



Reduction in inequality in antenatal care use and persistence of inequality in skilled birth attendance in the Philippines from 1993 to 2008.

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3 1 **Title: Reduction in inequality in antenatal care use and persistence of inequality in skilled**
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6 2 **birth attendance in the Philippines from 1993 to 2008.**

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12 5 **Short Title:** Reduction in inequality in maternal health care use, Philippines
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ARTICLE SUMMARY

Article Focus: Assessing changes in the inequalities associated with maternal health care use according to living condition index in the Philippines.

Key Messages:

- The study showed significant reduction in the inequality of ANC use through time suggesting substantial coverage of women in the lower living condition quintile.
- However, extreme inequality were shown to persist in SBA and MEDFAC indicating minimal professional delivery care among women under poorly equipped living conditions despite health system wide efforts and improvements in sociodemographic profile of the population.
- The results call for equity oriented research and policies to close the wide gap in skilled care at birth in the Philippines and to determine the success factors in the reduction of inequality in ANC.

Strengths and Limitations:

- All population based demographic health survey followed a strict data quality checks through pre testing, translation of questionnaires to local dialect, interviewer training, and double data entry.

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4 1 • Employed standardized questionnaire format which are comparable between countries
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6 2 and are carefully developed to ascertain accurate response and information from the
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8 3 participants.
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11 4 • The number of subjects was limited to live birth within one year. Though this was done
12
13 5 to standardize varying sample size per data year, it reduced accuracy and increased
14
15 6 potential for error.
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18 7 • The computation of Living Condition Quintile was based on a limited set of variables.
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20 8 This was done to standardize the different information provided for the variables in each
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22 9 survey year. It is recommended to include more indicators to precisely describe the living
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24 10 conditions of women.
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37 ABSTRACT

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41 17 **Objective:** To assess changes in the inequalities associated with maternal health care use
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43 18 according to a living condition index in the Philippines.
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48 20 **Design:** Prospective analysis on the level of inequalities using population based data between
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50 21 1993 and 2008.
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55 23 **Setting:** Philippines
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2 **Participants:** Women aged 15-49 years who had a live birth within one year in 1993 (n=1707),
3 1998 (n=1513), 2003 (n=1325), and 2008 (n=1209)
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5 **Outcomes:** Coverage of antenatal care at least 4 visits (ANC), skilled attendance at birth (SBA)
6 and delivery in a medical facility (MEDFAC).
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8 **Results:** The gradient of maternal health care utilization comparing the highest living condition
9 quintile with the lowest quintile declined from 1993 to 2008: adjusted OR was 2.78 (95% CI
10 1.64, 4.71) in 1993 and 1.99 (95% CI 1.05, 3.44) in 2008 for ANC; 5.84 (95% CI 2.77, 12.34) in
11 1993 and 4.25 (95% CI 2.31, 7.83) in 2008 for SBA; and 3.70 (95% 2.22, 6.18) in 1993 and 2.68
12 (95% CI 1.64, 4.38) in 2008 for MEDFAC. Considerable reduction in the level of inequality was
13 observed in ANC compared to the persistence of large inequalities in SBA and MEDFAC:
14 concentration index was 0.18 (SE: 0.013) in 1993 and 0.09 (SE: 0.010) in 2008 for ANC; 0.26
15 (SE: 0.013) in 1993 and 0.24 (SE: 0.013) in 2008 for SBA; and 0.41 (SE: 0.016) in 1993 and
16 0.34 (SE: 0.015) in 2008 for MEDFAC.
17

18 **Conclusion:** Over a 16 year period, gradients in ANC decreased and high level of inequalities in
19 SBA and MEDFAC persisted. The results also showed that disproportionate use of institutional
20 care at birth among Filipino women from poorer equipped living conditions despite having
21 sufficient coverage of ANC.
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For peer review only

1 INTRODUCTION

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3 Globally, there is an increasing concern regarding inequities in maternal health, especially in
4 developing countries. [1] The slow pace of reduction in maternal mortality rates despite cost-
5 effective solutions has urged the international community to look beyond accomplishing national
6 targets and to begin addressing the wide disparities in women's health. [2]

7
8 The key to realizing equity in maternal health is the achievement of equity in key maternal health
9 coverage, such as antenatal care and skilled birth attendance. A previous study indicated the
10 greatest inequity in SBA coverage followed by ANC of more than four visits. [3] Wide
11 inequalities in these interventions have significantly hindered the reduction by 0.75, the maternal
12 mortality indicated target in the Millennium Development Goal 5 ratio from 1990 to 2015. [4 –
13 6] This situation has prompted urgent and concerted efforts at both international and local levels
14 to ensure access to SBA and ANC for all women irrespective of socioeconomic position through
15 equity-oriented policies and actions.

16
17 The Philippines has made significant efforts to improve women's health as mandated in its
18 constitution and as a signatory to several women's international conventions including the
19 Millennium Development Goals. National laws passed includes the Magna Carta of Women (RA
20 9710), Maternity Benefits in Favor of Women Workers in the Private Sector (RA 7322), and
21 Maternal Package for Normal Spontaneous Vaginal Delivery of the Philippine Health Insurance
22 Corporation (Phil Health). Starting in the 1990s, Philippine government has also implemented a
23 number of maternal health programs, including two Women's Health and Safe Motherhood

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3 1 Projects (WHSM). Health system reforms to reduce maternal and neonatal mortality were also
4
5 2 spearheaded through the Department of Health Administrative Order No. 2008-0029 resulting to
6
7 3 the Integrated Maternal, Neonatal and Child Health and Nutrition Strategy (MNCHN). Specific
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9 4 reproductive health indicators of MNCHN to be met in 2010 include (1) an increase in modern
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11 5 contraceptive prevalence rate (CPR) to 60%, (2) an increase in the proportion of pregnant
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13 6 women having at least four ANC visits to 80%, (3) and an increase in SBA and facility-based
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15 7 births to 80%.
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22 9 There is, however, uncertainty regarding whether and how these maternal health policies and
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24 10 programs have substantially reduced gaps in the use of key maternal interventions among women
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26 11 from varying socioeconomic backgrounds through time. The Philippines is currently off track
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28 12 and slow in achieving Millennium Development Goal 5 (MDG-5). In 2010, the estimated
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30 13 maternal mortality rate was 99 per 100000 live births, compared to the goal of 52 per 100000
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32 14 live births in 2015. [7] This slow achievement of national targets suggests wide disparities in use
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34 15 of maternal health interventions. A study in 2003 indicated wide economic and regional
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36 16 inequalities in maternal and child health services, as well as differing patterns of use and
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38 17 concentration of services according to living conditions. [8] The objectives of the present study
39
40 18 were to examine trends of inequality in antenatal (ANC), skilled birth attendance (SBA), and
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42 19 delivery in medical facility (MEDFAC) in the Philippines between 1993 and 2008 according to
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44 20 women's living conditions and socio demographic characteristics.
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1 DATA AND METHODS

2 Data Source

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4 This study was performed using data from the Philippines Demographic and Health Survey
5 (PDHS) conducted for the periods of 1993, 1998, 2003, and 2008. All were nationally
6 representative household surveys overseen by the National Statistics Office and National
7 Steering Committee with financial and technical support from the United States Agency for
8 International Development. [9] PDHS gathers detailed information on population, health, and
9 nutrition to assist in the country's monitoring and impact evaluation. It ensures comparability
10 across countries and time by developing standard model questionnaires, extensive survey
11 procedures, interviewer training, and data processing guidelines. [10, 11]

12
13 The 1993 and 1998 PDHS employed a two-stage sample design, representing 14 regions and 16
14 regions, respectively. A sample of 13700 households (response rate: 99.2%) was randomly
15 selected from 750 primary sampling units (PSUs) for 1993 and a sample of 13708 households
16 (response rate: 98.7%) was randomly selected from 755 primary sampling units (PSUs) for 1998.
17 The 2003 and 2008 PDHS followed a stratified three-stage cluster sample design representing 17
18 regions. A sample of 13914 households (response rate: 99.1%) was randomly selected from 819
19 primary sampling units (PSUs) for 2003 and a sample of 13764 households (response rate:
20 99.3%) was randomly selected from 794 primary sampling units for 2008. Detailed descriptions
21 of the study design and methods of data collection are accessible online in household survey
22 reports. [12 – 15]

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6 2 **Subjects**
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10 4 The numbers of eligible women interviewed were as follows: 1993, $n = 15029$; 1998, $n = 13983$;
11 5 2003, $n = 13633$; and 2008, $n = 13594$. The average response rate was 98%. The Household
12 6 Questionnaire was used to identify women and men eligible for the interview in the household
13 7 surveys. The unit of analysis was women aged 15 – 49 years limited to those who had a live birth
14 8 within one year, resulting in final sample sizes of 1707 in 1993, 1513 in 1998, 1325 in 2003, and
15 9 1209 in 2008. The subjects were limited to those with a live birth within one year. This was done
16 10 to standardize the varying information on the children born in the last five years, which ranged
17 11 from information on the last birth, next to last birth, second from last birth (1993 and 2008), and
18 12 last birth only (2003).
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35 14 **Study variables**
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40 16 Three dependent variables were measured in the present study: (1) at least four antenatal
41 17 consultations; (2) assistance by professional health personnel during delivery—either a doctor,
42 18 nurse, or midwife, but excluding traditional birth attendants (*hilot*), relatives, or friends; and (3)
43 19 whether the birth occurred at home or in a medical facility (public or private).
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52 21 Of specific interest is computation of the living condition quintile (LCQ) to reflect the relative
53 22 living conditions of women and adjust for variables related to socioeconomic status in all
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1 household survey years. Variables included in the LCQ calculation were source of drinking
2 water, type of toilet facility, access to electricity, ownership of a television, refrigerator,
3 bicycle/trisikad, motorcycle/scooter, car/truck, and main flooring material. LCQ was categorized
4 into five levels ranging from 1 = poorly equipped to 5 = well equipped.

5
6 Other independent variables were type of residence (urban or rural), woman's age (< 20, 20 – 29,
7 30 – 39, ≥ 40), birth order (1, 2, 3, ≥ 4), and educational level of woman and her partner (none,
8 primary, secondary, higher).

10 **Ethical Review**

11
12 As protocols for all demographic health household surveys, the four PDHS were submitted for
13 ethical review to the ICF Institutional Review Board (Calverton, MD) and an institutional review
14 board or ethics review panel in the Philippines for approving research studies on human subjects.
15 [16]

17 **Statistical Analysis**

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19 The LCQ was constructed by principal component analysis on combined PDHS data sets (1993,
20 1998, 2003, and 2008) using STATA factor analysis. The five LCQ quintiles were drawn from
21 the first principal component. [17, 18]

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6 2 Changes in the socio demographic profile and use of ANC, SBA, and MEDFAC of the
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8 3 population were analyzed from household survey data in 1993, 1998, 2003, and 2008. Tests for
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10 4 trends were performed using the Mantel–Haenszel linear-by-linear association chi squared test.
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12 5 Crude and adjusted odds ratios between each dependent variable and all of the independent
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14 6 variables were assessed by multivariate logistic regression analysis. Complex household survey
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16 7 design was taken into account in all analyses using a sampling weight. All the missing data were
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18 8 excluded in the analysis. All analyses were performed using StataMP 11 Statistical Software
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21 9 (Stata Corp., College Station, TX).
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27 11 Inequalities of each outcome variable according to the living condition quintile were estimated
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29 12 using the concentration index. A measure similar to the GINI coefficient, defined as twice the
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31 13 area between the concentration curve and the line of inequality, was used to determine the
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33 14 magnitude of inequality; the result varied from -1 to $+1$ where values closer to 0 or 1 indicate a
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35 15 greater or lesser degree of equality in the distribution of maternal health service utilization,
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37 16 respectively. [19, 20]
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4 1 **RESULTS**
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10
11 3 Table 1 shows the changes in socio demographic profile of the population from 1993 to 2008.
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14 4 The percentage of women with secondary and higher education increased during this period. A
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16 5 corresponding increase was also observed in the percentage of partners who finished secondary
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18 6 and higher education. The proportion of the population with well-equipped living conditions
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21 7 increased dramatically by almost half between 1993 and 2008.
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Table 1 Socio-demographic characteristics and childbirth history of women aged 15-49 years, per survey year, Philippines, 1993-2008

Indicator	1993 n=1707 %	1998 n=1513 %	2003 n=1325 %	2008 n=1209 %	p Value*
Residence					
Urban	48.8	46.3	50.0	46.9	0.192
Rural	51.2	53.7	50.0	53.1	
Woman's Education					
None	2.3	1.8	1.9	1.2	<0.001
Primary	39.0	29.9	27.8	24.2	
Secondary	37.4	39.7	42.5	50.3	
Higher	21.3	28.6	27.8	24.3	
Partner's Education					
None	1.9	1.6	2.0	1.9	<0.001
Primary	40.8	33.4	31.8	27.5	
Secondary	37.3	36.7	40.1	45.0	
Higher	20.1	28.3	26.1	25.7	
Living Condition Quintile					
1 (Poorly equipped)	26.5	19.6	19.1	14.8	<0.001
2	24.8	20.0	16.2	15.4	
3	22.5	18.7	24.0	21.6	
4	14.1	18.1	19.7	22.2	
5 (Well equipped)	12.1	23.6	21.0	26.0	
Woman's Age					
<20	5.6	6.1	7.2	8.2	0.233
20-29	53.7	53.7	53.3	53.5	
30-39	35.6	35.1	34.4	32.5	
≥40	5.2	5.1	5.1	5.8	
Birth Order					
1	22.6	24.5	27.7	28.5	<0.001
2	20.7	21.1	23.6	24.6	
3	16.8	19.6	15.5	15.2	
≥4	39.9	34.8	33.2	31.7	

* Calculated by chi-square test.

