Socioeconomic Inequality in Maternal Healthcare Services: The Case of Tanzania

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Abstract
Low utilisation of maternal healthcare among women in developing countries increases the health risk of the child and mother during pregnancy, childbirth, and the postnatal period. It is in this context that this study intends to assess socioeconomic inequalities in maternal healthcare utilisation in Tanzania using the 2004/05, 2010, and 2015/16 Demographic and Health Survey. We first use the Concentration index to measure the presence of inequalities. Thereafter, we execute decomposition analysis to examine contributing factors of inequality in maternal healthcare utilization. Results from the Concentration index indicate that there is pro-rich inequality in maternal health utilisation and has increased over time. Meanwhile, the decomposition analysis reveals that household wealth status and women's education level contribute to the observed inequality. This could be due to the long distance to the health facilities, inadequate capacity of health facilities, and sociocultural barriers. We thus recommend that maternal healthcare in Tanzania should target the less privileged pregnant women to redress the inequality problem and ultimately alleviate maternal and child death rates in Tanzania.

Keywords: Maternal healthcare; Inequality; Concentration Index; Decomposition analysis; Tanzania

JEL Classification Codes: I14, C12

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1. Introduction

The present study is aimed at exploring trends and causes of socioeconomic inequalities in maternal healthcare utilization in Tanzania. For this study, maternal health denotes the health of women during pregnancy, childbirth, and the postnatal period[1]. Access to basic services during each stage is important to improve maternal health outcomes including economic growth (Kinyondo and Byaro, 2020; Byaro *et al.*, 2018; Byaro *et al.*, 2017). Evidence shows that a good attendance of antenatal care, facility delivery attended by a skilled health worker, and utilization of postnatal services improve maternal health outcomes. But, women from the developing world are not enjoying similar benefits as their counterparts in the developed region. Inequalities within populations and between populations persist despite international and national commitments in reducing the rising inequalities. Maternal healthcare-related services use is also reported to vary within developing countries, with most findings showing differences between wealthy and poor women, and between women living in urban and rural areas.

The World Health Organization (WHO) estimated that 295,000 women died from pregnancy-related causes that are preventable in 2017 (WHO *et al.*, 2019). Most of these deaths occurred in Sub-Saharan Africa (66%) and Asia (20%) in 2015 (WHO *et al.*, 2019). Globally, the maternal mortality ratio stands at 211 deaths per 100,000 live births while the average in sub-Saharan Africa is at 542 maternal deaths per 100,000 and that in Europe at 10 per 100,000 live births (WHO *et al.*, 2019). Sustainable Development Goal (SDG) target 3.1 aims at reducing the global maternal mortality rate of less than 70 per 100,000 live birth by 2030 (UN, 2015). Maternal deaths remain to be a major challenge to the public health system in developing countries including Tanzania if the stated UN numbers are anything to go by.

The recent status of maternal healthcare utilization in Tanzania indicates that health initiatives in the country are reaping some benefits. Indeed, various indicators of maternal healthcare access and utilization show improvements. For instance, women who received antenatal care from a skilled health professional during the pregnancy increased from 93% to 98% in 2015/16 (NBS and ICF Macro, 2005, 2016). Meanwhile, the number of antenatal visits for pregnancy meetings as recommended by WHO (4+ visits) was high in 2004/05 (62%) then dropped to 43% in 2010 and thereafter increased to 51% in 2015/16 (NBS and ICF Macro, 2005, 2016). Moreover, the same data shows that the percentage of pregnant women having their antenatal care visit (ANC) in the first trimester (i.e. less than 4 months) has increased from 15% in 2010 to 24% in 2015/16 (NBS and ICF Macro, 2005, 2016). In addition, delivery at health facilities has shown a consistent rise from 47% in 2004/05 to 50% in 2010 then to 63% in 2015/16 (NBS and ICF Macro, 2005, 2016).

Despite the stated progress, reducing maternal mortality from 854 in 2000 per 100,000 to 524 in 2017 in the country leaves a lot to be desired. This is because the improvement is far from the expected target of 70 death per 100,000 births. Besides, the country is only second to Burundi in terms of having a high maternal mortality ratio among East African countries(WHO *et al.*, 2019). Moreover, Tanzania's lifetime risk of maternal death is 1 in 36 which is the highest in East Africa (WHO *et al.*, 2019). Needless to say then that maternal health care in Tanzania still faces

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[1] https://www.euro.who.int/en/health-topics/Life-stages/maternal-and-newborn-health/maternal-and-newborn-health

huge challenges. The fact that the sluggish improvement persists even after the country decided to internalize maternal health care issues in the country's Second Five Year Development Plan (2016/17 -2020/21) which aimed at reducing the maternal mortality ratio down to 250 per 100,000 live births by 2020 through interventions like strengthening the health system, equipping hospitals with equipment, and training of health staffs to mention few (URT, 2016) raises the question of what exactly could be responsible for the problem. It is in this context that we hypothesize that socioeconomic inequality in maternal healthcare services could be the reason behind this conundrum and assessing that fact is at the core of this present study.

The remainder of this study is organized as follows. Section 2 reviews the literature and presents the conceptual framework. Section 3 presents the methodology. Section 4 presents and discusses the estimated results. Section 5 concludes.

2. Literature Review

Inequalities in maternal healthcare utilization are the results of barriers in accessing services. Most of these barriers are socioeconomic (Silal *et al.*, 2012; Pulok *et al.*, 2016). The presence of socioeconomic challenges implies that there are inequalities in the utilization of maternal healthcare services. Most of the empirical studies have focused on the determinants of maternal healthcare utilization in developing countries (Fekadu, Ambaw and Kidanie, 2019; Mekonnen *et al.*, 2019; Tiruaynet and Muchie, 2019). Determinants of utilization of maternal healthcare include educational attainment (Regassa, 2011; Singh *et al.*, 2012; Joshi *et al.*, 2014; Prusty, Gouda and Pradhan, 2015; Pulok *et al.*, 2016; Somefun and Ibisomi, 2016; Fekadu, Ambaw and Kidanie, 2019; Mekonnen *et al.*, 2019; Tiruaynet and Muchie, 2019); difference of ethnicity (Tiruaynet and Muchie, 2019); exposure to mass media (Regassa, 2011; Pulok *et al.*, 2016); place of residents (Singh *et al.*, 2012; Fekadu, Ambaw and Kidanie, 2019; Khaki, 2019; Mekonnen *et al.*, 2019; Tiruaynet and Muchie, 2019); wealth status (Singh *et al.*, 2012; Joshi *et al.*, 2014; Prusty, Gouda and Pradhan, 2015; Pulok *et al.*, 2016; Somefun and Ibisomi, 2016; Fekadu, Ambaw and Kidanie, 2019; Mekonnen *et al.*, 2019; Tiruaynet and Muchie, 2019); working status of the women (Fekadu, Ambaw and Kidanie, 2019; Khaki, 2019); previous use of contraceptive (Mekonnen *et al.*, 2019); women's age (Joshi *et al.*, 2014; Khaki, 2019); distance to health facility (Somefun and Ibisomi, 2016) as well as the level of parity (Regassa, 2011; Joshi *et al.*, 2014).

On the other hand, some studies have focused on the extent and nature of inequalities in the distribution of maternal healthcare utilization (Harris *et al.*, 2011; Abalo, Agbodji and Batana, 2014; Saito *et al.*, 2016; Cai, Coyte and Zhao, 2017; Fenny *et al.*, 2018)'(Harris *et al.*, 2011; Saito *et al.*, 2016; Cai, Coyte and Zhao, 2017; Fenny *et al.*, 2018). Findings indicate that factors that contribute to inequality in maternal healthcare utilization include wealth status (Harris *et al.*, 2011; Asamoah *et al.*, 2014; Kamal *et al.*, 2016; Pulok *et al.*, 2016; Saito *et al.*, 2016; Fenny *et al.*, 2018); women's age (Cai, Coyte and Zhao, 2017); lifestyle (Cai, Coyte and Zhao, 2017); education attainment (Asamoah *et al.*, 2014; Cai, Coyte and Zhao, 2017); race (Harris *et al.*, 2011); physical access (Fenny *et al.*, 2018), as well as the level of parity (Asamoah *et al.*, 2014). This study adds to the body of knowledge on inequalities in maternal healthcare utilization in that it seeks to understand the phenomenon from Tanzania's context. The context matters and it is a fact that there have been very few studies on the topic in Africa and most have been conducted in Ghana (Asamoah *et al.*, 2014; Fenny *et al.*, 2018), and South Africa (Harris *et al.*,

2011; Silal *et al.*, 2012). Otherwise, the majority of similar works have been conducted in Asian countries (Prusty, Gouda and Pradhan, 2015; Kamal *et al.*, 2016; Saito *et al.*, 2016; Cai, Coyte and Zhao, 2017).

Importantly, our study differs with few similar studies which have been conducted in Tanzania. For instance, a study by Langa and Bhatta (2020), while it uses Demographic and Health Survey (DHS) data like ours, it mainly focuses on the rural urban divide when it comes to inequality in accessing maternal health services. Besides, the study uses a different methodology (i.e. bivariate statistics and logistics regressions) and employs only four variables (i.e., antenatal care, skilled delivery assistance, and the before and after discharging postnatal care) with independent variables being wealth, education, residence, parity, occupation, age, and the head of the household's sex. Meanwhile a study by Hanson et al (2017) uses a combination of the 2007 census and 2013 DHS data to determine geographical inequalities of maternal health services in Tanzania. Only descriptive statistics and interviews were used to come up with findings that access for rural women is still low.

