

## **Socioeconomic Inequality in Delivery Care: Evidence from a Cross-Sectional Study in Egypt**

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### **Abstract:**

The analysis aims to clarify the role that the education of woman and the socioeconomic level of household have played in explaining the inequalities in utilization of health facility delivery, skilled birth attendant, and postnatal checkup in Egypt. Data from Egypt demographic health survey 2014 was analyzed. The inequality in utilization of maternal health care is measured using concentration curve and Wagstaff normalized concentration index (WCI) at national and subnational level. The results of this study clearly indicate that utilization of facility health delivery, skilled birth assistance and postnatal care was more concentrated among the richest and educated mothers at national and subnational regions. Our analysis highlights that wealth-based inequality in all maternal health indicators was higher than education-based inequality at national and subnational regions.

*Keywords: Inequality, Delivery care, postnatal care, Concentration curve, Concentration index, Egypt*

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### **1. Introduction**

In 2015, world leaders at United Nations summit adopted the 2030 Agenda for 17 Sustainable Development Goals (SDG). From these goals, the SDG 10 goal intends to reduce inequality within and among countries (UN, 2018). "From these inequalities, the maternal mortality ratio in developing countries in 2015 is 239 per 100 000 live births versus 12 per 100 000 live births in developed countries. There are large disparities between countries, but also within countries, and between women with high and low income (WHO, 2016)". Egypt has reduced its maternal mortality ratio from 106 per 100,000 live births in 1990 to 33 per 100,000 live births in 2015 (WHO and UNICEF, 2015). However, national data hide large discrepancies between rich and poor and urban and rural populations (WHO, 2015).

"One of the causes of death and disability among women of reproductive age in developing countries is childbirth (WHO, 2005). A strategy that promotes universal access to skilled birth attendance and early postnatal care will contribute to sustained reduction in maternal and neonatal mortality (WHO, 2014). All women need access to skilled care during childbirth and care in the weeks after childbirth (WHO, 2016). Almost half of all mothers and newborns in developing countries do not receive skilled care during birth, and over 70% of all babies born outside the hospital do not receive any postnatal care (WHO, 2014). Globally in 2015, births in the richest households were more than twice as likely to be attended by skilled health personnel as those in the poorest households (WHO, 2016)".

The objective of this paper is to examine and measure inequalities in utilization of reproductive and maternal health services based on education and economic status.

## **2. Research Problem**

In a previous study, Khadr (2009) analyzed three rounds of the EDHS, between 1995 and 2005, to monitor the progress in maternal health indicators in Egypt. Our paper attempts to contribute to the extant literature in three ways. First, our study seeks to examine degree of the socio-economic inequality in national and subnational level for three indicators of maternal health: delivery at health facility, skilled birth assistance, and postnatal care utilization. Second, our study uses simple and complex measures to assess the degree of inequality. Finally, the current study uses the most recent dataset available in Egypt in 2014.

## **3. Review of Literatures**

Some previous studies examined degree of inequalities in reproductive and maternal health services utilization by concentration curve and concentration index (Prusty et al., 2015; bobbe et al., 2017). Other studies provided a comprehensive analysis of trends in socioeconomic inequalities in utilization of maternal health indicators (Khader 2009; Hajizadeh et al., 2014; Paredes 2016; Pulok et al., 2016; Haideret et al., 2017). Some previous studies decomposed the concentration index in order to examine the contribution of different factors to the inequalities in utilization of maternal health services (Paredes 2016; Saito et al., 2016).

Most of the previous studies used data from Demographic and Health Survey (Khader 2009; Hajizadeh et al., 2014; Prusty et al 2015; Paredes 2016; Pulok et al. 2016; bobbe et al. 2017). Data of some studies were collected using questionnaires from selected sample of women (Saito et al. 2016)

## **4. Data and Method**

### **4.1 Data Source**

The study used data from 2014 Egypt Demographic and Health Survey (EDHS, 2014). The survey was conducted on behalf of the Ministry of Health [MoH], by El-Zanaty and Associates. The EDHS 2014 covered representative samples of 21,762 ever married



women in the age group of 15-49 years. Only married women aged 15 - 49 whose last birth was during the five-year period before the survey are included in this study. They amounted to 11,391 women.

#### **4.2 Variables**

The current paper aims to examine and measure socioeconomic inequalities in utilization of reproductive and maternal health services. Three binary maternal healthcare indicators were examined. The first binary variable is whether women gave birth at a health facility (public or private). The second indicator is whether women received skilled birth assistance. The last variable is whether women received postnatal care from a trained provider after the delivery. The socioeconomic variables that were included in this paper were wealth index and mother's education.

