributes and individual socioeconomic characteristics, which is a conventional form of reflecting heterogeneity of preferences (Amador, González, & Ortúzar, 2005). In particular, we consider a trend-model in the valuation weights:

$$\beta_{ij} = \beta_{j0} + \beta_{j1} x_i \qquad (7)$$

with x_i being a characteristic of respondent i. We can now test whether the slope coefficient β_{j1} is equal to zero. Adding interaction terms between the attributes and socio-economic characteristics of the respondents is a common approach in choice experiments to study individual heterogeneity in preferences (Hanson, McPake, Nakamba, & Archard, 2005; Ryan M., et al., 2001). We follow this procedure to study the influence of wealth and empowerment on the weight women attach to the different attributes of health facilities. To control for wealth and empowerment, we use the wealth and empowerment indices as described above. To study the influence of emergency we run all analyses separately for the two implemented treatments (normal versus emergency conditions). We also add further control variables that might bias individual preferences as captured by the choice experiment. In particular, we control for current pregnancy, because (not) being pregnant at the moment of the exercise can bias the stated preferences. Furthermore, we control for any effect of previous experience by adding the number of children one has delivered and a dummy equal to one if one has had complications with the last delivery.

[12] This result holds due to the assumption of the 'Independence of Irrelevant Alternatives' (IIA), according to which the addition or deletion of scenarios from the choice set does not affect the ratio of the probabilities associated with any other combination of scenarios (McFadden 1974). This assumption is not too restrictive in our case, due to the fact that we constructed the set of scenarios with maximum orthogonality and because of the fictitious nature of the scenarios, which are completely described by their stated attributes (see Van Ophem et al. 1999).

4. Results

We start this section with some background information on the Tanzanian health system as well as the government's policy. Thereafter, we present and discuss the two analyses that look at the influence of wealth, female empowerment and emergency conditions on women's *preferences* and actual *use* of health care facilities. We compare the results of both analyses in the discussion section.

4.1. Tanzania's health system

In Tanzania, maternal mortality rates have declined by an estimated annual rate of only 0.6% since 1990 (WHO 2010). This is far too little to reach the MDG5, for which an average annual decline of 5.5 percent between 1990 and 2015 is needed. Maternal mortality rates remain high because 54% of Tanzanian women do not have a health professional present at delivery (NBS 2005) and less than 60% of deliveries with expected complications are delivered in emergency obstetric care facilities (Olsen 2009).

The Tanzanian government is very aware of this problem and aims to increase the coverage of deliveries by skilled assistance from 46% in 2004/5 to 80% in 2015 (MoHSW 2008). Even while this objective is less ambitious than the original target of 100% coverage, the government makes a substantial effort to speed up the process to improve universal access to reproductive health care. The Tanzanian government has set up an exemption scheme, assuming that poverty works as an important barrier to high-quality obstetric care. With this scheme it tries to achieve that the majority of pregnant women receive free-of-charge services, drugs, medical supplies, medical equipment and transportation related to obstetric care (Quijada and Comfort 2002). However, even if such policy is successfully implemented, it may still be ineffective if women still not prefer to deliver at health facilities, even if all resource constraints were relieved. More research on this is needed, especially as the Tanzanian government itself lacks sufficient knowledge about women's preferences (Shackley and Ryan 1995).

4.2. An analysis of chosen delivery places

For the field research we selected the Tanzania's Lake region, which has an estimated population of 6.3 million people (NBS 2002). There are 34 hospitals, 82 health centres and 708 dispensaries in this region (NBS 2007), and the median population of assigned catchment areas for facilities is the largest within Tanzania. In this region, we took a random sample of 518 women in reproductive age and asked these women where they delivered their last pregnancy.[13] As explained before, with this information we create three categories (home delivery, delivery at local health facilities and delivery at hospitals), which are then used as dependent variable in a multinomial probit model. As explanatory variables we consecutively include in Models 1-3 the wealth index, the empowerment index and the 'complications' dummy variable.

In an additional model (Model 4) we add controls that might be correlated with both delivery care use and these explanatory variables (in order to avoid omitted variable bias). In particular, we control for age and the number of children the respondent has given birth to. As demonstrated in other studies, women are more likely to seek maternal health-care services for first than higher-order births (Elo 1992; Magadi et al. 2000), and have a lower risk perception the more children they have had before (Vecino-Ortiz 2008). In a final model (Model 5), we control for possible interaction effects between the wealth and empowerment indices and the complications dummy. This allows us to test whether emergency conditions have the same effect on women with different wealth or empowerment.