The closests work to our study is that by Bintabara (2021) which uses three waves of DHS data and employs the same methodology. However, Bintabara (2021) measures inequality focusing on institutional delivery and skilled birth attendance in accessing safe child birth, the two dimensions which do not form part of our investigation. Indeed, our paper differs from hers since we examine inequality on three different dimesions namely *place of delivery*, *timing for the first antenatal care (ANC)* and *the number of ANC*.

Recall four types of academic contributions as presented by Voss (2003): Firstly, a contribution can be made through *incremental innovation* which is basically a smaller but subtle addition to previous work such as adding a new variable to the model in question or changing methodology. Secondly, the contribution could be *environmental* which basically implies testing a model to a different setting. Thirdly, the contribution may be *modular* in that one could decide to redefine a specific conceptual construct. And lastly, the contribution could be *architectural* or *radical* if the aim of a research work is to completely change the way scholars view a particular phenomenon. Needless to say in this particular case our contribution is incremental in that we are examining inequality using variables that have been never used in previous studies.

Moreover, the goal to achieve universal healthcare access in Tanzania cannot and should thus not be overemphasized. This study is therefore crucial not only for knowledge contribution in academia but also for policy-relevant recommendations.

2.1   Conceptual Framework

The study at hand is guided by Andersen's behavioural framework of healthcare utilization in the choice of control variables (Andersen, 1995, 2008). The model identifies and categorizes factors into contextual characteristics (i.e., health system), and individual characteristics (i.e., need factors, enabling factors, and predisposing factors) combine to influence health behaviours (i.e., personal health practice, the process of medical care, and use of personal health services), which influences health status outcomes (i.e., perceived health, evaluated consumer satisfaction).

The following factors are hypothesized to determine trends and causes of inequalities in maternal healthcare utilization based on the framework and the literature reviewed: health system factor-distance to the health facility and place of residence; predisposing factor-age, education, and zone of residence; enabling factors women's occupation, women's media access, and marital status; need factor-perceived need of the maternal healthcare; outcome- maternal healthcare utilization (i.e. Number ANC visit, place of delivery and timing of first ANC visit). The model has been applied widely in grouping factors in previous studies (Kim and Lee, 2016; Agbanyo, 2020).

3. Methodology
3.1 Data
The study uses secondary data from three rounds of the Tanzania Demographic and Health Survey (TDHS) conducted in 2004, 2010, and 2016. Surveys are conducted by the National Bureau of Statistics (NBS) with technical assistance from ICF International. The primary objective of the DHS is to obtain current and reliable information on demographic and health indicators about family planning, fertility levels and preferences, maternal mortality, infant and child mortality, nutritional status of mothers and children, antenatal care, delivery care, and childhood immunizations and diseases (NBS and ICF Macro, 2005, 2016). Procedures for data collection are similar in all rounds. The sample was drawn in two stages to ensure that it is nationally representative and covers both rural and urban areas of Tanzania mainland and Zanzibar. The first stage consisted of enumeration areas (EAs) where '*clusters*' are selected. The second stage is comprised of a systematic selection of households from each cluster. For this study, only women aged 15 to 49 who had given birth in the last five years preceding the survey(s) were considered.

3.2 Variables
The study at hand focuses on maternal healthcare utilization during women's pregnancy. Specifically, we use the timing of the first antenatal visit, number of antenatal visits, and place of delivery as the main outcome variables. World Health Organization (WHO) recommends pregnant women have their first antenatal visit within the first trimester of their pregnancy. Therefore, we dichotomize timing for the first ANC visit into one if visited within the first trimester of their pregnancy and 0 if not. Moreover, WHO recommends a minimum of at least four ANC visits during a woman's pregnancy[2]. A dummy equal 1 if a woman attended at least four ANC and 0 if not is created. In addition, women are recommended to deliver at a health facility to reduce preventable maternal and neonatal mortality and complications during and after birth. Therefore, a dummy variable equals 1 if women delivered at health facilities and 0 if not.

Household socioeconomic status was measured by the household wealth index, obtained from Principal Component Analysis (PCA) which is calculated by including household assets and other wealth facilities like ownership of assets and dwelling characteristics, source of drinking water as well as sanitation facilities (Montgomery *et al.*, 2000; Sahn and Stifel, 2003; Filmer and Pritchett, 2011). Finally, five wealth quantiles were constructed from the predicted wealth index.

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[2] Please note that in 2016, WHO's new antenatal care model increased the number of minimum required visits a pregnant woman should make to health providers throughout her pregnancy from four to eight. The present study adopts a minimum of at least four ANC which was the standard used during the data collection phase in Tanzania.

Moreover, decomposition of socioeconomic inequalities in maternal health care utilization different socioeconomic and demographic variables of the woman and households are included. The socioeconomic and demographic characteristics of a woman included women's age, access to mass media, occupation, marital status, and education. The increase in women's age implies an accumulation of awareness towards the utilization of maternal health care. Therefore, age was categorized into 15-24 years, 20-34 years, and 35-49 years to see the variation of inequalities in maternal health care use with the age of the woman. In addition, women's access to media, which implies information on maternal health care, which in turn suggests such women, can utilize maternal health care as they are much more informed. A dummy variable equals 1 if a woman has access to mass media and 0 if does not have access.

Employment enables women to earn income and thus making them less dependent on their spouses for financial assistance. It enables women to have power in the decision to utilize and access maternal health care. In addition, this would enable a woman to pay for maternal health-related costs. We thus categorize woman's occupations into non-working, professional working, self-employed, and manual working to see the variation of maternal health inequalities with the nature of the occupation of the woman. Moreover, women's education is an important determinant of maternal health utilization. This is because it not only raises women's awareness on the benefits of maternal health care use during pregnancy but also educated women are more likely to be employed making them financially independent and hence more likely to utilize maternal health care.

We also include a dummy of a woman's marital status equal to 1 if married and 0 if not married. It is hypothesized that married women would get financial support and advice from their spouses making them utilize more maternal health care than unmarried women. A dummy variable for a place of residence equals 1 if a woman lives in an urban area and 0 if from a rural area. Also, a dummy equals 1 if the distance to a health facility is a problem and 0 if not a problem. Lastly, we included a dummy for each zone of residence to capture the variation of inequalities with a zone of residence of the woman.

3.3 Analytical approach

A three-stage of analysis was conducted in this study. First, we used the concentration curve to identify the existence of socioeconomic inequalities in maternal health care utilization measured by timing of the first antenatal visit, number of antenatal visits, and the place of delivery. We thereafter computed the concentration index to quantify the degree of socioeconomic inequalities. Finally, we decompose the concentration curve to understand the socio-economic contributor of inequality. We discuss these methods in detail below.

3.3.1 Concentration curves

A Concentration curve provides a complete picture that shows the share of health variables accounted for by cumulative proportions of individuals in the population ranked from poorest to richest (Wagstaff et al, 1991). It identifies whether socioeconomic inequality in the health sector variable exists and whether it is more pronounced at one point in time than others or in one country than another (O'Donnell et al, 2008). For this study, the concentration curve is used to assess differences in maternal healthcare utilization across time in Tanzania (2004-2016). The concentration curve plots the cumulative percentage of the maternal healthcare utilization (y-

axis) against the cumulative percentage of the population, ranked by living standards, beginning with the poorest, and ending with the richest (x-axis) (O'Donnell *et al.*, 2008). We plot the concentration curve for 2004, 2010, and 2016 years for the selected maternal healthcare variables (i.e., number of ANC visits, place of delivery, and timing of the first antenatal visit).

3.3.2 Concentration indices

Concentration curves discussed above assess whether socioeconomic inequality in maternal healthcare utilization variables exists and whether it is more pronounced at one point in time than the other. The limitation of the concentration curve is that it does not give a measure of the magnitude of inequality that can be compared conveniently across several periods. The concentration index (CI) which is directly related to the concentration curve, does quantify the degree of socioeconomic-related inequality in a health variable (see Kakwani et al, 1997, 1980; Wagstaff et al, 1989). The application of concentration index has been used to measure and compare the degree of socioeconomic-related in various health variables (O'Donnell *et al.*, 2008). For this study, the concentration index is estimated following the Wagstaff et al., (2003) approach. Subsequently, the concentration index, which accounts for the feasible bound of CI for binary variables is estimated using the Wagstaff Index (WI) for a binary health indicator which can be written as:

$$WI = \frac{2}{\mu_H(1-\mu_H)} cov(H_i, Y_i) \tag{1}$$

Where Y_i is the fractional socioeconomic rank of an individual; μ_H, the mean health of the population and H_i, the health situation of the individual and $cov(H_i, Y_i)$ is the covariance between the health variable and the fractional rank of the determinants of maternal healthcare utilization.

3.3.3 Decomposition analysis

To examine the contribution of each determinant to maternal health care utilization, the linkage between the outcome variable and the set of determinants is expressed using a linear equation 2. Specifically, linear regression model to identify the linkage between our outcome variable to the set of determinants is estimated as follows:

$$y_i = \alpha + \sum \beta_k x_{ki} + \varepsilon_i, \tag{2}$$

Where y_i is the maternal healthcare utilization, x_{ki} is the maternal healthcare utilization determinants, ε is the error term, and β_k are the coefficients of determinants of maternal healthcare utilization. Then, following, Wagstaff et al., (2003) the outcome variable can be decomposed using equation 3 and therefore the standard concentration index (CI) can be written as follows:

$$CI(y) = \sum_k (\beta_k \bar{x}_k/\mu)C_k + GC_\varepsilon/\mu, \tag{3}$$

Where μ is the mean of the maternal healthcare utilization, $\bar{x}_k$ is the mean of x_k and C_k is the concentration index for $x_k x_k$. The first is the determinant or 'explained' component. The last component GC_ε is the generalized concentration index for $\varepsilon_i \varepsilon_i$, defined as:

$$GC_\varepsilon = \frac{2}{n} \sum_{i=1}^{n} \varepsilon_i Y_i, \qquad (4)$$

The second part of the equation (3) cannot be explained by systematic variation across groups in the determinants of maternal healthcare utilization, and cannot be calculated (van Doorslaer and Koolman, 2004). Therefore, *CI* in equation (3) is reduced to its first component and can be written as:

$$CI = \sum_{k} (\beta_k \bar{x}_k / \mu) C_k \qquad (5)$$

Therefore, the coefficient, Wagstaff Index (WI), contribution, and percentage contribution of determinants is estimated.

