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# **The Evolution of Socioeconomic-Related Inequalities in Maternal Healthcare Utilization: Evidence from Zimbabwe, 1994-2011**

**Marshall Makate<sup>1</sup> and Clifton Makate<sup>2</sup>**

**Abstract:** Inequalities in maternal healthcare are pervasive in the developing world, a fact that has led to questions about the extent of these inequalities across socioeconomic groups. Yet, despite a growing literature on maternal health across Sub-Saharan African countries, relatively little is known about the evolution of these inequalities over time for specific countries. This study sought to examine and document the trends in the inequalities in prenatal care use, professional delivery assistance, and the receipt of information on pregnancy complications in Zimbabwe. We assess the extent to which the observed inequalities have been pro-poor or pro-rich. The empirical analysis uses data from four rounds of the nationally representative Demographic and Health Survey for Zimbabwe conducted in 1994, 1999, 2005/06 and 2010/11. Three binary indicators were used as measures of maternal health care utilization; (1) the receipt of four or more antenatal care visits, (2) the use of professional delivery assistance, and (3) the receipt of information regarding pregnancy complications for the most recent pregnancy. We measure and explain inequalities in maternal health care use using Erreyger's corrected concentration index. A decomposition analysis was conducted to determine the contributions of each determining factor to the measured inequalities. We found a significant and persistently pro-rich distribution of inequalities in professional delivery assistance and knowledge regarding pregnancy complications was observed between 1994 and 2010/11. Also, inequalities in prenatal care use were pro-rich in 1994, 2005/06 and 2010/11 periods and pro-poor in 1999. Furthermore, we stratified the results by rural or urban status. The results reveal a rising trend in observed inequalities in maternal health care use over time. Our findings suggest that addressing inequalities in maternal healthcare utilization requires coordinated public health policies targeting the more poor and vulnerable segments of the population in Zimbabwe.

**Keywords:** Socioeconomic-related inequality; maternal healthcare utilization; Erreygers concentration index; Zimbabwe

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# **The Evolution of Socioeconomic-Related Inequalities in Maternal Healthcare Utilization: Evidence from Zimbabwe, 1994-2011**

## **Background**

Across the world, studies have generally shown that inequalities in health do exist, mostly favor the high income groups and are more pronounced in some countries than others [1-5]. However, a number of these studies have mainly focused on measuring and explaining inequalities in health in the developed world with few studies for developing countries starting to emerge. Regardless of the setting, there is general agreement in the empirical literature that individuals from higher socioeconomic status groups enjoy better health compared to their counterparts from lower socioeconomic status groups [6, 7]. Achieving equity in maternal health care is one of the most stressed and important public health policy concern shared in almost every country of the world and requires that individuals with the same maternal health care needs be granted the same opportunities to access health care [8]. In Zimbabwe, for example, despite efforts to improve access to maternal health care utilization over the years, inequality in maternal health care remains a public health concern [9]. To date, the government of Zimbabwe has implemented a number of policies to improve access to maternal health care including the Primary Health Care (PHC) of the mid-1980s and the Maternal and Neonatal Health (MNH) roadmap 2007-2015 launched in 2009 among others [10]. It is also important to note that Zimbabwe has witnessed one of the worst economic crisis in its history that saw the deterioration in key sectors of the economy including health, manufacturing and farming [11, 12]. The deterioration in the quality of health as a result of the exodus of qualified health professionals to neighboring countries and abroad has contributed to inequalities in health [12]. The increase in user fees in health in 1993-94 is plausibly responsible for the widening gap between the poor and rich in the country. Thus, it is imperative for emerging research to focus on the extent to which access to

maternal health care is equitable among the individuals in need rather than focusing on the determinants of access to these services.

Previous studies examining equities in health care use in high income countries especially in the Organization for Economic Cooperation and Development (OECD) region and the U.S have established a more pro-rich concentration of health care utilization [1, 13, 14]. Related studies conducted in Asia have also established a pro-rich distribution of health care use among the more affluent segments of the population [15]. In other countries such as Nepal, significant pro-rich distribution of inequalities in healthcare use have been found [16]. Other studies have also found a pro-rich distribution in inequalities in maternal health care use [4, 17-19]. However, it is imperative to note that none of these studies focus on how inequalities in maternal health care use have evolved over time.

This study seeks to fill this gap by focusing on Zimbabwe – an important and yet understudied case in the literature. Specifically, we measure and explain wealth-related inequalities in prenatal care use, professional delivery assistance, and receipt of information regarding pregnancy complications using the G Erreygers [20] corrected concentration index. We document evolution over time since 1994 and provide a decomposition to explain the main factors explaining the observed inequalities in maternal health care in 2005/06 and 2010/11 following the guidelines laid out in O O'Donnell, E van Doorslaer, A Wagstaff and M Lindelow [21].

## **Methods**

### **Measuring inequalities in maternal healthcare utilization**

Our primary measure of socioeconomic status-related inequalities in maternal health care utilization is by means of the widely employed concentration index [22]. Derived from the concentration curve, the concentration index measures the extent to which a health care

outcome is associated with inequality in a measure of socioeconomic status, typically income [23]. Since the purpose in this study is on measuring and explaining wealth-related inequalities in maternal health care utilization, defined mainly by binary variables, we employ the corrected version of the concentration index which is suitable for bounded variables as suggested by G Erreygers [20]. One of the drawbacks often mentioned about the standard concentration index is about its overdependence on the mean of the health variable. This is problematic if one is interested in comparing populations with different average health levels [20]. In addition, in the case of a binary variable, the standard concentration index may not always be restricted to the  $[-1,+1]$  interval [24]. Moreover, the standard concentration index has also been shown to violate the “mirror property”, a property that says that inequalities in health should “mirror” inequalities in ill-health [25]. For the above reasons, we use the G Erreygers [20] concentration index which is algebraically expressed as follows:

$$E(h) = 8cov(h_i, R_i) \quad (1)$$

where  $E(h)$  is the Erreygers corrected concentration index,  $h_i$  is the maternal health outcome of interest,  $R_i$  is the individual or respondent’s relative rank in the household wealth distribution, The size and magnitude of  $E(h)$  reflects the strength and variability in the maternal health outcome of interest [21]. Positive (negative) values of  $E(h)$  indicate a pro-rich (pro-poor) distribution. To deduce more meaningful inferences A Wagstaff, E van Doorslaer and N Watanabe [26] suggested a way of decomposing the measured inequalities in health into their specific determining components using the following linear equation:

$$h_i = \beta_0 + \sum_{k=1}^K \beta_k x_{ik} + \sum_{l=1}^L \beta_l z_{il} + \varepsilon_i \quad (2)$$

where  $h_i$  is the health measure,  $x_{ik}$ , and  $z_{il}$  are need and non-need related characteristics. Following A Wagstaff, E van Doorslaer and N Watanabe [26] and G Erreygers [20], the corrected concentration index of  $h$  can be expressed as follows:

$$E(h) = 4 \left[ \sum_{k=1}^K \beta_k \bar{x}_k C(x_k) + \sum_{l=1}^L \beta_l \bar{z}_l C(z_l) + GC_\varepsilon \right] \quad (3)$$

where  $\bar{x}_k$  and  $\bar{z}_l$  are the means of variables  $\bar{x}_k$  and  $\bar{z}_l$  respectively, with  $C(x_k)$  and  $C(z_l)$  as their respective concentration indices, and  $GC_\varepsilon$  is an error component. We then decompose inequalities in maternal health care using equation (3) to show the contributions of each explanatory variable. To make a meaningful contribution to measured inequalities, each explanatory variable has to be correlated with the maternal health care outcome and be unequally distributed across the socioeconomic status distribution. From this point, we will refer the G Erreygers [20] corrected concentration index to simply the concentration index.

