# Inequalities in the Utilization of Maternal Health Services by Key Indicators in Ethiopia

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**Abstract**

**Introduction**: Inequalities in health are a major challenge for health policy, because most of them can be considered unfair or unreasonable. The aim of this study was to examine inequality in maternal health service indicators based on selected inequalities dimension. **Methods**: The Demographic and Health Survey datasets of Ethiopia (2000, 2005 and 2011) were used. Five maternal health service indicators such as four or more antenatal care visits from a skilled professional, at least one antenatal care visit, delivery assistance from a skilled birth attendant, modern contraceptive use by married women and demand family planning satisfied were included in the study. Each of these maternal health services were stratified by economic, education and place of residence. We calculated the ratio and concentration index inequality measure using World Health Organization health equity assessment toolkit (HEAT) software version 1.0.**Results:** Improvement in maternal health service utilization observed across each survey year by economic, education and place of residence but utilization was uneven. The maternal health services utilization are concentrated in advantage groups (richest quintile, urban and educated secondary & above).  The least equality related to economics, educational levels and residence is observed in the utilization of skilled birth attendants and four or more antenatal care visits. **Conclusion:** Maternal health services use inequality related to economic, education and residence are observed in all indicators and the utilization are concentrated in advantaged groups. Health inequality related to maternal health service use in terms of wealth quintiles, educational levels and residence need due emphasis to narrow the gap between advantaged and disadvantaged population distribution.

**Keywords:** Maternal; Health Service; Inequality; Ethiopia

## Introduction

Among eight Millennium Development goals, goal 5 targeted a reduction of maternal mortality by 75 percent in the period between 1990 and 2015, but since 1990, the maternal mortality ratio has declined by 45 percent worldwide and 49 per cent in sub-Saharan Africa[1].

The state of inequality in maternal, newborn and child health (MNCH) showed inequalities across low and middle income countries in terms of national figures. Within-country inequality differed across health indicators. Maternal health intervention indicators demonstrated pronounced within-country inequalities across population subgroups [2].

High levels of inequalities have been recorded within countries in maternal health care indicators such as skilled birth attendance (SBA), facility based deliveries (FBD) and contraceptive use by wealth quintile[3–8], education status [8–10],  and urban-rural location [3,4,7,8,10,11], with better outcomes favoring more advantaged groups. The evidence is less consistent regarding use of antenatal care (ANC) [3,5–9,12,13]

Studies were revealed that poorer groups within developing countries use less health care and there was poor–rich inequalities in maternal health care and maternal mortality[11,12,14].

Even though, births attended by skilled health personnel were improved globally and in sub-Saharan Africa and Asia, many studies have reported that there are large gap between the richest and poorest; the most and least educated; and urban and rural areas[2,15]**.** For instance, SBA intervention is in favoring of those with wealthiest quintile[2,3,7,16–19], of those with highest education level[17–19], and of those from urban areas [13,15,20–22]**.**

Studies have shown that maternal health interventions more used by mothers with formal education, those living in urban areas and richer parts of the population in Ethiopia[16,18,23].

In sub-Saharan Africa, coverage levels of four or more antenatal care visits have stagnated over the past two decades, with a small increase from 47 to 49 per cent. In Ethiopia, the proportion of pregnant women who received four or more antenatal care was 34% in 2011[15].

Contraceptive prevalence among women aged 15 to 49, married or in a union, increased from 55 percent in 1990 worldwide to 64 percent in 2015. In sub-Saharan Africa, this proportion more than doubled from 13 % to 28% between 1990 and 2015 [1]. In Ethiopia, 29 percent of currently married women report use of a contraceptive method, with 27 percent using a modern method in 2011[15].

The recent demographic and health survey conducted in Ethiopia 2014 showed considerable progress in coverage of maternal health service including antenatal cares, contraceptive prevalence and skilled birth attendants[15] however inequality persists.

In developing regions, there is a 31% point gap between urban and rural areas in the coverage of skilled birth attendants. For example, in Ethiopia skilled providers were attended 51% of births in urban areas compared with 4% of births in rural areas. Highly educated  mothers and mothers in the highest wealth quintile were more likely to have their births assisted by a skilled attendant 74% and 46% respectively[15].

