# Modelling Factors Influencing the Choice of Delivery Place at Birth among Pregnant Women in Rwanda Using Multinomial Logistic Method

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**Abstract:** *A significant number of women in developing countries, particularly in the sub-Saharan countries, do not have the opportunity to be attended to by skilled personnel during childbirth. This is a major factor in maternal mortality. Maternal mortality rates in Rwanda decreased from 476 per 100,000 live births in 2010 to 290 maternal deaths per 100,000 live births in 2015. The Rwandan health system is strengthened so that women have the opportunity to be attended by skilled personnel during childbirth in health facilities, but there still a significant proportion of deliveries taking place at home. Little is known about what influences the women's choice of place of delivery. This study used the Rwanda Demographic and Health Survey (RDHS) 2014-2015 data to model social economic and demographic factors that influence the choice of a place of delivery among women in Rwanda. the study population are women aged 15 – 49 years. The descriptive analysis along with chi square test and multinomial logit model were used to examine the factors that influence the choice of a place of delivery among women in Rwanda. Results from final model revealed that women's education, number of ANC visits, women's place of residence and women's age have been shown to be important factors that influence the women's choice of delivery at birth but strong association were found when comparing public health facilities with delivery at home.*

**Keywords:** Choice of delivery place, birth among pregnant women

## 1. Introduction

Good health in general and maternal health in particular, plays a major role in poverty alleviation and human development (Thomas, 1997). For that reason, targeting health investments on women is a strong lever for development policy. Investing in maternal health means that mothers are helped to live and to effectively involve themselves in economic development (Thomas, 1997). Improving maternal health was 1 of the 8 Millennium Development Goals (MDGs) adopted by the international community in 2000. Under MDG 5, countries committed to reducing maternal mortality by 3 quarters between 1990 and 2015. Since 1990, the number of maternal deaths worldwide has dropped by 43%. In sub-Saharan Africa, a number of countries halved their levels of maternal mortality since 1990. In other regions, including Asia and North Africa, even greater headway was made. Between 1990 and 2015, the global maternal mortality ratio (i.e. the number of maternal deaths per 100 000 live births) declined by only 2.3% per year between 1990 and 2015 (UN, 2015).

Now countries have united behind a new target to reduce maternal mortality even further. One target under Sustainable Development Goal 3 (SDGs) is to reduce the global maternal mortality rate to less than 70 per 100 000 births, with no country having a maternal mortality rate of more than twice the global average. Women die as a result of complications during and following pregnancy and childbirth. Most of these complications develop during pregnancy and most are preventable or treatable. This is the reason why, all women need skilled care during childbirth, care and support in the weeks after childbirth. It is particularly important that all births are attended by skilled health professionals, as timely management and treatment can make the difference between life and death for both the mother and the baby.

The World Health Organization (WHO) reported, every day, approximately nearly 830 women die from pregnancy- or childbirth-related complications around the world and 99% of all maternal deaths occur in developing countries. Moreover that, the risk of a woman in a developing country dying from a maternal-related cause during her lifetime is about 33 times higher compared to a woman living in a developed country which means there is a great gap between the status of mothers 'well-being in the developed country compared to those in the developing countries. This implies the maternal health is a global priority. The maternal mortality rate in developing countries in 2015 is 239 per 100 000 live births versus 12 per 100 000 live births in developed countries. There are large disparities between countries, but also within countries, and between women with high and low income and those women living in rural versus urban areas.

A significant number of women in developing countries, particularly in the sub-Saharan countries, do not have the opportunity to be attended to by skilled personnel during childbirth. Worldwide, about one third of births take place without the assistance of skilled health personnel. In 2014 alone, this translated into more than 40 million unattended births in low and middle-income countries, about 90 per cent of which were in South Asia and sub-Saharan Africa. The inadequate or non-existent care during pregnancy and delivery is largely responsible for the annual deaths of an estimated 289,000 mothers and 2.8 million newborns in the first month of life. Indeed, roughly three quarters of all maternal deaths take place during delivery and in the immediate postpartum period.