### Data source

Our empirical analysis utilizes data from four rounds of the nationally representative Demographic and Health Survey for Zimbabwe (henceforth ZDHS) conducted in 1994, 1999, 2005/2006, and 2010/2011. The survey is part of the global MEASURE DHS program currently conducted in more than 40 developing countries. This data is made available after a formal request at (<http://dhsprogram.com/data/available-datasets.cfm>). The ZDHS collects detailed health information for women of reproductive ages 15-49 and their children. The Zimbabwe National Statistics Agency (ZIMSTAT) conducted all the four rounds of the survey with collaborative assistance from numerous national and international organizations.

The survey utilized a stratified two-stage cluster sample design based on the Zimbabwe population census of 1992 and 2002. The 1994 and 1999 ZDHS utilized the 1992 population census while the 2005/06 and 2010/11 ZDHS utilized the 2002 population census sampling

frames. The first stage involved a random sampling of the enumeration areas followed by a random sampling of households (excluding households from institutional facilities such as army barracks, hospitals, police camps, and boarding schools) at the second stage. This dataset is ideal for our analysis since it contains detailed information on the household structure, asset ownership, health, and labor market participation and education characteristics for all the household members. An excellent guide to the DHS data can also be found in SO Rutstein and G Rojas [27].

The analysis in this study is based on the individual recode component of the ZDHS which contains detailed health information of the interviewed women. The ZDHS records information on maternal health care use for the most recent pregnancy that occurred in the five years preceding each survey. Thus, we restrict our analysis to the most recent birth that occurred five years prior to each survey for each interviewed woman. From the original sample of 21,601 observations from the pooled ZDHS 1994, 1999, 2005/2006 and 2010/2011 data, we are left with 13,506 women with non-missing observations on our outcome variables. All the estimates are weighted to be nationally representative. The original survey weights are adjusted to account for the possible effect of pooling across surveys. Specifically, we re-scale each survey's total weight to sum to one to manually preserve the initial probability of sampling within each survey to equally weight each survey. Here we make the assumption that the overall population did not significantly change over the analysis period to the extent of altering our conclusions.

### **Outcome variables**

This study uses three measures of maternal health care utilization derived from the various questions asked during the ZDHS. First, we consider the receipt of four or more ANC visits as our measure for prenatal care use. Antenatal care (ANC) or prenatal care is the medical

attention given to women during (excluding delivery period) pregnancy [28]. As recommended by the World Health Organization, women in developing countries with less complicated pregnancies are encouraged to complete at least four ANC visits during the course of the pregnancy [28]. We measure ANC as a binary variable taking 1 if woman completed four or more ANC visits during pregnancy and 0 otherwise. Second, we measure professional delivery assistance using a binary indicator taking 1 if woman received delivery assistance by a medical doctor, auxiliary nurse, midwife or other trained health professional and 0 otherwise. Third, we create a binary indicator taking 1 if the woman was advised about complications that might arise during pregnancy and where to seek further help and 0 otherwise. The last outcome variable was included since one reviewer pointed out the fact that many women still die from pregnancy-related complications in the developing world. The outcome we use here is a proxy for pregnancy-related complications since the ZDHS data we use does not have information on the use of emergency obstetric care.

### **Explanatory variables**

The demand for prenatal care, professional delivery assistance and the likelihood of receiving advice regarding pregnancy complications are thought to depend on a set number of characteristics including individual demographic, household, and locational factors. The choice of these variables is primarily guided by the current empirical literature on maternal health care utilization in developing and developed countries. These variables include binary indicators for the age of the woman at time of birth (13-19; 20-24; 25-29; 30-34; 35-39; 40-44; and 45-49), education level (no education; completed primary; secondary or higher), health insurance status (yes=1), contraceptive usage (yes=1), marital status (separated; never married; married), employment status (employed=1), religious beliefs (Christian; apostolic church member; other religion), access to information (watch television, listen to the radio and read newspapers), previously terminated pregnancy (yes=1). We also included dummy



indicators for the household wealth (poorest; poorer; average; rich; richer). To control for geographical differences, we included dummy indicators for urban/rural status (urban=1) and provinces (Manicaland; Mashonaland central; Mashonaland east; Mashonaland west; Matabeleland north; Matabeleland south; Midlands; Masvingo; Harare; Bulawayo).

### **Measuring socioeconomic status using the asset index**

This study makes use of an asset-based household wealth index as a measure of socioeconomic status, created using Principal Components Analysis (PCA) [29]. Numerous other studies have utilized the asset index as a measure of socioeconomic status in explaining inequalities in various health outcomes [21, 30, 31]. The ZDHS creates this index using information on household ownership of personal assets and household dwelling characteristics. A more technical description of how this index is computed can also be found in DJ McKenzie [32].

## **Results**

### **Descriptive statistics**

Table 1 presents the survey weighted means and standard deviations of all the variables used in the analysis stratified by the year of survey. Our sample is predominantly Christian (54.3%) and mostly living in rural areas (68.8%). The average education of the respondents has generally improved over time with 67.2% of respondents in 2010/11 having completed secondary education or higher compared to only 37.4% in 1994. The share of women in gainful employment has declined over time from 52% in 1994 to 36% in 2010/11. The overall marital status distribution indicates a 3% increase in the proportion of singles or divorced women over time. Overall health insurance coverage has remained relatively low (6.8%) with 61.1% of women practicing family planning, 39% read newspapers at least once

a week, 51.1% listen to the radio at least once a week and nearly 10.5% have terminated a pregnancy in the past.

**[Insert Table 1 here]**

Fig. 1 presents the trends in maternal health care utilization in Zimbabwe's ten provinces. While the average utilization rates appear to vary across provinces, we observe almost similar patterns in some of the provinces. For instance, the trends in professional delivery assistance and prenatal care appear to be somewhat similar in Manicaland, Mashonaland central, east, and west, Matabeleland north, Harare, and Bulawayo provinces. The trends in prenatal care use appear to slightly differ for Matabeleland south, Midlands, and Masvingo where we first observe a rise in average use in 1994-1999 period followed by a decline in average use over the period 2000-2010. Regarding average education on dangers occurring during pregnancy, we observe improvements in knowledge proliferation in nearly all the provinces except for Masvingo and Bulawayo provinces with marginal increases. Overall, the average maternal health care utilization rates in 2010/11 period have worsened compared to their 1994 levels in all the provinces.

**[Insert Fig. 1 here]**

Fig. 2 shows the trends in maternal health care utilization by household wealth quintile. According to Fig. 2, the average utilization rates for women in the bottom three wealth quintiles (poorest, poorer, and average) are lower than those in the two top wealth quintiles (richer and richest). Also, we observe steeper and declining trends in maternal health care use for Individuals in the bottom three wealth groups. Women from wealthier families (richer and richest) have maintained high utilization rates over time. However, women in the top two wealth quintiles appear to experience a volatile pattern in prenatal care utilization over time compared to those in the bottom three wealth quintiles. Regarding knowledge about

pregnancy complications, women in the top three wealth quintiles experienced a sharp increase in knowledge while the distribution for those in the bottom two wealth quintiles appear to show a non-linear and rising pattern.

**[Insert Fig. 2 here]**

Fig. 3 depicts the average utilization rates for women living in urban and rural areas. As expected, women living in urban communities have better access to professional delivery assistance compared to their rural counterparts. Regarding prenatal care, urban women have maintained a very unstable pattern in utilization compared to their rural counterparts who have experience a stable decline in use over time. Concerning education for complications that might arise during pregnancy, the share of educated women in urban areas has increased sharply over the years while the rural population has experienced a gradual increase over time. Overall, we observe lower utilization rates for both rural and urban communities in 2010/11 compared to 1994 for all the maternal health care outcomes.

