INEQUITY AND INEQUALITY IN HEALTH CARE UTILIZATION IN INDONESIA, 1997

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Abstract

So far, limited research has been done on inequity and inequality in health care utilisation in Indonesia. As anywhere else in the world, wealth and education are unequally distributed over the population. Need of health care is a major determinant which should affect use to health services. Using data from the 1997 Indonesia Demographic and Health Survey and the concentration index approach, models of access to preventive care in children age 12-23 months, pregnancy related care for mothers as well as curative care for children five years old or less is estimated. Asset scores are used to analyse whether health care utilisation of children and mothers is correlated to household wealth.

Significant inequity has been found in the utilisation of health care by wealth. Access to preventive care for children immunisation and pregnancy related care (tetanus injection, first visit for antenatal care, place for antenatal care, place for delivery, professional assistance for delivery) as well as curative care (medical treatment for diarrhoea and ARI) tend to be significantly different by household wealth. Wealthier mothers use more health services than poorer mothers do. An exception to this rule is treatment for diarrhoea and ARI. This may be explained by measurement error. Need (health care), urban-rural residence and education are confounding that are found to reduce the concentration indices for use. Horizontal equity principle is violated, in the sense that mothers in equal need are found to be treated unequally.

1. Introduction

It is common knowledge that the utilisation of health care varies considerably according to socio-economic conditions. Many studies have found that people at an socio-economic disadvantage suffer from a higher burden of morbidity, lower life expectancy and have higher mortality rates than their better-off counterpart [1].

Indonesia, with its almost 200 million inhabitants in 1997, has a shortage of antenatal care resources, leading to high maternal mortality. Maternal mortality was 390/100.000 live births in 1994, which is higher than the average of Asian countries of 280/100.000 live births [2]. Taking this into account, the Indonesian government has made many efforts to increase the coverage of antenatal care, i.e. at least four visits to antenatal care centers during pregnancy, and a policy of placing a midwife in every village over the country.

Although programs for maternal care have been implemented long ago, there is still a gap of utilization between the rich and the poor. For example, the poor-rich ratio for antenatal visit was 0.53 [3], which means that only half of the poor have access to the services delivered as compared to the rich group.

2. Methods

It is a cross-sectional study, utilizing data from Indonesia Demographic and Health Survey (DHS) 1997. The data were downloaded through the web site of Macro International (www.measuredhs.com). Tabulations for 1997 by quintiles of 'wealth' (as proxy by an asset index derived through a principal component analysis) had been provided by the World Bank.

Cases were selected from the children's data set. A case was a mother; aged of 15-49 years who has children of five years old or less. The reason for using this data set was that both mothers and the children need more health care than other members in the household do. 17.444 mothers were included in this study with a total of 16.544 alive children. Wealth score was merge with this data set.

2.1. Variables

1. Socioeconomic and educational status
   Wealth score was used to assess the socio-economic status [F1)]. In addition, mothers'

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education was divided in four categories, i.e. no education, primary, secondary and higher education.

2. Utilization Variables
   Preventive care in children was defined as whether vaccinations were adequately delivered to the children before completing two years of age. To analyse access to preventive care, children aged 12-23 months were selected. DPT1 vaccination was chosen for this analysis as indicator of access at very young age (first month after birth). Measles vaccination was used as an indicator of access at later age (up to one year of age). Finally, possession of a health card was used as an indicator of whether children were actively participating in health care activities that are organised in their local community (*'Posyandu'*). Pregnancy related care was defined as seeking care during pregnancy and delivery, provided by a health professional (doctors, nurse or midwife). Access to prenatal care was measured by having the first antenatal visit at first trimester, at- least two times of Tetanus Toxoid vaccinations during pregnancy, and delivery at health care facilities. Access to curative care was measured by looking at treatment for all children with Acute Respiratory Infection (ARI) and diarrhoea during two weeks and the preceding 24 hours of the data collection.

3. Need variables
   Health care need for all preventive care was assumed to be equal (everyone needs it) and therefore, will not be separately controlled for. Need for antenatal care was proxied by 'at-risk' factors, like age at first pregnancy >= 35 or <= 18 years old, and complication of prolonged labor.

4. Urban-rural and education
   The analysis was adjusted for urban rural location. It is important to know whether mothers in the urban areas have greater access to health care because there are more health facilities available and shorter distance, or, because they are richer or more educated.

2.2. Data Analysis

Data analysis was done using SPSS version 10.0. All cases were weighted using population weights in order to get a comparable result of the sample within the general population. A wealth index was used as a proxy for socio-economic status.

The unit of analysis consist of ever married women of 15-49 years old for access to pregnancy related care. Children aged 12-23 months were selected for preventive care in terms of immunisation. Finally, all children aged five years or less were included in the analysis of curative cares.