To improve maternal and newborn survival, skilled health personnel (a doctor, nurse or midwife) should be capable of handling normal deliveries safely. They must also be able to recognize warning signs for complications and

refer the mother to emergency care. Non-skilled attendants, including traditional birth attendants, can neither predict nor cope with serious complications, which are the leading killers of mothers during and after childbirth. As maternal mortality remains a pressing problem in the developing world, Rwanda; a densely populated country of about 11 million people located in central Africa, since the 1994 genocide against Tutsi, has seen impressive achievements for maternal and child health, but still has one of the highest maternal mortality rates in the world, estimated to be 290 maternal deaths per 100,000 live births in 2015, decreased from 476 per 100,000 live births in 2010.

This progress has been attributed to some factors, which have contributed to strengthen the Rwanda health system and to make quality services accessible to the population. Key factors include the introduction of a community health insurance scheme that contributed to the removal of barriers to access health services and the use of community health workers as one strategy to address the shortage of health workers. Geographical access to health services has been also improved with the construction and rehabilitation of new district hospitals and health centers, so that patients are facilitated to reach the health facility. All those factors show Rwandan women have the opportunity to be attended by skilled personnel during childbirth in health facilities. Now, according to Rwanda Demographic and Health Survey 2014-2015 (RDHS), 91% of births occur at a health facility and among them 90% took place in a public health facility, and only 1% took place in a private facility. 8% of women still deliver at home assisted by untrained persons (non-qualified health workers, traditional birth attendants, and relatives or other persons) and this is a major factor in maternal and infantile mortality.

The above information shows that some women still deliver at home despite various health policies that have been developed; and this shows that there is an underlying problem that should be addressed so that the number of women delivering at home assisted by untrained persons in Rwanda could be reduced even further. This study seeks to find out what influences the choice of place of delivery. It also seeks to agree or disagree with some of the past studies and finally to add to the already existing literature on maternal health.

## 2. Overview of Past Studies

According to WHO, safe delivery service is one of the most important maternity care issues for women who are pregnant. Since every pregnancy may be subject to complications, women are advised to deliver their babies in a health facility so that they access emergency services if needed during labor, delivery, and post-delivery. According to WHO/UNFPA/UNICEF/World Bank. statement (1999:1), the term skilled attendant refers exclusively to people with midwifery skills who have been trained to proficiency in the skills necessary to diagnose and manage normal deliveries or refer when there are complications. Traditional birth attendant: Independent (of health system), non-formally trained and

community – based providers of care during pregnancy, childbirth and the postnatal period (WHO 2004a:2). This study employed the WHO definition of a traditional birth attendant as its operational definition.

Skilled birth attendance for women in most developing countries follows a pattern similar to the use of health facilities. The reason being skilled personnel can only be found in health facilities. Presence of a skilled birth attendant at delivery has been greatly emphasized in all the international initiatives of maternal health. According to the world health organization (WHO) a skilled birth attendant is, an accredited health professional such as a midwife, doctor, or nurse who has been trained to proficiency in the skills needed to manage normal pregnancies, childbirth and the immediate postnatal period (WHO, 2004). The World Bank claims that in all the countries where skilled birth attendance is higher than 80%, the maternal mortality ratios are estimated to be less than 200 per 100,000 births. Skilled birth attendance refers to a skilled attendant operating within an enabling environment or health system capable of providing care for normal deliveries, as well as appropriate emergency obstetric care for all women who develop complications during childbirth (Canavan, 2009). Skilled birth attendance at delivery is advocated as the most important factor in preventing maternal deaths (WHO, 1999). Even so, many women (57%) in low-income countries deliver at home without skilled help; millions of women survive but suffer from morbidity related to pregnancy and childbirth. It is estimated that for each maternal death; 30 to 50, morbidities occur (WHO, 2010). Use of skilled attendants at delivery has been identified as a key indicator of the achievement of the Millennium Development Goals adopted by the United Nations in the year 2000.