**[Insert Fig. 3 here]**

### **Trends in inequalities in maternal healthcare use**

Fig. 4 shows a graphical presentation of the corrected concentration indices for prenatal care, professional delivery assistance and information on pregnancy complications for the overall, rural and urban samples. The concentration indices are calculated using O O'Donnell, S O'Neill, T Van Ourti and B Walsh [33] *conindex* command and are survey weighted to be nationally representative including clustering at the primary sampling unit to appropriately adjust the standard errors. The left panel of Fig. 4 shows the overall distribution of inequalities in maternal health care since 1994. The overall trends in inequalities in prenatal care use show a pro-rich distribution in 1994, 2005/06 and 2010/11 with a pro-poor distribution observed in 1999. The trends in inequalities in knowledge regarding pregnancy

complications show a persistent and rising pro-rich distribution. Inequalities in professional delivery assistance have been to the advantage of the rich for the period under study. Specifically, we observe a rising trend in inequalities in professional delivery assistance between 1994 and 2005/06 with a decline observed between 2005/06 and 2010/11.

**[Insert Fig. 4 here]**

The right panel of Fig.4 shows the distribution of inequalities for rural and urban samples. For the rural sample, we find a pro-rich distribution of inequalities in professional delivery assistance and the receipt of information regarding pregnancy complications. Specifically, we observe a decline in inequalities in professional delivery assistance in 1994-1999 and an increase in inequalities for the period 1999-2005/06. Though we observe a decline in inequalities in professional delivery assistance in the period 2005/06-2010/11, the gap between the rich and the poor has widened over time. Inequalities in the receipt of four or more prenatal care visits have changed from being pro-rich in 1994 to pro-poor in 1999 and pro-rich thereafter. From 2000 onwards, the trend in prenatal care use shows a widening gap between the rich and the poor in Zimbabwe's rural areas.

For the urban sample, we observe a slightly different distribution in inequalities in maternal health care utilization. We observe a rising pro-rich distribution in inequalities in knowledge regarding pregnancy complications over the 1999-2005/06 period with a decline observed over the 2005/06-2010/11 period. The overall distribution in inequalities in professional delivery assistance has been pro-rich and has significantly increased over time. For adequate prenatal care use, Fig. 4 shows a pro-rich distribution in inequalities in 1994, pro-poor in 1999, and pro-rich distribution in the years after 1999. Compared to their 1994 levels, inequalities in prenatal care use have widened and to the advantage of the rich over time.

## **Decomposition of socioeconomic status-related inequalities in maternal healthcare**

In this section, we conduct a decomposition of the measured inequalities in prenatal care, professional delivery assistance and knowledge regarding pregnancy complications. This exercise allows us to identify how much an observed factor contributes to measured inequalities in maternal health care. The coefficient estimates used for the decomposition analysis are presented in Table 2 for the survey years 2005/06 and 2010/11. For brevity, we omit the interpretation of the results in Table 2 and focus on the decomposition results for the two survey years, respectively.

**[Insert Table 2 here]**

The results of the decomposition analysis are presented in Table 3. For brevity, we only present the results for the decomposition analysis for the 2005/06 and 2010/11 survey periods. Table 3 shows the absolute and percent contributions of each explanatory variable to the overall inequalities in maternal health care use. The results indicate that household wealth explains a large share of the observed inequalities in maternal health care utilization between 2005/06 and 2010/11. Specifically, household wealth explains approximately 45.84% and 71.79% of the observed inequalities in the receipt of prenatal care in 2005/06 and 2010/11, respectively. Concerning professional delivery assistance, household wealth accounts for nearly 36.14% in 2005/06 and 64.23% in 2010/11. Also, nearly 49.95% and 48.30% of the observed inequalities in the knowledge regarding pregnancy complications observed in 2005/06 and 2010/11, respectively is explained by differences in household wealth. The positive sign on household wealth's contribution implies that if household wealth was distributed equally across the population then, the observed inequalities in maternal health care would be lower by the corresponding percentages indicated above.

**[Insert Table 3 here]**

Education is another important factor accounting for a sizeable share of the observed inequalities in maternal healthcare. The results show that if the distribution of education was uniformly distributed, inequalities in prenatal care use would have been 26.69% and 18.20% lower in 2005/06 and 2010/11, respectively. However, education only explains only 8.8% and 6.19% of the inequalities in professional delivery assistance observed in 2005/06 and 2010/11, respectively. We find that the contribution of education on the observed inequalities in knowledge regarding pregnancy complications has increased from 7.94% in 2005/06 to 22.67% in 2010/11. Information access through reading newspapers and magazines as well as listening to the radio also plays an important role in explaining the observed inequalities in maternal health care. We find that nearly 23.95% and 15.23% of the observed inequalities in prenatal care in 2005/06 and 2010/11 respectively can be explained by information acquisition through the radio. The contribution of radio listenership to inequalities in professional delivery assistance and information regarding pregnancy complications appear to be very low (below 5%) with 11.97% observed for pregnancy complications in 2010/11. Reading newspapers accounts for nearly 5.42% and 26.04% of the inequalities in prenatal care observed in 2005/06 and 2010/11 respectively. Also, reading newspapers accounts for nearly 11.12% and 16.09% of the measured inequalities in the receipt of information regarding pregnancy complications in 2005/06 and 2010/11 respectively. The contribution of reading newspapers on inequalities in professional delivery assistance was below 10% over the two years.

The results in Table 3 also show that health insurance accounts for a fair and positive share of the observed inequalities in prenatal care with contributions of less than 5% to inequalities in professional delivery assistance and pregnancy complications. Specifically, health insurance accounts for almost 12.88% and 12.13% of the observed inequalities in prenatal care utilization in 2005/06 and 2010/11 respectively. The overall contribution of

geographical regions to measured inequalities in maternal healthcare utilization is negative in nearly all the years except for the survey year 2005/06 for the receipt of information regarding pregnancy complications. Additionally, we also find that urban residence positively contributes to the observed inequalities in maternal health care except for prenatal care in 2010/11. We find that urban residence accounted for a larger share of the measured inequalities in 2005/06 of about 21.35%, 30.18%, and 17.43% for prenatal care, professional delivery assistance, and information regarding pregnancy complications, respectively. In 2010/11, urban residence account for less than 10% of the observed inequalities in maternal health care.

## **Discussion**

In this paper, we have measured and explained wealth-related inequalities in the receipt of four or more prenatal care visits, professional delivery assistance, and receipt of information regarding pregnancy complications using the corrected concentration index as suggested by G Erreygers [20]. We found a pro-rich distribution in inequalities in professional delivery assistance and receipt of information regarding pregnancy complications. The concentration indices for prenatal care use reveal a pro-rich distribution of inequalities in 1994, 2005/06 and 2010/11 with a pro-poor distribution observed in 1999. The decomposition analysis of wealth-related inequalities in maternal health care use demonstrated that household wealth was the most important factor explaining the observed inequalities. These findings corroborate the findings in previous studies [4, 17, 19]. Zimbabwe.

Our results indicate an increasing trend in the extent of wealth-related inequalities in maternal healthcare use for both rural and urban areas. Also, we found a pro-poor distribution in prenatal care use observed in 1999. This finding might be explained by the impact of the PHC act of the mid-1980s. The central goal of the PHC was that of improving access to

maternal health care services in rural areas. Through the Primary Health Care initiative, the number of health care centers and clinics in rural areas rose from 247 in 1980 to 1,062 in 1989. The results also indicate a widening gap between the poor and rich over time with regards to prenatal care access. It is also important to note that Zimbabwe experience one of its worst economic crisis that started in 2000. The hyperinflationary environment that prevailed over the crisis period worsened the plight of the rural population (nearly 60%) which to some extent worsened the gap between the rich and poor. The deterioration in a number of essential sectors of the economy including health, banking, and manufacturing sector among others is also partly responsible for the rising gap in inequalities.