Frequency distribution is applied to see the distribution of each variable. The concentration index (CI) method reflects the inequalities in health or health care of all the socio-economic groups, not only the top and bottom groups. The approach involves calculating the mean health status of each socio-economic group and then ranking classes by their socio-economic status [4]. The slope, expresses the health inequality between the top and the bottom of the socio-economic class in terms of rate differences instead of rate ratio [4,5,6]. The slope coefficient from the regression is equal to:

$$\beta = cov(x,h) / var(x)$$

where,

x = R/N = the fractional relative rank

cov (x,h) = covariance between the relative rank x and h

var (x) = the variance of the relative rank variable;

so,

$$C = 2\, var(x)\, (\beta/\mu)$$

where μ = mean level of health

F1) DHS surveys do not provide consumption or income data. Wealth score, based on asset index calculation is the only way to examine the DHS data from an economic perspective. Filmer and Pritchett, 1998 suggest that the asset-consumption relationship is quite close.

Inequalities of access were measured using concentration index and concentration curve. People were ranked by their socio-economic status, beginning with the most disadvantaged. The curve, concentration curve, express the cumulative proportion of the population against the cumulative proportion of health. The health concentration index 'C' was defined as twice the area between the concentration curve and the diagonal [4]. This index provides a measure of the extent of inequalities in health that are systematically associated with socio-economic status [F3)].

The equation of the standard concentration index is similar to that of the slope index of inequality:

$$C = 2\ cov(x,h)\ /\mu$$

Technically the regression was applied by transforming the values of the outcome variables to simplify the calculation of the concentration indices. Thus, inequality estimates were performed concentration indices by calculating different and horizontal indices of inequity.

In this analysis indirect standardisation was used in calculating the concentration index, and further controlling for need and adjusting for some possible predictors (urban, and education) [7] with the following steps:

1. Is there any difference of utilization between poor and rich?
2. What difference remains after adjusting for need differences?
3. Are location and education confounders?

3. Results

Table 1 shows a description of the variables in the analysis. In total, 3288 children aged 12 to 23 months were included in the analysis for preventive care. Of those, 80% got access to health care since birth. Most of them (70%) lived in rural areas. In addition, 16,073 mothers with children were included in our analysis for pregnancy related care and curative care for children after the exclusion of all the missing values. Table 2 shows concentration indices of utilization and appendix 1, gives complete information concerning inequality and inequity in access to health care. In addition, Table 3 mentioned results of the full regression model of inequality adjusted for need, urban residence and education.

3.1. Preventive cares for children

Table 2 shows that utilization of preventive care for children using three types of access determinants were significantly different by wealth. Wealthier mothers brought their children more often to the health care facilities than poor mothers (CI=0.0492, t=11.85). In addition, access to immunization was also higher among the wealthier (DPT1 CI=0.0578, t=12.97; Measles CI=0.0729, t=11.67). For this particular analysis, it did not adjust for need, because it was fair to assume that need was equal for all children. Adjusted for area of residence, the concentration indices were still significantly different. From the full model, wealthier children had significantly higher access to preventive care (had a health card β=0.0323, t=6.16; DPT1 β=0.0322, t=5.73; Measles β=0.0450, t=5.68) (table 4). In contrast with education, urban location has not affected access to the care as the t-value was in between $\pm$ 1.96.

The concentration curve (figure1) shows that the richest 20% of the population use about 23% of all those types of preventive care respectively.

3.2. Pregnancy related care

So far, it assumed that all mothers have an equal need for pregnancy related care. Need for delivery care was assessed by mothers age at-risk and prolonged labor. Results showed that there was no equality of pregnancy related risk factors. Poor mothers have more risk factors than wealthier mothers: age at risk and prolonged labor were higher at the lowest socioeconomic group.

Antenatal and delivery care were considered separately. The reason was that antenatal care in pregnancy provided by public health facilities is almost free of charge and highly subsidized. For these services, all pregnant mothers are assumed to have similar need for care. On the other hand, the use of delivery care has to be paid by the mothers and thus highly dependent on wealth. Two dependent variables were chosen, i.e. access for tetanus injection and first visit for prenatal care during the first trimester of pregnancy. Table 2 shows that there was significant difference in access to the care (tetanus injection CI=0.0680, t=19.58 and first visit for antenatal care during