#### **4.3 Analytic methods**

Inequality for each indicator of maternal health services were estimated using three methods: concentration curves, simple measures (difference and ratio) and complex measures (concentration indices).

"The concentration curve gives a comprehensive view of health inequality by plotting the cumulative percentage of the health variable (y-axis) against the cumulative percentage of the sample, ranked by living standards, beginning with the poorest, and ending with the richest (x-axis). If the concentration curve will be a 45° line, everyone has exactly the same value of the health variable and perfect equality is achieved. If the concentration curve is below or above the equality line, inequality in the utilization of health services exists. If the concentration curve is located below the equality line, the health sector variable takes higher values among the richest people. If the concentration curve is located above the equality line, the health sector variable takes higher values among the poorest people (Wagstaff, 2000; Kakwani et al., 1997; Wagstaff et al., 1991)".

"Simple measures of inequality make pairwise comparisons of health between two subgroups. The two most basic simple

measures of inequality are difference and ratio. Difference describes the absolute inequality that exists between two subgroups. Ratio indicates the relative inequality between two subgroups. On the other hand, one of the most common complex measures of inequality existing across all subgroups of a population is concentration index. The objective of the concentration index is to assess relative inequality that indicates the extent to which a health indicator is concentrated among the disadvantaged or the advantaged (WHO, 2013)."

The value of the concentration index can vary between -1 and +1 where zero indicating equality and negative values imply that a variable is concentrated among disadvantaged people while the opposite is true for its positive values (Wagstaff et al., 1991). The concentration index (C) can be written as (Wagstaff, 2000),

$$C = \frac{2}{\mu} \sum_{t=1}^T f_t \mu_t R_t - 1,$$

Where  $n$  denote the sample size,  $T$  the number of socio-economic groups,  $f_t$  the proportion of the sample in the group  $t$ ,  $\mu = \sum_{t=1}^T f_t \mu_t$  is the overall mean of health indicator and  $\mu_t$  the mean value of health indicator amongst the group  $t$ . The term  $R_t$  is its relative rank in the group  $t$  and may be defined as,

$$R_t = \sum_{y=1}^{t-1} f_y + \frac{1}{2} f_t$$

All indicators of reproductive health care used in our study are binary variables and this poses a problem where the concentration index for these variables may not always be within the [-1, 1] interval (Clarke et al. 2002). In order to solve this problem, Wagstaff (2005) suggested that the concentration index could usefully be normalized by dividing it through by 1 minus the mean of the variable in question. The Wagstaff normalized concentration index (WCI) is (Wagstaff, 2005; Rarani et al., 2017),

$$WCI = \frac{C}{1 - \mu}$$

## 5. Results

### 5.1 Socioeconomic inequality in indicators of maternal health services at national level

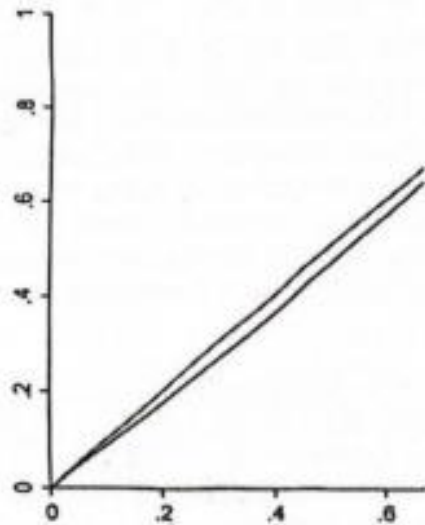
The study presents, in Figure (1), the concentration curves for each indicator of maternal health services utilization according to wealth index. In general, the concentration curves are all lying below the line of equality which means that maternal healthcare utilization is concentrated more among the wealthier women. Figure (1a) shows the cumulative proportion of women who give their birth in a health facility on the y-axis against the cumulative proportion of women who give their birth on the x-axis ranked by living standards and beginning with the most disadvantaged women. Since the concentration curve lies below the equality line, women from the poorest households utilize fewer deliveries at health facility compared to those from wealthier households. The data presented in Figure (1b) show that mothers from low economic households receive skilled attendance at birth less often than mothers from high economic background. Moreover, the findings from Figure (1c) clearly indicate that a disproportionately lower concentration of postnatal care utilization in poor households than in rich ones.