Table 4 presents the results of the different models. We first look at models 1-4. The positive coefficient of the household wealth index (in all models and in both outcomes) indicates that the likelihood of delivery at a health facility relative to delivery at home (the base outcome) is higher for women of wealthier households. This confirms earlier findings (Gabrysch and Campbell 2009; Gage 2007; Graham et al. 2004). The coefficient of the empowerment index, which is added from Model 2 onwards, is positive and statistically significant for delivery at a hospital, indicating that the likelihood to deliver at a hospital relative to the likelihood to deliver at home is larger for more empowered women.

[13] A similar two-stage sampling strategy as the Tanzanian Demographic Health Survey was used. In the first stage, 18 clusters were selected in three sub-regions Kagera, Mwanza and Mara. In the second stage, around 10 households were selected from each of the clusters. After applying weights to correct for differences in population size across clusters we obtain results that are representative for the Tanzanian Lake region.

Table 4. Determinants of delivery at health facilities

		Model 1		Model 2		Model 3		Model 4		Model 5	
		B	SE	B	SE	B	SE	B	SE	B	SE
Local health facility (N = 135)	Wealth	0.364***	0.131	0.369***	0.136	0.383 ***	0.138	0.326 **	0.142	0.135	0.148
	Empowerment			-0.003	0.089	-0.003	0.088	0.022	0.093	0.126	0.109
	Complications					0.224	0.197	0.223	0.198	0.438 **	0.203
	Num. children							-0.082	0.051	-0.082	0.052
	Age							0.004	0.023	0.003	0.023
	Complications x Wealth									0.957 ***	0.321
	Complications x Empowerment									-0.286	0.177
	Constant	-0.432***	0.159	-0.431***	0.159	-0.509 ***	0.192	-0.235	0.697	-0.204	0.683
Hospital (N = 121)	Wealth	0.849***	0.160	0.817***	0.154	0.835 ***	0.157	0.816 ***	0.149	0.605 ***	0.151
	Empowerment			0.192*	0.106	0.201 **	0.100	0.182 *	0.107	0.296 **	0.130
	Complications					0.534 ***	0.171	0.543 ***	0.171	0.741 ***	0.203
	Num. children							-0.092 *	0.055	-0.093 *	0.057
	Age							0.044 **	0.020	0.042 **	0.021
	Complications x Wealth									1.015 ***	0.325
	Complications x Empowerment									-0.281	0.188
	Constant	-0.588***	0.137	-0.592***	0.138	-0.800 ***	0.152	-1.743 ***	0.544	-1.688 ***	0.564
Log likelihood		-501.165		-498.663		-494.618		-489.473		-482.641	
Chi-squared		30.960		31.100		39.570		61.320		66.020	
Prob > chi-squared		0.000		0.000		0.000		0.000		0.000	

N = 518; multinomial probit regression with base outcome = 'Delivery at home or on the way' (N = 262); standard errors corrected for clustering: * p < 0.1; ** p < 0.05; *** p < 0.01.

In Model 5, we add interaction terms between the wealth and empowerment indices and the complications dummy. The wealth and empowerment indices remain significant for delivery at hospital, but are not significant for delivery at a local health facility. For both outcomes, we also find a significant interaction effect between wealth and the presence of complications which is positive, indicating that the difference between poor and rich becomes larger in case of complications.

To see how these effects translate into probability terms we calculate predicted probabilities. We do so for the average household wealth in the sample and the average wealth plus one standard deviation, and for the case of complications compared with a situation without complications. All other control variables are set to their average value in the sample. The results are presented in Table 5. We find that without complications the average wealth group has a probability of 53.3% to deliver at home, whereas the higher wealth group has a probability of 42.2% (a difference of 11.1%). However, this difference between both groups more than doubles in case of complications, with the average wealth group having a 36.0% of delivering at home and the higher wealth group only a probability of 7.4% (a difference of 28.6%). A similar effect is observed for the likelihood of delivery at a hospital, with differences of 13.6% and 28.2%, respectively; but not for delivery at local health facilities (with differences of -2.4% and 0.3%, respectively).

Table 5. Predicted probabilities

		Not in facility	Local health facility	Hospital
Complication = 0	Wealth = sample average	53.3%	27.9%	18.8%
Complication = 0	Wealth = sample average + 1 st.dev.	42.2%	25.5%	32.4%
Complication = 1	Wealth = sample average	36.0%	31.7%	32.3%
Complication = 1	Wealth = sample average + 1 st.dev.	7.4%	32.0%	60.5%

4.3. An analysis of preferences for delivery place

As described before, all women in the sample also participated in a choice experiment, in which they ranked eight hypothetical scenarios according to their preference. We estimate a ranked ordered logit regression with the rank as dependent variable, and use the following models. In Model 1 we include an interaction effect with a dummy variable equal to 1 if the respondent delivered her last pregnancy at home. This allows us to test whether women who delivered at home give different weights to the health facility attributes compared to women who delivered in a health facility. Any such difference can then be used to support the hypothesis that variation in women's propensity to deliver at different places is the result of variation in preferences and not of varying constraints.