Tables 1
Frequency and Descriptive Analysis for All Variables

VARIABLES	N (n)	MEAN	STD.DEV
I. Access to preventive care for children (12-23 month)	3288	-	-
1. Having a health card	(2794)	0.85	0.36
2. DPT1 Immunization	(2729)	0.83	0.38
3. Measles Immunization	(2350)	0.71	0.45
4. Urban location	(989)	0.30	0.46
II. Access for curatives care for children	16073	-	-
1. Had diarrhea with medical treatment	(1591)	0.10	0.30
2. Diarrhea with blood in the stool	(899)	0.06	0.23
3. Had ARI with medical treatment	(5427)	0.34	0.47
4. ARI with rapid breath	(3365)	0.21	0.41
III. Maternal related care	16073	-	-
1. Access to tetanus injection	(9275)	0.58	0.49
2. First visit for prenatal care	(10725)	0.67	0.47
3. Prenatal in health care facilities	(15561)	0.97	0.17
4. Delivery in health facilities	(6994)	0.44	0.50
5. Professional Assistance for prenatal	(15516)	0.97	0.18
6. Professional Assistance for delivery	(8401)	0.52	0.50
7. Mothers' age at risk	(5238)	0.33	0.47
8. Complication during delivery	(3455)	0.22	0.41
9. Urban location	16037	0.29	0.45
10. Education	16037	0.29	0.67

Note: All of those variables recoded as 1 = yes

Table 2
Concentration Indices for Utilization of Health Care by Wealth Adjusted for Need, Urban and Education

Utilization of Health Care	Unadjusted C.I	C.I. adjusted for		
		Need	Need +Urban	Need + Urban + Educ
1. Preventive care for children				
a. Had a health card	0.0492	-	0.0459	0.0323
b. DPT1 Immunization	0.0578	-	0.0508	0.0322
c. Measles Immunization	0.0729	-	0.0699	0.0450
2. Pregnancy related care				
a. Access to Tetanus Injection	0.0680	-	0.0715	0.0674
b. First visit during 1st.trimester	0.0853	-	0.0802	0.0667
c. Prenatal care at HC facilities	0.0163	0.0159	0.0159	0.0153
d. Prof. assistance for prenatal	0.0180	0.0176	0.0178	0.0172
e. Delivery at HC facilities	0.1543	0.1507	0.1027	0.0875
f. Prof. assistance for delivery	0.2172	0.2082	0.0338	0.1253
3. Curative care for children				
a. Medical treatment for diarrhea	-0.0689	-0.0350	-0.0444	-0.0336
b. Medical treatment for ARI	0.0208	-0.0169	-0.0256	-0.0199

Table 3
Utilization of Health Care by Weallth in the 'Full Model'
(Regression results including urban location and education)

a). Preventive care for children

Utilization of Health Care	Had a health card		DPT1 immunization		Measles immunization	
	CI & Betas	t-value	CI & Betas	t-value	CI & Betas	t-value
- Constant	0.1139	26.14	0.1139	24.39	0.1086	16.50
- Rfract Wealth	**0.0323**	6.16	**0.0322**	5.73	**0.0450**	5.68
- Urban location	0.0004	0.13	0.0037	1.12	-0.0021	-0.44
- Primary Education	0.0344	7.88	0.0304	6.51	0.0278	4.22
- Secondary Education	0.0509	10.58	0.0538	10.46	0.0577	7.95
- Higher Education	0.0437	5.90	0.0536	6.76	0.0722	6.46

b). Maternal related care

Utilization of Health Care	T.T injection		First prenatal visit		Facilities for prenatal	
	CI & Betas	t-value	CI & Betas	t-value	CI & Betas	t-value
- Constant	0.0793	21.46	0.0763	25.55	0.1253	161.38
- Rfract Wealth	**0.0674**	15.80	**0.0667**	19.35	**0.0153**	17.55
- Age at-risk	-	-	-	-	-0.0010	-2.45
- Prolong labor	-	-	-	-	-	-
- Urban location	-0.0046	-1.97	0.0030	1.60	-0.0002	-0.35
- Primary Education	0.0192	5.43	0.0153	5.33	0.0020	2.79
- Secondary Education	0.0252	6.56	0.0326	10.49	0.0032	4.04
- Higher Education	0.0071	1.17	0.0354	7.27	0.0012	0.10

Utilization of Health Care	Prof.ass. for prenatal		Delivery at HC fac.		Prof.ass. for Delivery	
	CI & Betas	t-value	CI & Betas	t-value	CI & Betas	t-value
- Constant	0.1245	153.39	0.0626	12.67	0.0079	2.13
- Rfract Wealth	**0.0172**	18.91	**0.0875**	15.97	**0.1253**	30.68
- Age at-risk	-0.0014	-3.27	-0.0048	-1.86	-0.2314	-12.06
- Prolong labor	-	-	-0.0110	-3.89	0.0189	8.97
- Urban location	-0.0004	-0.76	0.0530	17.63	0.0414	18.49
- Primary Education	0.0020	2.58	0.0041	0.09	0.0281	8.28
- Secondary Education	0.0031	3.71	0.0244	4.90	0.0875	23.58
- Higher Education	0.0009	0.07	0.0432	5.54	0.0992	17.06