4. Estimated Results and Discussion
4.1 Results
Table 1 shows the descriptive statistics of the variable used in the estimation of the determinant of maternal health care inequalities. Results indicate that there has been an increase in maternal health care utilization between 2004 and 2016. For instance, we observe an increase in the proportion of women who attended their first ANC within the first trimester from about 14.1% in 2004 to 15.8% in 2010 and thereafter 22.9% in 2016. In addition, the proportion of women with a minimum of four ANC visits decreased from 62.4% in 2004 to 44.2% in 2010 and then increased to 49.7% in 2016. Moreover, the proportion of delivery at health facilities increased from 48.7% in 2004 to 53.7% in 2010 and then to 67.2% in 2016.

On socioeconomic determinants, women aged 20-34 consisted of the largest proportion across the three years of the survey. It represented 51.1% in 2004, 48.1% in 2010 and 47.7% in 2016. The proportion of women with secondary and above levels of education also increased from 13.7% in 2004 to 23.3% in 2010 and then increased to 27.3% in 2016. There is also a decrease in the proportion of women with no formal education from 24.5% in 2010 to 18.9% in 2010 and then to 15.1% in 2016. In addition, there is also a slight decrease of women with primary education levels from 61.8% in 2004 to 57.9 in 2010 and 57.6 in 2016. Furthermore, we witnessed an increase in the proportion of women with access to mass media. Also, the proportion of women residing in urban areas increased from 24.3% in 2004 to 31.2% in 2016.

Nevertheless, the proportion of women reporting distance to the health facility as a problem has remained high as we observe a slight decrease from 36.5% in 2004 to 35.8% in 2010 and thereafter increased to 39.9% in 2016. Equally, the results show that the proportion of married women has decreased from 65.7% in 2004 to 62.2% in 2010 and finally to 61.7% in 2016. Moreover, over the stated period, the economic status of households has improved as women from the poorest households decreased from 17.3% in 2004 to 16.2% in 2016. Further, women residing in the richest households increased from 23.9% in 2004 to 25.7% in 2016. The proportion of self-employed is high compared to other occupations despite experiencing a decrease from 61.1% in 2004 to 49.6% in 2010 and then 41.4% in 2016. Also, working women has increased over the stated period while women working in manual works increased from 15% in 2004 to 31.3% in 2016. We also observed a slight increase in women with professional work from 2.3% in 2004 to 3.2% in 2016.

Table 1: Descriptive statistics

Variable	2004/05		2010		2015/16	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Outcome variable						
Timing of first ANC visit	0.141	0.348	0.158	0.365	0.229	0.420
Number of ANC visits	0.624	0.484	0.442	0.497	0.497	0.500
Place of delivery	0.487	0.500	0.537	0.499	0.672	0.470
Socioeconomic factors						
Wealth quintile						
Poorest	0.173	0.378	0.159	0.365	0.162	0.368
Poorer	0.183	0.387	0.187	0.390	0.163	0.370
Middle	0.181	0.385	0.188	0.391	0.184	0.387
Richer	0.225	0.418	0.226	0.418	0.234	0.424
Richest	0.239	0.426	0.240	0.427	0.257	0.437
Urban residence	0.243	0.429	0.256	0.436	0.312	0.464
Women media access	0.819	0.385	0.802	0.399	0.849	0.358
Distance is a problem	0.365	0.481	0.358	0.479	0.399	0.490
Women is married	0.657	0.475	0.622	0.485	0.617	0.486
Women's level of education						
No formal education	0.245	0.430	0.189	0.391	0.151	0.358
Primary education	0.618	0.486	0.579	0.494	0.576	0.494
Secondary and above	0.137	0.344	0.233	0.423	0.273	0.446
Woman's age						
Age 15-19 years	0.222	0.416	0.219	0.414	0.221	0.415
Age 20-34 years	0.511	0.500	0.480	0.500	0.477	0.499
Age 35-49 years	0.267	0.442	0.301	0.459	0.302	0.459

Variable	2004/05		2010		2015/16	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Zone of residence						
Western zone	0.087	0.282	0.083	0.276	0.079	0.270
Northern zone	0.107	0.310	0.100	0.301	0.095	0.293
Central zone	0.113	0.317	0.102	0.303	0.090	0.286
Southern highlands zone	0.067	0.250	0.069	0.254	0.082	0.274
Southern zone	0.065	0.246	0.062	0.242	0.055	0.228
South west highlands zone	0.078	0.268	0.065	0.247	0.095	0.294
Lake zone	0.165	0.371	0.174	0.379	0.232	0.422
Eastern zone	0.104	0.305	0.107	0.309	0.111	0.314
Zanzibar	0.214	0.410	0.236	0.425	0.161	0.368
Women's occupation						
Not working	0.217	0.412	0.240	0.427	0.242	0.428
Professional working	0.023	0.148	0.022	0.148	0.032	0.175
Self employed	0.611	0.488	0.496	0.500	0.414	0.492
Manual working	0.150	0.357	0.240	0.427	0.313	0.464

Source: Tanzania DHS 2004/05, 2010 and 2015/16

4.1.1   Inequality in maternal healthcare utilization

To present a picture of trends in inequality in Tanzania's maternal health care utilization between 2004 and 2016, we present concentration curves. The concentration curves lie below the line of equality in all three rounds of survey for all indicators of maternal health care utilization. Figure 1 shows a concentration of maternal health care utilization among the richest in Tanzania. Further, there is an observed increase in inequality for timing for the first antenatal visit and the number of antenatal visits to the health facility. However, there is an observed decrease in inequality in place of delivery between the three rounds of surveys.
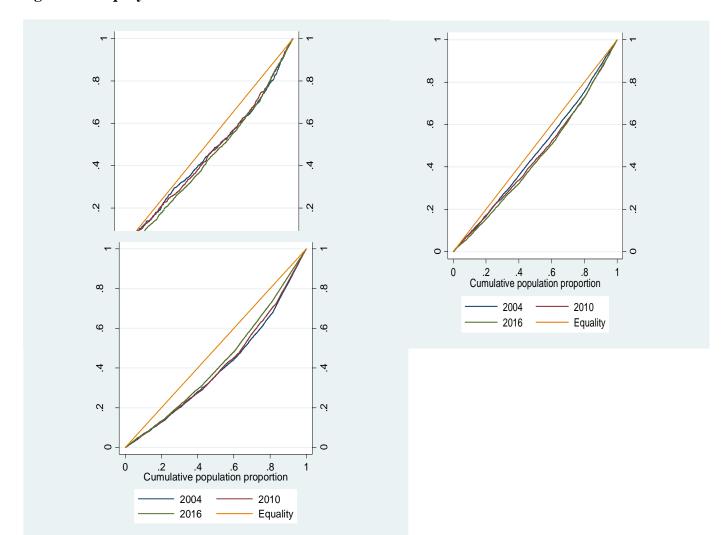
Figure 1: Inequity in maternal health service utilization

The degree of wealth-related inequality, as measured by Wagstaff Concentration Index (WI) is presented in Table 2. We estimate a positive value for the timing of the first visit, number of ANC, number of ANC visits, and place of delivery. Results indicate that the distribution of outcomes is concentrated among the richest. These findings confirm the results obtained from the concentration curves. Results show that inequality for the timing of first ANC visits and the number of visits increased from 0.0607 in 2004 to 0.1392 in 2016 and from 0.1617 in 2004 to 0.2375 in 2016, respectively. The result further shows that on the place of delivery, we observe an increase in inequality from 0.3990 in 2004 to 0.4222 in 2010 and then was a slight decrease to 0.4094 in 2016. In general, there is an observed inequity in maternal health care utilization in Tanzania and the extent of inequity has increased for the timing of first visit and number of ANC visits but for a place of delivery slightly increased in 2010 before experiencing decreased in 2016 again. Socioeconomic inequality was highest in fdelivery at a health facility.

Table 2: Socioeconomic inequality in maternal utilization

Variables	2004	2010	2016
Timing of first visit	0.0607***(0.0157)	0.0659***(0.0147)	0.1392***(0.0174)
Number of visits	0.1617***(0.0241)	0.1671***(0.0215)	0.2375***(0.0203)
Place of delivery	0.3990***(0.0226)	0.4222***(0.0225)	0.4094***(0.0201)

Notes: Robust standard error in parentheses; *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

4.1.2 Regression results

The association between maternal health care utilization estimated in Tables 3, 4, and 5 was estimated using Linear Probability Model (LPM). For comparison, we also estimate the average marginal effects obtained from Logistic regression. It is indicated that the magnitude and level of significance of estimates are similar for both the LPM and the average marginal effect.

The richest wealth quantile was observed to be positively associated with women timing for the first ANC visit during the first trimester in both periods. Furthermore, women residing in urban areas are less likely to attend their first ANC within the first trimester of their pregnancy in 2004 and 2010. Moreover, women's access to media was found to be positively associated first ANC with the first trimester of their pregnancy in 2004. Moreover, the distance to the health facility negatively affects the likelihood of women attending their first ANC within the first trimester of 2010. Women's education positively affects the likelihood of women having their first ANC within the first trimester of their pregnancy.