1 On the other hand, the distribution of household assets varied significantly across living
2 condition quintiles. Approximately half (53.2%) of poorly equipped women had wells as their
3 source of drinking water, and 27.1% have unsafe sources, such as springs, rivers, and tanker
4 trucks. The majority of the poorly equipped women had substandard or no toilet facilities
5 (65.6%), such as bucket toilets, drop/hanging toilets, and open fields. None of the poorly
6 equipped women had a refrigerator, car, or truck. The percentages of television, motorcycle, or
7 scooter ownership were low among poorly equipped women, only 3.5% of whom had electricity
8 (data shown in the supplementary data).

9
10 There was a substantial increase in utilization of ANC from 53.4% in 1993 to 74.8% in 2008.
11 However, there were limited changes in utilization of SBA and MEDFAC from 55.5% in 1993 to
12 63.3% in 2008 and 30.7% in 1993 to 46.3% in 2008, respectively (data shown in the
13 supplementary data).

14
15 As shown in Table 2, from 1993 to 2008, the rates of utilization of ANC, SBA, MEDFAC were
16 higher for women who were educated, better off, had well-equipped living conditions, resided in
17 an urban area, and those with educated partners than among their poorer and less educated
18 counterparts. The odds ratio of ANC use declined, but the odds ratio for SBA and MEDFAC
19 were consistently high between 1993 and 2008.

Table 2 Adjusted odd ratios of the association between living condition and socio-demographic characteristics and antenatal care, skilled birth attendance or delivery at medical facility of women age 15-49 years, Philippines, 1993(n=1707), 1998(n=1513), 2003(n=1325), 2008(n=1209)

Indicator	Antenatal Care								Skilled Birth Attendance								Delivery at medical facility							
	1993		1998		2003		2008		1993		1998		2003		2008		1993		1998		2003		2008	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Residence																								
Urban	1.41**	1.13, 1.76	1.65**	1.24, 2.19	1.88**	1.42, 2.49	1.10	0.80, 1.51	3.20**	2.53, 4.05	3.58**	2.66, 4.84	4.09**	3.07, 5.47	3.09	2.25, 4.25	3.70**	2.83, 4.85	2.73***	2.00, 3.71	2.32**	1.74, 3.10	2.10***	1.55, 2.85
Rural (Reference)	1		1		1		1		1		1		1		1		1		1		1		1	
Woman's Education																								
None	0.47	0.22, 1.03	0.45	0.15, 1.34	0.24**	0.08, 0.69	0.06**	0.01, 0.28	0.14**	0.05, 0.43	0.47	0.16, 1.43	0.12**	0.04, 0.38	0.49	0.11, 2.22	0.28	0.06, 1.40	0.40	0.09, 1.79	0.06**	0.01, 0.57	0.73	0.08, 6.79
Primary	0.45**	0.31, 0.65	0.41**	0.26, 0.65	0.49**	0.31, 0.76	0.28**	0.16, 0.50	0.32**	0.21, 0.50	0.45**	0.27, 0.75	0.30**	0.19, 0.48	0.45**	0.27, 0.76	0.44**	0.29, 0.65	0.37***	0.23, 0.61	0.32**	0.21, 0.49	0.43*	0.26, 0.73
Secondary	0.59**	0.42, 0.84	0.58**	0.39, 0.87	0.65*	0.44, 0.96	0.49**	0.30, 0.80	0.52**	0.35, 0.79	0.67	0.43, 1.05	0.45**	0.29, 0.69	0.75	0.48, 1.18	0.56**	0.39, 0.79	0.42***	0.29, 0.61	0.39**	0.27, 0.56	0.74	0.50, 1.10
Higher (Reference)	1		1		1		1		1		1		1		1		1		1		1		1	
Partner's Education																								
None	0.37*	0.15, 0.89	0.27*	0.08, 0.87	0.48	0.19, 1.22	0.56	0.20, 1.55	0.05**	0.01, 0.38	0.01**	0.00, 0.14	0.16**	0.06, 0.44	0.03**	0.00, 0.31	0.12	0.01, 1.18	(omitted)		0.06*	0.01, 0.63	(omitted)	
Primary	0.53**	0.37, 0.76	0.54**	0.35, 0.84	0.58**	0.38, 0.89	0.73	0.43, 1.25	0.51**	0.34, 0.76	0.32**	0.19, 0.52	0.43**	0.28, 0.68	0.30**	0.18, 0.50	0.31**	0.21, 0.47	0.22***	0.14, 0.36	0.40**	0.25, 0.62	0.32***	0.20, 0.52
Secondary	0.80	0.57, 1.12	0.65*	0.44, 0.96	0.70	0.48, 1.04	0.85	0.53, 1.35	0.69	0.47, 1.01	0.62*	0.41, 0.94	0.61*	0.40, 0.93	0.55**	0.36, 0.85	0.58**	0.42, 0.82	0.42***	0.29, 0.60	0.61**	0.42, 0.87	0.65*	0.46, 0.94
Higher (Reference)	1		1		1		1		1		1		1		1		1		1		1		1	
Living Condition Quintile																								
1 (Poorly equipped)	1		1		1		1		1		1		1		1		1		1		1		1	
2	0.86	0.63, 1.17	1.56*	1.07, 2.27	0.93	0.62, 1.41	1.18	0.75, 1.85	1.12	0.81, 1.55	0.83	0.56, 1.24	0.96	0.63, 1.45	0.76	0.47, 1.21	0.85	0.56, 1.29	0.65	0.39, 1.11	0.98	0.61, 1.58	0.54*	0.30, 0.95
3	1.05	0.76, 1.46	1.46	0.93, 2.30	1.22	0.84, 1.78	0.93	0.62, 1.40	1.88**	1.31, 2.69	1.76*	1.12, 2.79	1.64*	1.10, 2.45	1.37	0.91, 2.08	1.23	0.85, 1.78	1.38	0.85, 2.24	1.53*	1.00, 2.34	1.11	0.72, 1.71
4	1.87**	1.21, 2.91	1.89**	1.18, 3.01	0.92	0.60, 1.42	1.98**	1.17, 3.35	2.74**	1.63, 4.62	3.44**	1.99, 5.96	1.95**	1.20, 3.17	2.04**	1.26, 3.30	1.94**	1.22, 3.09	1.47	0.91, 2.38	1.91**	1.24, 2.95	1.39	0.90, 2.17
5 (Well equipped) (Reference)	2.78**	1.64, 4.71	2.50**	1.47, 4.28	2.33**	1.36, 3.98	1.90*	1.05, 3.44	5.84**	2.77, 12.34	4.32**	2.24, 8.33	3.03**	1.72, 5.36	4.25**	2.31, 7.83	3.70**	2.22, 6.18	2.14**	1.30, 3.53	2.42**	1.54, 3.78	2.68***	1.64, 4.38
Woman's Age																								
<20	0.90	0.56, 1.45	0.53*	0.31, 0.90	0.94	0.55, 1.59	0.98	0.56, 1.71	1.04	0.62, 1.73	0.69*	0.38, 1.23	0.92	0.55, 1.55	0.74	0.42, 1.33	0.93	0.49, 1.75	0.89	0.42, 1.87	0.75	0.44, 1.26	0.56	0.29, 1.10
20-29 (Reference)	1		1		1		1		1		1		1		1		1		1		1		1	
30-39	1.36*	1.04, 1.78	1.85**	1.31, 2.60	1.32	0.95, 1.83	1.41	0.98, 2.02	1.28	0.95, 1.73	1.54	1.07, 2.21	1.44*	1.00, 2.08	1.61**	1.09, 2.36	1.39*	1.00, 1.92	1.35	0.91, 2.00	1.41*	1.00, 2.01	1.72*	1.16, 2.54
≥40	1.48	0.87, 2.50	1.50	0.83, 2.71	0.96	0.52, 1.80	0.79	0.42, 1.49	2.09**	1.18, 3.69	1.55	0.81, 2.96	1.08	0.53, 2.23	2.59**	1.25, 5.38	2.01*	1.03, 3.93	2.05	0.98, 4.26	1.07	0.47, 2.45	2.89*	1.46, 5.72
Birth Order																								
1 (Reference)	1		1		1		1		1		1		1		1		1		1		1		1	
2	0.87	0.62, 1.23	1.12	0.74, 1.71	0.91	0.61, 1.36	0.94	0.58, 1.53	0.97	0.66, 1.42	0.72	0.47, 1.11	0.98	0.63, 1.52	0.99	0.63, 1.56	0.65*	0.43, 0.96	0.62*	0.39, 0.98	0.63*	0.42, 0.95	0.61*	0.40, 0.93
3	0.70	0.48, 1.02	0.73	0.46, 1.16	1.03	0.65, 1.64	0.64	0.38, 1.10	0.65*	0.43, 1.00	0.98	0.62, 1.56	0.84	0.50, 1.39	0.71	0.42, 1.21	0.43**	0.27, 0.68	0.85	0.51, 1.42	0.57*	0.36, 0.90	0.42***	0.26, 0.69
≥4	0.45**	0.32, 0.65	0.43**	0.27, 0.67	0.56**	0.35, 0.88	0.61	0.36, 1.05	0.59**	0.40, 0.88	0.38**	0.24, 0.61	0.60*	0.36, 0.98	0.45**	0.26, 0.77	0.37**	0.24, 0.57	0.47**	0.28, 0.79	0.35**	0.22, 0.56	0.21***	0.12, 0.35

* p<0.05; ** p<0.01; *** p<0.001

Adjusted for residence, woman's education, partner's education, women' age and birth order

1 Figure 1 shows that there was a marked reduction in inequality of ANC use from 1993 to 2008.
2 Although gradients of ANC use among women with no education and women with higher
3 education widened from 1993 to 2008, the gradients of ANC use among women with primary
4 education and women with higher education decreased from a difference of 40.4% in 1993 to
5 31.6% in 2008. The gulf between women with partners who had no education and those whose
6 partners had higher education levels also decreased, with a difference of 54.4% in 1993 to 50.0%
7 in 2008. A marked reduction was seen among women in the well-equipped living conditions
8 quintile compared to those in the poorly equipped living conditions quintile, with a difference of
9 48.0% in 1993 decreasing to 32.9% in 2008. A considerable decline in the concentration index
10 computed for the living condition quintile was observed from 1993 to 2008.

11

1 **Figure 1** Trends in the percentage of antenatal care use by (a) woman's education, (b) partner's
 2 education and (c) living condition quintile, 1993-2008

3 Part a: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

4 Part b: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

5 Part c: -◆- 1 (Poorly equipped), -■- 2, -▲- 3, ···×··· 4, -×- 5 (Well equipped)

6 Note: Concentration index was 0.18 (Standard Error: 0.013) in 1993; 0.18 (Standard Error:
 7 0.013) in 1998; 0.12 (Standard Error: 0.012) in 2003; 0.09 (Standard Error: 0.010) in 2008

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3 1 Figure 2 shows the limited changes in the inequality of SBA from 1993 to 2008. A reduction was
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6 2 observed in the gradient of SBA in comparison between women with no education and those
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8 3 with higher education with a difference of 76.6% in 1993 decreasing to 70.7% in 2008. In
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10 4 contrast, the gradient widened between women with partners who had no education and those
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12 5 whose partners had higher education levels, with a difference of 80.4 % in 1993 increasing to
13
14 6 84.9% in 2008. The same trend was also observed among women in the well-equipped living
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16 7 condition quintile compared to those in the poorly equipped living condition quintile, with a
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18 8 difference of 69.4% in 1993 increasing to 72.5% in 2008. The concentration index for living
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20 9 condition quintile did not show consistent trends and remained at the same level from 1993 to
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24 10 2008.
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1 **Figure 2** Trends in the percentage of skilled birth attendance by woman's education (a),
2 partner's education (b) and living condition quintile (c), 1993-2008

3 Part a: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

4 Part b: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

5 Part c: -◆- 1 (Poorly equipped), -■- 2, -▲- 3, ···×··· 4, -×- 5 (Well equipped)

6 Note: Concentration index was 0.26 (Standard Error: 0.013) in 1993; 0.28 (Standard Error:
7 0.012) in 1998; 0.22 (Standard Error: 0.013) in 2003; 0.24 (Standard Error: 0.013) in 2008

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3 1 Figure 3 shows the changes in inequality of MEDFAC from 1993 to 2008. As shown in the
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6 2 figure, the gradient of MEDFAC between women with no education and those with higher
7
8 3 education widened from a difference of 60.4% in 1993 to 67.0% in 2008. The gradient between
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10 4 women with partners who had no education and those whose partners had higher education
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12 5 levels also widened, with a difference of 60.1% in 1993 increasing to 74.4% in 2008. The gulf
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14 6 between women in the well-equipped living condition quintile and those in the poorly equipped
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16 7 living condition quintile also widened, with a difference of 65.5% in 1993 increasing to 70.1% in
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18 8 2008. Similar to SBA, the concentration index computed for the living condition quintile from
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20 9 1993 to 2008 remained at the same level.
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1 **Figure 3** Trends in the percentage of delivery at medical facility by woman's education (a),
2 husband's education (b) and living condition quintile (c), 1993-2008

3 Part a: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

4 Part b: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

5 Part c: -◆- 1 (Poorly equipped), -■- 2, -▲- 3, ···×··· 4, -×- 5 (Well equipped)

6 Note: Concentration index was 0.41 (Standard Error: 0.016) in 1993; 0.41 (Standard Error:
7 0.017) in 1998; 0.34 (Standard Error: 0.017) in 2003; 0.34 (Standard Error: 0.015) in 2008