This study has found a pro-rich distribution in inequalities in professional delivery assistance. During the 2000-2011 period saw the exodus of important and qualified health personnel to neighboring countries including the closing down of important public health institutions [34]. Also, the collection of user fees formally enforced during 1993-94 period meant an increasing difficulty for the poor to use maternal health care services [35]. Over the years, the rising costs associated with delivering in a health facility have significantly contributed to the rising inequalities in professional delivery assistance as poorer households struggle to have access to these services.

Additionally, our study found a rising trend in inequalities in the receipt of information regarding pregnancy complications. This finding can plausibly be the result of the poor or less educated individuals not knowing or asking about the possibility of these complications arising during pregnancy. The observed inequalities might be an artifact of the fact that the rich are more likely to be educated and thus more liable to have access to such information from a health professional. In Zimbabwe, the rise in the user fees associated with access to maternal services might be the reason why we observe a pro-rich distribution in the receipt of information regarding pregnancy complications.



Our study is not without its shortcomings. One of the shortcomings of this study is that, the factors identified to influence maternal health care outcomes do not necessarily have a causal interpretation. We do not make an attempt to ascertain a causal effect of the socioeconomic factors and the two maternal health care outcomes considered. One can only interpret the reported coefficients as mere correlations or associations between the explanatory variables and maternal health care outcomes. Another shortcoming of our study is that, some of the data recorded by the ZDHS on maternal health care use is based on self-reports by the interviewed women. There is possibility of recall bias associated with such responses which potentially biases our findings. Despite the highlighted shortcomings, this study makes an important contribution to the literature in developing countries particularly sub-Saharan Africa.

## **Conclusions**

This study measured and explained inequalities in prenatal care, professional delivery assistance, and receipt of information on pregnancy complications. We found a pro-rich distribution of inequalities in professional delivery assistance and information regarding pregnancy complications. Overall, we find a rising trend in inequalities in maternal health care over time even after stratifying the sample by rural and urban status. The observed pro-rich distribution in inequalities in maternal health care was mostly explained by household wealth, education, and access to information. The findings in this study suggest a focus on vulnerable segments of the population to improve access to maternal health care and consequently lower inequalities.

## References

1. van Doorslaer E, Koolman X: **Explaining the Differences in Income-Related Health Inequalities across European Countries.** *Health Economics* 2004, **13**(7):609-628.
2. Hernandez-Quevedo C, Masseria C: **Measuring Income-Related Inequalities in Health in Multi-country Analysis.** *Estudios de Economia Aplicada* 2013, **31**(2):455-476.
3. Hajizadeh M, Nandi A, Heymann J: **Social inequality in infant mortality: What explains variation across low and middle income countries?** *Social Science & Medicine* 2014, **101**:36-46.
4. Alam N, Hajizadeh M, Dumont A, Fournier P: **Inequalities in Maternal Health Care Utilization in Sub-Saharan African Countries: A Multiyear and Multi-Country Analysis.** *PLoS ONE* 2015, **10**(4):1-16.
5. van Doorslaer E, Wagstaff A, Bleichrodt H, Calonge S, Gerdtham UG, Gerfin M, Geurts J, Gross L, Hakkinen U, Leu RE *et al*: **Income-related inequalities in health: some international comparisons.** *Journal of health economics* 1997, **16**(1):93-112.
6. Hosseinpoor AR, Stewart Williams JA, Itani L, Chatterji S: **Socioeconomic inequality in domains of health: results from the World Health Surveys.** *BMC Public Health* 2012, **12**:198-198.
7. Devaux M: **Income-Related Inequalities and Inequities in Health Care Services Utilisation in 18 Selected OECD Countries.** *European Journal of Health Economics* 2015, **16**(1):21-33.
8. Culyer AJ, Wagstaff A: **Equity and equality in health and health care.** *Journal of health economics* 1993, **12**(4):431-457.
9. MoHCW MoHaCW: **The Zimbabwe National Maternal and Neonatal Health Road Map 2007-2015.** In. Harare, Zimbabwe: Ministry of Health and Child Welfare; 2007.
10. MoHCW TMoHaCWoz: **National Child Survival Strategy for Zimbabwe 2010-2015.** In. Edited by The Ministry of Health and Child Welfare Z. Harare, Zimbabwe; 2010.
11. ZIMSTAT: **Zimbabwe National Health Profile 2010.** In. Harare, Zimbabwe: Zimbabwe Statistical Agency; 2010.
12. WHO: **Human Resources for Health, Country Profile Zimbabwe.** In.: CSO, Census 2002 & ICDS 2008; 2010.
13. van Doorslaer E, Wagstaff A, van der Burg H, Christiansen T, De Graeve D, Duchesne I, Gerdtham U-G, Gerfin M, Geurts J, Gross L *et al*: **Equity in the delivery of health care in Europe and the US.** *Journal of Health Economics* 2000, **19**:553-583.
14. Bago d'Uva T, Jones AM, van Doorslaer E: **Measurement of horizontal inequity in health care utilisation using European panel data.** *Journal of Health Economics* 2009, **28**(2):280-289.
15. Lu J-fR, Leung GM, Kwon S, Tin KYK, Van Doorslaer E, O'Donnell O: **Horizontal equity in health care utilization evidence from three high-income Asian economies.** *Social Science & Medicine* 2007, **64**:199-212.
16. Saito E, Gilmour S, Yoneoka D, Gautam GS, Rahman MM, Shrestha PK, Shibuya K: **Inequality and inequity in healthcare utilization in urban Nepal: a cross-sectional observational study.** *Health policy and planning* 2016:czv137.

17. Bonfrer I, van de Poel E, Grimm M, Van Doorslaer E: **Does the Distribution of Healthcare Utilization Match Needs in Africa?** *Health Policy and Planning* 2014, **29**(7):921-937.
18. Magadi MA, Zulu EM, Brockerhoff M: **The inequality of maternal health care in urban sub-Saharan Africa in the 1990s.** *Population studies* 2003, **57**(3):347-366.
19. Zere E, Oluwole D, Kirigia JM, Mwikisa CN, Mbeeli T: **Inequities in skilled attendance at birth in Namibia: A decomposition analysis.** *BMC Pregnancy & Childbirth* 2011, **11**(1):34-43.
20. Erreygers G: **Correcting the Concentration Index.** *Journal of Health Economics* 2009, **28**:504-515.
21. O'Donnell O, van Doorslaer E, Wagstaff A, Lindelow M: **Analyzing Health Equity Using Household Survey Data : A Guide to Techniques and Their Implementation.** 2008.
22. Wagstaff A, Paci P, van Doorslaer E: **On the measurement of inequalities in health.** *Social science & medicine (1982)* 1991, **33**(5):545-557.
23. Wagstaff A, van Doorslaer E: **Measuring and Testing for Inequity in the Delivery of Health Care.** In.: University of Wisconsin Press; 2000: 716.
24. Wagstaff A: **The bounds of the concentration index when the variable of interest is binary, with an application to immunization inequality.** *Health Economics* 2005, **14**(4):429-432.
25. Clarke PM, Gerdtham U-G, Johannesson M, Bingefors K, Smith L: **On the measurement of relative and absolute income-related health inequality.** *Social Science & Medicine* 2002, **55**:1923-1928.
26. Wagstaff A, van Doorslaer E, Watanabe N: **On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam.** *Journal of Econometrics* 2003, **112**:207-223.
27. Rutstein SO, Rojas G: **Guide to DHS statistics.** *Calverton, Maryland: ORC Macro* 2006.
28. Lincetto O, Mothebesoane-Anoh S, Gomez P, Munjanja S: **Antenatal care. Opportunities for Africa's newborns: Practical data, policy and programmatic support for newborn care in Africa** 2006.
29. Filmer D, Pritchett LH: **Estimating Wealth Effects without Expenditure Data-or Tears: An Application to Educational Enrollments in States of India.** In.: Population Association of America; 2001: 115.
30. Wagstaff A: **Inequalities in Health in Developing Countries: Swimming Against the Tide?** 2002.
31. Lindelow M: **Sometimes More Equal Than Others: How Health Inequalities Depend on the Choice of Welfare Indicator.** *Health Economics* 2006, **15**(3):263-279.
32. McKenzie DJ: **Measuring Inequality with Asset Indicators.** *Journal of Population Economics* 2005, **18**(2):229-260.
33. O'Donnell O, O'Neill S, Van Ourti T, Walsh B: **conindex: Estimation of concentration indices.** *The Stata journal* 2016, **16**(1):112.
34. ZIMSTAT: **Zimbabwe National Health Profile 2011.** In. Harare, Zimbabwe: Zimbabwe Statistical Agency; 2011.
35. Bijlmakers L, Bassett M, Sanders D: **Health and Structural Adjustment in Rural and Urban Settings in Zimbabwe. Some Interim Findings.** *Structural Adjustment and the Working Poor in Zimbabwe: Studies on Labour, Women Informal Sector Workers and Health* 1995:215.