Meanwhile, women with primary and secondary positively affect the possibility of a woman having their first ANC within the first trimester in 2010 compared to women with no formal education. In addition, women aged 20-34 years were found to be positively associated with a woman attending ANC within the first trimester in 2016. Importantly, it was found that compared to women residing in the Western zone of the country, women from another zone were more likely to attend their first ANC within the first trimester. An exception to the rule is Zanzibar which was found to have women who are less likely to attend their first ANC within the first trimester of their pregnancy.

In terms of the number of ANC visits, the result shows that the richest quantile is positively associated with women attending at least four ANC during their pregnancy in three rounds of the survey. Furthermore, women's access to media is positively associated with women attending at least four ANC in 2004 and 2016. Distance to the health facility is negatively associated with women attending at least four ANC across the period. In addition, being married is positively associated with attending four or more ANC. Moreover, compared to no formal education, women with primary and secondary or higher levels of education are positively associated with attending 4 or more ANC across the three periods.

Zone of residence indicates that, compared to women residing in the Western zone of the country, living in other zones is positively associated with women attending 4 or ANC during

their pregnancy, except women from South West Highland zone who were found to be negatively associated in 2010. Also, women being professionally working are positively associated with attending 4 or more ANC. Furthermore, self-employed women were found to be positively associated with 4 or more ANC during their pregnancy. Moreover, self-employed women were found to be positively associated with 4 or more ANC in 2004 while manual working women were found to be positively associated in 2004 and 2010.

Furthermore, results show that higher economic status is positively associated with delivery at a health facility. Moreover, women's media access and residing in urban areas were also positively associated with delivery at a health facility. Distance to the health facility was found to be negatively associated with delivery at a health facility. Moreover, women having a primary level of education are positively associated with delivery at health facilities compared to women with no formal education.

However, contrary to what we excepted; women aged 35-49 years were found to be negatively associated with delivery at health facilities. Zone of residence indicated similar results except for the Southern zone and South West Highlands zone who were found to be negatively associated with delivery at a health facility in 2004 and 2010 respectively. Furthermore, women from the Lake zone and Zanzibar are less likely to deliver at health facilities compared to women from the western zone. Also, professionally employed women and manual work were positively associated with delivery at health facilities.

Table 3: OLS estimated coefficients of LPM and Average Marginal Effects from Logistic Regression for determinants of Timing of First ANC visit

Variables	LPM			Average Marginal Effect		
	2004	2010	2016	2004	2010	2016
Wealth quintile						
Poorer	0.0111	-0.00397	0.0302*	0.0119	-0.00469	0.0368**
	(0.0150)	(0.0160)	(0.0159)	(0.0156)	(0.0166)	(0.0184)
Middle	0.00648	0.0189	0.0253	0.00667	0.0206	0.0308*
	(0.0154)	(0.0167)	(0.0163)	(0.0160)	(0.0180)	(0.0186)
Richer	0.0180	0.0230	0.0521***	0.0180	0.0236	0.0597***
	(0.0162)	(0.0182)	(0.0182)	(0.0171)	(0.0194)	(0.0209)
Richest	0.0669***	0.0705***	0.0916***	0.0706***	0.0691**	0.0998***
	(0.0205)	(0.0237)	(0.0231)	(0.0250)	(0.0279)	(0.0278)
Urban residence	-0.0396***	-0.0345**	-0.0211	-0.0349***	-0.0281**	-0.0218
	(0.0153)	(0.0166)	(0.0154)	(0.0126)	(0.0139)	(0.0149)
Women media access	0.0223*	-0.0105	0.0185	0.0233*	-0.00983	0.0222
	(0.0129)	(0.0129)	(0.0139)	(0.0121)	(0.0134)	(0.0144)
Distance is a problem	-0.0125	-0.0182*	-0.00447	-0.0117	-0.0183*	-0.00400
	(0.0101)	(0.0109)	(0.0104)	(0.00975)	(0.0106)	(0.0106)
Women is married	0.0239*	-0.0166	-0.0111	0.0220*	-0.0155	-0.0115
	(0.0136)	(0.0141)	(0.0130)	(0.0122)	(0.0138)	(0.0132)
Women's level of education						
Primary education	-0.00855	0.0327**	0.00691	-0.00868	0.0360***	0.00832
	(0.0115)	(0.0128)	(0.0136)	(0.0116)	(0.0128)	(0.0144)
Secondary and above	0.0252	0.0483**	0.00899	0.0242	0.0533**	0.0109
	(0.0210)	(0.0209)	(0.0187)	(0.0221)	(0.0241)	(0.0197)
Women's age						
Age 20-34 years	-0.00362	-0.00559	0.0341*	-0.00391	-0.00543	0.0355*
	(0.0186)	(0.0216)	(0.0189)	(0.0185)	(0.0211)	(0.0196)
Age 35-49 years	0.0103	-0.0305	0.0139	0.00946	-0.0295	0.0162
	(0.0204)	(0.0230)	(0.0206)	(0.0206)	(0.0208)	(0.0227)
Zone of residence						

Variables	LPM			Average Marginal Effect		
	2004	2010	2016	2004	2010	2016
Northern zone	0.0620***	0.0623**	0.0660***	0.0769**	0.0889**	0.0747**
	(0.0217)	(0.0244)	(0.0247)	(0.0306)	(0.0366)	(0.0302)
Central zone	0.0517**	0.0498**	0.0195	0.0659**	0.0692**	0.0247
	(0.0205)	(0.0223)	(0.0230)	(0.0282)	(0.0328)	(0.0267)
Southern highlands zone	0.0856***	0.162***	0.138***	0.107***	0.208***	0.151***
	(0.0234)	(0.0255)	(0.0243)	(0.0353)	(0.0444)	(0.0323)
Southern zone	0.131***	0.197***	0.267***	0.161***	0.260***	0.291***
	(0.0237)	(0.0257)	(0.0276)	(0.0389)	(0.0469)	(0.0380)
South west highlands zone	0.0476**	-0.000232	0.0290	0.0613**	0.00206	0.0356
	(0.0223)	(0.0245)	(0.0223)	(0.0303)	(0.0301)	(0.0263)
Lake zone	-0.0156	0.00831	-0.00871	-0.0205	0.0153	-0.00997
	(0.0188)	(0.0201)	(0.0192)	(0.0201)	(0.0255)	(0.0213)
Eastern zone	0.137***	0.137***	0.196***	0.161***	0.181***	0.202***
	(0.0219)	(0.0234)	(0.0236)	(0.0360)	(0.0402)	(0.0323)
Zanzibar	-0.00631	0.0729***	-0.0656***	-0.000122	0.100***	-0.0623***
	(0.0203)	(0.0219)	(0.0238)	(0.0222)	(0.0321)	(0.0220)
Women's occupation						
Professional working	0.0141	0.113***	0.0754**	0.00964	0.105**	0.0663*
	(0.0393)	(0.0391)	(0.0328)	(0.0364)	(0.0474)	(0.0357)
Self employed	0.0133	0.0458***	-0.0257	0.0146	0.0433***	-0.0262
	(0.0164)	(0.0166)	(0.0160)	(0.0156)	(0.0157)	(0.0163)
Manual working	0.0163	0.0451***	0.00327	0.0165	0.0449**	0.00192
	(0.0185)	(0.0171)	(0.0155)	(0.0191)	(0.0187)	(0.0155)
Constant	0.0472	0.0540	0.125***			
	(0.0312)	(0.0339)	(0.0324)			
Observations	5,494	5,221	6,914	5,494	5,221	6,914
R-squared	0.027	0.041	0.061			

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4: OLS estimated coefficients of LPM and Average Marginal Effects from Logistic Regression for determinants of Number of ANC visits

Variables	LPM			Average Marginal Effect		
	2004	2010	2016	2004	2010	2016
Wealth quintile						
Poorer	0.0474**	-0.0154	0.0213	0.0460**	-0.0164	0.0229
	(0.0203)	(0.0213)	(0.0186)	(0.0199)	(0.0228)	(0.0199)
Middle	0.0518**	0.0110	0.0435**	0.0501**	0.0121	0.0461**
	(0.0209)	(0.0223)	(0.0191)	(0.0204)	(0.0238)	(0.0203)
Richer	0.0814***	0.0539**	0.125***	0.0787***	0.0559**	0.128***
	(0.0219)	(0.0244)	(0.0213)	(0.0212)	(0.0260)	(0.0219)
Richest	0.135***	0.0839***	0.172***	0.134***	0.0866**	0.178***
	(0.0279)	(0.0318)	(0.0272)	(0.0256)	(0.0338)	(0.0272)
Urban residence	-0.0139	-0.0211	-0.0144	-0.0149	-0.0210	-0.0145
	(0.0208)	(0.0223)	(0.0181)	(0.0227)	(0.0232)	(0.0193)
Women media access	0.0335*	0.0240	0.0341**	0.0324*	0.0257	0.0355**
	(0.0174)	(0.0171)	(0.0161)	(0.0180)	(0.0182)	(0.0172)
Distance is a problem	-0.0442***	-0.0331**	-0.0366***	-0.0463***	-0.0354**	-0.0393***
	(0.0137)	(0.0147)	(0.0122)	(0.0143)	(0.0155)	(0.0130)
Women is married	0.0427**	0.00126	-0.00904	0.0458**	0.00123	-0.00935
	(0.0183)	(0.0188)	(0.0153)	(0.0197)	(0.0199)	(0.0164)
Women's level of education						
Primary education	0.0455***	0.0404**	0.0304*	0.0453***	0.0432**	0.0325*
	(0.0156)	(0.0171)	(0.0159)	(0.0161)	(0.0182)	(0.0170)
Secondary and above	0.135***	0.128***	0.0819***	0.140***	0.134***	0.0869***
	(0.0287)	(0.0281)	(0.0220)	(0.0262)	(0.0296)	(0.0232)
Women's age						
Age 20-34 years	-0.0359	0.0390	0.00593	-0.0364	0.0427	0.00645
	(0.0252)	(0.0289)	(0.0222)	(0.0259)	(0.0308)	(0.0238)
Age 35-49 years	-0.0244	0.0274	-0.00986	-0.0244	0.0310	-0.0103
	(0.0276)	(0.0308)	(0.0241)	(0.0293)	(0.0332)	(0.0258)
Zone of residence						