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1 DISCUSSION

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8 This is the first study to describe the time trends in the inequalities of maternal health care
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10 utilization in the Philippines. The analysis of four nationally representative PDHS survey data
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12 sets ranging over a period of 16 years showed substantial increase in antenatal coverage and
13
14 limited improvement in professional and institutional delivery care. Furthermore, findings
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16 demonstrated significant reduction in the inequality of ANC use through time suggesting
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18 substantial coverage of women in the lower living condition quintile. The study also provided
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20 evidence of persistence of extreme inequality in SBA and MEDFAC indicating minimal
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22 professional delivery care among women under poorly equipped living conditions.
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29 The main strength of this study is the representativeness of the four PDHS surveys to the whole
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31 population. A national sample of women aged 15-49 years were collected obtaining a sufficient
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33 sample sizes for each survey year. PDHS followed a strict data quality checks through pre testing,
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35 translation of questionnaires to local dialect, interviewer training, and double data entry. It also
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37 employed standardized questionnaire format which are comparable between countries and are
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39 carefully developed to ascertain accurate response and information from the participants. (10, 11)
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45 In the evaluation of results, some limitations should be considered. First, the number of subjects
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47 was limited to live birth within one year which was approximately 0.1 of the original sample.
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49 Though this was done to standardize varying sample size per data year, it reduced accuracy and
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51 increased potential for error. Second, computation of Living Condition Quintile was based on a
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53 limited set of variables. This was done to standardize the different information provided for the
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3 1 variables in each survey year. It is recommended to include more indicators to precisely describe
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6 2 the living conditions of women.
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10 4 Findings from in India reported that both ANC and SBA have low use among poor women
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12 5 through time. [21] Evidence on 25 low income countries indicated huge inequalities on
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14 6 institutional delivery rates and indicated a weak health system and lack of skilled birth workers
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16 7 as the main barriers of use. [22] Marked underutilization of SBA has been noted among poor
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18 8 women in many studies. [23-24]
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24 10 The total proportion of antenatal coverage increased compare to the total proportion of births
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26 11 attended by skilled health personnel and delivery at a medical facility from 1993 to 2008. Over
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28 12 the last several decades, the Philippine government has launched maternal health projects and
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30 13 programs to improve women's health. These were implemented alongside extensive health
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32 14 system reforms across the country on health financing, health regulation, health service delivery,
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34 15 and good governance in health following decentralization of health care services. [25] A recent
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36 16 study indicated that implementation areas that have intensively adopted the health system-wide
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38 17 reforms have improved overall maternal health outcomes compared to those that did not.
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40 18 However, the poorly developed health information systems and lack of referral emergency care
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42 19 facilities in remote coastal and isolated mountain communities were noted as challenges that
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44 20 remain to be addressed. [26]
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53 22 The results of the present study indicated significant reductions in the inequality of ANC use.
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55 23 This translates to substantial ANC use among women under poorly equipped living conditions.
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1 This can be explained by improvements in both the health care system and in the socio
2 demographic profile of the population. The Phil Health has been reported to increase uptake and
3 standards of ANC. Improvements in the quality of services in health care institutions through
4 accreditation and the covering of financial costs by insurance contributed to the increased use of
5 ANC by Filipino women regardless of socio demographic status. [27, 28] There was also an
6 increase in the total number of midwives and rural (*barangay*) health units through the years,
7 which addressed the problems of distance and lack of availability of health workers and ANC
8 facilities. [29] Moreover, positive changes in sociodemographic and demographic profiles, such
9 as increases in educational status of women and their partners, better living conditions of women,
10 and decreased fertility, may also explain the observed reductions in the inequality of ANC use.
11 [30]

12
13 Extreme inequalities in SBA and MEDFAC persist in the Philippines despite health system-wide
14 efforts and improvements in the socio demographic profile of the population. After 16 years, the
15 majority of Filipino women from poorly equipped living conditions continue to deliver at home
16 without professional assistance. In the Philippines, financial, transportation, companion to health
17 facility, high burden of health workers, and congestion in large hospitals are major barriers that
18 must be addressed to increase the rate of hospital delivery. The majority of unskilled home
19 deliveries among Filipino women occur near hospitals, and financial burden associated with
20 hospital delivery is the main concern regardless of socioeconomic status. [31] In 2009, the
21 families in the bottom 30% income group spent more than they earned, with average figures of
22 Php 64000 (approx. US\$1,535.50) and Php 62000 (approx. US\$1,487.47), respectively. The
23 minimum cost of a normal single delivery in secondary, tertiary, and private health care

1 institutions are Php 4071 (approx. US\$97.69), Php 5316 (approx. US\$127.57), and Php 15040
2 (approx. US\$360.77), respectively. [32, 33] In families from the lowest 30% income group,
3 delivery at a hospital would consume a minimum of 6.6% – 24.3% of the family's total annual
4 income. This indicates that catastrophic financial costs are responsible for the decision by poorer
5 Filipino women to deliver at home, even if they are close to health facilities. Furthermore, of
6 total health spending, out-of-pocket payments by patients continue to increase from 40% in 2000
7 to 54% in 2010, and Phil Health coverage is low. [34] Internal armed conflicts are also pervasive
8 in some regions in the Philippines, where rates of literacy and human development are lowest
9 and poverty rates are high. An exploratory study revealed scarcity of staff and funds and
10 disruption of maternal health services because of military, rebel, and political or clan conflicts.
11 [35]

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13 Our study implies the need to research solutions to reduce inequality in SBA and delivery at a
14 medical facility, and to determine the factors responsible for the persistence of inequality in SBA
15 and delivery at a medical facility as well as the inconsistencies in trends despite government and
16 non-governmental efforts. Recognizing reproductive health as a basic right of women regardless
17 of socio demographic status is important in formulating national policy and programs to address
18 inequality in maternal health service utilization.

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For peer review only

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9
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16
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19
20 8 The authors declare that they have no competing interests.
21
22 9

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32

33
34 15 FM and KN conceptualized and designed the study. FM obtained and FM and MK analyzed the
35 16 data. FM, KN, MK, and KS interpreted the results of analysis. FM drafted an initial manuscript
36 17 and FM, KN, MK, and KS structured and edited the manuscript. All authors approved the final
37 18 manuscript.
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42 20 **DATA SHARING**
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44 21 There are no additional unpublished data from the study.
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1 REFERENCES

- 2 1. Commission on information and accountability for Women's and Children's Health.
3 Keeping promises, measuring results. World Health Organization; 2011. Available from:
4 [http://www.everywomaneverychild.org/images/content/files/accountability_commission/f](http://www.everywomaneverychild.org/images/content/files/accountability_commission/final_report/Final_EN_Web.pdf)
5 [inal_report/Final_EN_Web.pdf](http://www.everywomaneverychild.org/images/content/files/accountability_commission/final_report/Final_EN_Web.pdf) (accessed March 2012).
- 6 2. Thomsen S, Hoa Dt, Målqvist M, et al. Promoting equity to achieve maternal and child
7 health. *Reprod Health Matters* 2011;**19**(38):176-82.
- 8 3. Barros AJ, Ronsmans C, Axelson H, et al. Equity in maternal, newborn and child health
9 interventions in countdown to 2015: a retrospective review of survey data from 54
10 countries. *Lancet* 2012;**379**(9822):1225-33.
- 11 4. Zere E, Kirigia JM, Duale S, et al. Inequities in maternal and child health outcomes and
12 interventions in Ghana. *BMC Public Health* 2012;**12**:252.
- 13 5. Wirth M, Sacks E, Delamonica E, et al. “Delivering on the mdgs?”:equity and maternal
14 health in Ghana, Ethiopia and Kenya. *East Afr J Public Health* 2008;**5**(3):133-41.
- 15 6. Silal SP, Penn Kenana L, Harris B, et al. Exploring inequalities in access to and use of
16 maternal health services in South Africa. *BMC Health Serv Res* 2012;**12**(1):120.
- 17 7. WHO, UNICEF, UNFPA, The World Bank. Trends in maternal mortality 1990-2010:
18 WHO, UNICEF, UNFPA and The World Bank estimates. Geneva: World Health
19 Organization; 2012. Available from:
20 [http://www.unfpa.org/webdav/site/global/shared/documents/publications/2012/Trends_in](http://www.unfpa.org/webdav/site/global/shared/documents/publications/2012/Trends_in_maternal_mortality_A4-1.pdf)
21 [_maternal_mortality_A4-1.pdf](http://www.unfpa.org/webdav/site/global/shared/documents/publications/2012/Trends_in_maternal_mortality_A4-1.pdf) (accessed March 2012).

- 1
2
3 1 8. Lavado RF, Lagrada LP. Are Maternal and Child Care Programs Reaching the Poorest
4
5 2 Regions in the Philippines? Philippine Institute for Developmental Studies. 2008 Nov;
6
7 3 Discussion Paper Series No. 2008-30.
8
9
10 4 9. Demographic and Health Surveys [Internet]. Calverton: Macro International. Available
11
12 5 from: <http://www.measuredhs.com/> (accessed July 2011).
13
14
15 6 10. Rutstein SO, Rojas G. Guide to DHS statistics. Calverton, MD: ORC Macro,2003.
16
17 7 11. Croft T. DHS Data Editing and Imputation. Calverton, MD: ORC Macro International.
18
19 8 12. National Statistics Office (NSO) [Philippines] and Macro International Inc. (MI).1994.
20
21 9 National Demographic Survey 1993. Calverton, Maryland: NSO and MI.
22
23 10 13. National Statistics Office (NSO)], Department of Health (DOH) [Philippines] and Macro
24
25 11 International Inc. (MI).1999. National Demographic Survey 1998. Manila: NSO and MI.
26
27 12 14. National Statistics Office (NSO) [Philippines], and ORC Macro. 2004. National
28
29 13 Demographic Survey 2003. Calverton, Maryland: NSO and ORC Macro.
30
31 14 15. National Statistics Office (NSO) [Philippines], and ICF Macro. 2009. National
32
33 15 Demographic Survey 2008. Calverton, Maryland: National Statistics Office and ICF
34
35 16 Macro.
36
37 17 16. ICF International. 2012. Survey Organization Manual for Demographic and Health
38
39 18 Surveys. MEASURE DHS. Calverton. Maryland: ICF International. Available from:
40
41 19 [http://www.measuredhs.com/pubs/pdf/DHSM10/DHS6_Survey_Org_Manual_28Feb201](http://www.measuredhs.com/pubs/pdf/DHSM10/DHS6_Survey_Org_Manual_28Feb2012.pdf)
42
43 20 [2.pdf](http://www.measuredhs.com/pubs/pdf/DHSM10/DHS6_Survey_Org_Manual_28Feb2012.pdf) (accessed July 2011).
44
45
46 21 17. Coste J, Bouée S, Ecosse E, et al. Methodological issues in determining the
47
48 22 dimensionality of composite health measures using principal component analysis: case
49
50 23 illustration and suggestions for practice. *Quality of Life Research* 2005;**14**(3):641-54.
51
52
53
54
55
56
57
58
59
60

- 1
2
3 1 18. Vyas S, Kumaranayake L. Constructing socio-economic status indices: how to use
4 principal components analysis. *Health Policy Plan* 2006;**21**(6):459-68.
5
6 2
7
8 3 19. O'Donnell O, van Doorslaer E, Wagstaff A, et al. Analyzing health equity using
9 household survey data: a guide to techniques and their implementation. Washington, D.C:
10 The World Bank; 2008. Available from:
11
12 5 The World Bank; 2008. Available from:
13
14 6 [http://siteresources.worldbank.org/INTPAH/Resources/Publications/459843-](http://siteresources.worldbank.org/INTPAH/Resources/Publications/459843-1195594469249/HealthEquityFINAL.pdf)
15
16 7 [1195594469249/HealthEquityFINAL.pdf](http://siteresources.worldbank.org/INTPAH/Resources/Publications/459843-1195594469249/HealthEquityFINAL.pdf) (accessed July 2011).
17
18
19
20 8 20. Wagstaff A. The concentration index of a binary outcome revisited. *J Health Econ*
21
22 9 2011;**20**(10):1155-60.
23
24
25 10 21. Pathak PK, Singh A, Subramanian SV. Economic Inequalities in maternal health care:
26 prenatal care and skilled birth attendance in India, 1992-2006. *PLoS One*
27 11 2010;**5**(10):e13593.
28
29
30
31
32 13 22. Limwattananon S, Tangcharoensathien V, Sirilak S. Trends and inequities in where
33 women delivered their babies in 25 low-income countries: evidence from Demographic
34 14 and Health Surveys. *Reprod Health Matters* 2011;**19**(37):75-85.
35
36
37 15
38
39 16 23. Zere E, Oluwole D, Kirigia JM, et al. Inequalities in skilled attendance at birth in
40 Namibia: a decomposition analysis. *BMC Pregnancy Childbirth* 2011;**11**:34.
41 17
42
43
44 18 24. Collin SM, Anwar I, Ronsmans C. A decade of inequality in maternity
45 care: antenatal care, professional attendance at delivery, and caesarean section in
46 19 Bangladesh (1991–2004). *Int J Equity Health* 2007 Aug;**6**:9.
47
48
49 20
50
51 21 25. Lakshminarayanan, R. Decentralisation and its implications for reproductive health: the
52 Philippines experience. *Reprod Health Matters* 2003;**11**(21):96-107.
53 22
54
55
56
57
58
59
60

- 1
2
3 1 26. Huntington D, Banzon E, Recidoro ZD. A systems approach to improving maternal
4 health in the Philippines. *Bull World Health Organ* 2012;**90**(2):104-110.
5
6 2
7
8 3 27. Kozhimannil KB, Valera MR, Adams A, et al. The population-level impacts of a national
9 health insurance program and franchise midwife clinics on achievement of prenatal and
10 4 health insurance program and franchise midwife clinics on achievement of prenatal and
11 delivery care standards in the Philippines. *Health Policy* 2009;**92**(1):55-64.
12 5
13 6 28. Quimbo SA, Peabody JW, Shimkhada R, et al. Should we have confidence if a physician
14 is accredited? A study of the relative impacts of accreditation and insurance payments on
15 7 quality of care in the Philippines. *Soc Sci Med* 2008;**67**(4):505-10.
16 8
17 9 29. Department of Health. Vital, Health and Nutrition. Manila; National Statistical
18 10 Coordination Board; 2012. Available from: http://www.nscb.gov.ph/secstat/d_vital.asp
19 11 (accessed Mar 2012).
20 12 30. Simkhada B, Teijlingen ER, Porter M, et al. Factors affecting the utilization of antenatal
21 13 in developing countries: a systematic review of the literature. *J Adv Nurs* 2008;**61**(3):244-
22 14 60.
23 15 31. Sobel HL, Oliveros YE, Nyunt US. Secondary analysis of a national health survey on
24 16 factors influencing women in the Philippines to deliver at home and unattended by a
25 17 healthcare professional. *Int J Gynaecol Obstet* 2010;**111**(2):157-60.
26 18 32. Ericta CN. Families in the bottom 30 percent income group earned 62 thousand pesos in
27 19 2009. Manila:National Statistics Office; 4 Feb 2011. Available from:
28 20 <http://www.census.gov.ph/data/pressrelease/2011/ie09frtx.html> (accessed Mar 2012).
29 21 33. Tsolmongerel T. Costing study for selected hospitals in the Philippines. March 2009
30 22 Available from:
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
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59
60

1
2
3 1 <http://www.doh.gov.ph/sites/default/files/Costing%20Study%20for%20Selected%20Hospitals%20in%20the%20Philippines.pdf> (accessed Mar 2012).