c). Currative care for children

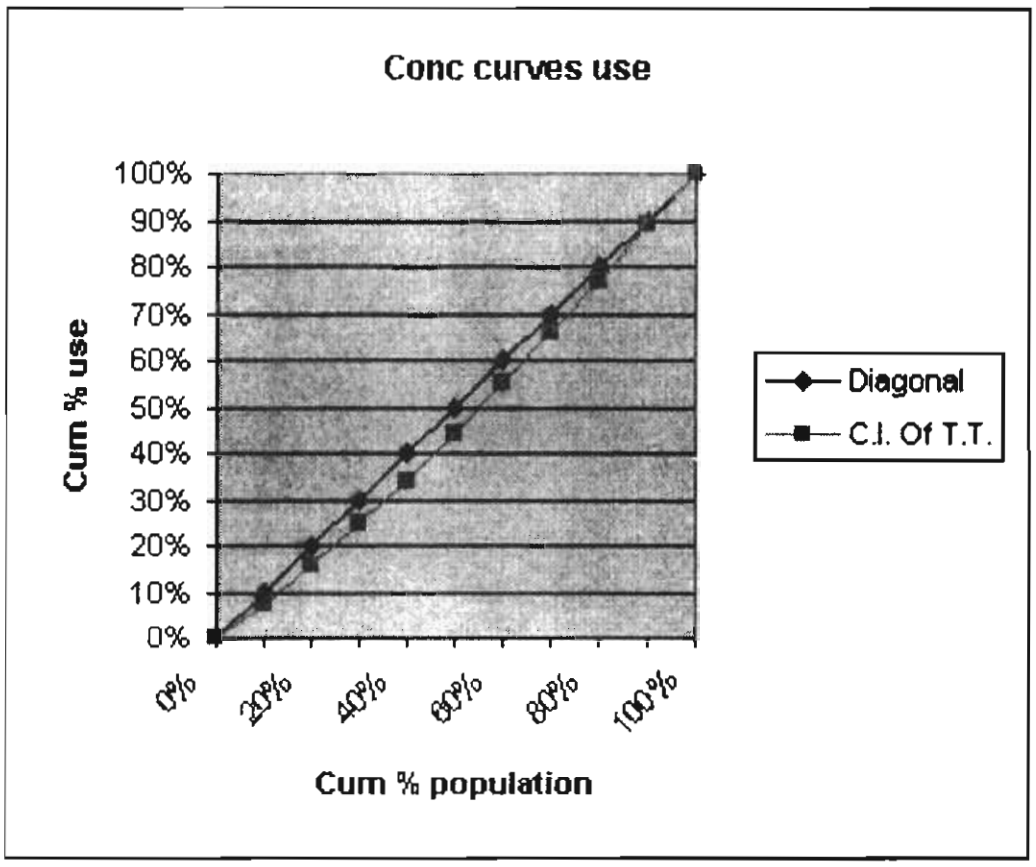
Utilization of Health Care	Med.Treatment Diarrhe		Med.Treatment ARI	
	CI & Betas	t-value	CI & Betas	t-value
- Constant	0.0758	8.45	0.0802	18.85
- Rfract wealth	**-0.0336**	-3.25	**-0.0199**	-4.06
- Severity of the diseases	1.3066	136.79	0.3376	131.71
- Urban location	0.0132	2.33	0.0113	4.20
- Primary Education	0.0093	1.08	-0.0041	-0.99
- Secondary Education	-0.0054	-0.57	-0.0129	-2.91
- Higher Education	-0.0280	-1.92	-0.0109	-1.58

Figure 1
Concentration Curves of Variables of Interest

1. Access to Tetanus Injection

Cum % pop	Cum %
0%	0%
10%	0.072325
20%	0.155954
30%	0.248763
40%	0.341195
50%	0.444764
60%	0.549745
70%	0.657716
80%	0.770858
90%	0.891237
100%	1