It is possible to conclude, from Table (1), that there is a prevalence of delivery at health facility, skilled birth assistance, and postnatal care utilization among the richest and educated mothers. The results indicate that 15% of women who are in the poorest quintile gave their birth in a health facility while this percentage increased to about 19% among women who are in the richest quintile. Evidence in Table (1) show that about 15% of women who have never attended school gave their birth in a health facility while this percentage increased to almost 18% among women who have university education or higher.

Figure (1): Concentration curve for some indicators of reproductive health services according to wealth index, EDHS 2014



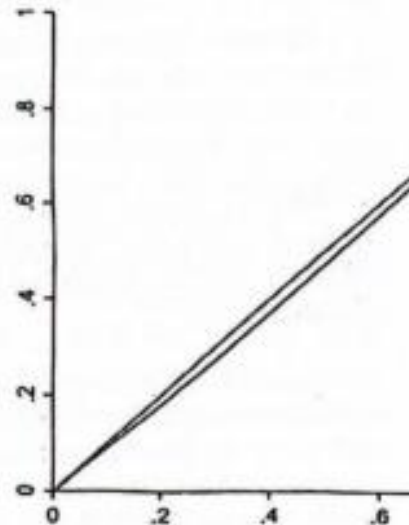
Fig.(1a): Health Facility Delivery



cumulative percentage of women ranked by their cumulative percentage of women ranked by their

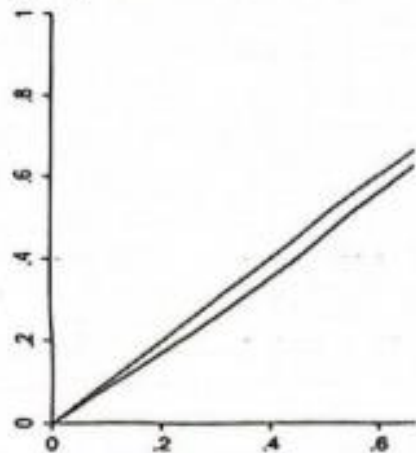
— concentration curve for de  
— line of equality

Fig.(1b): Skilled Birth Assistance



— concentration curve  
— line of equality

Fig.(1c): Postnatal Care



cumulative percentage of women ranked by their

— concentration curve for  
— line of equality

Moreover, Table (1) illustrates difference and ratio calculations for each maternal health indicator. With regard to simple measures of inequality (difference and ratio), one can observe that wealth-based inequality in all maternal health indicators was higher than education-based inequality. Evidence in Table (1) indicates there is an inequality in health facility delivery based on wealth index and women's education. The findings from Table (1) clearly indicate that delivery in health facility was concentrated among the richest and educated mothers.

Additionally, data of Table (1) shows that skilled birth assistance was concentrated among the richest and the educated mothers depending on the values of difference and ratio. On the other hand, the results show that there is an inequality in postnatal care utilization based on wealth index and women's education since the values of difference have a positive sign and the values of ratio are more than one which means that postnatal care utilization was higher among the richest and the educated women.

Table (1): Simple measures of inequality in delivery and postnatal care across socioeconomic variables, EDHS 2014

Socioeconomic Variables		Delivery at health facility	Skilled birth attendant	Postnatal care
Wealth index	Poorest (%)	15	15.5	14.7
	Richest (%)	19.1	18.4	19.8
Difference (Richest – Poorest)		4.1	2.9	5.1
Ratio (Richest / Poorest)		1.27	1.19	1.35
Mother's education	No education (%)	14.8	15.6	14.5
	Higher (%)	17.9	17.3	18.1
Difference (Higher - No education)		3.1	1.7	3.6
Ratio (Higher / No education)		1.21	1.11	1.25



The study reported the Wagstaff normalized concentration indices (WCI) with 95% confidence interval for maternal health care indicators at national level according to socioeconomic variables in Table (2). The positive values of the Wagstaff normalized concentration indices indicate evidence of the inequality in utilization of maternal health care services. The findings from Table (2) clearly indicate that wealth-based inequality in all maternal health indicators was higher than education-based inequality. Based on wealth index, the Wagstaff normalized concentration index of health facility delivery was positive, which meant the service was more utilized by the rich. The results from Table (2) show that the WCI for skilled birth assistance is 0.470, indicating that; the service was more concentrated among the women belonging to the richest households. Regarding postnatal care, the WCI is 0.369, indicating that; the service was mainly utilized by the rich.