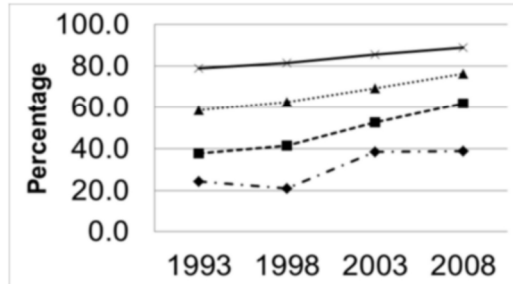
4
5 2
6
7
8 3 34. Global Health expenditure Database. Philippines National Expenditure on Health
9
10 4 (Philippine Peso) 1995-2010. World Health Organization; 2012. Available from:
11
12 5 http://apps.who.int/nha/database/StandardReport.aspx?ID=REP_WEB_MINI_TEMPLATE_WEB_VERSION&COUNTRYKEY=84655 (accessed Mar 2012).

13
14
15 6
16
17 7 35. Lee R. Delivering maternal health care services in an internal conflict setting in
18
19 8 Maguindanao, Philippines. *Reprod Health Matters* 2008;**16**(5):65-74.

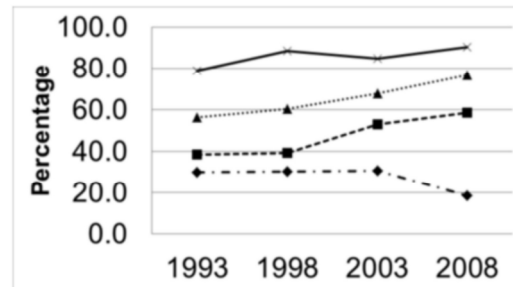
20
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Part a. Woman's education



Part b. Partner's education



Part c. Living Condition Index

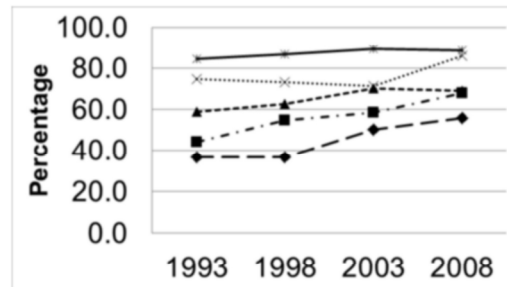
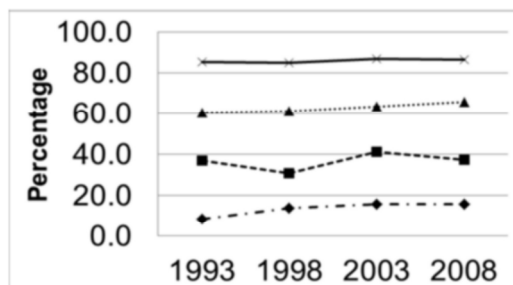


Figure 1 Trends in the percentage of antenatal care use by (a) woman's education, (b) partner's education and (c) living condition quintile, 1993-2008
 Note: Concentration index was 0.18 (Standard Error: 0.013) in 1993; 0.18 (Standard Error: 0.013) in 1998; 0.12 (Standard Error: 0.012) in 2003; 0.09 (Standard Error: 0.010) in 2008

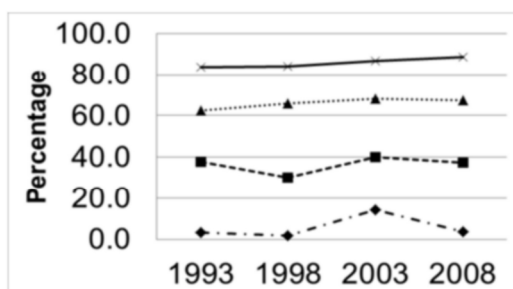
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Part a. Woman's education



Part b. Partner's education



Part c. Living Condition Index

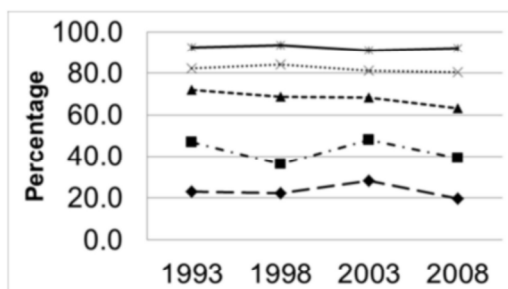


Figure 2 Trends in the percentage of skilled birth attendance by woman's education (a), partner's education (b) and living condition quintile (c), 1993-2008

Note: Concentration index was 0.26 (Standard Error: 0.013) in 1993; 0.28 (Standard Error: 0.012) in 1998; 0.22 (Standard Error: 0.013) in 2003; 0.24 (Standard Error: 0.013) in 2008
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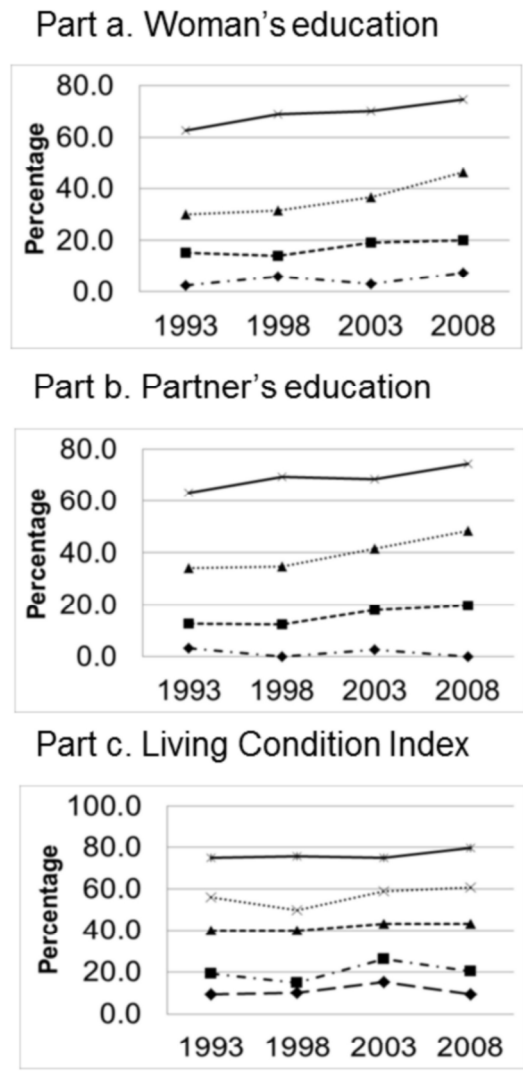


Figure 3 Trends in the percentage of delivery at medical facility by woman's education (a), husband's education (b) and living condition quintile (c), 1993-2008
 Note: Concentration index was 0.41 (Standard Error: 0.016) in 1993; 0.41 (Standard Error: 0.017) in 1998; 0.34 (Standard Error: 0.017) in 2003; 0.34 (Standard Error: 0.015) in 2008

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SUPPLEMENTARY DATA

Table A Household assets and living condition index of women aged 15-49 years, Philippines

Household assets	Living Condition Index					Total
	1 Poorly equipped	2	3	4	5 Well equipped	
Source of drinking water (%) ¹						
Piped	18.9	43.5	58.6	69.9	84.5	54.7
Well	53.9	46.3	35.2	24.6	13.3	35.0
Others	27.1	10.2	6.2	5.5	2.2	10.4
Toilet Facility (%) ²						
Flush type	12.2	58.8	81.4	94.7	98.9	68.6
Pit latrine	22.2	22.0	11.8	4.5	1.1	12.5
Others	65.6	19.2	6.8	0.8	0.1	18.9
Main floor material (%) ³						
Floor Material 1	2.8	17.8	47.4	77.9	95.3	47.5
Floor Material 2	71.7	65.3	42.5	19.4	4.7	41.2
Others	25.5	16.9	10.1	2.8	0.1	11.3
Has electricity (%)	3.5	45.1	96.7	99.6	100.0	68.6
Has television (%)	0.2	7.6	56.1	94.0	99.8	50.7
Has refrigerator (%)	0.0	0.6	4.9	36.5	97.2	27.2
Has bicycle/ trisikad (%)	2.9	14.6	17.8	26.9	35.8	19.4
Has motorcycle/ scooter (%)	0.4	2.4	4.0	17.2	31.9	10.9
Has car/truck (%)	0.0	0.2	0.3	1.7	26.1	5.6

¹ Piped - piped into dwelling, piped to yard plot, public tap/standpipe, bottled water; Well - tube well or borehole, protected well, unprotected well, semi-protected well; Others - protected spring, unprotected spring, river/dam/lake/ponds/stream/canal/irrig, rainwater, tanker truck, cart with small tank, neighbors tap(source unknown to others), neighbors tap (NAWASA), other

² Flush Type - flush toilet to piped sewer system, flush toilet to septic tank, flush toilet to pit latrine, flush toilet to somewhere else, flush (don't know where); Pit latrine - pit latrine (ventilated improve), pit latrine (with slab), pit latrine (without slab/open pit); Others - no facility/bush/field/river, composting toilet, bucket toilet, drop/hanging toilet, other

³ Floor Material 1 - ceramic tiles, cement, carpet, marble; Floor Material 2 - wood planks, palm/bamboo, parquet(polished wood), vinyl/asphalt strips; Others - earth, sand, others

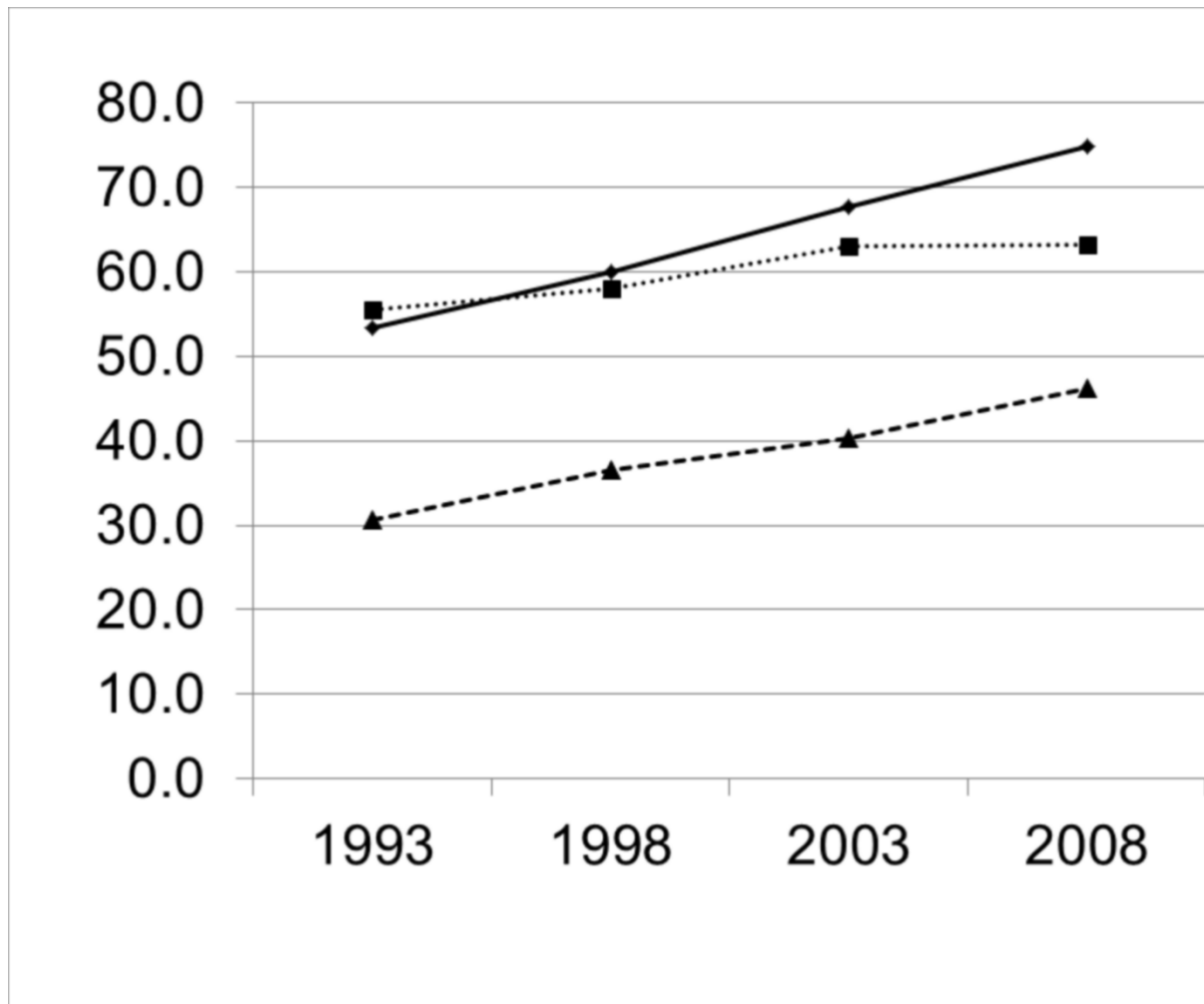


Figure A Total percentage of antenatal care use, skilled birth attendance and delivery in a medical facility, 1993-2008

—◆— Antenatal care, ···■··· Skilled birth attendance, -▲- Delivery at Medical Facility

STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*
Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	7
Objectives	3	State specific objectives, including any pre-specified hypotheses	8
Methods			
Study design	4	Present key elements of study design early in the paper	11
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	10
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9
Bias	9	Describe any efforts to address potential sources of bias	12
Study size	10	Explain how the study size was arrived at	10
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	11
		(b) Describe any methods used to examine subgroups and interactions	-
		(c) Explain how missing data were addressed	12
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed	12

		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10
		(b) Give reasons for non-participation at each stage	10
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12,14
		(b) Indicate number of participants with missing data for each variable of interest	-
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	15
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	16
		(b) Report category boundaries when continuous variables were categorized	
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	21
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	22
Generalisability	21	Discuss the generalisability (external validity) of the study results	-
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.