Table 1. Summary statistics of variables used in the analysis

Variables	Overall		1994		1999		2005/06		2010/11	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age 13-19	0.154	0.361	0.147	0.354	0.166	0.372	0.156	0.363	0.145	0.352
Age 20-24	0.324	0.468	0.319	0.466	0.327	0.469	0.339	0.474	0.309	0.462
Age 25-29	0.235	0.424	0.211	0.408	0.231	0.421	0.232	0.422	0.259	0.438
Age 30-34	0.160	0.367	0.175	0.380	0.138	0.344	0.160	0.366	0.174	0.379
Age 35-39	0.087	0.283	0.100	0.300	0.098	0.297	0.073	0.260	0.082	0.275
Age 40-44	0.032	0.177	0.040	0.195	0.034	0.181	0.033	0.178	0.025	0.156
Age 45-49	0.007	0.082	0.008	0.087	0.007	0.084	0.007	0.081	0.006	0.078
Marital status – separated	0.108	0.310	0.082	0.274	0.098	0.298	0.137	0.343	0.108	0.310
Marital status – married	0.841	0.366	0.864	0.343	0.838	0.368	0.814	0.389	0.851	0.356
Marital status – never married	0.051	0.220	.	.	0.064	0.244	0.049	0.216	0.041	0.197
Employed	0.438	0.496	0.520	0.500	0.526	0.499	0.364	0.481	0.360	0.480
No education	0.058	0.234	0.126	0.332	0.065	0.247	0.041	0.197	0.017	0.131
Primary education	0.393	0.489	0.500	0.500	0.436	0.496	0.352	0.478	0.311	0.463
Secondary education	0.548	0.498	0.374	0.484	0.499	0.500	0.607	0.488	0.672	0.470
Religion – Christian	0.543	0.498	0.495	0.500	0.815	0.388	0.435	0.496	0.408	0.492
Religion – apostolic church member	0.394	0.489	.	.	.	.	0.347	0.476	0.440	0.496
Reads newspapers at least one a week	0.390	0.488	0.435	0.496	0.390	0.488	0.388	0.487	0.359	0.480
Listens to the radio at least once a week	0.511	0.500	0.383	0.486	0.580	0.494	0.528	0.499	0.522	0.500
Health insurance coverage	0.068	0.251	.	.	.	.	0.081	0.273	0.054	0.226
Family planning	0.611	0.488	0.575	0.494	0.596	0.491	0.643	0.479	0.621	0.485
Terminated pregnancy	0.105	0.306	0.120	0.325	0.107	0.310	0.097	0.296	0.098	0.297
Wealth quintile 1 – poorest	0.219	0.413	0.241	0.428	0.195	0.397	0.228	0.420	0.216	0.412
Wealth quintile 2	0.192	0.394	0.183	0.386	0.179	0.383	0.201	0.401	0.205	0.404
Wealth quintile 3	0.183	0.387	0.179	0.384	0.186	0.389	0.174	0.379	0.191	0.393
Wealth quintile 4	0.222	0.415	0.211	0.408	0.233	0.423	0.220	0.414	0.219	0.414
Wealth quintile 5 – (richest)	0.184	0.388	0.186	0.389	0.207	0.405	0.177	0.382	0.168	0.374
Urban resident	0.312	0.464	0.267	0.442	0.346	0.476	0.313	0.464	0.312	0.463
Manicaland province	0.137	0.344	0.131	0.337	0.151	0.358	0.121	0.326	0.142	0.349
Mashonaland central province	0.101	0.301	0.087	0.282	0.094	0.293	0.111	0.315	0.106	0.308
Mashonaland east province	0.090	0.286	0.102	0.302	0.087	0.282	0.078	0.268	0.096	0.295
Mashonaland west province	0.110	0.313	0.116	0.320	0.099	0.299	0.101	0.301	0.125	0.330
Matabeleland north province	0.060	0.237	0.077	0.266	0.054	0.226	0.064	0.245	0.049	0.215
Matabeleland south province	0.052	0.223	0.058	0.234	0.059	0.236	0.045	0.207	0.048	0.214
Midlands province	0.131	0.338	0.137	0.343	0.123	0.329	0.143	0.350	0.124	0.329
Masvingo province	0.117	0.322	0.102	0.303	0.103	0.304	0.149	0.356	0.112	0.316
Harare province	0.151	0.358	0.140	0.347	0.168	0.373	0.138	0.345	0.156	0.363
Bulawayo province	0.052	0.221	0.051	0.221	0.061	0.240	0.051	0.219	0.043	0.202
Observations	13506		2218		2818		4073		4397	

Notes: All estimates are weighted to be nationally representative.