Variables	LPM			Average Marginal Effect		
	2004	2010	2016	2004	2010	2016
Northern zone	0.201***	0.149***	0.158***	0.173***	0.158***	0.163***
	(0.0293)	(0.0324)	(0.0289)	(0.0228)	(0.0343)	(0.0288)
Central zone	0.217***	0.129***	0.218***	0.186***	0.140***	0.220***
	(0.0277)	(0.0296)	(0.0271)	(0.0213)	(0.0319)	(0.0253)
Southern highlands zone	0.180***	0.0860**	0.0970***	0.155***	0.0947***	0.103***
	(0.0320)	(0.0340)	(0.0287)	(0.0253)	(0.0367)	(0.0299)
Southern zone	0.250***	0.104***	0.173***	0.206***	0.115***	0.178***
	(0.0324)	(0.0344)	(0.0326)	(0.0223)	(0.0370)	(0.0312)
South west highlands zone	0.125***	-0.0568*	0.0458*	0.110***	-0.0644*	0.0510*
	(0.0299)	(0.0325)	(0.0261)	(0.0259)	(0.0354)	(0.0283)
Lake zone	0.109***	0.0763***	0.0791***	0.0983***	0.0853***	0.0863***
	(0.0256)	(0.0266)	(0.0226)	(0.0234)	(0.0294)	(0.0244)
Eastern zone	0.316***	0.257***	0.293***	0.262***	0.266***	0.295***
	(0.0299)	(0.0312)	(0.0279)	(0.0185)	(0.0303)	(0.0237)
Zanzibar	0.190***	0.0742**	0.0658**	0.167***	0.0808**	0.0692**
	(0.0276)	(0.0291)	(0.0281)	(0.0235)	(0.0318)	(0.0299)
Women's occupation						
Professional working	0.0972*	0.0894*	0.0791**	0.122**	0.0960*	0.0941**
	(0.0537)	(0.0525)	(0.0388)	(0.0561)	(0.0574)	(0.0431)
Self employed	0.0677***	0.0116	0.00286	0.0724***	0.0114	0.00265
	(0.0217)	(0.0223)	(0.0188)	(0.0235)	(0.0233)	(0.0201)
Manual working	0.0605**	0.0800***	0.00869	0.0648**	0.0823***	0.00912
	(0.0250)	(0.0230)	(0.0183)	(0.0254)	(0.0242)	(0.0196)
Constant	0.281***	0.220***	0.267***			
	(0.0417)	(0.0451)	(0.0379)			
Observations	5,612	5,281	7,019	5,612	5,281	7,019
R-squared	0.058	0.060	0.070			

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 5: OLS estimated coefficients of LPM and Average Marginal Effects from Logistic Regression for determinants of Delivery at the health facility

Variables	LPM			Average Marginal Effect		
	2004	2010	2016	2004	2010	2016
Wealth quintile						
Poorer	0.0381**	0.0634***	0.0479***	0.0430*	0.0736***	0.0349**
	(0.0192)	(0.0195)	(0.0161)	(0.0235)	(0.0228)	(0.0150)
Middle	0.0616***	0.128***	0.115***	0.0676***	0.137***	0.0875***
	(0.0198)	(0.0204)	(0.0166)	(0.0238)	(0.0226)	(0.0142)
Richer	0.117***	0.173***	0.203***	0.124***	0.180***	0.162***
	(0.0207)	(0.0224)	(0.0184)	(0.0244)	(0.0242)	(0.0148)
Richest	0.285***	0.292***	0.241***	0.326***	0.331***	0.235***
	(0.0264)	(0.0292)	(0.0235)	(0.0259)	(0.0252)	(0.0160)
Urban residence	0.173***	0.124***	0.0661***	0.220***	0.169***	0.0950***
	(0.0197)	(0.0204)	(0.0157)	(0.0229)	(0.0241)	(0.0169)
Women media access	0.0444***	0.0264*	0.0888***	0.0524***	0.0285	0.0775***
	(0.0164)	(0.0157)	(0.0140)	(0.0202)	(0.0193)	(0.0156)
Distance is a problem	-0.0691***	-0.0791***	-0.0747***	-0.0843***	-0.0953***	-0.0838***
	(0.0130)	(0.0134)	(0.0105)	(0.0159)	(0.0165)	(0.0117)
Women is married	-0.0200	-0.0172	-0.00980	-0.0236	-0.0220	-0.0133
	(0.0173)	(0.0172)	(0.0133)	(0.0221)	(0.0218)	(0.0150)
Women's level of education						
Primary education	0.112***	0.0914***	0.0968***	0.129***	0.101***	0.0768***
	(0.0147)	(0.0157)	(0.0137)	(0.0179)	(0.0192)	(0.0144)
Secondary and above	0.158***	0.169***	0.195***	0.187***	0.200***	0.181***
	(0.0271)	(0.0257)	(0.0190)	(0.0323)	(0.0279)	(0.0154)
Woman's age						
Age 20-34 years	-0.0575**	-0.0435	-0.0665***	-0.0689**	-0.0539	-0.0654***
	(0.0239)	(0.0265)	(0.0192)	(0.0295)	(0.0329)	(0.0199)
Age 35-49 years	-0.0773***	-0.0662**	-0.0693***	-0.0935***	-0.0859**	-0.0752***
	(0.0262)	(0.0282)	(0.0209)	(0.0320)	(0.0355)	(0.0244)
Zone of residence						

Variables	LPM			Average Marginal Effect		
	2004	2010	2016	2004	2010	2016
Northern zone	-0.0823***	0.0476	0.00895	-0.0982***	0.0449	-0.00398
	(0.0277)	(0.0297)	(0.0251)	(0.0334)	(0.0364)	(0.0273)
Central zone	-0.0841***	0.0790***	0.0404*	-0.0958***	0.0879***	0.0332
	(0.0263)	(0.0271)	(0.0235)	(0.0313)	(0.0309)	(0.0225)
Southern highlands zone	0.205***	0.276***	0.222***	0.239***	0.294***	0.218***
	(0.0304)	(0.0312)	(0.0249)	(0.0320)	(0.0253)	(0.0138)
Southern zone	-0.0874***	0.149***	0.239***	-0.102***	0.153***	0.186***
	(0.0307)	(0.0315)	(0.0282)	(0.0360)	(0.0324)	(0.0156)
South west highlands zone	-0.121***	-0.0847***	0.0237	-0.143***	-0.107***	0.0152
	(0.0283)	(0.0298)	(0.0226)	(0.0329)	(0.0372)	(0.0227)
Lake zone	-0.100***	-0.0206	-0.0577***	-0.115***	-0.0254	-0.0598***
	(0.0242)	(0.0244)	(0.0196)	(0.0287)	(0.0299)	(0.0213)
Eastern zone	-0.0463	0.121***	0.116***	-0.0411	0.158***	0.135***
	(0.0284)	(0.0285)	(0.0241)	(0.0359)	(0.0319)	(0.0203)
Zanzibar	-0.187***	-0.160***	-0.111***	-0.230***	-0.232***	-0.184***
	(0.0262)	(0.0267)	(0.0243)	(0.0293)	(0.0329)	(0.0325)
Women's occupation						
Professional working	0.146***	0.0982**	0.0527	0.248***	0.197***	0.142***
	(0.0507)	(0.0482)	(0.0336)	(0.0678)	(0.0627)	(0.0392)
Self employed	-0.0486**	-0.0214	-0.0134	-0.0621**	-0.0193	-0.0133
	(0.0205)	(0.0204)	(0.0163)	(0.0261)	(0.0253)	(0.0178)
Manual working	0.0322	0.0975***	0.0363**	0.0397	0.131***	0.0432**
	(0.0236)	(0.0210)	(0.0158)	(0.0317)	(0.0258)	(0.0179)
Constant	0.444***	0.352***	0.441***			
	(0.0395)	(0.0412)	(0.0329)			
Observations	5,636	5,308	7,050	5,636	5,308	7,050
R-squared	0.205	0.215	0.206			

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

4.1.3 Decomposition analysis

Tables 6, 7, and 8 show the coefficient for each determinant, WI, its contribution, and percentage contribution. In each indicator of maternal health care utilization and both years, household wealth status and women's education are the strongest drivers of an increase in inequalities. In the timing for the first ANC visit within the first trimester of their pregnancy, the household wealth contributed to 65%, 54%, and 68% of the total in 2004, 2010, and 2016, respectively (Table 6). Moreover, women's education contributed to the total inequality by 58%, 28%, and 2% of the total inequality in 2004, 2010, and 2016, respectively (Table 6). Other variables that contributed to inequalities in the first ANC visit include women's employment which contributed 65% of the increase in inequality in 2010 which decreased to 21% in 2016 (Table 6). In 2004, women employment negatively contributed by 10% of the total inequality. Equally, women residing in the urban area contributed to the decrease in the total inequalities by 33%, 18%, and 1% in 2004, 2010, and 2016, respectively.

In terms of the number of ANC visits with the minimum recommended of 4 visits, household wealth contributed by 82%, 30%, and 62% to the total inequalities in 2004, 2010, and 2016, respectively (Table 7). Women's education contributed 60%, 59%, and 19% of the total contribution in 2004, 2010, and 2016, respectively (Table 7). Furthermore, women's occupation contributed 11% of the total contribution to inequalities which then increased and remained constant at 23% in 2010 and 2016 (Table 7).