Table (2): Wagstaff normalized concentration index, standard error, t-value, and 95% confidence interval of WCI for delivery and postnatal care in Egypt across socioeconomic variables from EDHS 2014

Indicator	Socioeconomic Variables	WCI	SE(WCI)	t-values (WCI)	95% confidence interval of WCI	
					low	High
Delivery at health facility	Wealth index	0.422	0.002	200.6*	0.417	0.426
	Mother's education	0.396	0.002	186.9*	0.392	0.400
SBA	Wealth index	0.470	0.002	287.8*	0.467	0.473
	Mother's education	0.447	0.002	265.9*	0.444	0.450
Postnatal care	Wealth index	0.369	0.003	146.9*	0.364	0.373
	Mother's education	0.325	0.003	128.7*	0.320	0.330

\* Significant at 5%

On the other hand, the findings from Table (2) clearly indicate that WCI of health facility delivery, skilled birth assistance, and postnatal care were 0.396, 0.447, and 0.325 respectively based on mother's education. These positive values indicate that utilization of maternal health care services was more concentrated among the

educated mothers. Additionally, Wagstaff normalized concentration indices and its t-values show that inequality in utilization of maternal health care services was statistically significant based on wealth index and mother's education.

## **5.2 Socioeconomic inequality in indicators of maternal health services at subnational level**

Table (3) shows Wagstaff normalized concentration index, the corresponding standard error, and 95% confidence interval of health facility delivery at subnational regions according to wealth index and mother's education. The positive values of WCI indicate that utilization of health facility delivery was more concentrated among the richest and educated mothers at all subnational regions. It is possible to conclude, from Table 3, that inequality in health facility delivery according to wealth index is higher than inequality according to mother's education in all subnational regions. As shown in Table (3), inequality in health facility delivery was statistically significant in all subnational regions across socioeconomic variables.

The findings from Table (3) show that the values of WCI lie between 0.340 and 0.508 across wealth index variable at all subnational regions. The results report that the value of WCI for health facility delivery at the national level was 0.422 (see Table 2) across wealth index variable but varied across the Egyptian regions, as shown from Table (3), with the highest for Lower Egypt rural (0.508) and the lowest for Upper Egypt rural (0.340). Additionally, value of WCI for health facility delivery at Upper Egypt urban (0.424) was close to the corresponding national value (0.422). On the other hand, the results indicates that the value of WCI for health facility delivery at the national level was 0.396 (see Table 2) across mother's education variable but varied across the Egyptian regions, as shown from Table (3), with the highest for Lower Egypt rural (0.455) and the lowest for Upper Egypt rural (0.338).



Table (3): Wagstaff normalized concentration index, standard error, t-value, and 95% confidence interval of WCI for delivery care in Egypt across wealth index and mother's education at subnational regions from EDHS 2014

Socioeconomic variables at subnational regions	WCI	SE (WCI)	t-values(WCI)	95% confidence interval of WCI	
				low	High
<b>Urban governorates</b>					
Wealth index	0.370	0.002	162.6*	0.365	0.374
Mother's education	0.363	0.002	153.5*	0.358	0.367
<b>Lower Egypt Urban</b>					
Wealth index	0.369	0.002	166.1*	0.365	0.374
Mother's education	0.366	0.002	160.2*	0.361	0.370
<b>Lower Egypt Rural</b>					
Wealth index	0.508	0.003	193.8*	0.503	0.513
Mother's education	0.455	0.003	170.6*	0.450	0.460
<b>Upper Egypt Urban</b>					
Wealth index	0.424	0.002	192.9*	0.419	0.428
Mother's education	0.381	0.002	167.9*	0.377	0.386
<b>Upper Egypt Rural</b>					
Wealth index	0.340	0.002	177.2*	0.336	0.344
Mother's education	0.338	0.002	175.2*	0.334	0.342
<b>Frontier governorates</b>					
Wealth index	0.443	0.002	209.5*	0.438	0.447
Mother's education	0.414	0.002	191.4*	0.410	0.418

\* Significant at 5%

With regard to skilled birth assistance, Table (4) presents Wagstaff normalized concentration index of skilled birth assistance according to wealth index and mother's education at all subnational regions. Findings from Table (4) clearly indicate that WCI for skilled birth assistance according to socioeconomic variables at all



subnational regions consistently gives positive values, showing concentration of skilled birth assistance among the mothers belonging to the richest and educated households. According to WCI and its t-values, inequality in skilled birth assistance was statistically significant in all subnational regions across socioeconomic variables.