Table 2: Coefficient estimates used for the decomposition analysis

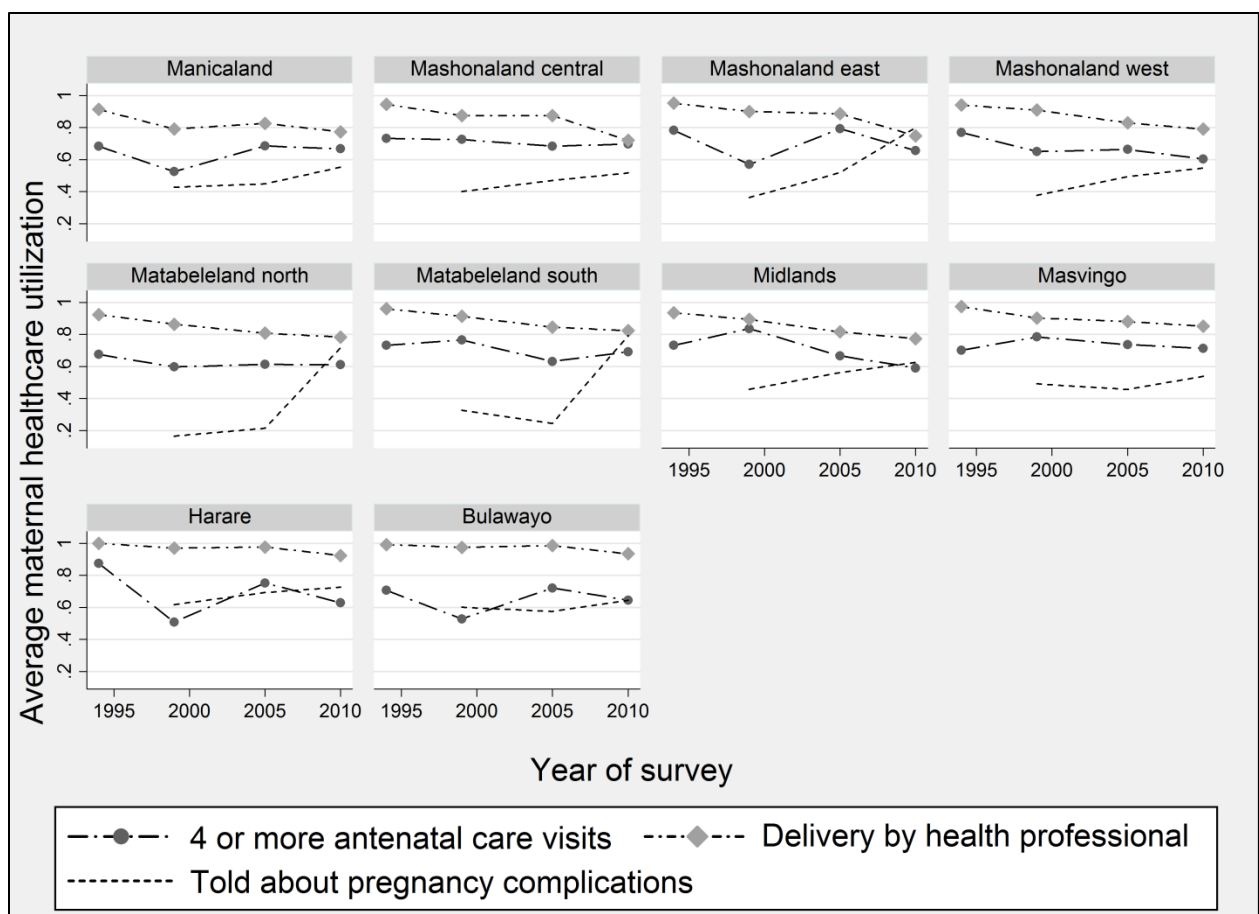
Variables	Four or more prenatal care visits				Professional delivery assistance				Told about pregnancy complications			
	2005/06		2010/11		2005/06		2010/11		2005/06		2010/11	
	Coefficient	Std. error	Coefficient	Std. error	Coefficient	Std. error	Coefficient	Std. error	Coefficient	Std. error	Coefficient	Std. error
Age 20-24	-0.010	(0.023)	0.039	(0.027)	0.018	(0.022)	0.005	(0.024)	0.030	(0.027)	0.001	(0.026)
Age 25-29	0.024	(0.023)	0.019	(0.030)	-0.008	(0.024)	0.009	(0.023)	0.054**	(0.027)	0.097***	(0.030)
Age 30-34	-0.003	(0.029)	0.034	(0.029)	-0.001	(0.023)	-0.025	(0.025)	0.137***	(0.030)	0.056*	(0.031)
Age 35-39	-0.005	(0.036)	0.043	(0.033)	0.007	(0.037)	-0.036	(0.030)	0.137***	(0.036)	0.077**	(0.036)
Age 40-44	-0.125*	(0.067)	0.047	(0.051)	-0.007	(0.045)	-0.075*	(0.043)	0.246***	(0.054)	0.129**	(0.054)
Age 45-49	0.124	(0.091)	-0.084	(0.111)	-0.185	(0.118)	0.034	(0.104)	0.194	(0.164)	0.320***	(0.093)
Marital status – married	-0.031	(0.027)	0.025	(0.029)	0.010	(0.019)	0.005	(0.025)	0.032	(0.030)	0.020	(0.027)
Marital status – never married	-0.155***	(0.041)	-0.043	(0.043)	-0.028	(0.034)	-0.013	(0.039)	-0.067	(0.047)	0.036	(0.044)
Employed	0.019	(0.016)	0.007	(0.019)	0.001	(0.016)	-0.010	(0.018)	0.014	(0.022)	0.048***	(0.019)
Primary education	0.025	(0.046)	-0.109*	(0.060)	0.105*	(0.054)	0.108*	(0.062)	0.046	(0.053)	0.087	(0.069)
Secondary education	0.080*	(0.048)	-0.055	(0.061)	0.191***	(0.063)	0.211***	(0.062)	0.084	(0.057)	0.163**	(0.070)
Religion – Christian	0.018	(0.020)	0.033	(0.023)	0.063***	(0.017)	0.056**	(0.024)	0.038	(0.027)	0.042*	(0.022)
Religion – apostolic church member	-0.026	(0.026)	-0.039	(0.024)	0.016	(0.019)	-0.023	(0.024)	0.042*	(0.024)	0.032	(0.023)
Reads newspapers at least one a week	0.014	(0.017)	0.051***	(0.019)	0.055***	(0.015)	0.044***	(0.016)	0.055*	(0.030)	0.050***	(0.018)
Listens to the radio at least once a week	0.043**	(0.018)	0.043**	(0.017)	0.026*	(0.015)	0.008	(0.015)	0.012	(0.030)	0.054***	(0.017)
Health insurance coverage	0.066***	(0.025)	0.066**	(0.031)	0.039**	(0.016)	0.066***	(0.020)	0.068**	(0.030)	0.003	(0.037)
Family planning	0.039**	(0.017)	0.091***	(0.018)	0.034**	(0.016)	0.039**	(0.016)	0.021	(0.030)	-0.014	(0.018)
Terminated pregnancy	0.031	(0.028)	-0.015	(0.024)	0.020	(0.023)	-0.017	(0.025)	-0.006	(0.027)	-0.002	(0.028)
Urban resident	0.028	(0.033)	-0.005	(0.030)	0.111***	(0.027)	0.055**	(0.027)	0.059	(0.051)	0.008	(0.035)
Wealth quintile 1 – poorest	-0.073	(0.046)	-0.088**	(0.038)	-0.084**	(0.042)	-0.231***	(0.034)	-0.180***	(0.051)	-0.090**	(0.041)
Wealth quintile 2	-0.061	(0.042)	-0.077**	(0.036)	-0.056*	(0.031)	-0.153***	(0.031)	-0.105**	(0.044)	-0.086**	(0.038)
Wealth quintile 3	-0.040	(0.040)	-0.072**	(0.035)	0.031	(0.032)	-0.110***	(0.033)	-0.064	(0.046)	-0.031	(0.036)
Wealth quintile 4	-0.064**	(0.027)	-0.063**	(0.026)	0.013	(0.016)	-0.022	(0.019)	-0.036	(0.028)	-0.044*	(0.025)
Manicaland province	0.085*	(0.047)	0.103***	(0.039)	-0.017	(0.033)	0.006	(0.035)	0.049	(0.061)	-0.021	(0.045)
Mashonaland central province	0.091*	(0.048)	0.143***	(0.044)	0.076*	(0.045)	-0.068	(0.050)	0.085	(0.059)	-0.015	(0.048)
Mashonaland east province	0.161***	(0.049)	0.067	(0.044)	0.013	(0.036)	-0.048	(0.033)	0.075	(0.061)	0.234***	(0.044)
Mashonaland west province	0.044	(0.050)	0.049	(0.038)	-0.015	(0.025)	-0.011	(0.037)	0.102	(0.073)	0.006	(0.049)
Matabeleland north province	0.040	(0.053)	0.077	(0.048)	0.049	(0.039)	0.067	(0.045)	-0.124**	(0.058)	0.219***	(0.042)
Matabeleland south province	0.051	(0.049)	0.144***	(0.040)	0.006	(0.036)	0.050	(0.035)	-0.142**	(0.057)	0.228***	(0.041)
Midlands province	0.046	(0.047)	0.030	(0.041)	-0.003	(0.027)	-0.011	(0.034)	0.183***	(0.057)	0.070*	(0.042)
Masvingo province	0.171***	(0.058)	0.163***	(0.041)	0.066*	(0.036)	0.156***	(0.038)	0.061	(0.055)	0.009	(0.051)
Harare province	0.007	(0.042)	-0.026	(0.041)	-0.014	(0.018)	-0.020	(0.030)	0.118***	(0.040)	0.085**	(0.035)
Constant	0.586***	(0.083)	0.566***	(0.083)	0.520***	(0.078)	0.566***	(0.072)	0.256**	(0.109)	0.326***	(0.087)
Observations	4,042		4,397		4,035		4,395		3,796		3,980	

Notes: \*\*\*Significant at 1% level; \*\*significant at 5% level; \*significant at 10% level. Reported are regression coefficient estimates and robust standard errors shown in parentheses. All estimates are weighted to be nationally representative and clustered at the primary sampling unit. The reference categories are as follows: Age 13-19; marital status = separated/divorced; no education; other religion; region 10 = Bulawayo; wealth quintile = 5 (richest).