Reduction in inequality in antenatal care use and persistence of inequality in skilled birth attendance in the Philippines from 1993 to 2008.

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2012-002507.R1
Article Type:	Research
Date Submitted by the Author:	04-Apr-2013
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Primary Subject Heading:	Public health
Secondary Subject Heading:	Reproductive medicine, Health services research, Health policy
Keywords:	PUBLIC HEALTH, REPRODUCTIVE MEDICINE, SOCIAL MEDICINE, STATISTICS & RESEARCH METHODS

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Manuscripts

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3 1 **Title: Reduction in inequality in antenatal care use and persistence of inequality in skilled**
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6 2 **birth attendance in the Philippines from 1993 to 2008**

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8 3 Faith Molina¹, Keiko Nakamura¹, Masashi Kizuki², Seino Kaoruko¹
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12 5 **Short Title:** Reduction in inequality in maternal health care use, Philippines
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43 20 **Key Words:** socioeconomic factors, prenatal care/statistical & numerical data; healthcare
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46 21 disparities/statistics & numerical data, delivery, obstetrics/ statistics & numerical data, pregnancy
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50 23 **Word Count:** 2, 768
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1 ARTICLE SUMMARY

2 **Article Focus:** Assessing the changes in the inequalities associated with maternal health care
3 use according to economic status in the Philippines.

4 **Key Messages:**

- 5 • The study showed reduction in the inequality of antenatal care use through time
6 suggesting substantial coverage of women in the lowest quintile.
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- 8 • However, inequality was shown to persist in skilled birth attendance and delivery in
9 medical facilities indicating minimal professional delivery care among disadvantaged
10 women despite health system wide efforts and improvements in the socio demographic
11 profile of the population.
- 12 • The results call for equity oriented research and policies to close the wide gap in skilled
13 care at birth in the Philippines and to determine the success factors in the reduction of
14 inequality in antenatal-care use.

15 **Strengths and Limitations:**

- 16 • This is the first study of long-term trends in inequalities in utilization of critical maternal
17 health interventions using four comparable, nationally-representative Demographic
18 Health Survey (DHS) datasets commonly used as data sources in the literature.
- 19 • Comparability of the different survey years was achieved by selecting only the women
20 who had live births within one year.
- 21 • The DHS wealth index was used to represent changes in socioeconomic inequalities
22 through time.
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3 1 **ABSTRACT**
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5 2 **Objective:** To assess changes in the inequalities associated with maternal health care use
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8 3 according to economic status in the Philippines.
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12 5 **Design:** An analysis of four, population-based datasets that were conducted between 1993 and
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14 6 2008.
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20 8 **Setting:** Philippines.
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25 10 **Participants:** Women aged 15-49 years who had a live birth within one year in 1993 (n=1707),
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27 11 1998 (n=1513), 2003 (n=1325), and 2008 (n=1209).
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32 13 **Outcomes:** At least 4 visit of antenatal care, skilled birth attendance and delivery in a medical
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34 14 facility.
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39 16 **Results:** The adjusted odds ratio (OR) for antenatal-care use when comparing the highest wealth
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41 17 index quintile with the lowest quintile declined from 1993 to 2008: 3.43 (95% confidence
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43 18 interval (CI) 2.22-5.28) to 2.87 (95%CI 1.31-6.29). On the other hand, the adjusted OR for the
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45 19 other two outcome indicators by the wealth index widened from 1993 to 2008: 9.92 (95%CI
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47 20 5.98-16.43) to 15.53 (95%CI 6.90-34.94) for skilled birth attendance; and 7.74 (95%CI 4.22-
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49 21 14.21) to 16.00 (95%CI 7.99-32.02) for delivery in a medical facility. The concentration index
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51 22 for maternal health utilization in 1993 and 2008 were 0.19 and 0.09 for antenatal care; 0.26 and
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53 23 0.24 for skilled birth attendance; and 0.41 and 0.35 for delivery in a medical facility.
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6 2 **Conclusion:** Over a 16-year period, gradients in antenatal care use decreased and high level of
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8 3 inequalities in skilled birth attendance and delivery in a medical facility persisted. The results
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10 4 showed a disproportionate use of institutional care at birth among disadvantaged Filipino women.
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6 2 **INTRODUCTION**
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10 4 Globally, there is an increasing concern regarding inequities in maternal health, especially in
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12 5 developing countries. [1] The slow pace of reduction in maternal mortality rates despite cost-
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14 6 effective solutions has urged the international community to look beyond accomplishing national
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16 7 targets and to begin addressing wide disparities in women's health. [2]
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21 9 The key to realizing equity in maternal health is the achievement of equity in key maternal health
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23 10 coverage, such as antenatal care (ANC) and skilled birth attendance (SBA). A previous study
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25 11 indicated the greatest inequity in SBA coverage followed by ANC of more than four visits. [3]
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27 12 Wide inequalities in these interventions have hindered the reduction by 0.75 of maternal
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29 13 mortality ratio from 1990 to 2015. [4 – 6]
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35 15 The Philippines has made efforts to improve women's health as mandated in its constitution and
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37 16 as a signatory to several women's international conventions including the Millennium
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39 17 Development Goals (MDG). National laws passed include the Magna Carta of Women (RA
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41 18 9710), Maternity Benefits in Favor of Women Workers in the Private Sector (RA 7322), and
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43 19 Maternal Package for Normal Spontaneous Vaginal Delivery of the Philippine Health Insurance
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45 20 Corporation (PhilHealth). Starting 1995, the Philippine government has also implemented a
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47 21 number of maternal health programs, including two Women's Health and Safe Motherhood
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49 22 Projects. [7] Health system reforms to reduce maternal and neonatal mortality were also
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51 23 spearheaded through the Department of Health Administrative Order No. 2008-0029 resulting to
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53 24 the Integrated Maternal, Neonatal and Child Health and Nutrition Strategy (MNCHN). Specific
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1 reproductive health indicators of MNCHN to be met in 2010 include (1) an increase in modern
2 contraceptive prevalence rate to 60%, (2) an increase in the proportion of pregnant women
3 having at least four ANC visits to 80%, and (3) an increase in SBA and facility-based births to
4 80%.

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6 There is, however, uncertainty regarding whether and how these maternal health policies and
7 programs have substantially reduced gaps in the use of key maternal interventions among women
8 from varying socioeconomic backgrounds through time. The Philippines is currently off track
9 and slow in achieving MDG-5. In 2010, the estimated maternal mortality ratio was 99 per
10 100000 live births, compared to the goal of 52 per 100000 live births in 2015. [8] This slow
11 achievement of national targets indicates wide economic and regional inequalities in maternal
12 and child health services. [9] The objective of this study was to assess the changes in inequalities
13 in ANC, SBA, and delivery in medical facility (MEDFAC) in the Philippines between 1993 and
14 2008 according to women's residence, woman's education, partner's education, wealth index,
15 woman's age and birth order.

1 2 3 1 **DATA AND METHODS** 4 5 6 2

7 8 3 **Data Source** 9 10 4

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12 5 This study was performed using the data from the Philippine Demographic and Health Survey
13 6 (PDHS) conducted for the periods of 1993, 1998, 2003, and 2008. All were nationally
14 7 representative household surveys overseen by the National Statistics Office and National
15 8 Steering Committee with financial and technical support from the United States Agency for
16 9 International Development. [10] PDHS gathers detailed information on population, health, and
17 10 nutrition to assist in the country's monitoring and impact evaluation. It ensures comparability
18 11 across countries and time by developing standard model questionnaires, extensive survey
19 12 procedures, interviewer training, and data processing guidelines. [11, 12]
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34 14 The 1993 and 1998 PDHS employed a two-stage sample design, representing 14 regions and 16
35 15 regions, respectively. A sample of 13700 households (response rate: 99.2%) was randomly
36 16 selected from 750 primary sampling units (PSUs) for 1993 and a sample of 13708 households
37 17 (response rate: 98.7%) was randomly selected from 755 PSUs for 1998. The 2003 and 2008
38 18 PDHS followed a stratified three-stage cluster sample design representing 17 regions. A sample
39 19 of 13914 households (response rate: 99.1%) was randomly selected from 819 PSUs for 2003 and
40 20 a sample of 13764 households (response rate: 99.3%) was randomly selected from 794 PSUs for
41 21 2008. Detailed descriptions of the study design and methods of data collection are accessible
42 22 online in household survey reports. [13 – 16]
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1 2 3 1 **Subjects** 4 5 6 2

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8 3 The numbers of women interviewed were as follows: 1993, $n = 15029$; 1998, $n = 13983$; 2003, n
9 4 = 13633; and 2008, $n = 13594$. The average response rate was 98%. The subjects we included in
10 5 the analysis were women aged 15-49 years who had a live birth within one year, resulting in final
11 6 sample sizes of 1707 in 1993, 1513 in 1998, 1325 in 2003, and 1209 in 2008.
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20 8 **Study Variables** 21 22 9

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24 10 Three dependent variables were measured in the present study: (1) at least four antenatal
25 11 consultations; (2) assistance by professional health personnel during delivery—either a doctor,
26 12 nurse, or midwife, excluding traditional birth attendants (*hilot*), relatives, or friends; and (3)
27 13 whether the birth occurred at home or in a medical facility (public or private).
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36 15 The Demographic and Health Survey (DHS) wealth index is defined as a composite measure of a
37 16 household's relative economic status by using the data in the DHSs. It is calculated by using data
38 17 on a household's ownership of selected assets such as television or car, persons per sleeping
39 18 room, ownership of agricultural land, domestic servant and other country specific items. [17] The
40 19 asset quintile was derived from this DHS wealth index score of women who had a live birth
41 20 within one year categorized into lowest, second, middle, fourth and highest, in respective survey
42 21 years.
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3 1 Other independent variables were type of residence (urban or rural), woman's age (< 20, 20 – 29,
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5 2 30 – 39, ≥ 40), birth order (1, 2, 3, ≥ 4), and educational level of woman and her partner (none,
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7 3 primary, secondary, higher).
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13 **Ethical Review**

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17 7 As protocols for all demographic health household surveys, the four PDHS were submitted for
18 8 ethical reviews to the ICF Institutional Review Board (Calverton, MD) and an institutional
19 9 review board or ethics review panel in the Philippines for approving research studies on human
20 10 subjects. [18]
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29 **Statistical Analysis**

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34 14 Changes in the socio demographic profile and use of ANC, SBA, and MEDFAC of the
35 15 population were analyzed from household survey data in 1993, 1998, 2003, and 2008. Tests for
36 16 trends were performed using the Mantel–Haenszel linear-by-linear association chi squared test.
37 17 Crude and adjusted odds ratios between each dependent variable and all of the independent
38 18 variables were assessed by multivariate logistic regression analysis. Complex household survey
39 19 design was taken into account in all analyses using a sampling weight. All the missing data were
40 20 excluded in the analysis. All analyses were performed using StataMP 11 Statistical Software
41 21 (Stata Corp., College Station, TX).
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3 1 Inequalities of each outcome variable according to the wealth index were estimated using the
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6 2 concentration index. It is defined as twice the area between the concentration curve and the line
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8 3 of equality (the 45-degree line) and was used to determine the magnitude of inequality. A
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10 4 concentration index of 0 indicates perfect equality. A measure of 1 (or -1) indicates perfect
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13 5 inequality. [19, 20]
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1 RESULTS

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8 There were changes in socio demographic profile of the population from 1993 to 2008. (Table 1)
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10 The percentage of women with secondary and higher education increased during this period from
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12 58.7% in 1993 to 74.6% in 2008. A corresponding increase was also observed in the percentage
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14 of partners who finished secondary and higher education from 57.4% in 1993 to 70.7% in 2008.
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17 The percentage of women who have four or more children declined from 39.9% in 1993 to
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Table 1 Socio demographic characteristics and childbirth history of women aged 15-49 years, per survey year, Philippines, 1993-2008

Indicator	1993 n=1707 %	1998 n=1513 %	2003 n=1325 %	2008 n=1209 %
Residence				
Urban	48.8	46.3	50.0	46.9
Rural	51.2	53.7	50.0	53.1
Woman's Education				
None	2.3	1.8	1.9	1.2
Primary	39.0	29.9	27.8	24.2
Secondary	37.4	39.7	42.5	50.3
Higher	21.3	28.6	27.8	24.3
Partner's Education				
None	1.9	1.6	2.0	1.9
Primary	40.8	33.4	31.8	27.5
Secondary	37.3	36.7	40.1	45.0
Higher	20.1	28.3	26.1	25.7
Wealth Index				
Lowest	20.2	20.0	20.0	20.0
Second	19.8	20.0	20.1	20.0
Middle	20.0	20.0	20.0	20.1
Fourth	20.0	20.1	19.9	20.1
Highest	20.0	19.9	20.0	19.8
Woman's Age				
<20	5.6	6.1	7.2	8.2
20-29	53.7	53.7	53.3	53.5
30-39	35.6	35.1	34.4	32.5
≥40	5.2	5.1	5.1	5.8
Birth Order				
1	22.6	24.5	27.7	28.5
2	20.7	21.1	23.6	24.6
3	16.8	19.6	15.5	15.2
≥4	39.9	34.8	33.2	31.7

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2
3 1 Figure 1 shows that the utilization of ANC and MEDFAC increased from 53.4% in 1993 to
4
5 2 74.8% in 2008 and from 30.7% in 1993 to 46.3% in 2008, respectively. However, there is a
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7 3 limited change in utilization of SBA from 55.5% in 1993 to 63.3% in 2008.
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For peer review only