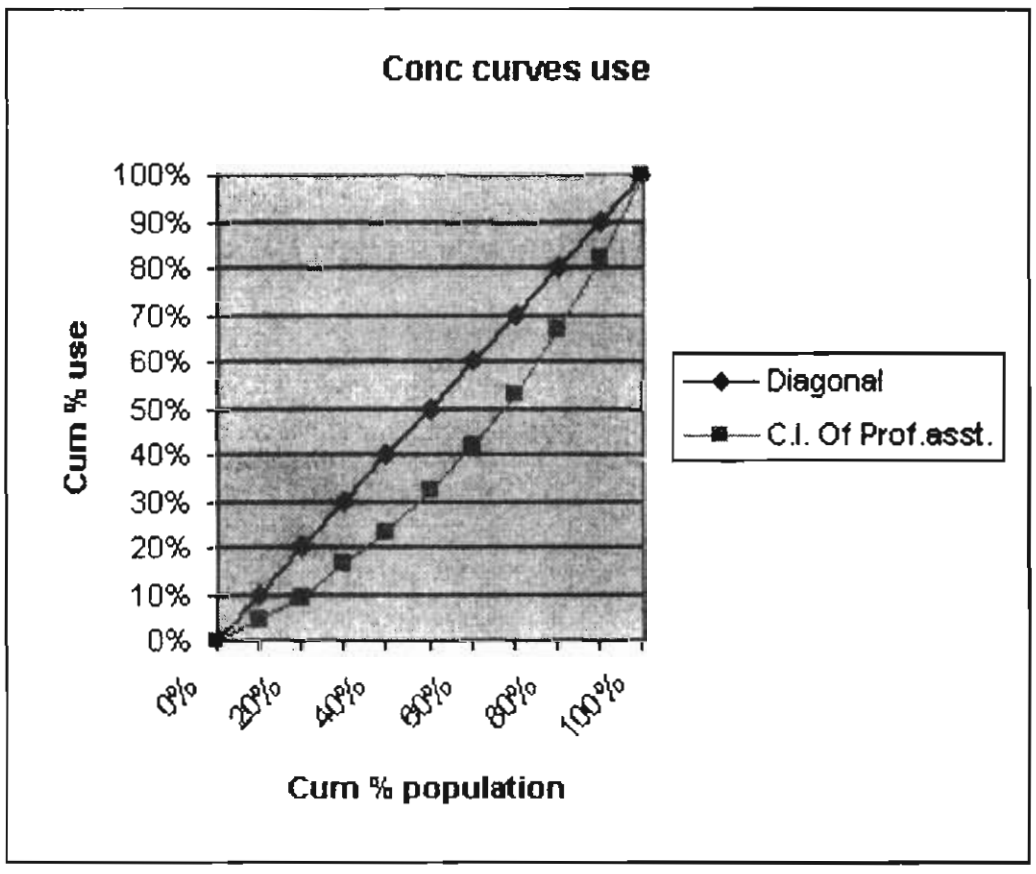
Concentration Index=0.068042



2. Assistance during delivery

Cum % pop	Cum %
0%	0%
10%	0.041311
20%	0.093847
30%	0.165093
40%	0.232788
50%	0.320629
60%	0.42079
70%	0.529897
80%	0.66638
90%	0.819943
100%	1