Similarly, in terms of place of delivery results show that household wealth remained to be the major contributor of inequality in women giving birth at health facilities. Indeed, it is indicated that household wealth contribution remained constant at 72% in 2004 and 2010 which then declined to 56% in 2016 (Table 8). Women's education showed an increase in inequality which contributed 23% of the total inequality in 2004 and then the contribution to inequalities remained constant at 19% in 2010 and 2016 (Table 8). Moreover, women living in the urban area and access to mass media had a moderate contribution to inequality on delivery at health facilities across time. Women working status contributed to inequality by 22% in 2004 which decreased to 13% in 2010 and then to only 4% in 2016 (Table 8). Nevertheless, results indicate no variable with significant contribution in lowering inequality on delivery at health facilities among women across time.

Table 6: Decomposition of socioeconomic inequalities in the timing of the first antenatal visit

Determinants	2004				2010				2016			
	β	WI	Contr. (β. WI)	%	β	WI	Contr. (β. WI)	%	β	WI	Contr. (β. WI)	%
Poorer	-0.006	0.561	-0.003	-3	0.003	-0.590	-0.002	-1	0.023	-0.591	-0.014	-7
Middle	-0.003	-0.097	0.000	0	0.006	-0.109	-0.001	-1	0.023	-0.174	-0.004	-2
Richer	0.020	0.376	0.008	6	0.021	0.401	0.009	7	0.023	0.311	0.007	4
Richest	0.080	1.000	0.080	65	0.069	1.000	0.069	54	0.127	1.000	0.127	68
Urban residence	-0.052	0.780	-0.040	-33	-0.029	0.787	-0.023	-18	-0.030	0.779	-0.024	-13
Women media access	0.021	0.540	0.011	9	0.013	-0.529	-0.007	-5	0.027	0.515	0.014	8
Distance is a problem	0.013	0.310	0.004	3	0.018	0.330	0.006	5	0.002	0.276	0.001	0
Women is married	0.040	-0.162	-0.006	-5	-0.008	-0.147	0.001	1	-0.024	-0.196	0.005	3
Primary education	-0.005	0.140	-0.001	-1	-0.030	0.016	-0.001	0	-0.002	0.152	0.000	0
Secondary and above	0.105	0.676	0.071	58	0.063	0.555	0.035	28	0.006	0.534	0.003	2
Age 20-34 years	0.010	0.054	0.001	0	0.003	0.051	0.000	0	0.053	0.029	0.002	1
Age 35-49 years	-0.023	0.104	-0.002	-2	-0.018	-0.136	0.002	2	-0.043	0.058	-0.002	-1
Northern zone	0.055	0.199	0.011	9	0.062	0.188	0.012	9	0.084	0.195	0.016	9
Central zone	-0.070	0.216	-0.015	-12	-0.060	0.337	-0.020	-16	-0.037	0.293	-0.011	-6
Southern highlands zone	0.087	0.039	0.003	3	0.154	0.120	0.018	15	0.136	0.069	0.009	5
Southern zone	-0.130	0.353	-0.046	-38	-0.201	0.305	-0.061	-49	-0.278	0.193	-0.054	-29
South West highlands zone	-0.068	0.106	-0.007	-6	0.007	0.009	0.000	0	-0.098	0.101	-0.010	-5

	β	WI	Contr. (β.WI)	%	β	WI	Contr. (β.WI)	%	β	WI	Contr. (β.WI)	%
Lake zone	-0.017	-0.116	0.002	2	0.007	-0.190	-0.001	-1	0.006	0.222	-0.001	-1
Eastern zone	0.133	0.475	0.063	52	0.129	0.463	0.060	47	0.191	0.532	0.102	55
Zanzibar	-0.025	0.350	-0.009	-7	0.058	0.365	0.021	17	0.077	0.424	-0.032	-17
Professional working	-0.019	0.672	-0.013	-10	0.118	0.691	0.082	65	0.067	0.590	0.040	21
Self employed	-0.020	0.628	-0.013	-10	-0.042	0.624	-0.026	21	-0.020	0.633	0.013	7
Manual working	0.018	0.568	0.010	9	0.035	0.556	0.019	15	0.002	0.463	0.001	0

Table 7: Decomposition of socioeconomic inequalities and a number of antenatal visits

Determinants	2004				2010				2016			
	β	WI	Contr. (β. WI)	%	β	WI	Contr. (β. WI)	%	β	WI	Contr. (β. WI)	%
Poorer	-0.054	0.561	-0.030	-18	-0.019	-0.590	0.011	7	0.024	-0.591	-0.014	-6
Middle	0.046	-0.097	-0.004	-3	0.019	-0.109	-0.002	-1	0.037	-0.174	-0.007	-3
Richer	0.075	0.376	0.028	17	0.044	0.401	0.018	10	0.097	0.311	0.030	13
Richest	0.140	1.000	0.140	82	0.052	1.000	0.052	30	0.147	1.000	0.147	62
Urban residence	-0.008	0.780	-0.006	-4	-0.012	0.787	-0.010	-6	0.014	0.779	0.011	5
Women media access	0.028	0.540	0.015	9	0.018	0.529	0.010	6	0.026	0.515	0.014	6
Distance is a problem	-0.050	-0.310	0.016	9	-0.027	-0.330	0.009	5	-0.035	-0.276	0.010	4
Women is married	0.053	-0.162	-0.009	-5	-0.009	-0.147	0.001	1	-0.022	-0.196	0.004	2
Primary education	0.042	0.140	0.006	3	0.047	-0.016	-0.001	0	0.034	-0.152	-0.005	-2
Secondary and above	0.151	0.676	0.102	60	0.180	0.555	0.100	59	0.084	0.534	0.045	19
Age 20-34 years	-	0.054	-0.002	-1	0.077	0.051	0.004	2	0.005	0.029	0.000	0

Determinants	2004				2010				2016			
	β	*WI*	*Contr. (β. WI)*	*%*	*β*	*WI*	*Contr. (β. WI)*	*%*	*β*	*WI*	*Contr. (β. WI)*	*%*
	0.037											
Age 35-49 years	-0.013	-0.104	0.001	1	0.077	0.136	-0.011	-6	0.015	0.058	-0.001	0
Northern zone	0.202	0.199	0.040	24	0.124	0.188	0.023	14	0.183	0.195	0.036	15
Central zone	-0.228	0.216	-0.049	29	-0.106	0.337	-0.036	21	-0.236	0.293	-0.069	29
Southern highlands zone	0.187	0.039	0.007	4	0.050	0.120	0.006	4	0.115	0.069	0.008	3
Southern zone	-0.249	0.353	-0.088	51	0.091	0.305	-0.028	16	0.187	0.193	-0.036	15
South West highlands zone	0.140	-0.106	-0.015	-9	0.105	0.009	0.001	1	0.099	0.101	-0.010	-4
Lake zone	-0.106	0.116	-0.012	-7	0.057	0.190	-0.011	-6	0.104	0.222	-0.023	-10
Eastern zone	0.334	0.475	0.159	93	0.226	0.463	0.105	61	0.314	0.532	0.167	70
Zanzibar	0.189	0.350	0.066	39	0.041	0.365	0.015	9	0.094	0.424	0.040	17
Professional working	0.027	0.672	0.018	11	0.057	0.691	0.039	23	0.091	0.590	0.054	23
Self employed	-0.069	0.628	-0.044	25	-0.022	0.624	0.014	8	-0.010	0.633	0.006	3
Manual working	0.029	0.568	0.017	10	0.050	0.556	0.028	16	-0.011	0.463	-0.005	-2

Table 8: Decomposition of socioeconomic inequalities in delivery at a health facility

Determinants	2004				2010				2016			
	β	WI	Contr. (β.WI)	%	β	WI	Contr. (β.WI)	%	β	WI	Contr. (β.WI)	%
Poorer	-0.037	0.561	-0.021	-5	0.045	-0.590	-0.026	-6	0.057	-0.591	-0.034	-7
Middle	-0.047	0.097	-0.005	-1	0.114	-0.109	-0.012	-3	0.127	0.174	-0.022	-5
Richer	0.113	0.376	0.042	11	0.185	0.401	0.074	17	0.223	0.311	0.069	15
Richest	0.287	1.000	0.287	72	0.308	1.000	0.308	72	0.265	1.000	0.265	56
Urban residence	0.161	0.780	0.126	32	0.104	0.787	0.082	19	0.053	0.779	0.042	9
Women media access	0.045	0.540	0.024	6	0.018	0.529	0.009	2	0.098	0.515	0.050	11
Distance is a problem	-0.072	-0.310	0.022	6	-0.102	-0.330	0.034	8	-0.073	-0.276	0.020	4
Women is married	-0.013	-0.162	0.002	1	-0.037	-0.147	0.005	1	0.005	0.196	0.001	0
Primary education	-0.083	0.140	0.012	3	0.084	-0.016	-0.001	0	0.083	-0.152	-0.013	-3
Secondary and above	0.138	0.676	0.093	23	0.146	0.555	0.081	19	0.171	0.534	0.092	19
Age 20-34 years	-0.059	0.054	-0.003	-1	-0.038	0.051	-0.002	0	-0.086	0.029	-0.002	-1
Age 35-49 years	-0.084	-0.104	0.009	2	-0.051	-0.136	0.007	2	-0.094	-0.058	0.005	1
Northern zone	-0.060	0.199	-0.012	-3	0.055	0.188	0.010	2	0.011	0.195	0.002	0
Central zone	-0.086	-0.216	0.018	5	0.115	-0.337	-0.039	-9	-0.059	0.293	-0.017	-4
Southern highlands zone	0.226	0.039	0.009	2	0.293	0.120	0.035	8	0.214	0.069	0.015	3
Southern zone	-0.088	-0.353	0.031	8	0.153	-0.305	-0.047	-11	-0.238	0.193	-0.046	-10
South West highlands zone	-0.109	-0.106	0.012	3	0.041	0.009	0.000	0	-0.063	0.101	-0.006	-1