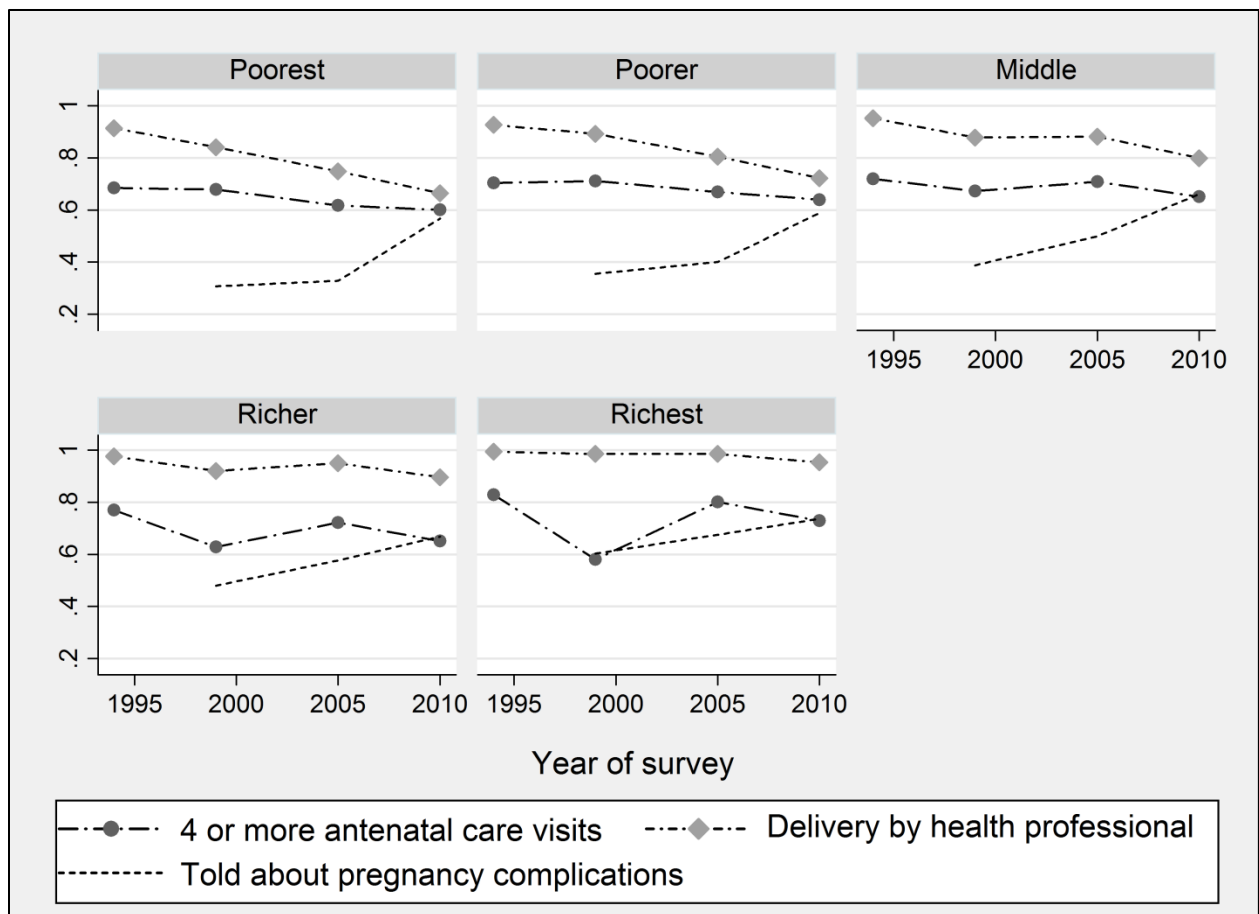
Table 3: Contributions of regressors in percent (%) of concentration index

Variables	Four or more prenatal care visits				Professional delivery assistance				Told about pregnancy complications			
	2005/06		2010/11		2005/06		2010/11		2005/06		2010/11	
	Contribution	%	Contribution	%	Contribution	%	Contribution	%	Contribution	%	Contribution	%
Household wealth	0.0175	45.84	0.0258	71.79	0.0170	36.14	0.0406	64.23	0.0701	49.95	0.0284	48.30
Age	0.0012	3.47	-0.0016	-4.61	0.0020	4.40	0.0018	2.99	-0.0097	-6.94	-0.0045	-7.55
Employed	0.0007	1.87	0.0005	1.47	0.0003	0.65	0.0004	0.57	0.0009	0.65	0.0037	6.32
Education	0.0103	26.69	0.0066	18.20	0.0041	8.80	0.0039	6.19	0.0112	7.94	0.0134	22.67
Religion	0.0046	12.01	0.0081	22.69	0.0029	5.98	0.0042	6.66	0.0004	0.29	0.0012	1.90
Marital status	-0.0084	-21.93	-0.0048	-13.34	0.0020	4.11	0.0038	5.94	-0.0092	-6.60	0.0012	2.17
Read newspapers	0.0021	5.42	0.0093	26.04	0.0038	8.12	0.0044	6.92	0.0156	11.12	0.0095	16.09
Listen to radio	0.0092	23.95	0.0055	15.23	0.0015	3.12	0.0002	0.37	0.0022	1.58	0.0071	11.97
Health insurance	0.0049	12.88	0.0044	12.13	0.0016	3.48	0.0019	2.96	0.0071	5.07	0.0002	0.33
Family planning	0.0002	0.58	-0.0011	-3.03	-0.0001	-0.23	0.0003	0.52	0.0002	0.12	0.0002	0.28
Terminated pregnancy	-0.0006	-1.48	0.0001	0.27	-0.0004	-0.90	-0.0001	-0.12	0.0002	0.11	0.0000	0.02
Urban residence	0.0082	21.35	-0.0014	-3.99	0.0141	30.18	0.0053	8.36	0.0245	17.43	0.0025	4.27
Region (nine provinces)	-0.0197	-51.81	-0.0250	-69.64	-0.0035	-7.27	-0.0054	-8.56	0.0144	10.29	-0.0043	-7.29
Residual		21.15		26.76		3.42		2.98		9.01		0.51
Total	0.0302	78.85	0.0264	73.24	0.0453	96.58		97.02	0.1279	90.99	0.0586	99.49
Erreygers corrected concentration index	0.111***		0.094***		0.171***		0.217***		0.290***		0.154***	

Notes: Estimates are weighted to be nationally representative. Contribution = the absolute contributions of explanatory variables to the concentration index.