Table (4): Wagstaff normalized concentration index, standard error, t-value, and 95% confidence interval of WCI for SBA in Egypt across wealth index and mother's education at subnational regions from EDHS 2014

Socioeconomic variables at subnational regions	WCI	SE (WCI)	t-values(WCI)	95% confidence interval of WCI	
				low	High
<b>Urban governorates</b>					
Wealth index	0.420	0.002	232.5*	0.416	0.423
Mother's education	0.416	0.002	220*	0.413	0.420
<b>Lower Egypt Urban</b>					
Wealth index	0.429	0.002	242.4*	0.425	0.432
Mother's education	0.420	0.002	229.5*	0.416	0.423
<b>Lower Egypt Rural</b>					
Wealth index	0.573	0.002	269.8*	0.569	0.578
Mother's education	0.524	0.002	240.2*	0.520	0.529
<b>Upper Egypt Urban</b>					
Wealth index	0.473	0.002	270.3*	0.469	0.476
Mother's education	0.433	0.002	237.7*	0.430	0.437
<b>Upper Egypt Rural</b>					
Wealth index	0.395	0.001	269*	0.392	0.398
Mother's education	0.411	0.001	277*	0.408	0.414
<b>Frontier governorates</b>					
Wealth index	0.487	0.002	289.1*	0.484	0.490
Mother's education	0.463	0.002	266.7*	0.459	0.466

\* Significant at 5%

It can be noticed that inequality in skilled birth assistance according to wealth index is higher than inequality according to mother's education in all subnational regions except in Upper Egypt rural region which has the highest WCI for mother's education. Data of Table (4) shows that the highest value of WCI at all subnational regions according to wealth index and mother's education was 0.573 and 0.524 respectively in Lower Egypt rural. Meanwhile, the lowest value of WCI at all subnational regions according to wealth index and mother's education was 0.395 and 0.411 respectively in Upper Egypt rural.

Wagstaff normalized concentration index of postnatal care at subnational regions according to socioeconomic variables is presented in Table (5). The positive values of WCI at all subnational regions show concentration of postnatal care among the mothers belonging to the richest and educated households. One can observe, from Table (5), that wealth-based inequality in postnatal care is higher than education-based inequality in all subnational regions.

The findings from Table (5) clearly show that the highest value of WCI at all subnational regions according to wealth index and mother's education was 0.461 and 0.388 respectively in Lower Egypt rural. On the other hand, the lowest value of WCI at all subnational regions according to wealth index and mother's education was 0.288 and 0.250 respectively in Upper Egypt rural. According to Wagstaff normalized concentration indices and its t-values, it is possible to conclude that inequality in postnatal care was statistically significant in all subnational regions across wealth index and mother's education.

Table (5): Wagstaff normalized concentration index, standard error, t-value, and 95% confidence interval of WCI for postnatal care in Egypt across wealth index and mother's education at subnational regions from EDHS 2014

Socioeconomic variables at subnational regions	WCI	SE (WCI)	t-values(WCI)	95% confidence interval of WCI	
				low	High
<b>Urban governorates</b>					
Wealth index	0.299	0.003	109*	0.294	0.304
Mother's education	0.284	0.003	100.5*	0.278	0.289
<b>Lower Egypt Urban</b>					
Wealth index	0.327	0.003	123.8*	0.322	0.332
Mother's education	0.302	0.003	111.5*	0.297	0.308
<b>Lower Egypt Rural</b>					
Wealth index	0.461	0.003	148.6*	0.455	0.468
Mother's education	0.388	0.003	123.4*	0.382	0.395
<b>Upper Egypt Urban</b>					
Wealth index	0.359	0.003	136.9*	0.354	0.364
Mother's education	0.311	0.003	115.1*	0.305	0.316
<b>Upper Egypt Rural</b>					
Wealth index	0.288	0.002	121.2*	0.284	0.293
Mother's education	0.250	0.002	104.2*	0.245	0.254
<b>Frontier governorates</b>					
Wealth index	0.374	0.003	148.5*	0.369	0.379
Mother's education	0.329	0.003	127.9*	0.324	0.334

\* Significant at 5%

## 6. Discussion

The results of the concentration curve of health facility delivery show that mothers who live in households with higher economic status give their birth at health facility than those with lower economic



status. These findings agree with the literatures which showed evidence of the inequality in facility health delivery (Prusty et al., 2015; Paredes, 2016; Pulok et al., 2016; Saito et al., 2016).