However, in low-income countries, studies are lacking that systematically monitor and evaluate health programs with regard to their effect on specific inequalities. There are few studies in Ethiopia in inequality in maternal health intervention. Most of them focused on one or two maternal health indicators at the national level, while others examined one or more maternal health indicators for a specific region or town.  Additional some of them focused analysis of maternal health care inequalities on a single inequality dimension that is wealth quintile.

Therefore, the aim of this study is to assess the inequalities in maternal health service for the range of indicators such as modern contraceptive use, demand for family planning satisfied, four or more antenatal care visits (ANC4+), at least one antenatal care visit (ANC1) and skilled birth attendant by economic status, education status and place of residence subgroups in Ethiopia

**Methods**

Ethiopia, located in the horn of Africa, has nine regional states and two city administrations. The estimated total populations of Ethiopia were 99 million.  Over 85 percent of the population lives in rural areas and over 50.8 percent of women were with no education[15,24] According government report, the primary health service coverage in the country is 93%[25].

This study used data of three Ethiopian Demographic and Health Surveys (EDHS), conducted in 2000, 2005 and 2011, which obtained comparable nationally representative samples from WHO Health Equity Monitor database data. The World Health Organization Health Equity Assessment Toolkit (HEAT): version 1.0 Software was used to estimate inequalities in maternal health service indicators by wealth, education and place of residence. HEAT is a Software application for use on desktop or laptop computers. It was developed to facilitate the assessment of within-country health inequalities. It helps to analyze disaggregated measures and aggregated summary measures of inequalities from DHS and/or Multiple Indicator Cluster Survey (MICs) data by economic status, mother's educational status and place of residence for selected health indicators.

We calculated the ratio to observe inequality in service utilization by place of residence (urban/rural) and concentration index (CI) inequality to assess inequalities in maternal health services utilization by economic status and mother's educational status subgroups using HEAT Software.  The ratio is the relative inequality measures between two subgroups.

Relative concentration index (RCI) is the relative measure of inequality that indicates the extent to which a health indicator is concentrated among the disadvantaged (negative value) or the advantaged (positive value). And if there is not an inequality or distribution of health indicator by the living standards is proportionate the concentrative index will be zero. Its advantage over other measurement of inequality is that it summarizes relative inequality across the entire socioeconomic distribution rather than simply comparing the extremes. The calculation of concentration index depends only on the relationship between health indicator variable (e.g. skilled birth attendant) and the rank of the living standards    variable and not on the variation in living standards variable itself. The formula for the calculation of concentration index according to World Bank is

$$C = \frac{2}{n\mu} \sum_{i=1}^{n} h_i r_i - 1 - \frac{1}{n}$$

 Where $n$ is sample size, $h$ the health variable proportion in $i^{th}$ rank, r the fractional rank by living standard (e.g. income).

Data of maternal health service utilization in WHO Health Equity Monitor database were analyzed using the World Health Organization Health Equity Assessment Toolkit (HEAT): version 1.0 Software for each of the above mentioned inequality measurements. Concentration index calculated for each maternal health service use indicators by wealth quintile and education level. In addition to this we calculated maternal health service use ratio by residence.

Five maternal health services indicators were included in this study such as four or more antenatal care visits from a skilled professional (ANC4+), at least one antenatal care visit (ANC +1), delivery assistance from a skilled birth attendant, modern contraceptive use by married women and  demand family planning satisfied. The following are WHO's definition of each indicator [26].

**Antenatal care visits- 4 or more (ANC+4):** Percentage of mothers aged 15 to 49 who had a live birth in the past 5 years who received at least 4 antenatal care visits from any skilled personnel during pregnancy for the most recent birth for reasons related to the pregnancy.

**Antenatal care visits- at least one (ANC+1):** Percentage of mothers aged 15 to 49 who had a live birth in the past 5 years who received at least one antenatal care visits from any skilled personnel during pregnancy for the most recent birth for reasons related to the pregnancy.

**Skilled birth attendant (SBA)**: Percentage of mothers aged 15 to 49 who had a live birth in the past years who were attended by skilled health attendant

**Contraceptive prevalence (Modern method)**: Percentage of women aged 15–49 years, married or in union, who is currently using, or whose sexual partner is using, at least one modern method of contraception.

**Demand for family planning satisfied**: Proportion of all women aged 15–49 years using contraception among those who are fecund, in union and in need of contraception.