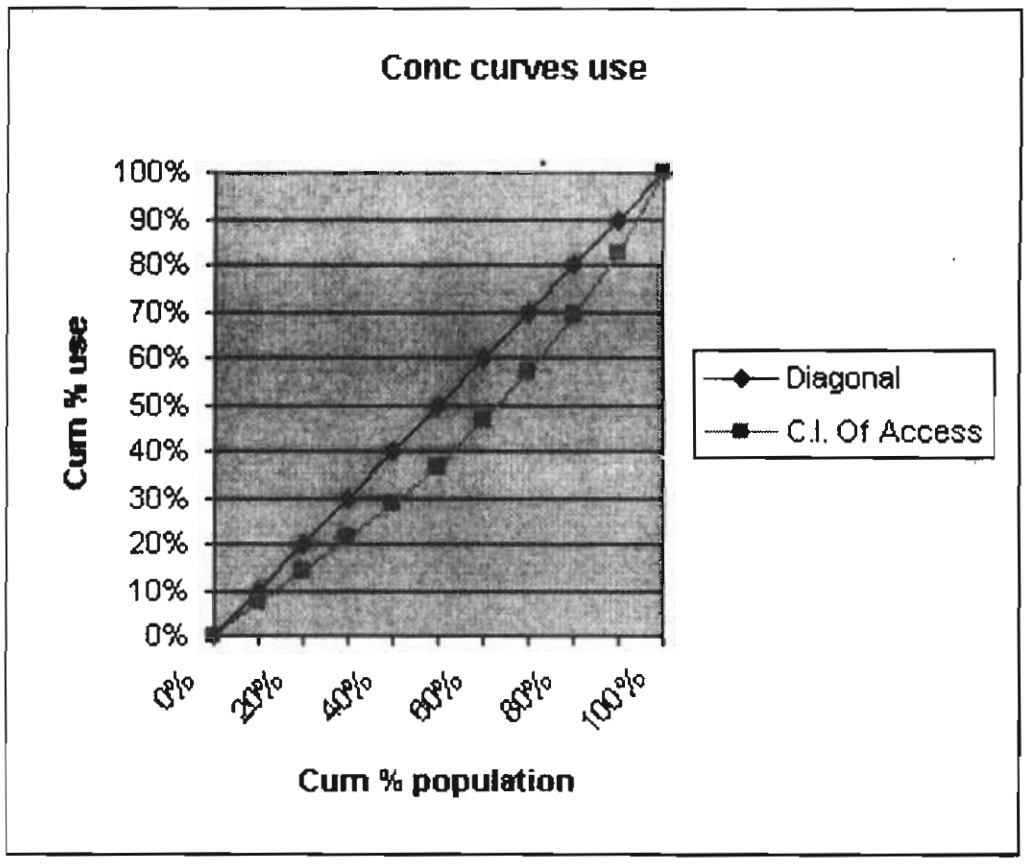
Concentration Index=0.217246



3. Delivery at Health Care Facilities

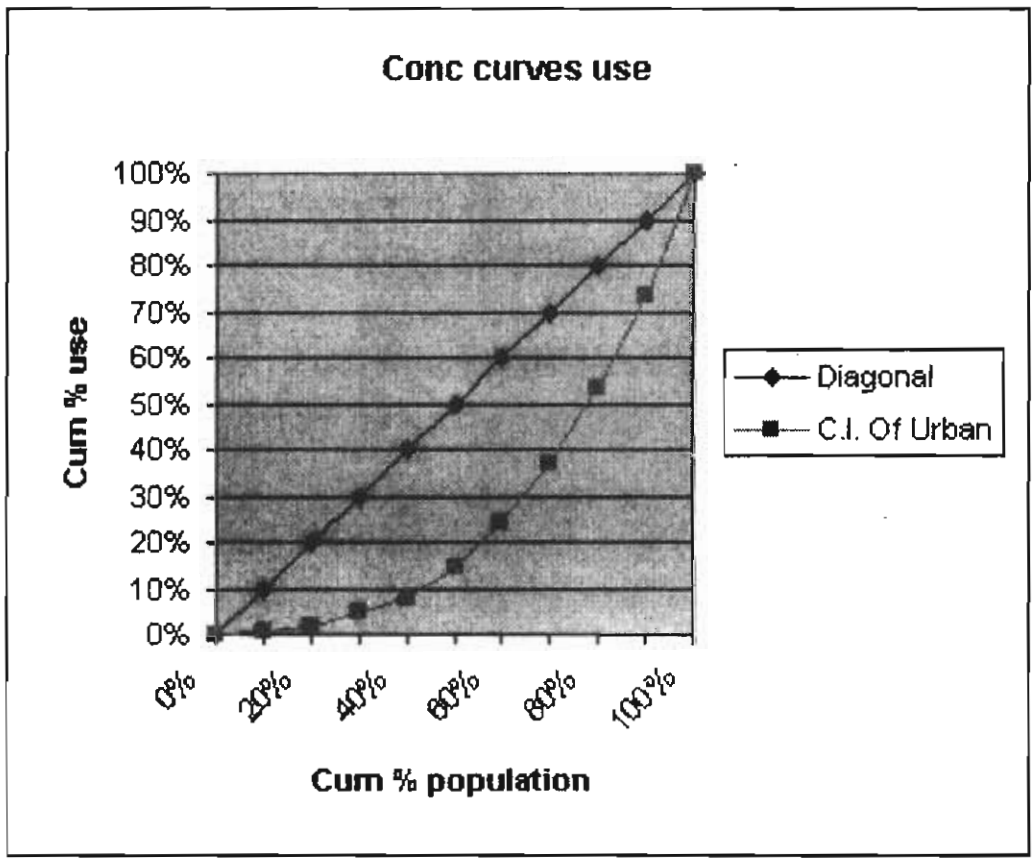
Cum % pop	Cum %
0%	0%
10%	0.073595
20%	0.137053
30%	0.212228
40%	0.285434
50%	0.365936
60%	0.467576
70%	0.567444
80%	0.687955
90%	0.82697
100%	1

Concentration Index=0.154253



4. Concentration curve of urban rural

Cum % pop	Cum %
0%	0%
10%	0.005332
20%	0.016972
30%	0.045673
40%	0.080787
50%	0.144679
60%	0.244072
70%	0.370024
80%	0.530411
90%	0.730862
100%	1



first trimester, CI=0.0853, t=30.27). The concentration curve (appendix 1, curve no. 4, 6) shows that of the bottom 20% of the population, only 14% went to health care facilities for delivery; this was only 9% for professional delivery assistance. Wealthier mothers had more access to both types of care before and after adjusting for area of residence. In addition, table 4b has shown that urban residence itself has no significant effect on access, as both the t-values are in between –1.96 and +1.96.