Determinants	2004				2010				2016			
	β	*WI*	*Contr. (β. WI)*	*%*	*β*	*WI*	*Contr. (β. WI)*	*%*	*β*	*WI*	*Contr. (β. WI)*	*%*
Lake zone	-0.073	-0.116	0.008	2	0.012	-0.190	-0.002	-1	-0.068	-0.222	0.015	3
Eastern zone	-0.026	0.475	-0.012	-3	0.116	0.463	0.054	13	0.108	0.532	0.058	12
Zanzibar	-0.159	0.350	-0.056	14	-0.138	-0.365	-0.050	12	-0.094	-0.424	-0.040	-8
Professional working	0.128	0.672	0.086	22	0.079	0.691	0.054	13	0.029	0.590	0.017	4
Self employed	-0.039	-0.628	0.024	6	-0.012	0.624	0.008	2	0.011	-0.633	0.007	1
Manual working	0.028	0.568	0.016	4	0.084	0.556	0.047	11	0.042	0.463	0.019	4

4.2   Discussion

Our analysis has led to several relevant findings concerning changes in maternal use. Few are of note and will be discussed in this section. First, inequalities in maternal health utilization have slightly increased between 2004 and 2016 especially on the timing for first antenatal visit and number of antenatal visits during pregnancy. In addition, there has been an increase in inequalities in delivery at health facilities between 2004 and 2010 which slightly decreased in 2016. Moreover, maternal health utilization is concentrated among the better-off households. However, we find an increase in inequality over 12 years, suggesting more utilization of maternal health care has occurred among the richest. This further implies that maternal health care use in Tanzania benefited the privileged households. These findings are in line with the study that was conducted in Nigeria which observed an increase in inequality in maternal healthcare utilization (Nghargbu and Olaniyan, 2017)

On the determinants of maternal health care utilization, results show that household wealth is positively associated with maternal health care utilization. This could be explained by the fact that richer households would be more able and willing to pay for services even from private health facilities while poorer are disadvantaged in accessing and affording the needed services (Pulok *et al.*, 2016). In addition, results show that maternal education is positively associated with maternal health care utilization. This could be attributed to the fact that women's education increases their autonomy and decision-making power in the household (Raghupathy, 1996; Matsumura and Gubhaju, 2001).

In addition, education enables women to realize the benefits of maternal health care utilization (Pulok *et al.*, 2016). This result is consistent with several other studies conducted in Tanzania (Mrisho *et al.*, 2007; Ngowi *et al.*, 2017; Kimario *et al.*, 2020). They are also consistent with studies done elsewhere around the world (Pulok, Sabah and Enemark, 2016; Fenny *et al.*, 2018; Novignon *et al.*, 2019). Women's access to media was found to be positively associated with women's maternal health care utilization during their pregnancy. This result is important since women's access to information related to maternal utilization can influence their use (Pulok *et al.*, 2016). Moreover, distance to the health facility being a problem was found to be negatively associated with maternal health care use by women during their pregnancy, a result which is in line with several others(Singh *et al.*, 2015; Novignon *et al.*, 2019).

Our decomposition analysis shows that household wealth is the major contributor to maternal health care use. This implies that women from poor and lower socioeconomic status have not benefited from different efforts that the government has initiated. The increase in inequality can be explained by challenges in the implementation of the exemption policy which was expected to benefit women from poor households. Moreover, there could be unavailability of services at government health facilities which discourages women from poor households who cannot afford the services from private health facilities where they are required to pay for the services. In addition, women's education level is another contributor to increased inequalities in maternal health care utilization. Indeed, educated women utilize maternal health care more than their non-educated counterparts. This is not surprising given that women with education are aware of the importance of utilizing maternal health care during their pregnancy. Moreover, education increase women's decision-making at the household level. However, it has been noted that

women from wealthy households are more likely to be educated compared to their counterparts from poor households.

The present study has its limitation in terms of the type of data employed. Specifically, the use of the wealth index as the measure of socioeconomic status instead of consumption and household income is debatable in literature. That said, the present study uses a wealth index based on assets as a valid indicator of socioeconomic status as demonstrated by (Montgomery *et al.*, 2000; Sahn and Stifel, 2003; Filmer and Pritchett, 2011). Moreover, data on household income and consumption have several disadvantages including issues around seasonality and under-reporting (O'Donnell *et al.*, 2008). Indeed, we acknowledge that the use of cross-sectional data and regression-based decomposition provides the limited possibility to determine causal inferences from the results obtained. Conducting the same study using panel data would be a welcome contribution to the topic at hand in the future.

5. Conclusion

Tanzania's efforts towards addressing inequity in maternal and child morbidity and mortality have been indicated in the Health Sector Strategic Plan IV and National Health Policy (URT, 2015, 2017). For instance, in the National Road Map, the services for maternal, newborn, and child health are exempted from cost-sharing. This study was intended to measure and explain the trends in socioeconomic inequalities in Tanzania's maternal health care use. Generally, the study shows that there is an increase in inequalities in Tanzania's maternal health care utilization despite Tanzania's many efforts towards equality and universal provision of primary health care services (URT, 2007).

Specifically, the study results indicate that wealth-related inequalities in maternal health care utilization exist in Tanzania. This means maternal health care utilization is concentrated among women from a household with high socioeconomic status. Furthermore, findings revealed that trends of maternal health care utilization inequalities have increased between 2004 and 2016 in the selected indicator similar to results from related studies in Tanzania (see Bintabara, 2021; Langa and Bhatta, 2020; Hanson et al., 2017). The decomposition analysis indicated that household wealth status and women's education were the major contributors to inequalities in antenatal visits and place of delivery. Potential challenges in the implementation of the exemption policy, long distance to the health facilities, inadequate capacity of health facilities, and sociocultural barrier could explain the observed results. Therefore, proper implementation of the exemption policy and targeting of less privileged women (i.e., less educated and from poor households) are highly needed.

References

Abalo, K., Agbodji, A. E. and Batana, Y. M. (2014) 'Nutritional Health Inequalities among Children in Togo', *African Development Review*, 26(4), pp. 584–596. doi: 10.1111/1467-8268.12115.

Agbanyo, R. (2020) 'Ghana's national health insurance, free maternal healthcare and facility-based delivery services', *African Development Review*, 32(1), pp. 27–41. doi: 10.1111/1467-8268.12412.

Andersen, R. M. (1995) 'Revisiting the behavioral model and access to medical care : Does it matter?', *Journal of Health and Social Behavior*, 36(1), pp. 1–10. Available at: https://www.jstor.org/stable/2137284.

Andersen, R. M. (2008) 'National health surveys and the behavioral model of health services use', *Medical Care*, 46(7), pp. 647–653. doi: 10.1097/MLR.0b013e31817a835d.

Asamoah, B. O. *et al.* (2014) 'Magnitude and trends of inequalities in antenatal care and delivery under skilled care among different socio-demographic groups in Ghana from 1988-2008', *BMC Pregnancy & Childbirth*, 14(295).

Bintabara D (2021) Addressing the huge poor–rich gap of inequalities in accessing safe childbirth care: A first step to achieving universal maternal health coverage in Tanzania. *PLoS ONE* 16(2): e0246995. https://doi.org/10.1371/journal.pone.0246995

Byaro, M., Kinyondo, A., Michello, C. and Musonda, P (2018). "Determinants of public health expenditure growth in Tanzania: An application of Bayesian Model". *African Journal of Economic Review.* 6(1) pp 1-13

Byaro, M., Kinyondo, A**.,** and Musonda, P. (2017). "Economic Growth and Under-Five Malaria Mortality in Tanzania Mainland: From Correlation Analysis to Causality". *International Journal of Health. 5(1) pp. 91-96*

Cai, J., Coyte, P. C. and Zhao, H. (2017) 'Decomposing the causes of socioeconomic-related health inequality among urban and rural populations in China: A new decomposition approach', *International Journal for Equity in Health*. International Journal for Equity in Health, 16(1), pp. 1–14. doi: 10.1186/s12939-017-0624-9.

van Doorslaer, E. and Koolman, X. (2004) 'Explaining the differences in income-related health inequalities across European countries', *Health Economics*, 13, pp. 609–628. doi: 10.1002/hec.918.

Fekadu, G. A., Ambaw, F. and Kidanie, S. A. (2019) 'Facility delivery and postnatal care services use among mothers who attended four or more antenatal care visits in Ethiopia: Further analysis of the 2016 demographic and health survey', *BMC Pregnancy and Childbirth*. BMC Pregnancy and Childbirth, 19(1), pp. 1–9. doi: 10.1186/s12884-019-2216-8.

Fenny, A. P. *et al.* (2018) 'Trends and causes of socioeconomic inequalities in maternal healthcare in Ghana, 2003–2014', *International Journal of Social Economics*, 46(2), pp. 288–308. doi: 10.1108/IJSE-03-2018-0148.

Filmer, D. and Pritchett, L. (2011) 'Estimating wealth effects without expenditure data-or tears : an application to educational enrollments in states of India', *Demography*, 38(1), pp. 115–132. doi: 10.1353/dem.2001.0003.

Hanson, C., Gabrysch, S., Mbaruku, G., Cox, J., Mkumbo, E., Manzi,F., Schellenberg, J., and Ronsmans, C. (2017) "Access to maternal health services: geographical inequalities, United Republic of Tanzania",. *Bulletin of World Health Organization*, 95(12): 810–820 doi: 10.2471/BLT.17.194126

Harris, B. *et al.* (2011) 'Inequities in access to health care in South Africa', *Journal of Public Health Policy*, 32(S1), pp. S102–S123. doi: 10.1057/jphp.2011.35.