As the data were obtained from records and public access data, we could not consent participants for accessing their records. However, we were anonymized the data and de-identified prior to analysis. We accepted the terms and conditions attached to data sharing policy.

**Results**

**Maternal Health Service Indicators by Inequalities Dimension**

All maternal health service utilization indicators were improved or increased between 2000 and 2011. For example, percent of birth assisted by skilled attendants among the richest quintile women increased from 25.3 percent in 2000 to 46.3 percent in 2011. Moreover, increases in the use of maternal health service are universal across the wealth quintiles for all the indicators (Table 1).

Maternal health services utilization indicators were increased both across educational level subgroup (no education, primary schooling and Secondary & above) in each survey years. Similarly, they were increased across survey years in each education level subgroups. For example, percent of births attended by skilled health personnel in those mothers who were attended secondary schooling & above increased from 45 percent to 74.4 percent between 2000 and 2011 (Table 2).

Use of maternal health service were substantial improved in both urban and rural across each survey years in all indicators, even though level of improvement different among each indicators. For example, percent of women 15-49 years old use modern contraceptive increased by more than six fold from 3.3 percent to 22.3 percent between 2000 and 2011 in rural areas (Table 3). There was residence based inequality in each maternal and reproductive health intervention indicators.

Despite substantial improvement in use of the five maternal health service among the rural women, Table 3 shows that inequalities still exist, reflected by ratios greater than one, showing more services use among urban than rural women. However, the ratios declined across survey years for the five indicators which mean the inequalities between urban and rural women narrowed and faster progress in the use of maternal health services was made among rural women than urban one.

**Inequalities in Maternal Health Service Use by Wealth Quintile, Education and Residence Using Summery Measures (Relative Concentration Index and Ratio)**

All concentration index measures of wealth-related inequalities in the use of five maternal health services have a positive value: it indicates that maternal health services are concentrated among the advantaged groups (wealthiest quintile). Moreover, wealth-related inequality was declined in modern contraceptive use, family planning needs satisfied, four or more antenatal visits (ANC4+) and skilled birth attendant from the earliest to latest survey year. It indicates the improvement of equality over time. However, use of antenatal care at least one visit is increased from 26.8 in 2010 to 28.1 in 2011 showing the increase of wealth-related inequalities. Despite the improvement in the wealth related maternal health service utilization, the inequalities is still substantial in the case of ANC4+and SBA (Table 4).

Education level based inequality in the four maternal health service indicators was declined across survey years. However, there was no changes in inequality in the use of antenatal care at least one visit. Both birth attended by skilled health personnel and ANC+4 are the least equitable health interventions among other indicators (Table 4).

Relative place of residence inequality in the use of five maternal health service indicators were declined over survey years. For example, for a skilled birth attendant, ratio declined from 15.0 in 2000 to 10.8 in 2011 in favor of rural women (Table 4)

The two inequality measures, concentration index and ratio, have positive value for all five maternal health services indicators. It indicates that maternal health services distribution are concentrated in advantaged groups (wealthiest, high education level and urban).

**Trends in inequalities in Maternal Health Services Utilization**

We disaggregated the trends in maternal health services use by selected background characteristics: wealth quintiles, place of residence (urban and rural) and mother's education to see change over time.

In general, relative measures of inequalities (ratio and concentration index) in maternal health services use were found to have declined over time in each inequality dimension. Despite this progress, the inequalities

are still substantial in the case of ANC4+ and skilled birth attendants by economic, education and place of residence in Ethiopia (Fig.1 and 2)

## Discussion

Maternal health service utilization for all five indicators included in the study was improved across survey years 2000, 2005 and 2011. However, there were a substantial inequality in each six maternal and reproductive health intervention indicators of economic status, education status and place of residence. The calculated estimate of relative measures of inequality, such as ratios and relative concentration index, demonstrated a decline in inequalities of the utilization of maternal health intervention across survey years. Despite this progress, a skilled birth attendant was the indicator with the highest inequality across each inequality measures dimension (economic, education and residence) and followed by antenatal care coverage - at least four visits in latest survey years 2011.

The utilization of skilled birth attendant increased over time in both rural and urban areas in Ethiopia, which is similar with the study finding in Uganda. However, it was different from study Madagascar [27].