Consistent with previous researches (Prusty et al., 2015; Pulok et al., 2016; Bobo et al., 2017; Haider et al., 2017), it can be noticed that the concentration curves of skilled birth assistance and postnatal care are all lying below the line of equality which means that mothers from high economic households receive skilled attendance at birth and postnatal care more than mothers from low economic background.

Our findings highlight that high utilization of facility health delivery and skilled birth assistance is more evident among women with higher socioeconomic status and is consistent with results from similar studies (Khadr, 2009; Prusty et al., 2015; Paredes, 2016; Pulok et al., 2016; Hajizadeh et al., 2014; Haider et al., 2017; Bobo et al., 2017). The positive values of the concentration indices for facility health delivery and skilled birth assistance in Bangladesh indicate evidence of the inequality in these services (Pulok et al., 2016). Moreover, concentration indices based on economic status of the women in Ethiopia demonstrated inequality in utilization of facility based delivery and skilled birth attendances (Bobo et al., 2017).

According to Wagstaff normalized concentration index, the results of this study clearly indicate that utilization of facility health delivery and skilled birth assistance was more concentrated among the educated mothers at national and subnational regions. Our findings are consistent with results obtained from other studies in different parts of the world (Khadr, 2009; Paredes, 2016; Pulok et al., 2016; Hajizadeh et al., 2014; Shimazaki 2013). More highly educated mothers in Bangladesh utilized facility based delivery and skilled birth attendance more than uneducated mothers (Hajizadeh et al., 2014).

It can be concluded that that utilization of postnatal care was more concentrated among the richest and educated mothers at national and subnational regions. These findings agree with the

literature in Egypt, Ethiopia and Bangladesh (Khadr, 2009; Haider et al., 2017; Bobo et al., 2017). Concentration index based on education attainment of the women in Egypt showed inequality in utilization of postnatal care where more highly educated mothers in Egypt received postnatal care more than uneducated mothers (Khadr, 2009). Moreover, concentration index based on economic status of the women in Ethiopia indicated inequality in utilization of postnatal care (Bobo et al., 2017).

Our analysis highlights that wealth-based inequality in all maternal health indicators was higher than education-based inequality at national and subnational regions. This finding is supported by a study in Egypt; it is proved that differentials by wealth were higher than those by educational attainment for indicators related to utilization of delivery care and postnatal care (Khadr, 2009). Moreover, in another study on inequality in the use of maternal and child health services in the Philippines found that household wealth remains as the most important contributor to the resulting inequalities in utilization of maternal health services, followed by women's education (Paredes, 2016).

The findings of our study, in general, confirm similar results from Egypt which indicated that utilization of maternal health care services was more concentrated among the richest and educated mothers, but the degree of inequality in all maternal health indicators in our study was lower than the degree of inequality in this previous study where the concentration indices for these indicators in 2014 were found to be lower than the indices in 2005.(Khadr, 2009).

## **7. Conclusion**

This study attempted to assess inequalities in utilization of maternal health services indicators in Egypt. In general, the findings of the concentration curves show a disproportionate service utilization of delivery at health facility, skilled birth assistance, and postnatal care. Moreover, significant inequality in the utilization of maternal health care services was demonstrated across wealth index



of households and mother's education at national and subnational regions.

The results of Wagstaff normalized concentration index indicate that wealth-based inequality in all maternal health indicators was higher than education-based inequality at national and subnational regions. Moreover, the highest and the lowest value of WCI at all subnational regions according to socioeconomic variables were in Lower Egypt rural and Upper Egypt rural respectively.

"Poor and uneducated women lack the necessary knowledge and awareness to reach the health facilities to receive necessary care during and after delivery. High availability of birthing facilities and skilled birth attendants are considered one of the main elements of successful safe motherhood programmes (Koblinsky and Kureshy 2009). Therefore, health promotion programs about maternal health care are advisable to target the poorest and uneducated mothers for increasing community awareness about the necessity of maternal services utilization and this is considered one of the main elements of successful safe motherhood programmes and one of the ways to decrease the degree of inequality in utilization of maternal health care services (Koblinsky and Kureshy 2009)". Finally, future research may be important for conducting decomposition of concentration index analysis to quantify the determinants' contributions of socioeconomic inequality in utilization of maternal health care services.



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