Joshi, C. *et al.* (2014) 'Factors associated with the use and quality of antenatal care in Nepal: A population-based study using the demographic and health survey data', *BMC Pregnancy and Childbirth*. BMC Pregnancy and Childbirth, 14(1), pp. 1–11. doi: 10.1186/1471-2393-14-94.

Kakwani, N., Wagstaff, A. and Van Doorslaer, E. (1997) 'Socioeconomic inequalities in health: Measurement, computation, and statistical inference', *Journal of Econometrics*, 77, pp. 87–103.

Kamal, N., Curtis, S., Hasan, M. S., & Jamil, K. (2016) 'Trends in equity in use of maternal health services in urban and rural Bangladesh', *International Journal for Equity in Health*, 15(27). doi: 10.1186/s12939-016-0311-2.

Khaki, J. (2019) 'Factors associated with the utilization of postnatal care services among Malawian women', *Malawi Medical Journal*, 31(1), p. 2. doi: 10.4314/mmj.v31i1.2.

Kim, H. and Lee, M. (2016) 'Factors associated with health services utilization between the years 2010 and 2012 in Korea : using Andersen ' s Behavioral model', *Osong Public Health and Research Perspectives*. Elsevier Korea LLC, 7(1), pp. 18–25. doi: 10.1016/j.phrp.2015.11.007.

Kimario, F. F., Festo, C., Shabani, J., & Mrisho, M. (2020) 'Determinants of Home Delivery among Women Aged 15-24 Years in Tanzania', *International Journal of Maternal and Child Health and AIDS (IJMA)*, 9(2), pp. 191–199. doi: 10.21106/ijma.361.

Kinyondo, A., and Byaro, M. (2020). Human Capital Contribution to the Economic Growth of Sub-Saharan Africa: Does Health Status Matter? Evidence from Dynamic Panel Data. In Rossi, I (ed.), *Challenges of Globalization and Prospects for an Inter-civilizational World Order*. Springer Nature, Switzerland, Pages 713-724.

Langa, N., and Bhatta, T. (2020) The rural-urban divide in Tanzania: Residential context and socioeconomic inequalities in maternal health care utilization. *PLoS ONE* 15(11): e0241746. https:// doi.org/10.1371/journal.pone.0241746

Matsumura, M. and Gubhaju, B. (2001) 'Women's status, household structure and the utilization of maternal health services in Nepal', *Asia-Pacific Population Journal*, 16(1), pp. 23–44. doi: 10.18356/e8a4c9ed-en.

Mekonnen, T., Dune, T., Perz, J., & Ogbo, F. A. (2019) 'Trends and Determinants of Antenatal Care Service Use in Ethiopia between 2000 and 2016', *International Journal of Environmental Research and Public Health*, 16(5), p. 748. doi: 10.3390/ijerph16050748.

Montgomery, M. R., Gragnolati, M., Burke, K. A., & Paredes, E. (2000) 'Measuring living standards with proxy variables', *Demography*, 37(2), pp. 155–174. doi: 10.2307/2648118.

Mrisho, M., Schellenberg, J. A., Mushi, A. K., Obrist, B., Mshinda, H., Tanner, M., & Schellenberg, D. (2007) 'Factors affecting home delivery in rural Tanzania', *Tropical Medicine and International Health*, 12(7), pp. 862–872. doi: 10.1111/j.1365-

3156.2007.01855.x.

NBS and ICF Macro (2005) *Tanzania Demographic and Health Survey 2004-05*. Dar es Salaam, Tanzania and Calverton, Maryland, USA.

NBS and ICF Macro (2016) *Tanzania Demographic and Health Survey and Malaria Indicator Survey 2015-2016 report*. Dar es Salaam, Tanzania.

Nghargbu, R. and Olaniyan, O. (2017) 'Inequity in Maternal and Child Health Care Utilization in Nigeria', *African Development Review*, 29(4), pp. 630–647. doi: 10.1111/1467-8268.12301.

Ngowi, A. F., Kamazima, S. R., Kibusi, S., Gesase, A., & Bali, T. (2017) 'Women's determinant factors for preferred place of delivery in   Dodoma region Tanzania: A cross sectional study', *Reproductive Health*. Reproductive   Health, 14(1), pp. 1–8. doi: 10.1186/s12978-017-0373-7.

Novignon, J., Ofori, B., Tabiri, K. G., & Pulok, M. H. (2019) 'Socioeconomic inequalities in maternal health care utilization in   Ghana', *International journal for equity in health*. International Journal for Equity in   Health, 18(1), p. 141. doi: 10.1186/s12939-019-1043-x.

O'Donnell, O., Van Doorslaer, E., Wagstaff, A., & Lindelow, M. (2008). (2008) *Analyzing Health Equity Using Household Survey Data: A Guide to   Techniques   and   their Implementation*, *WBI Learning Resources Series*. doi: 10.2471/BLT.08.052357.

Prusty, R. K., Gouda, J. and Pradhan, M. R. (2015) 'Inequality in the Utilization of Maternal Healthcare Services in Odisha, India', *International Journal of Population Research*, 2015. doi: 10.1155/2015/531485.

Pulok, M. H., Sabah, N.-U., & Enemark, U. (2016) 'Progress in the utilization of antenatal and delivery care services in   Bangladesh: where does the equity gap lie?', *BMC Pregnancy and Childbirth*, 16(200). doi: 10.1186/s12884-016-0970-4.

Pulok, M. H., Sabah, N.-U. and Enemark, U. (2016) 'Socioeconomic inequalities of child malnutrition in Bangladesh Md Nasim-Us Sabah', *International Journal of Social Economics*, 43(12), pp. 1439–1459. doi: 10.1108/IJSE-03-2015-0065.

Raghupathy, S. (1996) 'Education and the use of maternal health care in Thailand', *Social Science and Medicine*, 43(4), pp. 459–471. doi: 10.1016/0277-9536(95)00411-4.

Regassa, N. (2011) 'Antenatal and postnatal care service utilization in southern Ethiopia: a population-based study', *African Health Sciences*, 11(3), pp. 390–397.

Sahn, D. E. and Stifel, D. (2003) 'Exploring alternative measures of welfare in the absence of expenditure data', *Review of Income and Wealth*, 49(4), pp. 463–489.

Saito, E., Gilmour, S., Yoneoka, D., Gautam, G. S., Rahman, M. M., Shrestha, P. K., & Shibuya, K.. (2016) 'Inequality and inequity in healthcare utilization in urban Nepal: A cross-sectional observational study', *Health Policy and Planning*, 31(7), pp. 817–824. doi:

10.1093/heapol/czv137.

Silal, S. P., Penn-Kekana, L., Harris, B., Birch, S., & McIntyre, D. (2012). (2012) 'Exploring inequalities in access to and use of maternal health services in South Africa.', *BMC health services research*, 12(120). doi: 10.1186/1472-6963-12-120.

Singh, K., Osei-Akoto, I., Otchere, F., Sodzi-Tettey, S., Barrington, C., Huang, C., Fordham, C., & Speizer, I. (2015) 'Ghana's national health insurance scheme and maternal and child health: A mixed methods study', *BMC Health Services Research*, 15(1), pp. 1–13. doi: 10.1186/s12913-015-0762-y.

Singh, P. K., Rai, R. K., Alagarajan, M., & Singh, L. (2012) 'Determinants of maternity care services utilization among married adolescents in rural India', *PLoS ONE*, 7(2). doi: 10.1371/journal.pone.0031666.

Somefun, O. D. and Ibisomi, L. (2016) 'Determinants of postnatal care non-utilization among women in Nigeria', *BMC Research Notes*. BioMed Central, 9(1), pp. 1–11. doi: 10.1186/s13104-015-1823-3.

Tiruaynet, K. and Muchie, K. F. (2019) 'Determinants of utilization of antenatal care services in Benishangul Gumuz Region, Western Ethiopia: a study based on demographic and health survey', *BMC Pregnancy and Childbirth*. BMC Pregnancy and Childbirth, 19(1), pp. 1– 5. doi: 10.1186/s12884-019-2259-x.

UN (2015) *Transforming our world: the 2030 Agenda for Sustainable Development*. Available at: https://sustainabledevelopment.un.org/post2015/transformingourworld/publication.

URT (2007) *The Primary Health Service Development Programme (PHSDP/MMAM 2007-2017)*.

URT (2015) *Health Sector Strategic Plan July 2015-June 2020 (HSSP IV): Reaching all households with quality health care*.

URT (2016) *Five Year Development Plan 2016/17-2020/21: 'Nurturing Industrialization for Economic Transformation and Human Development'*. Available at: https://extranet.who.int/nutrition/gina/sites/default/files/FYDP2_II__April 1.pdf.

URT (2017) *Tanzania National Health Policy 2017*.

Voss, Glenn B. (2003) "Formulating interesting research questions." *Journal of the Academy of Marketing Science* 31, no. 3, pages 356-359

Wagstaff, A., Van Doorslaer, E. and Paci, P. (1989) 'Equity in the finance and delivery of health care: Some tentative cross-country comparisons', *Oxford Review of Economic Policy*, 5(1), pp. 89–112. doi: 10.1093/oxrep/5.1.89.

Wagstaff, A., van Doorslaer, E. and Watanabe, N. (2003) 'On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam', *Journal of Econometrics*, 112(1), pp. 207–223. doi: 10.1016/S0304-4076(02)00161-6.

Wagstaff, A., Paci, P. and van Doorslaer, E. (1991) 'On the measurement of inequalities in health', *Social Science and Medicine*, 33(5), pp. 545–557. doi: 10.1016/0277-

9536(91)90212-U.

WHO *et al.* (2019) *Trends in maternal mortality 2000 to 2017: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division.* Geneva, Switzerland.