Our study demonstrated huge variations in disparities of maternal health care between mothers in the wealthiest and poorest quintiles. The finding confirmed with previous study from Madagascar, Uganda, Zambia and Zimbabwe[27].

According this study wealth-based inequality as measured on a relative concentration index suggested that wealthier mothers utilized more ANC, Skilled birth attendant and modern contraceptive across all survey years. These findings support the existing literature, which also shows evidence for substantial inequalities in the use of maternal health service in terms of wealth and rural-urban settings in various African countries [3,28].

The study finding showed that women from urban areas used more ANC, skilled birth attendant and modern contraceptive than those from rural areas. The finding is in line with finding form Madagascar, Uganda, Zambia and Zimbabwe[27]. Urban-rural differentials in maternal health service utilization could be explained by the concentration of health infrastructure and better quality services in urban areas [7].

The study finding indicates education and place of residence related inequality in modern contraceptive use were more common than a income level. There was progress in modern contraceptive use in each education, economic and residence subgroups across three survey years. In Ghana education related inequality in the use of modern contraceptive was more common rather than a residence or income level [29]. The study was used only relative measures of inequalities (ratio and concentration curve) and did not consider the absolute difference. We could not draw concentration curve using HEAT software version 1.0.

## Conclusion

Maternal health services utilization showed progress across the survey years and across each inequality dimension. However, inequality related to economics, education and residence was observed in all five indicators. Skilled birth attendant is the most inequitable maternal health service followed by ANC[4+] visits across each inequalities dimension. We concluded that all maternal health service utilization indicators are pro-advantaged groups. Therefore, a due attention should be given to the disadvantaged groups (rural resident, lower educational level and lower wealth status) to increase the overall maternal health service use of the countries and reduce related maternal health burden.

## Conflict of Interest
We do not have any conflict interest

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**Table1: Maternal Health Service Use Indicators by Household Wealth Quintile in 2000, 2005 and 2011**

| Health Services  Use | Survey Year | Wealth Quintile | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | Lowest | Second | Meddle | Fourth | Highest |
| Births attended by skilled health personnel (%) | 2000 | 0.90 | 1.50 | 2.00 | 3.30 | 25.30 |
| | 2005 | 0.90 | 1.30 | 2.00 | 4.50 | 26.70 |
| | 2011 | 2.10 | 3.80 | 4.10 | 8.50 | 46.30 |
| Contraceptive prevalence- modern method (%) | 2000 | 2.70 | 2.70 | 2.00 | 3.60 | 22.90 |
| | 2005 | 4.00 | 6.50 | 11.60 | 15.20 | 33.70 |
| | 2011 | 13.00 | 21.50 | 24.00 | 30.30 | 48.20 |
| Demand for family planning satisfied (%) | 2000 | 8.80 | 8.50 | 8.40 | 11.20 | 48.30 |
| | 2005 | 11.30 | 15.10 | 24.90 | 30.40 | 60.80 |
| | 2011 | 30.40 | 45.50 | 46.40 | 54.20 | 77.90 |
| % of women had 1+ ANC visit | 2000 | 15.10 | 17.70 | 21.10 | 25.70 | 59.80 |
| | 2005 | 12.70 | 18.60 | 25.20 | 30.60 | 58.00 |
| | 2011 | 17.00 | 23.70 | 26.80 | 35.40 | 74.90 |
| % of women had 4+ANC Visits | 2000 | 4.10 | 4.60 | 6.00 | 7.00 | 34.70 |
| | 2005 | 4.00 | 6.10 | 8.50 | 8.70 | 39.30 |
| | 2011 | 8.30 | 11.70 | 13.80 | 21.50 | 46.00 |