Different studies have shown that poverty is the most frequently cited reason for preferring home delivery. Other major reasons include; traditional views, religious fallacy, poor roads conditions, lack of transportation to reach the nearest health facility. The study in Nigeria, shows that in most developing countries, a number of women still prefer to deliver at home than to deliver in the health facilities. Some of the reasons given by those who chose home as a preferred place of delivery includes cost of hospital bill, unfriendly attitude of health care workers, unexpected labor, distance to the health facilities, failure to book for ANC and others had no particular reason for choosing home as a place to deliver.

According to Kistiana 2009, Chakra borty et al, 2003, older women are more likely to use health facilities compared to the young women. This is due to the fact that older women are possibly more confident and influential in household's decision making than younger women and adolescents in particular. Furthermore, older women may be told by health workers to deliver in a facility since older age is a biological risk factor. However, being older can negatively influence the choice of place of delivery, this could be attributed to non-complicated pregnancies in the past. Older women may be long to older traditional cohorts and thus be less likely to use modern facilities than young women. (Sadiq, 2013) The age at first

pregnancy was also found to be another determinant as more women who had the first pregnancies before the age of 18 years delivered at home.

The studies related to the trends and uses of skilled attendants have noted that the more educated and wealthier women are, the more likely that they will have their births attended to by a professional health practitioner (Luc et al 2003:43).According to Obago, 2013 et al, education for women increases the likelihood of women delivering in a modern health facility. the more educated and wealthier women are, the more likely that they will have their births attended to by a professional health practitioner. They are more likely to seek modern health care than those who are not. Education is likely to improve the general status of women and help them to build up confidence to make decisions about their own health. Educated women could have better access to information through reading and following media about maternal health care and they could have better knowledge about the advantages of maternal health care and pregnancy related complications.

Different studies show, not only women's education level influences her choice on delivery place at birth, but also husband educational status. Those women whose husbands' illiterate were less likely to choose health facility as delivery place when compared to women whose husbands were receive secondary education and above. This finding was comparable with other study conducted in Syrian. Owino, 2001; Hasan et al 2008; Mekonnen and Mekonnen, 2002, suggested that living in the urban area increases the likelihood of women using the health facilities during delivery. The main reason could be the accessibility, availability and quality of services at the health facilities as in most developing countries, urban areas are more developed than rural areas. Those studies show that most important significant predictors of choosing an informal delivery setting (home) are the household's distance from the nearest maternity centre and whether a household member has insurance. The obstacle effect of distance is stronger when combined with lack of transport and poor roads. Transport in rural areas is extremely hard for different factors: most villages are far from the main road, to get public transport they go more kilometers by foot, the cost of transport is not affordable and during the rainy season the roads are washed away and too muddy or impassable.

Studies show that antenatal care visits increase the likelihood of delivering at a health institution where women who never attended ante natal care visits were less likely to deliver in a health facility (Obago, 2013). To be effective, antenatal care must be sought early during the pregnancy, preferably in the first semester; more important, it must continue regularly through to delivery. The World Health Organization (WHO) recommends at least four ANC visits at regular intervals throughout the pregnancy, as does the Rwandan health system. However, a study by Breen and Ensor (2011) argue that, receiving antenatal care during the first trimester of pregnancy does

not increase the likelihood of later use of skilled attendance during delivery. In contrast, receiving antenatal care in several occasions has a significant effect on the use institutional delivery services.

## 3. Research Methods and Procedures

This study was a quantitative non-experimental study design.

Quantitative design is objective. There is normally one reality whereby control and prediction can be done. It is context free; participants are referred to as subjects while the researcher is not part of the research process. This study is focusing on choice of place of delivery place at birth; therefore, information on the most recent births is necessary. Hence, the population of interest is women aged 15 – 49 years who gave birth in the last five years preceding the survey. The chosen age group represents women in the reproductive age bracket. This is considered to be the age range when a female could become pregnant. Age group 15 -18 years though considered under age, was included in the study because of existence of teenage pregnancies that contribute to maternal mortality.