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3 **Figure 1** Total percentage of antenatal care use, skilled birth attendance and delivery in a
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6 medical facility, 1993-2008

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8 —●— Antenatal care, ···■··· Skilled birth attendance, -▲- Delivery at medical facility
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3 1 As shown in Table 2, from 1993 to 2008, the rates of utilization of ANC, SBA and MEDFAC
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5 2 were higher for women who were educated, better off, resided in an urban area, and those with
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7 3 educated partners than among their poorer and less educated counterparts. There was a decline in
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9 4 the odds ratio of women in highest wealth quintile compared to the lowest in ANC from 1993 to
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11 5 2008. The adjusted odds ratio (OR) for antenatal-care use when comparing the highest wealth
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13 6 index quintile with the lowest quintile declined from 1993 to 2008: 3.43 (95% confidence
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15 7 interval (CI) 2.22-5.28) to 2.87 (95%CI 1.31-6.29). On the other hand, the adjusted OR for the
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17 8 other two outcome indicators by the wealth index widened from 1993 to 2008: 9.92 (95%CI
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19 9 5.98-16.43) to 15.53 (95%CI 6.90-34.94) for skilled birth attendance; and 7.74 (95%CI 4.22-
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21 10 14.21) to 16.00 (95%CI 7.99-32.02) for delivery in a medical facility.
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1 **Table 2** Adjusted odd ratios of the association between wealth index and socio demographic characteristics and antenatal care, skilled birth attendance or delivery in medical facility of women age 15-49 years,
 2 Philippines, 1993(n=1707), 1998(n=1513), 2003(n=1325), 2008(n=1209)

Indicator	Antenatal Care				Skilled Birth Attendance				Delivery at medical facility															
	1993		1998		2003		2008		1993		1998		2003		2008									
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI								
Residence																								
Urban	1.29*	1.02, 1.62	1.44**	1.08, 1.93	1.70***	1.26, 2.28	0.99	0.71, 1.38	2.59**	2.03, 3.31	3.08**	2.27, 4.18	3.21***	2.37, 4.34	2.11**	1.52, 2.93	3.12***	2.35, 4.12	2.43**	1.77, 3.35	1.90***	1.41, 2.56	1.47*	1.07, 2.02
Rural (Reference)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Woman's Education																								
None	0.58	0.27, 1.26	0.55	0.21, 1.45	0.25**	0.09, 0.71	0.08***	0.02, 0.36	0.17*	0.05, 0.65	0.70	0.21, 2.39	0.22**	0.08, 0.66	0.66	0.14, 3.21	0.17	0.02, 1.94	0.48	0.11, 2.00	0.09*	0.01, 1.01	0.82	0.09, 7.51
Primary	0.54**	0.37, 0.79	0.46***	0.29, 0.74	0.53**	0.34, 0.85	0.38***	0.21, 0.68	0.43**	0.27, 0.67	0.67	0.39, 1.12	0.48**	0.30, 0.78	0.69	0.40, 1.19	0.58**	0.38, 0.88	0.52*	0.31, 0.86	0.44***	0.28, 0.70	0.60	0.35, 1.03
Secondary	0.67*	0.47, 0.95	0.65*	0.44, 0.97	0.69	0.46, 1.03	0.59**	0.36, 0.96	0.58*	0.38, 0.88	0.86	0.56, 1.34	0.57	0.37, 0.89	0.89	0.56, 1.41	0.59**	0.41, 0.84	0.54**	0.37, 0.78	0.49***	0.34, 0.70	0.77	0.53, 1.13
Higher (Reference)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Partner's Education																								
None	0.39*	0.16, 0.94	0.30*	0.10, 0.85	0.41	0.16, 1.05	0.55	0.19, 1.58	0.09*	0.01, 0.71	0.02**	0.00, 0.20	0.22**	0.08, 0.61	0.06*	0.01, 0.61	0.28	0.03, 2.54	¶(omitted)		0.11	0.01, 1.11	¶(omitted)	
Primary	0.53***	0.36, 0.78	0.67	0.43, 1.03	0.54**	0.34, 0.86	0.65	0.37, 1.13	0.65	0.42, 1.02	0.47*	0.29, 0.78	0.53**	0.33, 0.86	0.41**	0.23, 0.71	0.36***	0.23, 0.55	0.30*	0.19, 0.42	0.55*	0.34, 0.87	0.50*	0.30, 0.83
Secondary	0.74	0.52, 1.05	0.75	0.52, 1.09	0.68	0.45, 1.02	0.75	0.45, 1.24	0.74	0.50, 1.11	0.78	0.51, 1.19	0.66	0.43, 1.04	0.66	0.40, 1.07	0.58**	0.41, 0.83	0.46**	0.32, 0.65	0.72	0.50, 1.04	0.85	0.57, 1.27
Higher (Reference)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Woman's Age																								
<20	0.91	1.02, 1.62	0.45**	0.27, 0.74	1.12	0.66, 1.90	0.91	0.52, 1.58	0.93	0.54, 1.61	0.70	0.39, 1.26	0.89	0.52, 1.53	0.92	0.51, 1.66	0.88	0.46, 1.71	0.73	0.34, 1.57	0.70	0.41, 1.20	0.74	0.42, 1.31
20-29 (Reference)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
30-39	1.29	0.98, 1.69	1.86***	1.34, 2.58	1.20	0.86, 1.66	1.42	0.98, 2.04	1.17	0.86, 1.60	1.59*	1.10, 2.29	1.31	0.92, 1.89	1.54*	1.03, 2.30	1.36	0.98, 1.91	1.26	0.85, 1.85	1.46**	1.03, 2.07	1.59*	1.05, 2.40
≥40	1.41	0.84, 2.39	1.66	0.94, 2.91	0.87	0.46, 1.62	0.92	0.49, 1.70	1.96*	1.07, 3.57	1.56	0.81, 2.99	0.87	0.42, 1.83	3.12*	1.48, 6.58	1.96	0.97, 3.97	2.02	0.98, 4.15	1.04	0.47, 2.32	3.44**	1.69, 6.98
Birth Order																								
1 (Reference)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
2	0.76	0.55, 1.06	0.88	0.60, 1.30	0.84	0.57, 1.25	0.79	0.50, 1.27	0.76	0.53, 1.11	0.61*	0.40, 0.93	0.76	0.49, 1.17	0.87	0.57, 1.33	0.53***	0.35, 0.78	0.52*	0.33, 0.80	0.50***	0.34, 0.74	0.56*	0.37, 0.84
3	0.64*	0.45, 0.93	0.64*	0.42, 0.97	0.92	0.59, 1.45	0.55**	0.33, 0.92	0.50**	0.33, 0.76	0.75	0.47, 1.18	0.69	0.42, 1.13	0.61	0.36, 1.02	0.36***	0.23, 0.55	0.72	0.44, 1.16	0.45***	0.29, 0.70	0.37**	0.23, 0.61

≥4	0.41 ***	0.30, 0.58	0.36 ***	0.24, 0.54	0.56 **	0.36, 0.87	0.53 **	0.32, 0.88	0.47* **	0.32, 0.69	0.31* **	0.20, 0.49	0.51 **	0.31, 0.82	0.47* *	0.28, 0.80	0.32 ***	0.21, 0.49	0.41* **	0.25, 0.67	0.28 ***	0.18, 0.45	0.23* **	0.13, 0.38
Wealth Index																								
Lowest (Reference)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Second	1.09	0.79, 1.50	1.21	0.86, 1.70	0.85	0.59, 1.24	1.48	0.99, 2.20	2.00* **	1.38, 2.89	1.99* **	1.34, 2.96	2.06 ***	1.36, 3.13	1.74* *	1.14, 2.64	2.11 **	1.16, 3.83	1.88* *	1.07, 3.29	2.15 **	1.25, 3.71	1.79* *	1.05, 3.05
Middle	1.26	0.89, 1.78	1.85 **	1.26, 2.72	0.77	0.51, 1.16	1.25	0.80, 1.96	3.30* **	2.26, 4.83	4.05* **	2.63, 6.24	2.95 ***	1.88, 4.64	3.43* **	2.18, 5.34	2.83 ***	1.58, 5.07	2.31* *	1.29, 4.14	3.01 ***	1.73, 5.22	3.46* **	2.02, 5.91
Fourth	1.68 **	1.16, 2.43	2.25 ***	1.45, 3.52	1.12	0.70, 1.81	2.06 **	1.19, 3.57	4.71* **	3.11, 7.13	7.17* **	4.33, 11.86	4.87 ***	2.90, 8.19	7.20* **	4.22,1 2.30	4.50 ***	2.50, 8.13	4.29* **	2.38, 7.74	4.07 ***	2.32, 7.13	6.09* **	3.41, 10.89
Highest	3.43 ***	2.22, 5.28	3.54 ***	1.98, 6.33	2.44 **	1.31, 4.54	2.87 **	1.31, 6.29	9.92* **	5.98, 16.43	12.29 ***	6.22, 24.27	6.98 ***	3.62, 13.46	15.53 ***	6.90, 34.94	7.74 ***	4.22, 14.21	7.55* **	3.95, 14.44	6.98 ***	3.76, 12.94	16.00 ***	7.99, 32.02

* p<0.05; ** p<0.01; *** p<0.001

Adjusted for residence, woman's education, partner's education, women' age and birth order.

¶All subject in this category did not deliver in medical facility and removed from analysis.

1 Figure 2 shows that there was a marked reduction in inequality of ANC from 1993 to 2008.
2 Although gradients of its use among women with no education and women with higher
3 education widened from 1993 to 2008, the gradients of ANC use among women with primary
4 education and women with higher education as their highest educational attainment decreased
5 from a difference of 40.4% in 1993 to 31.6% in 2008. A marked reduction was seen among
6 women in the highest quintile compared to those in the lowest quintile, with a difference of
7 48.2% in 1993 decreasing to 35.0% in 2008. A reduction in the concentration index from
8 1993 to 2008 of ANC was observed.

1 **Figure 2** Trends in the percentage of antenatal care use by (a) woman's education, (b)
2 partner's education, (c) wealth index, 1993-2008

3 Part a: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

4 Part b: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

5 Part c: -◆- Lowest -■- Second, -▲- Middle, ···×··· Fourth, -×- Highest

6 Note: Concentration Index 0.19, 95% CI 0.16 to 0.21 in 1993; Concentration Index 0.18, 95%
7 CI 0.16 to 0.21 in 1998; Concentration Index 0.12, 95% CI 0.09 to 0.14 in 2003;
8 Concentration Index 0.09, 95% CI 0.07 to 0.11 in 2008

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3 1 Figure 3 shows the limited changes in the inequality of SBA from 1993 to 2008. A reduction
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5 2 was observed in the gradient of SBA in comparison between women with no education and
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7 3 those with higher education with a difference of 76.6% in 1993 decreasing to 70.7% in 2008.
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10 4 Reverse direction of the difference was observed between women in the highest quintile
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12 5 compared to those in the lowest quintile from a difference of 69.1% in 1993 increasing to
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14 6 71.1% in 2008. A reduction in the concentration index from 1993 to 2008 of SBA was
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16 7 observed, however the concentration index obtained was larger than that of ANC.
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1 **Figure 3** Trends in the percentage of skilled birth attendance by (a) woman's education, (b)
2 partner's education, (c) wealth index, 1993-2008

3 Part a: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

4 Part b: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

5 Part c: -◆- Lowest -■- Second, -▲- Middle, ···×··· Fourth, -×- Highest

6 Note: Concentration Index 0.26, 95% CI 0.24 to 0.29 in 1993; Concentration Index 0.29, 95%
7 CI 0.26 to 0.31 in 1998; Concentration Index 0.22, 95% CI 0.20 to 0.24 in 2003;
8 Concentration Index 0.24, 95% CI 0.21 to 0.27 in 2008

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3 1 Figure 4 shows the changes in inequality of MEDFAC from 1993 to 2008. As shown in the
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5 2 figure, the gradient of MEDFAC between women with no education and those with higher
6
7 3 education widened from a difference of 60.4% in 1993 to 67.0% in 2008. The same
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9 4 increasing direction for difference in use between women in the highest quintile compared to
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11 5 those in the poorest quintile, with a difference of 59.5% in 1993 decreasing to 75.6% in 2008.
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14 6 A reduction in the concentration index from 1993 to 2008 of MEDFAC was observed,
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16 7 however the concentration index obtained was also large in comparison to ANC.
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1 **Figure 4** Trends in the percentage of delivery at medical facility by (a) woman's education,
2 (b) partner's education, (c) wealth index, 1993-2008

3 Part a: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

4 Part b: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

5 Part c: -◆- Lowest -■- Second, -▲- Middle, ···×··· Fourth, -×- Highest

6 Note: Concentration Index 0.41, 95% CI 0.38 to 0.45 in 1993; Concentration Index 0.41, 95%
7 CI 0.38 to 0.44 in 1998; Concentration Index 0.34, 95% CI 0.31 to 0.37 in 2003;
8 Concentration Index 0.35, 95% CI 0.32 to 0.38 in 2008

1 DISCUSSION

2 This is the first study to describe the time trends in the inequalities of maternal health care
3 utilization in the Philippines. The analysis of four nationally representative PDHS survey data
4 sets ranging over a period of 16 years from 1993 to 2008 and showed a substantial increase in
5 antenatal coverage and limited improvement in professional delivery care. Furthermore, our
6 findings demonstrated reduction in the inequality of ANC use through time suggesting
7 coverage of women in the lowest quintile or possibly decreased coverage for the wealthier
8 quintile. The study also provided evidence of persistence of inequality in SBA and MEDFAC
9 indicating minimal professional delivery care among women under lowest socioeconomic
10 conditions.