**Table2: Maternal Health Service Use Indicators by Mother's Educational Level in 2000, 2005 and 2011**

| Maternal Health Service Use | Survey Year | Education level | | |
| --- | --- | --- | --- | --- |
| | | No Education | Primary Education | Secondary schooling and above |
| Births attended by skilled health personnel (%) | 2000 | 2.50 | 10.40 | 45.00 |
| | 2005 | 2.40 | 8.60 | 57.70 |
| | 2011 | 5.30 | 16.30 | 74.40 |
| Contraceptive prevalence- modern method (%) | 2000 | 3.70 | 13.20 | 33.00 |
| | 2005 | 9.80 | 21.90 | 45.90 |
| | 2011 | 21.80 | 33.70 | 55.10 |
| Demand for family planning satisfied (%) | 2000 | 11.70 | 28.50 | 60.80 |
| | 2005 | 22.70 | 38.80 | 75.90 |
| | 2011 | 45.80 | 57.20 | 86.00 |
| Percent of women had 1+ ANC visit | 2000 | 21.00 | 45.00 | 71.70 |
| | 2005 | 21.70 | 39.40 | 80.90 |
| | 2011 | 25.00 | 45.50 | 87.60 |
| Percent of women had 4+ ANC visits | 2000 | 6.20 | 21.80 | 49.20 |
| | 2005 | 7.90 | 16.90 | 63.10 |
| | 2011 | 12.20 | 27.50 | 64.90 |

**Table 3: Maternal Health Service Use Indicators by Place of Residency in 2000, 2005, and 2011**

| Maternal Health Service Use | Survey Year | Place of Residency | | Urban/Rural ratio |
|---|---|---|---|---|
| | | Rural | Urban | |
| Births attended by skilled health personnel (%) | 2000 | 2.30 | 34.50 | 15.00 |
| | 2005 | 2.70 | 44.80 | 16.60 |
| | 2011 | 4.80 | 51.60 | 10.75 |
| Contraceptive prevalence- modern method (%) | 2000 | 3.30 | 28.30 | 8.60 |
| | 2005 | 10.60 | 42.20 | 4.00 |
| | 2011 | 22.50 | 49.50 | 2.20 |
| Demand for family planning satisfied (%) | 2000 | 10.40 | 58.80 | 5.70 |
| | 2005 | 23.70 | 73.50 | 3.10 |
| | 2011 | 46.00 | 77.80 | 1.70 |
| Percent of women had 1+ ANC visit | 2000 | 21.60 | 66.60 | 3.10 |
| | 2005 | 23.70 | 68.90 | 2.90 |
| | 2011 | 26.30 | 76.00 | 2.90 |
| Percent of women had 4+ ANC visits | | | | |
| | 2000 | 6.10 | 43.70 | 7.20 |
| | 2005 | 8.10 | 54.50 | 6.70 |
| | 2011 | 14.40 | 45.50 | 3.20 |

**Table 4: Inequality in Maternal Health Service Utilization by Economic, Education and Residence in 2000, 2005 and 2011.**

| Maternal Health Service Use | Survey Year | Inequality Dimension measures estimate | | |
|---|---|---|---|---|
| | | Economic (CI)[1] | Education (CI) | Residence (Urban/Rural Ratio) |
| Births attended by skilled health personnel (%) | 2000 | 61.60 | 49.00 | 15.00 |
| | 2005 | 62.70 | 52.10 | 16.70 |
| | 2011 | 57.40 | 40.70 | 10.80 |
| Modern contraceptive methods prevalence (%) | 2000 | 47.70 | 36.70 | 8.60 |
| | 2005 | 37.90 | 25.00 | 4.00 |
| | 2011 | 23.30 | 14.80 | 2.20 |
| Demand for family planning satisfied (%) | 2000 | 39.60 | 30.60 | 5.60 |
| | 2005 | 31.00 | 20.70 | 3.10 |
| | 2011 | 16.30 | 9.70 | 1.70 |
| Percent of women had 1+ ANC visit | 2000 | 26.80 | 18.20 | 3.10 |
| | 2005 | 27.50 | 18.00 | 2.90 |
| | 2011 | 28.10 | 19.00 | 2.90 |
| Percent of women had 4+ ANC visits | 2000 | 44.10 | 35.40 | 7.10 |
| | 2005 | 42.50 | 30.60 | 6.70 |
| | 2011 | 33.20 | 26.50 | 3.20 |