An important finding of this analysis concerns utilization of health care for delivery. There was significant difference of delivery in health care facilities between the rich and the poor even after controlling for all possible confounders. In addition, professional assistance for delivery was more unequally distributed between the poor and the rich than the type of facilities the mothers delivered at.

Table 3 shows that the effect of 'assumed' need, defined as mother's age at-risk did not significantly (β=-0.0048, t=-1.86) influence access to delivery care. However, prolonged labor was significantly different (β =-0.0110, t =-3.89) favoring the poor in utilizing health facilities and favoring the rich (β=0.0189, t=8.97) in professional assistance during delivery.

3.3. Curative cares in children

Table 2 shows that poor mothers more often sought medical treatment for diarrhea than rich mothers did (CI=-0.0689, t=-5.55). After adjustment for need, need and urban as well as need, urban and education, none of those confounding could explain the variation (CI=-0.0336, t=-3.25), although the concentration index was reduced in every step. Conversely, unadjusted medical treatment for ARI was significantly in favor the better-off children (CI=0.0208, t=3.61), the difference became smaller and, in fact, moving into favoring the poor when it is adjusted for need and other predictors.

From the full model (table 3) it can be seen that severity of the diseases explains a lot of the access to medical treatment for both diarrhea (β=1.3066 t=136.79) and ARI (β=0.3376 t=131.71), with negative indices.

4. Conclusion and Discussion

This analysis shows that wealth and education are strongly associated with utilization of health care in Indonesia. Significant differences in access to health services exist between poor and rich. The share of medical care was not equal with the share of need. In other words, there is evidence of horizontal inequity in the sense that equal need was treated unequally. Location (urban-rural) and education are both confounding of the wealth – health care utilization relationship, since they reduce the concentration indices after controlling for them.

4.1. Preventive Cares for Children

Concentration indices showed significant difference for utilization of DPT1 and Measles. The better-off mothers utilized health more than the worse-off for all types of care. The former had better access to immunization and participate more in health care activities as indicated by possession of a health card for their children.

In Indonesia, provision of preventive care for children is free of charge. At the village level, the integrated Family Health Post *Posyandu* provides promotive and preventive services. The Posyandu is established and managed by the community with the assistance of health center staff to improve maternal and child health. A midwife is also deployed to the village in the expectation that preventive care will be more equally distributed [8]. In this particular analysis, we did not adjust for need because it is fair to assume that need for preventive care is equal for all children.

Adjusted for area of residence, the concentration indices are still significantly different; this means that urban location does not apparently "explain away" the differences in utilization of care by wealth. In other words, wealth affects the utilization of health cares not only between urban-rural, but also within urban and rural areas. Unfortunately, 'free of charge' is not a guarantee that mothers will bring the children for the care. The analysis shows that education is a confounding. It reduces the gradient of access, although it is still significant.

4.2. Pregnancy related care

Prenatal care is important for pregnant mothers to improve delivery outcomes. The Indonesian maternal health program recommends that pregnant women have at least four antenatal visits during pregnancy, one visit in either the first or second trimester, two visits in the third trimester.

In addition, tetanus injection is supposed to be given to pregnant mothers twice during the pregnancy and is free of charge.

Seeking health care facilities for prenatal care was also significantly different by wealth. None of the potential confounding was able to explain any variation. The concentration indices for both accesses to health care facilities for prenatal care and assistance of a health professional for the care were not affected very much. It is expected that mothers who got prenatal care at health facilities would get professional assistance was confirmed (table 3), where the concentration indices and all the betas and the t-values for both types of care presented very similar results.

Many previous studies in developing countries found that socioeconomic status is the most important determinant of maternal health care utilization [9,10,11]. Inadequate utilization has been found to be due to several factors including expense, distance, tradition, cultural and belief prejudices as well as low education. I found that a lower percentage of mothers got tetanus injection than those who visited the health care facilities during the first trimester. Mothers who visit health care facilities during the first trimester of pregnancy should get at least two tetanus injections. However, as we know that the injection is given freely to the mothers, this finding was surprising; on the one hand, the Ministry of Health spends lots of resources to improve maternal care; on the other hand, attended mothers worth to taking care of, are just lost to follow-up. This could be one possible reason why the maternal mortality is hardly being reduced, despite all efforts.

The analysis found significant inequality of access to tetanus injection and first prenatal visit between the poor and wealthier mothers. Wealthier mothers got better access to the care than their poor counterparts. From these findings we can see the 'pocket' where the problems are more concentrated. It is true that mothers in the urban areas got better access (appendix), but, I would argue that location has more effect than wealth itself. The results proved that the gradients of the concentration were reducing, but the differences of access were still significant even after it is adjusted.