In Models 2, 3 and 4 we add the same independent variables we used in the multinomial probit regressions. In particular, we consecutively add the wealth index, the empowerment index and the control variables 'age' and 'number of children (given birth to)'. In Model 4 we also add controls for current pregnancy and complications with the last delivery. In particular, we add a dummy variable equal to one if the respondent is pregnant at the moment of the exercise and a dummy variable equal to one when the respondent had complications with her last delivery. Women who had complications before might attach different weights to each of the health facility attributes, and because of the hypothetical nature of the ranking exercise, stated preferences might be slightly biased by current pregnancy.

Tables 6 and 7 present the results for the normal and emergency frames separately. We first look at stated preferences in normal delivery conditions. In Table 6 we observe that the coefficients of the attributes in virtually all models are statistically significant and have the expected sign. Facilities served by doctors, with responsive staff and technically well equipped receive higher utility scores, whereas larger distance and higher costs make facilities less attractive. The fact that these results are consistent with a priori expectations is a proof for the internal validity of our conjoint analysis. The results also confirm findings from earlier research (Kruk et al. 2009).

At the same time, there is substantial heterogeneity in individual preferences, as shown by the interaction effects. In Model 1 we find significant interaction effects with the home delivery dummy. The sign of the coefficients indicates that women who delivered their last pregnancy at home attach a lower weight to provider attitude and technical quality. In Model 2, where we look at the influence of wealth on women's preferences, we find that poorer women attach lower weights to provider attitude and technical quality. These results can be explained by poorer women being less demanding on service delivery. Poorer women also attach a lower weight to 'distance'. Compared to richer women they are probably more used to walking long distances. As a result, when expecting a normal delivery they find walking a considerable distance to a health facility less of an issue compared to richer women.[14] In Model 3 we find significant effects of the empowerment index. More empowered women attach a higher weight to technical quality of the health facility and to costs. These effects can be explained by the higher cost/quality awareness of more empowered women.

[14] It should be noted that 'distance' in the choice experiment was framed in terms of 'walking by foot', and that – due to differences in use of transport means between poorer and wealthier women – results are likely to be different if it was framed in a different way (e.g. travelling by car, or public transport).

Table 6. Determinants of women's utility of delivery care use (normal treatment)

	Model 1		Model 2		Model 3		Model 4	
	B	SE	B	SE	B	SE	B	SE
Provider	0.343 **	0.092	0.331 **	0.076	0.369**	0.078	0.010	0.418
Attitude	0.934 **	0.083	0.785 **	0.064	0.800**	0.069	0.946 *	0.398
Distance	-0.728 **	0.102	-0.732 **	0.070	-0.730**	0.069	-0.458	0.330
Costs	-0.432 **	0.046	-0.385 **	0.039	-0.405**	0.041	-0.193	0.175
Technical Quality (TQ)	2.134 **	0.157	1.774 **	0.117	1.856**	0.117	1.398 *	0.698
Home delivery * Provider	-0.078	0.151						
Home delivery * Attitude	-0.357 *	0.149						
Home delivery * Distance	0.102	0.133						
Home delivery * Costs	0.097	0.084						
Home delivery * TQ	-0.794 **	0.202						
Wealth * Provider			0.118	0.090	0.089	0.092	0.081	0.092
Wealth * Attitude			0.214 **	0.078	0.193*	0.084	0.192 *	0.081
Wealth * Distance			-0.304 **	0.079	-0.312**	0.087	-0.254 **	0.088
Wealth * Costs			-0.025	0.045	-0.010	0.045	0.002	0.041
Wealth * TQ			0.330 **	0.127	0.257*	0.125	0.160	0.122
Empowerment * Provider					0.115	0.070	0.117	0.076
Empowerment * Attitude					0.054	0.057	0.059	0.061
Empowerment * Distance					0.034	0.074	0.037	0.074
Empowerment * Costs					-0.063*	0.032	-0.063	0.034
Empowerment * TQ					0.284**	0.084	0.303 **	0.091
Complications * Provider							-0.197	0.143
Complications * Attitude							-0.005	0.144
Complications * Distance							0.469 **	0.152
Complications * Costs							0.076	0.078
Complications * TQ							0.002	0.205
Num. children * Provider							-0.012	0.047
Num. children * Attitude							0.003	0.047
Num. children * Distance							0.071 *	0.035
Num. children * Costs							0.016	0.029
Num. children * TQ							-0.111	0.071
Age * Provider							0.014	0.018
Age * Attitude							-0.005	0.017
Age * Distance							-0.024	0.014
Age * Costs							-0.009	0.009
Age * TQ							0.031	0.031
Pregnancy * Provider							0.432 **	0.132
Pregnancy * Attitude							0.080	0.151
Pregnancy * Distance							-0.228	0.163
Pregnancy * Costs							-0.194 *	0.078
Pregnancy * TQ							0.412	0.249
Log pseudo likelihood	-2191.18		-2198.13		-2185.78		-2163.27	
Chi-squared	400.68		371.74		524.56		1135.61	
Prob > chi-squared	0.0000		0.0000		0.0000		0.0000	