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12 Our findings are in the line with evidence on 25 low income countries referred inequalities on
13 institutional delivery rates as well as a weak health system and lack of skilled birth workers
14 as the main barriers of use. [21] Marked underutilization of SBA has been noted among poor
15 women in many studies. [22-23] However, one study conducted in India reported low
16 utilization of both ANC and SBA among poor women through time despite of governmental
17 interventions. [24]

18
19 The increase of proportion of antenatal coverage from 1993 to 2008 was greater than that of
20 proportion of births attended by skilled health personnel or that of delivery at a medical
21 facility. Over the last several decades, the Philippine government has launched maternal
22 health projects and programs to improve women's health. These were implemented alongside
23 extensive health system reforms across the country on health financing, health regulation,
24 health service delivery, and good governance in health following decentralization of health
25 care services. [25] A study indicated that implementation areas that have intensively adopted

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3 1 the health system-wide reforms have improved overall maternal health outcomes compared to
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5 2 those that have not adopted. However, the poorly developed health information systems and
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7 3 lack of referral emergency care facilities in remote coastal and isolated mountain
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9 4 communities were the challenges that remain to be addressed. [26]
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14 6 The results of the present study indicated reductions in the inequality of ANC use. This
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16 7 translates to substantial ANC use among women under lowest living standard quintile. This
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18 8 can be explained by improvements in both the health care system and in the socio
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20 9 demographic profile of the population. The PhilHealth has been reported to increase uptake
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22 10 and standards of ANC. [27] Improvements in the quality of services in health care institutions
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24 11 through accreditation and the covering of financial costs by insurance contributed to the
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26 12 increased use of ANC by Filipino women regardless of socio demographic status. [27, 28]
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30 13 There was also an increase in the total number of midwives and rural (*barangay*) health units
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32 14 through the years, which addressed the problems of distance and lack of availability of health
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34 15 workers and ANC facilities. [29] Moreover, positive changes in socio demographic and
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36 16 demographic profiles, such as increases in educational status of women and their partners,
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38 17 better economic status of women, and decreased fertility, may also explain the observed
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40 18 reductions in the inequality of ANC use. [30]
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45 20 Inequalities in SBA and MEDFAC persist in the Philippines despite health system-wide
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47 21 efforts and improvements in the socio demographic profile of the population. After 16 years,
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49 22 the majority of Filipino women from lowest living standard quintile continue to deliver at
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51 23 home without professional assistance. In the Philippines, financial, transportation, absence of
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53 24 companion to health facility, and treatment of health professionals to disadvantaged women
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55 25 are major barriers that must be addressed to increase the rate of hospital delivery. [31] The
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1 majority of unskilled home deliveries among Filipino women occur near hospitals, and
2 financial burden associated with hospital delivery is the main concern regardless of
3 socioeconomic status. In 2009, families from the lowest 30% income group, delivery at a
4 hospital would consume a minimum of 6.6% – 24.3% of the family's total annual income.
5 [32, 33] This indicates that catastrophic financial costs are responsible for the decision by
6 poorer Filipino women to deliver at home, even if they are close to health facilities in
7 addition to low educational status and rural residence. PhilHealth coverage is low with only
8 42% of families with at least one family member is enrolled in 2004. [34] Furthermore, the
9 out of pocket expenditure as percentage of private expenditure on health has increased from
10 77.2% in 2000 to 83.6% in 2010. [35]

11
12 There are number of strengths in this study. The study used four nationally representative
13 samples obtained by the DHSs commonly used as data sources in literatures worldwide. A
14 national sample of women aged 15-49 years were collected to obtain a sufficient sample size
15 for each survey year. Selection of the women who had live births only within one year as the
16 subjects of the individual surveys sharpened the comparison of the data of four different years.
17 This reduced the magnitude of recall bias by the respondents. All four PDHSs followed strict
18 data quality checks through pre testing, translation of questionnaires to local dialect,
19 interviewer training, and duplicate data entry. It also employed standardized questionnaire
20 format which are carefully developed to ascertain accurate response and information from the
21 participants. The analysis used the DHS wealth index, a systematically developed composite
22 index to measure economic status of the subjects among the DHS samples. The study used
23 relevant measurements of inequity, the concentration index, which measures the long term
24 trends in inequalities in utilization of critical maternal health care interventions in the
25 Philippines which is important for future health policy.

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There should be a caution in interpreting trends of maternal health care use by the DHS wealth index since it is an index to show a relative position measured by a composite economic status indicator among the subjects of the particular year and country. Therefore the scores of wealth index in different years are not comparable.

Our study implies the need to research solutions to reduce inequality in SBA and delivery at a medical facility, and to determine the factors responsible for the persistence of inequality in SBA and delivery at a medical facility despite government and non-governmental efforts.

Recognizing reproductive health as a basic right of women regardless of socio demographic status is important in formulating national policy and programs to address inequality in maternal health service utilization.

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2
3 We are thankful to MEASURE DHS for allowing us to analyze the 1993, 1998, 2003 and
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6

7 **COMPETING INTERESTS**

8
9 The authors declare that they have no competing interests.
10

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12
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14 or not-for-profit sectors.
15

16 **CONTRIBUTORSHIP**

17
18 FM and KN conceptualized and designed the study. FM obtained and FM and MK analyzed
19 the data. FM, KN, MK, and KS structured and edited the manuscript. All authors approved
20 the final manuscript.
21

22 **DATA SHARING**

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24 There are no additional unpublished data from the study.
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3 **1 REFERENCES**

- 4
5 2 1. Commission on information and accountability for Women's and Children's Health.
6
7 3 Keeping promises, measuring results. World Health Organization; 2011. Available
8
9 4 from:
10
11 5 http://www.everywomaneverychild.org/images/content/files/accountability_commissi
12
13 [on/final_report/Final_EN_Web.pdf](http://www.everywomaneverychild.org/images/content/files/accountability_commissi) (accessed March 2012).
14
15 6
16 7 2. Thomsen S, Hoa Dt, Målvqvist M, et al. Promoting equity to achieve maternal and
17
18 8 child health. *Reprod Health Matters* 2011;**19**(38):176-82.
19
20 9 3. Barros AJ, Ronsmans C, Axelson H, et al. Equity in maternal, newborn and child
21
22 10 health interventions in countdown to 2015: a retrospective review of survey data from
23
24 11 54 countries. *Lancet* 2012;**379**(9822):1225-33.
25
26 12 4. Zere E, Kirigia JM, Duale S, et al. Inequities in maternal and child health outcomes
27
28 13 and interventions in Ghana. *BMC Public Health* 2012;**12**:252.
29
30 14 5. Wirth M, Sacks E, Delamonica E, et al. "Delivering on the mdgs?":equity and
31
32 15 maternal health in Ghana, Ethiopia and Kenya. *East Afr J Public Health*
33
34 16 2008;**5**(3):133-41.
35
36 17 6. Silal SP, Penn Kenana L, Harris B, et al. Exploring inequalities in access to and use of
37
38 18 maternal health services in South Africa. *BMC Health Serv Res* 2012;**12**(1):120.
39
40 19 7. Asian Development Bank Operations Evaluation Department. Project performance
41
42 20 evaluation report in the Philippines. Asian Development Bank; 2007. Available from:
43
44 21 <http://www.adb.org/sites/default/files/27010-PHI-PPER.pdf> (accessed January 2013)
45
46 22 8. WHO, UNICEF, UNFPA, The World Bank. Trends in maternal mortality 1990-2010:
47
48 23 WHO, UNICEF, UNFPA and The World Bank estimates. Geneva: World Health
49
50 24 Organization; 2012. Available from:
51
52
53
54
55
56
57
58
59
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- 1
2
3 1 <http://www.unfpa.org/webdav/site/global/shared/documents/publications/2012/Trends>
4
5 2 [in_maternal_mortality_A4-1.pdf](#) (accessed March 2012).
6
7 3 9. Lavado RF, Lagrada LP. Are Maternal and Child Care Programs Reaching the
8
9 4 Poorest Regions in the Philippines? Philippine Institute for Developmental Studies.
10
11 5 2008 Nov; Discussion Paper Series No. 2008-30.
12
13 6 10. Demographic and Health Surveys [Internet]. Calverton: Macro International.
14
15 7 Available from: <http://www.measuredhs.com/> (accessed July 2011).
16
17 8 11. Rutstein SO, Rojas G. Guide to DHS statistics. Calverton, MD: ORC Macro,2003.
18
19 9 12. Croft T. DHS Data Editing and Imputation. Calverton, MD: ORC Macro International.
20
21 10 13. National Statistics Office (NSO) [Philippines] and Macro International Inc. (MI).1994.
22
23 11 National Demographic Survey 1993. Calverton, Maryland: NSO and MI.
24
25 12 14. National Statistics Office (NSO)], Department of Health (DOH) [Philippines] and
26
27 13 Macro International Inc. (MI).1999. National Demographic Survey 1998. Manila:
28
29 14 NSO and MI.
30
31 15 15. National Statistics Office (NSO) [Philippines], and ORC Macro. 2004. National
32
33 16 Demographic Survey 2003. Calverton, Maryland: NSO and ORC Macro.
34
35 17 16. National Statistics Office (NSO) [Philippines], and ICF Macro. 2009. National
36
37 18 Demographic Survey 2008. Calverton, Maryland: National Statistics Office and ICF
38
39 19 Macro.
40
41 20 17. Rutstein, SO, Kiersten J. 2004. The DHS Wealth Index. DHS Comparative Reports
42
43 21 No. 6. Calverton, Maryland: ORC Macro
44
45 22 18. Filmer D, Pritchett LH. Estimating wealth effects without expenditure data or tears:
46
47 23 an application to educational enrollments in states of India. Demography 2001,
48
49 24 **38**(1):115-132.
50
51
52
53
54
55
56
57
58
59
60

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2
3 1 19. O'Donnell O, van Doorslaer E, Wagstaff A, et al. Analyzing health equity using
4
5 2 household survey data: a guide to techniques and their implementation. Washington,
6
7 3 D.C: The World Bank; 2008. Available from:
8
9 4 [http://siteresources.worldbank.org/INTPAH/Resources/Publications/459843-](http://siteresources.worldbank.org/INTPAH/Resources/Publications/459843-1195594469249/HealthEquityFINAL.pdf)
10
11 5 [1195594469249/HealthEquityFINAL.pdf](http://siteresources.worldbank.org/INTPAH/Resources/Publications/459843-1195594469249/HealthEquityFINAL.pdf) (accessed July 2011).
12
13
14 6 20. Wagstaff A. The concentration index of a binary outcome revisited. *J Health Econ*
15
16 7 2011;**20**(10):1155-60.
17
18 8 21. Limwattananon S, Tangcharoensathien V, Sirilak S. Trends and inequities in where
19
20 9 women delivered their babies in 25 low-income countries: evidence from
21
22 10 Demographic and Health Surveys. *Reprod Health Matters* 2011;**19**(37):75-85.
23
24 11 22. Zere E, Oluwole D, Kirigia JM, et al. Inequalities in skilled attendance at birth in
25
26 12 Namibia: a decomposition analysis. *BMC Pregnancy Childbirth* 2011;**11**:34.
27
28 13 23. Collin SM, Anwar I, Ronsmans C. A decade of inequality in maternity
29
30 14 care: antenatal care, professional attendance at delivery, and caesarean section in
31
32 15 Bangladesh (1991–2004). *Int J Equity Health* 2007 Aug;**6**:9.
33
34 16 24. Pathak PK, Singh A, Subramanian SV. Economic Inequalities in maternal health care:
35
36 17 prenatal care and skilled birth attendance in India, 1992-2006. *PLoS One*
37
38 18 2010;**5**(10):e13593.
39
40 19 25. Lakshminarayanan, R. Decentralisation and its implications for reproductive health:
41
42 20 the Philippines experience. *Reprod Health Matters* 2003;**11**(21):96-107.
43
44 21 26. Huntington D, Banzon E, Recidoro ZD. A systems approach to improving maternal
45
46 22 health in the Philippines. *Bull World Health Organ* 2012;**90**(2):104-110.
47
48 23 27. Kozhimannil KB, Valera MR, Adams A, et al. The population-level impacts of a
49
50 24 national health insurance program and franchise midwife clinics on achievement of
51
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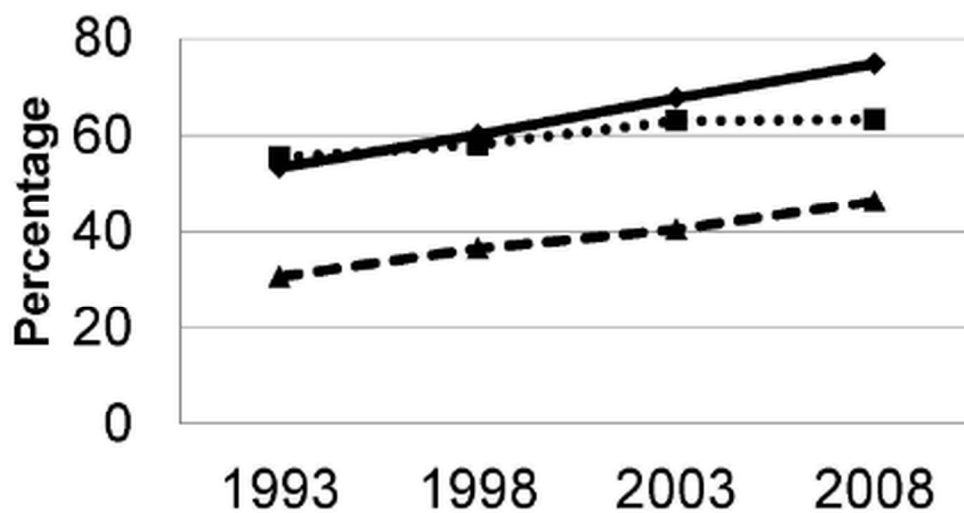
- 1 prenatal and delivery care standards in the Philippines. *Health Policy* 2009;**92**(1):55-
2 64.
- 3 28. Quimbo SA, Peabody JW, Shimkhada R, et al. Should we have confidence if a
4 physician is accredited? A study of the relative impacts of accreditation and insurance
5 payments on quality of care in the Philippines. *Soc Sci Med* 2008;**67**(4):505-10.
- 6 29. Department of Health. Vital, Health and Nutrition. Manila; National Statistical
7 Coordination Board; 2012. Available from:
8 http://www.nscb.gov.ph/secstat/d_vital.asp (accessed Mar 2012).
- 9 30. Simkhada B, Teijlingen ER, Porter M, et al. Factors affecting the utilization of
10 antenatal in developing countries: a systematic review of the literature. *J Adv Nurs*
11 2008;**61**(3):244-60.
- 12 31. Sobel HL, Oliveros YE, Nyunt US. Secondary analysis of a national health survey on
13 factors influencing women in the Philippines to deliver at home and unattended by a
14 healthcare professional. *Int J Gynaecol Obstet* 2010;**111**(2):157-60.
- 15 32. National Statistics Office. 2004 Annual Poverty Indicators Survey (APIS)
16 (Preliminary Results). Manila:National Statistics Office; 23 Sept 2005. Available
17 from: [http://www.census.gov.ph/content/2004-annual-poverty-indicators-survey-apis-](http://www.census.gov.ph/content/2004-annual-poverty-indicators-survey-apis-preliminary-results)
18 [preliminary-results](http://www.census.gov.ph/content/2004-annual-poverty-indicators-survey-apis-preliminary-results) (accessed Jan 2013).
- 19 33. Ericta CN. Families in the bottom 30 percent income group earned 62 thousand pesos
20 in 2009. Manila:National Statistics Office; 4 Feb 2011. Available from:
21 <http://www.census.gov.ph/data/pressrelease/2011/ie09frtx.html> (accessed Mar 2012).
- 22 34. Tsolmongerel T. Costing study for selected hospitals in the Philippines. March 2009
23 Available from:
24 [http://www.doh.gov.ph/sites/default/files/Costing%20Study%20for%20Selected%20](http://www.doh.gov.ph/sites/default/files/Costing%20Study%20for%20Selected%20Hospitals%20in%20the%20Philippines.pdf)
25 [Hospitals%20in%20the%20Philippines.pdf](http://www.doh.gov.ph/sites/default/files/Costing%20Study%20for%20Selected%20Hospitals%20in%20the%20Philippines.pdf) (accessed Mar 2012).