This study analyzes the data from the Rwanda Demographic and Health Survey (RDHS) conducted in 2014-2015 by the National Institute of Statistics of Rwanda. This is a nationally representative sample survey of 13,497 women age 15-49 and 6,217 men age 15-59 from 12,699 interviewed households selected from 492sample clusters throughout Rwanda.

The 2014-15 RDHS is a follow-up to the 1992, 2000, 2005, 2007-08, and 2010 RDHS surveys. Each survey provides data on background characteristics of the respondents, demographic and health indicators, household health expenditures, and domestic violence. The survey is designed to provide data for monitoring the population and health situation in Rwanda. The 2014-15 RDHS utilized a systematic two stage sampling technique based on the 2012 population and housing census, during the selection of households to be included in the sample, and the design used was cross sectional.

## 4. Empirical Results and Discussion

Descriptive analysis along with chi-square test and multinomial logistic regression were used to identify the predictors of women's place of delivery at birth. Primarily, the percentage distribution of study sample was presented by the various selected characteristics women's socio economic and demographic characteristics while the study applied cross-tabulation using (chi-square) techniques to compare proportion. Furthermore, A multinomial logistic regression was then employed to examine the net relationship between all the independent variables and the outcome variable. A p value <5% and 10% were considered statistically significant.

**Table 1:** Women's place of delivery at birth by socio economic and demographic factors

| | | | Place of delivery | | | | Bivariate test |
|---|---|---|---|---|---|---|---|
| | | | Home | Private | Public | Total | |
| Age category | 15-19 | N | 5 | 0 | 144 | 149 | Chi-square=116.20 P-value = 0.000 |
| | | % | 3% | 0% | 97% | 100% | |
| | 20-24 | N | 41 | 13 | 1,052 | 1,106 | |
| | | % | 4% | 1% | 95% | 100% | |
| | 25-29 | N | 82 | 37 | 1,537 | 1,656 | |
| | | % | 5% | 2% | 93% | 100% | |
| | 30-34 | N | 129 | 43 | 1,347 | 1,519 | |
| | | % | 8% | 3% | 89% | 100% | |
| | 35-39 | N | 100 | 37 | 779 | 916 | |
| | | % | 11% | 4% | 85% | 100% | |
| | 40-44 | N | 55 | 11 | 404 | 470 | |
| | | % | 12% | 2% | 86% | 100% | |
| | 45-49 | N | 23 | 2 | 113 | 138 | |
| | | % | 17% | 1% | 82% | 100% | |
| | Total | N | 435 | 143 | 5,376 | 5,954 | |
| | | % | 7% | 3% | 90% | 100% | |
| Place of residence | Rural | N | 395 | 85 | 4,157 | 4,637 | Chi square = 71.3 P-value = 0.000 |
| | | % | 9% | 2% | 89% | 100% | |
| | Urban | N | 40 | 58 | 1,219 | 1,317 | |
| | | % | 3% | 4% | 93% | 100% | |
| | Total | N | 435 | 143 | 5,376 | 5,954 | |
| | | % | 7% | 3% | 90% | 100% | |
| Education Level | High | N | 1 | 25 | 132 | 158 | Chi square =250.8 P-value= 0.000 |
| | | % | 1% | 16% | 84% | 100% | |
| | Secondary | N | 15 | 29 | 677 | 721 | |
| | | % | 2% | 4% | 94% | 100% | |
| | Primary | N | 292 | 71 | 3870 | 4233 | |
| | | % | 7% | 2% | 91% | 100% | |
| | No education | N | 127 | 18 | 697 | 842 | |
| | | % | 15% | 2% | 83% | 100% | |
| | Total | N | 435 | 143 | 5,376 | 5,954 | |
| | | % | 7% | 2% | 90% | 100% | |
| ANC visits | | Mean | 2.7 | 3.4 | 3.3 | 3.3 | |
| | | s.d | 1.1 | 1.1 | 0.8 | 0.9 | |

The above table 1 shows the distribution of women's place of delivery by selected socio economic and demographic characteristics and the association between those variables. Chi square test was used to check whether there is an independence between each of the selected women's characteristics with the dependent variable. Therefore, the results revealed that there is a strong association between women's education and place of delivery at birth(Chi2=250.8 P-value= 0.000); a strong association between place of residence and place of delivery at birth(Chi2 = 71.3, P-value = 0.000) and there is also a strong association between women's age category and place of delivery at birth(Chi2= 116.20, P-value = 0.000). Multinomial Logistic Regression Model.