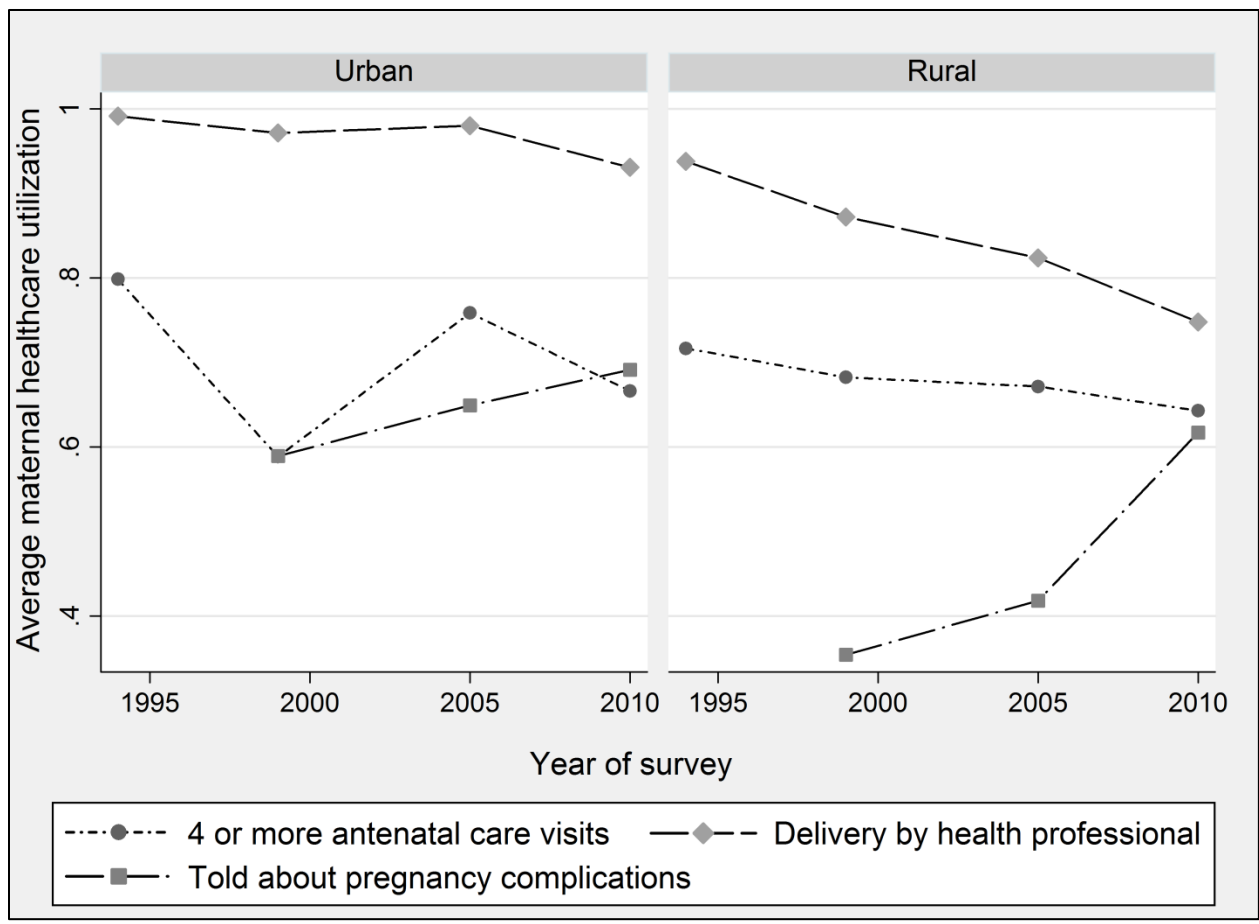


**Fig. 1** Evolution of maternal healthcare utilization in Zimbabwe, 1994-2011

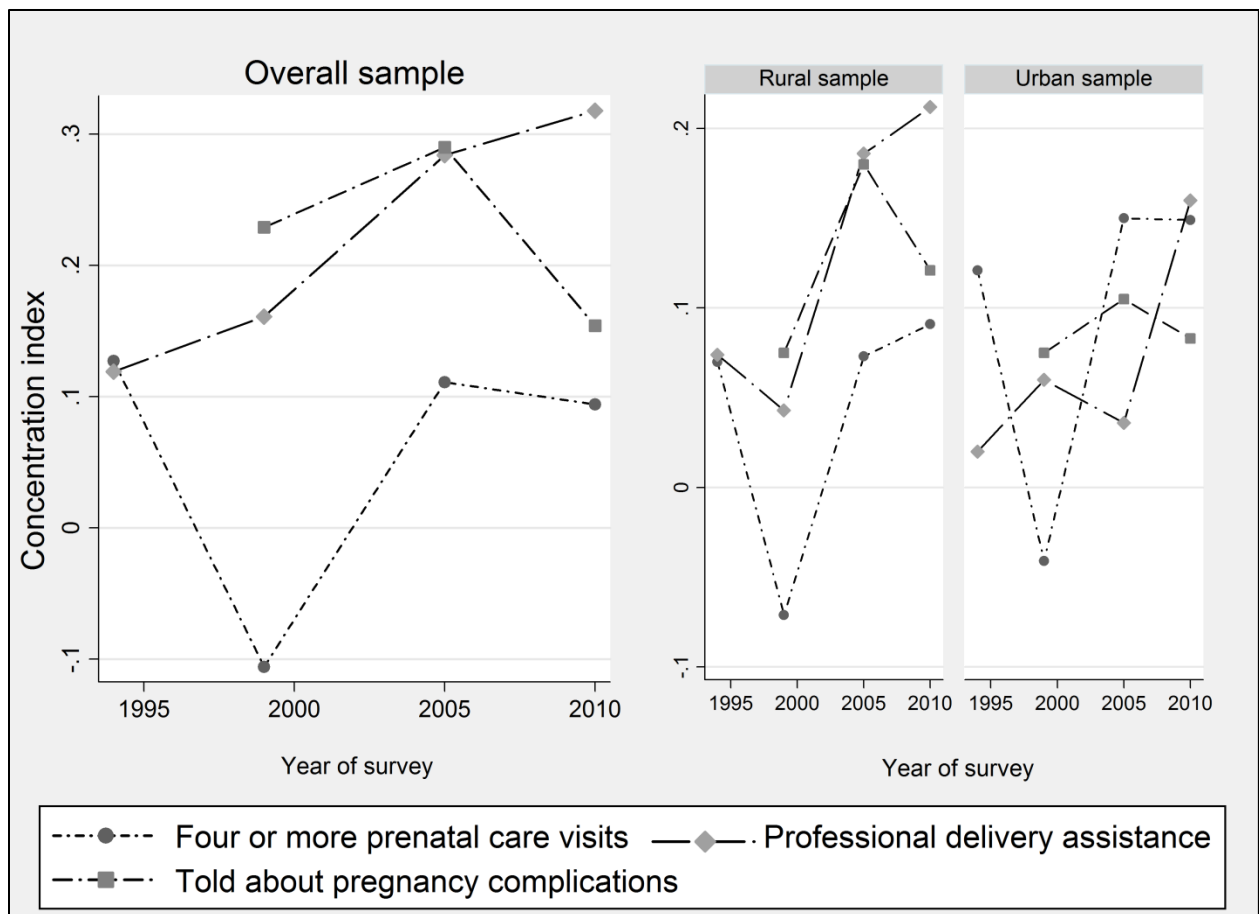


**Fig. 2** Trends in average maternal healthcare utilization by province in Zimbabwe, 1994-2011





**Fig. 3** Trends in average maternal healthcare utilization by household wealth group in Zimbabwe, 1994-2011



**Fig. 4** Trends in inequalities in maternal healthcare utilization by rural/urban status in Zimbabwe, 1994-2011