With regard to delivery care, most mothers who came to the government facilities seeking for antenatal, finally delivered at home. One reason is education. Most women who live in rural areas do not know and do not realize their pregnancy and delivery related risk. A study by Kunst and Houweling (2000) indicated that women's education is an important determinant of the use of maternal health services. Educational level seems to have larger effect on health care utilization than the wealth index has [12]. In addition, a study on Tanzania showed there was discrepancy between times attending at prenatal care and low percentages for delivery in health care facilities [13]. In developing countries, lack of education is always more prevalent in rural than urban areas. In Indonesia, low level of education of women in rural areas might influence their choice of place and assistance for delivery. As a result, a traditional birth attendant (TBAs) is highly regarded by mothers. The TBAs do not just help the mother for delivery, but they provide help even before and after delivery. For example, they will frequently come and visit the mother for some 'advice' (related to culture and beliefs) and to take care of the baby and the mother after birth. They might help the mother in preparing the ceremonial for the newborn baby. In addition, the mother prefers to deliver at home, because she feels more comfortable than in a hospital setting.

Another reason why mothers prefer to deliver at home may be financial problems. In contrast to developed countries where health insurance is well provided [14], in Indonesia, health services are mostly paid out of pocket. This causes the poor to have less access to the care. The wide discrepancy between rich and poor in the use of professional assistance during delivery hence puts the poor mothers more at a disadvantage; they don't have enough money to pay for the care, and moreover, the care itself is unequally distributed. In conjunction with this situation, the concentration curve of urban-rural (appendix) shows that the wealthier mothers mostly live in the urban areas, where health care facilities are more concentrated. A study from seven developing countries showed that the incidence rate of births not delivered by a trained professional was the highest in Indonesia [10].

Prolonged labor and mother's age at-risk are more frequent among the poor. Again, the poor are at a disadvantaged position. We can not relate this situation as a causal pathway for wealth. It is not because they are wealthy that they are less at-risk age for delivery, or get less complications during delivery; but, lack of awareness and education may play a role.

4.3. Curative cares for children

Indication of severity of diseases (blood in the stool and rapid breathing) in children was based on mother's report. The finding concerning severity of the diseases showed that diarrhea is most common among the poor children, while ARI is most common among the rich children. Poor households might live more in slum conditions, lacking of nutrition, sanitation and probably with less clean water available that makes them susceptible to diarrhea. On the other hand, the fact that severity of ARI is common among the rich may due to information bias. Wealthier mothers may be more likely to report sickness than poor mothers did.

The concentration index shows the poor were treated more than the rich for diarrhea, and the rich got more access to medical treatment for ARI. Mother's perception in reporting the diseases might be different. Poor mothers reported the disease that was really severe, while rich mothers reported the symptoms or indication as 'severe'.

Rich households got fewer diarrheas because they live better and have better nutritional status as well. In other word, they prevent the children more from sicknesses. They seek medical treatment as soon as the disease symptoms occurred. On the other hand, poor households tend to delay for seeking care until the illness gets severe. This assumption contradicts with the results from analysis adjusted for need. In fact, poor mothers seek medical treatment more for both diarrhea and ARI after controlling for need. I think these results are best explained by measurement error. In other words, mother's perception in reporting the sicknesses may well have been different.

In summary, this study indicates that there was a strong association between wealth and access to health services. Our findings were consistent with the Indonesian DHS report 1997, which examined rate difference and rate ratio of access to preventive care in children. Our results for the concentration index are less comparable with the results from Macro International, because the choice of indicators and the unit of analysis are different. We used the children's recode data set, while Macro's report concerned the total population. Potential information bias in the DHS data set may be due to mother's perception on severity of diseases and types of immunization. The differences between types and reasons of health care facilities used cannot be further explored.

Lack of information on household income has hindered the circumstances of this analysis. Wealth may not directly relate to money. For example, in some Indonesian cultures, although people have lands (by inheritance), some might 'stay poor' in terms of household assets, especially those who live in rural areas. The reason is that there is no access to piped drinking water, piped into yard, or geographically they are dependent on rainwater, they have no gas or electric stove; or they have no refrigerator. The wealth score will automatically be affected. After all, most of the wealthier people will be concentrated in the cities or urban areas.

It is quite difficult to proxy risk factors in pregnancy and delivery for this data set. Using age at-risk and prolonged labor is quite less appropriate for measuring need, unless the 'abnormalities' in pregnancy are indicated. Both of those proxies can be just by chance, not because of wealth. Otherwise, variables such as of body mass index, height of the mothers, haemoglobin status, or other health histories would be more sensitive to proxy the risk.

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