**Table 2:** Association between selected socio economic and demographic characteristics and women's place of birth aged 15-49 in Rwanda

| | Coefficient(B) | p-value | 95% CI | |
|---|---|---|---|---|
| *1. Public "Base outcome "* | | | | |
| *2. Home vs Public* | | | | |
| *Age category (15-19)* | | | | |
| *20-24* | 0.06 | 0.90 | -0.89 | 1.02 |
| *25-29* | 0.24 | 0.61 | -0.69 | 1.18 |
| *30-34* | 0.82 | 0.08 | -0.10 | 1.75 |
| *35-39* | 1.06 | 0.03 | 0.13 | 1.99 |
| *40-44* | 0.96 | 0.05 | 0.01 | 1.92 |
| *45-49* | 1.41 | 0.01 | 0.39 | 2.43 |
| *Place of residence ( Rural)* | | | | |
| *Urban* | -0.83 | 0.00 | -1.18 | -0.49 |
| *Education ( High education)* | | | | |
| *No education* | 2.1 | 0.04 | 0.10 | 4.10 |

| | *Coefficient(B)* | *p-value* | *95% CI* | |
|---|---|---|---|---|
| *1. Public "Base outcome "* | | | | |
| *Primary* | 1.49 | 0.14 | -0.50 | 3.48 |
| *Secondary* | 0.67 | 0.52 | -1.38 | 2.72 |
| *ANC visits* | -0.66 | 0.00 | -0.76 | -0.55 |
| *3. Private vs Public* | | | | |
| *Age category ( 15-20)* | | | | |
| *20-24* | 14.15 | 0.99 | -1720.08 | 1748.39 |
| *25-29* | 14.78 | 0.99 | -1719.45 | 1749.02 |
| *30-34* | 15.04 | 0.99 | -1719.20 | 1749.28 |
| *35-39* | 15.5 | 0.99 | -1718.74 | 1749.73 |
| *40-44* | 14.96 | 0.99 | -1719.28 | 1749.20 |
| *45-49* | 14.65 | 0.99 | -1719.59 | 1748.89 |
| *Place of residence ( Rural)* | | | | |
| *Urban* | 0.33 | 0.11 | -0.07 | 0.74 |
| *Education ( High education)* | | | | |
| *No education* | -1.74 | 0.00 | -2.46 | -1.02 |
| *Primary* | -2 | 0.00 | -2.57 | -1.42 |
| *Secondary* | -1.12 | 0.00 | -1.73 | -0.52 |
| *ANC visits* | -0.01 | 0.88 | -0.19 | 0.17 |

**Note**

a) Dependent Variable: women's place of delivery at birth with three levels "Public, Private, and Home"

b) public is referred here as "Base Outcome" which means that both Private and Home place of delivery are interpreted referring to Public place of delivery

c) Reference group for categorical independent variable referred in parenthesis ( )

d) Level of significance is at 5% and 10%

e) RRR = exp (coefficient). This means that RRR can be obtained by exp (coefficient)

In this study the dependent variables are; home delivery, public hospital delivery and private hospital delivery. Public hospital delivery is the base outcome.

It is considered as the baseline comparison group. Therefore, the multinomial logit will show the results for home and private hospital delivery in comparison to public hospital delivery.