N = 1712 (214 women); Rank ordered logit; Significance levels (two-sided): * $p < 0.05$; ** $p < 0.01$; Robust standard errors to correct for multiple observations per respondent.

In Model 4 we add further control variables. We find that most wealth and empowerment effects remain robust to the addition of these control variables. Some of the control variables also have statistically significant coefficients, which are interesting to have a look at. We observe that women who are pregnant at the moment of the exercise attach a higher weight to the provider type and costs, and that lower weights are attached to 'distance' with more children having given birth to. Finally, we find that having had complications at the last birth strongly reduces the weight attached to 'distance'. Due to their earlier experience these women most likely make sure they will arrive on time at the health centre or hospital, no matter the distance.

We now look at the stated preferences in case of emergency delivery (Table 7). The coefficients of all attributes (except 'provider') are statistically significant and have the expected sign. The fact that the type of provider is not taken into account by the respondents is not surprising as in case of emergency it is important to receive medical assistance and whether it is provided by a doctor or a nurse/midwife is less of an issue. The results in Model 1 indicate that women who delivered their last pregnancy at home do not weigh the attributes of health facilities differently compared to women who delivered their last pregnancy at a health centre or hospital. Poorer women, however, attach lower weights to provider attitude and costs, compared to richer women. A plausible explanation for this result lies in the fact that low scores on these attributes (compared to the attributes 'distance' and 'technical quality') do not necessarily translate into life threatening conditions and therefore are less of an issue for poorer women, while richer women remain critical about these attributes, even in case of complications.

In Model 3 we find that more empowered women tend to attach higher weights to provider attitude. This effect is taken over from the wealth variable. In Model 4, where more controls are added, more empowered women also appear to be more critical on technical quality. The same effect is observed for women who are pregnant at the moment of exercise.

Table 7. Determinants of women's utility of delivery care use (emergency treatment)

	Model 1		Model 2		Model 3		Model 4	
	B	SE	B	SE	B	SE	B	SE
Provider	0.074	0.082	0.093	0.056	0.079	0.059	-0.147	0.324
Attitude	0.651**	0.078	0.730 **	0.057	0.765**	0.064	0.608*	0.274
Distance	-0.488**	0.089	-0.563 **	0.072	-0.558**	0.072	-0.794*	0.342
Costs	-0.157**	0.043	-0.209 **	0.027	-0.211**	0.028	-0.068	0.158
Technical Quality (TQ)	1.631**	0.151	1.742 **	0.113	1.785**	0.113	1.905**	0.557
Home delivery * Provider	0.029	0.100						
Home delivery * Attitude	0.111	0.097						
Home delivery * Distance	-0.141	0.122						
Home delivery * Costs	-0.086	0.063						
Home delivery * TQ	0.178	0.220						
Wealth * Provider			0.028	0.048	0.057	0.046	0.052	0.059
Wealth * Attitude			0.157 **	0.045	0.102	0.058	0.095	0.067
Wealth * Distance			-0.007	0.062	-0.017	0.064	-0.024	0.069
Wealth * Costs			-0.068 *	0.028	-0.060*	0.029	-0.071*	0.034
Wealth * TQ			0.120	0.143	0.056	0.143	0.030	0.138
Empowerment * Provider					-0.087	0.061	-0.087	0.065
Empowerment * Attitude					0.167*	0.069	0.164*	0.067
Empowerment * Distance					0.040	0.073	0.031	0.073
Empowerment * Costs					-0.023	0.029	-0.014	0.027
Empowerment * TQ					0.199	0.105	0.215*	0.107
Complications * Provider							0.014	0.106
Complications * Attitude							-0.134	0.135
Complications * Distance							0.178	0.135
Complications * Costs							0.058	0.069
Complications * TQ							-0.420	0.216
Num. children * Provider							-0.031	0.047
Num. children * Attitude							-0.032	0.032
Num. children * Distance							-0.023	0.037
Num. children * Costs							-0.006	0.018
Num. children * TQ							-0.047	0.054
Age * Provider							0.011	0.015
Age * Attitude							0.011	0.011
Age * Distance							0.010	0.014
Age * Costs							-0.005	0.006
Age * TQ							0.007	0.021
Pregnancy * Provider							0.229	0.173
Pregnancy * Attitude							0.178	0.190
Pregnancy * Distance							-0.218	0.165
Pregnancy * Costs							0.055	0.096
Pregnancy * TQ							0.552 *	0.273
Log pseudo likelihood	-1555		-1552		-1540		-1526	
Chi-squared	1029.26		932.58		1100.555		2411.24	
Prob > chi-squared	0.000		0.000		0.000		0.000	