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[1] Concentration index is a relative measure of inequality that indicates the extent to which a health indicator is concentrated among the disadvantaged (negative value) or the advantaged (positive value). WHO handbook on monitoring inequality.
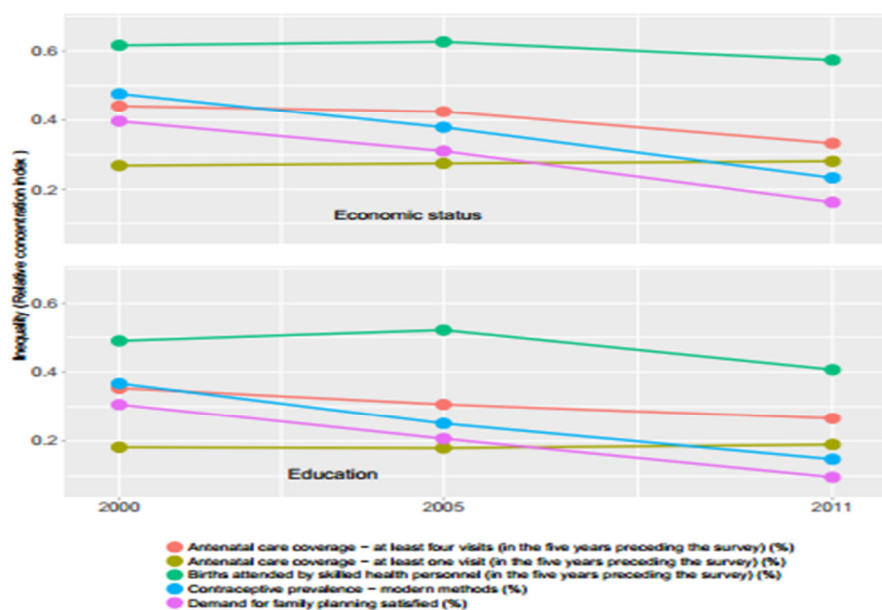
**Source:** Health Equity Assessment Toolkit (HEAT): Software for exploring and comparing health inequalities in countries. Built−in database edition. Version 1.0. Geneva, World Health Organization, 2016. Data source: The disaggregated data used in this version were drawn from the WHO Health Equity Monitor database (2015 update), and subsequent updates are likely to have occurred.

*Figure 1*: **Trends in Inequalities of Maternal Health Service Indicators by Wealth Quintile and Education Level in 2000, 2005 and 2011.**
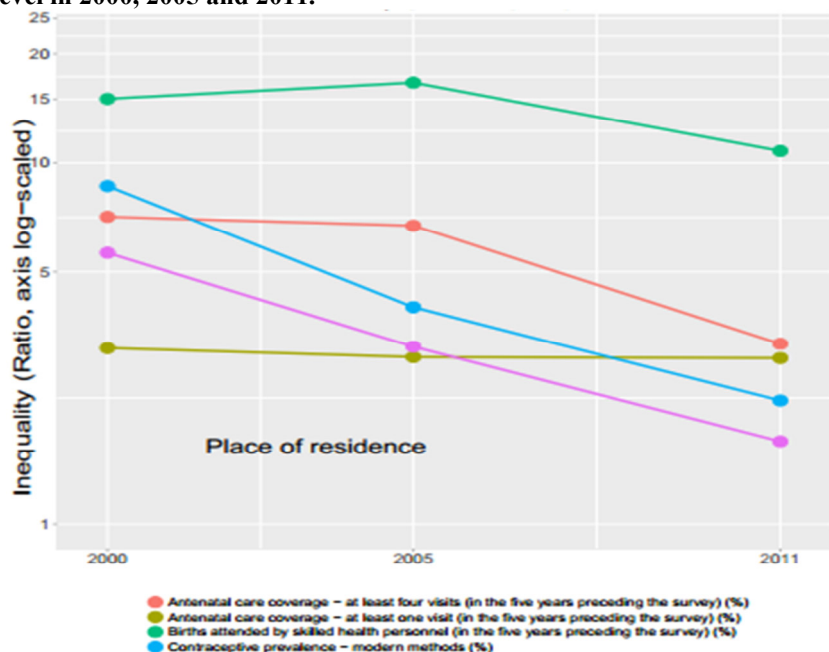


**Source:** Health Equity Assessment Toolkit (HEAT): Software for exploring and comparing health inequalities in countries. Built−in database edition. Version 1.0. Geneva, World Health Organization, 2016.Data source: The disaggregated data used in this version were drawn from the WHO Health Equity Monitor database (2015 update),and subsequent updates are likely to have occurred.

*Figure 2*: **Trends in Inequalities of Maternal Health Service Indicators by Place of Residence in 2000, 2005 and 2011.**