Multinomial logistic regression was used to compare the women's birth delivery at private, home with delivery at public as the reference category after adjusting for women's age category, women's place of residence, women's education level and number of antenatal care visits. Each factor that had a significant association with the response variable and was interpreted in terms of having been statistically controlled for the influences of other explanatory variables included in the model. Also, the predictor/independent variables are both categorical (women's age category, women's place of residence, women's education level) and numerical categorical (Number of antenatal care visits). Therefore, interpretation for categorical variables whereby made in terms of a reference categories which are in parentheses.

Coefficients (B) are the estimated multinomial logistic regression coefficients for the model. Since the parameter estimates are relative to the referent group, the standard interpretation of the multinomial logit is that for a unit change in the predictor variable, the logit of outcome m relative to the referent group is expected to change by its respective parameter estimate given the variables in the model are held constant. 95% CI is the Confidence Interval (CI) for an individual multinomial logit regression coefficient given the other predictors are in the model for outcome m relative to the referent group. For a given predictor with a level of 95% confidence, we'd say that we are 95% confident that the "true" population multinomial logit regression coefficient lies between the lower and upper limit of the interval for outcome m relative to the referent group. It is calculated as the Coef. $\pm$ $(z_{\alpha/2})$ *(Std.Err.), where $z_{\alpha/2}$ is a critical value on the standard normal distribution. The CI is equivalent to the z test statistic: if the CI includes zero, we'd fail to reject the null hypothesis that a particular regression coefficient is zero given the other predictors are in the model. An advantage of a CI is that it is illustrative; it provides a range where the "true" parameter may lie. Our multinomial regression model shows that Women who had over 30 years i.e. [(30-34 age with B=0.81 ,p value=0.08);( 35-39 age with B=1.06 , p value=0.03) ; (40-44 age with B=0.96, P-value=0.05,(45-49 age with B=0.96 , p=0.01) ] were found to be statistically significance and had high odds than women aged 15-19 to give birth at home compared to delivering at public health facility. This is due to the factor that being pregnant at older age could be attributed to non-complicated pregnancies in the past. Older women may be long to

more older traditional cohorts and thus be less likely to use modern facilities than young women.

Women who resided in urban area (B=-0.84, p-value =000) were significantly less likely than women who live in rural area to give birth at Home compared to public health facility. Women who were illiterate were found to be statistically significant had high odds ((B=2.1, P-value=0.04) than women who had high education level to give birth at Home compare to delivering at public health facility. Other levels of education (primary, secondary) were found to be insignificant with place of delivery. In regards with antenatal care visits, the results revealed that the ANC visits (B=-0.66, P-value=0.00) had reduced the likelihood of giving birth at home compared to public. This implies that women who visit health facilities for ante natal care have high chance to deliver at public health facility than delivering at home/on way.

In this study, numbers of ANC visits were found to be positively correlated with giving birth at public healthcare facilities compared to home delivery. This implies that number of visits as well as content of services received have significant effect on mothers' preferences for places to give birth. When comparing private and public health facility, the effect of rural/urban residence, women's age category and ANC visits were not statistically significant after controlling for other variables. However, women's education was found to be associated with place of delivery.

## 5. Conclusion

The observation that utilization of public health facilities was high among younger age groups compared to older women was interesting and factors that demotivate older women from utilizing health facilities need to be studied further. Although the high number of ANC visits among women in Rwanda notable pregnant women especially among rural place of residence still chose to deliver at home, Level of literacy still determines uptake of delivery services. To prevent women from reverting back to home delivery, effective communication and particularly counselling of women during ANC visits about the danger signs and complications of pregnancy and childbirth should be enhanced, and concerted effort should be made to encourage every pregnant woman to attend ANC services. Efforts should be directed at the healthcare facilities so that they should provide quality ANC services. Also, the study revealed that educated women's have high preference of the private health facilities in Rwanda is that they may offer better quality services than that offered in the public facilities. Research recommends that due to women's less level of education may back them to delivery at home, there is need to develop reproductive health programs that lead to closer and more community engagements with the health workers in order to sensitize the community and give correct information and messages to guide women in decision making on the place of delivery. The adequacy of ANC visits should be enhanced because available evidences and content of services received have significant effect on mothers' preferences for places to give birth.

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