N = 1640 (205 women); Rank ordered logit; Significance levels (two-sided): * $p < 0.05$; ** $p < 0.01$; Robust standard errors to correct for multiple observations per respondent.

5. Discussion and concluding remarks

This research started with the observation that maternal mortality rates remain high because of low use of high-quality obstetric care. Every pregnant woman should have access to skilled care during delivery, as every pregnancy is at risk (WHO 1999). As most deliveries at home are conducted without any skilled assistance and referral to higher level of care is often difficult or impossible (Worell 2001), women should be stimulated to deliver at health facilities.

In this study we looked for explanations of the low use of obstetric care in Tanzania, by comparing the results of two analyses that investigate the influence of wealth, empowerment and emergency conditions on 1) the *use* of health care facilities and 2) *preferences* for (attributes of) health care facilities. Comparing the results of both analyses helps us assess the extent to which low use of delivery care is driven by women's *preferences* or is the result of *barriers to access.*

In this section, we put all evidence together. The analysis of the preference data showed that women who delivered their last pregnancy at home attach a lower weight to provider attitude and technical quality in case of normal delivery. This provides evidence in support of the hypothesis that women who deliver at home do so because they prefer so. A similar picture is found when looking at the influence of wealth. Based on the analysis of the observational data, we found that poorer women have a lower likelihood to give birth at a hospital. At the same time, poorer women also attach lower weights to technical quality for delivery in normal conditions, as demonstrated by the analysis of the preference data. This suggests that poor women's lower likelihood to deliver at hospitals might, at least partly, be induced by their weaker preference for technical quality.

This does not indicate that poverty cannot create important 'barriers to access'. As indicated by the analysis of the observational data, differences between poor and rich women regarding their likelihood to deliver at a hospital become very prominent in case of emergency conditions. This is an important result as use of high-quality obstetric care is of highest importance in emergency conditions, when most cases of maternal death occur (Mavalankar and Rosenfield 2005). This indicates that exemption schemes need to be designed such that they are most useful in case of emergency delivery, when access barriers for the poorest sectors are most severe.

Our results also suggest some additional venues to further increase the use of high-quality obstetric care. In particular, the observation that technical quality receives lower attention among women with lower empowerment indicates that more can be done to raise these women's awareness of the importance of high-quality obstetric care. Moreover, as female empowerment makes women attach higher weights to the costs of service delivery, the exemption schemes may be most effective among the

more empowered women. Increasing female empowerment, therefore, may stimulate the use of delivery care both directly and indirectly.

Our analysis also shed light on the influence of complications on women's use of and preferences for health facilities. While we found that complications stimulate women to deliver at a hospital (and the more so for richer women), the influence of complications on women's preferences is less clear. If anything, we found that preferences are less strongly correlated with socio-economic characteristics in the emergency treatment than in the normal treatment. This is not surprising given the fact that without high-quality obstetric care complications make women end up in life threatening conditions, which few people would question. Besides analyzing the influence of complications on women's preferences, a useful extension to our research would be to analyze the causes and effects of the *anticipation* of such complications. As suggested by the identified effect of former complications on women's preferences in our analysis, there might be substantial variation in individual beliefs about future complications. A further investigation of factors that influence women's beliefs and its behavioural effect would certainly be a promising extension to our research.

Finally, the starting point for our research was that little medical assistance is available for home delivery, and therefore women need to be stimulated to give birth at health centres where skilled care is available. However, for those women who prefer delivery at home over delivery at a health facility, it is perhaps better to increase the coverage of home deliveries by skilled assistance. An interesting way to do so is through the use of domiciliary care practices (NBS 2007). The results of our analyses may be relevant here as well. Our analysis of women's preferences indicates that particular groups of women may need to be convinced of the importance of high-quality care, even if this care is brought directly to them.

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