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1 35. Global Health expenditure Database. Philippines National Expenditure on Health
2 (Philippine Peso) 1995-2010. World Health Organization; 2012. Available from:
3 http://apps.who.int/nha/database/StandardReport.aspx?ID=REP_WEB_MINI_TEMP
4 [LATE_WEB_VERSION&COUNTRYKEY=84655](http://apps.who.int/nha/database/StandardReport.aspx?ID=REP_WEB_MINI_TEMP_LATE_WEB_VERSION&COUNTRYKEY=84655)
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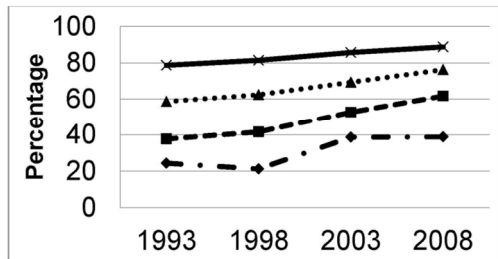


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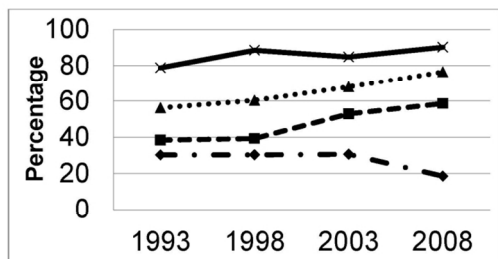
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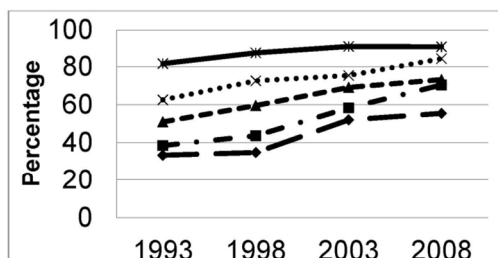
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Part b. Partner's education



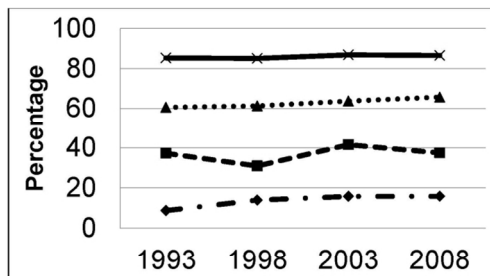
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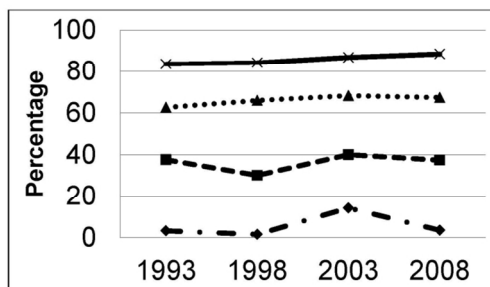
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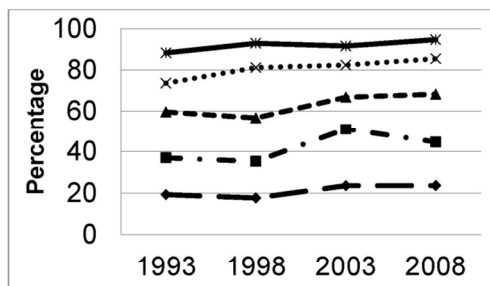
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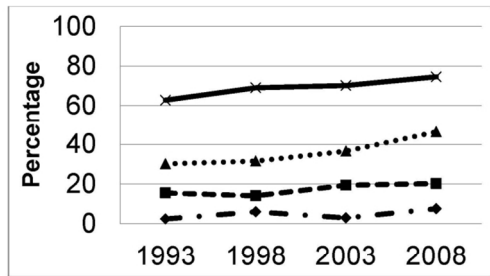
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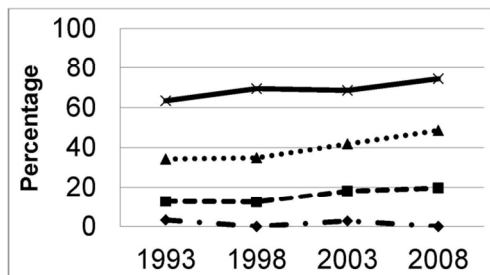
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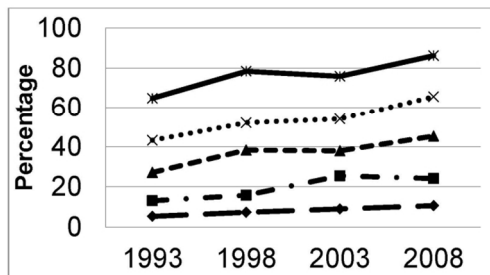
Part a. Woman's education



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Part c. Wealth Index



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STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*
Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any pre-specified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	8
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	9
		(b) Describe any methods used to examine subgroups and interactions	-
		(c) Explain how missing data were addressed	9
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed	9

		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11,12
		(b) Indicate number of participants with missing data for each variable of interest	-
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	13,15,18-23
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	16
		(b) Report category boundaries when continuous variables were categorized	
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	24
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	27
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	24-26
Generalisability	21	Discuss the generalisability (external validity) of the study results	24
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	28

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

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3 1 **Title: Reduction in inequality in antenatal care use and persistence of inequality in skilled**
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6 2 **birth attendance in the Philippines from 1993 to 2008**

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8 3 Faith Molina¹, Keiko Nakamura¹, Masashi Kizuki², Seino Kaoruko¹
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12 5 **Short Title:** Reduction in inequality in maternal health care use, Philippines
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43 18 **Key Words:** socioeconomic factors, prenatal care/statistical & numerical data; healthcare
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1 ARTICLE SUMMARY

2 **Article Focus:** Assessing the changes in the inequalities associated with maternal health care
3 use according to **economic status** in the Philippines.

4 **Key Messages:**

- 5 • The study showed reduction in the inequality of **antenatal care** use through time
6 suggesting substantial coverage of women in the lowest quintile.
- 7 • However, inequality **was** shown to persist in **skilled birth attendance** and **delivery in**
8 **medical facilities** indicating minimal professional delivery care among disadvantaged
9 women despite health system wide efforts and improvements in **the** socio demographic
10 profile of the population.
- 11 • The results call for equity oriented research and policies to close the wide gap in skilled
12 care at birth in the Philippines and to determine the success factors in the reduction of
13 inequality in **antenatal-care** use.

14 **Strengths and Limitations:**

- 15 • **This is the first study of long-term trends in inequalities in utilization of critical maternal**
16 **health interventions using four comparable, nationally-representative Demographic**
17 **Health Survey (DHS) datasets commonly used as data sources in the literature.**
- 18 • **Comparability of the different survey years was achieved by selecting only the women**
19 **who had live births within one year.**
- 20 • **The DHS wealth index was used to represent changes in socioeconomic inequalities**
21 **through time.**

1
2
3 **1 ABSTRACT**
4

5 **2 Objective:** To assess changes in the inequalities associated with maternal health care use
6
7 according to **economic status** in the Philippines.
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10 **3 Design:** **An analysis of four, population-based datasets that were conducted** between 1993 and
11
12 2008.
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15 **4 Setting:** Philippines.
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18 **5 Participants:** Women aged 15-49 years who had a live birth within one year in 1993 (n=1707),
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20 1998 (n=1513), 2003 (n=1325), and 2008 (n=1209).
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23 **6 Outcomes:** **At least 4 visit of antenatal care**, skilled birth attendance and delivery in a medical
24
25 facility.
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28 **7 Results:** **The adjusted odds ratio (OR) for antenatal-care use when comparing the highest wealth**
29
30 **index quintile with the lowest quintile declined from 1993 to 2008: 3.43 (95% confidence**
31
32 **interval (CI) 2.22-5.28) to 2.87 (95%CI 1.31-6.29). On the other hand, the adjusted OR for the**
33
34 **other two outcome indicators by the wealth index widened from 1993 to 2008: 9.92 (95%CI**
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36 **5.98-16.43) to 15.53 (95%CI 6.90-34.94) for skilled birth attendance; and 7.74 (95%CI 4.22-**
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38 **14.21) to 16.00 (95%CI 7.99-32.02) for delivery in a medical facility. The concentration index**
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40 **for maternal health utilization in 1993 and 2008 were 0.19 and 0.09 for antenatal care; 0.26 and**
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42 **0.24 for skilled birth attendance; and 0.41 and 0.35 for delivery in a medical facility.**
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2 **Conclusion:** Over a 16-year period, gradients in antenatal care use decreased and high level of
3 inequalities in skilled birth attendance and delivery in a medical facility persisted. **The results**
4 **showed a disproportionate use of institutional care at birth among disadvantaged Filipino women.**

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INTRODUCTION

Globally, there is an increasing concern regarding inequities in maternal health, especially in developing countries. [1] The slow pace of reduction in maternal mortality rates despite cost-effective solutions has urged the international community to look beyond accomplishing national targets and to begin addressing wide disparities in women's health. [2]

The key to realizing equity in maternal health is the achievement of equity in key maternal health coverage, such as antenatal care (ANC) and skilled birth attendance (SBA). A previous study indicated the greatest inequity in SBA coverage followed by ANC of more than four visits. [3] Wide inequalities in these interventions have hindered the reduction by 0.75 of maternal mortality ratio from 1990 to 2015. [4 – 6]

The Philippines has made efforts to improve women's health as mandated in its constitution and as a signatory to several women's international conventions including the Millennium Development Goals (MDG). National laws passed include the Magna Carta of Women (RA 9710), Maternity Benefits in Favor of Women Workers in the Private Sector (RA 7322), and Maternal Package for Normal Spontaneous Vaginal Delivery of the Philippine Health Insurance Corporation (PhilHealth). Starting 1995, the Philippine government has also implemented a number of maternal health programs, including two Women's Health and Safe Motherhood Projects. [7] Health system reforms to reduce maternal and neonatal mortality were also spearheaded through the Department of Health Administrative Order No. 2008-0029 resulting to the Integrated Maternal, Neonatal and Child Health and Nutrition Strategy (MNCHN). Specific

1 reproductive health indicators of MNCHN to be met in 2010 include (1) an increase in modern
2 contraceptive prevalence rate to 60%, (2) an increase in the proportion of pregnant women
3 having at least four ANC visits to 80%, and (3) an increase in SBA and facility-based births to
4 80%.

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6 There is, however, uncertainty regarding whether and how these maternal health policies and
7 programs have substantially reduced gaps in the use of key maternal interventions among women
8 from varying socioeconomic backgrounds through time. The Philippines is currently off track
9 and slow in achieving MDG-5. In 2010, the estimated maternal mortality ratio was 99 per
10 100000 live births, compared to the goal of 52 per 100000 live births in 2015. [8] This slow
11 achievement of national targets indicates wide economic and regional inequalities in maternal
12 and child health services. [9] The objective of this study was to assess the changes in inequalities
13 in ANC, SBA, and delivery in medical facility (MEDFAC) in the Philippines between 1993 and
14 2008 according to women's residence, woman's education, partner's education, wealth index,
15 woman's age and birth order.

1 DATA AND METHODS

3 Data Source

5 This study was performed using the data from the Philippine Demographic and Health Survey
6 (PDHS) conducted for the periods of 1993, 1998, 2003, and 2008. All were nationally
7 representative household surveys overseen by the National Statistics Office and National
8 Steering Committee with financial and technical support from the United States Agency for
9 International Development. [10] PDHS gathers detailed information on population, health, and
10 nutrition to assist in the country's monitoring and impact evaluation. It ensures comparability
11 across countries and time by developing standard model questionnaires, extensive survey
12 procedures, interviewer training, and data processing guidelines. [11, 12]

14 The 1993 and 1998 PDHS employed a two-stage sample design, representing 14 regions and 16
15 regions, respectively. A sample of 13700 households (response rate: 99.2%) was randomly
16 selected from 750 primary sampling units (PSUs) for 1993 and a sample of 13708 households
17 (response rate: 98.7%) was randomly selected from 755 PSUs for 1998. The 2003 and 2008
18 PDHS followed a stratified three-stage cluster sample design representing 17 regions. A sample
19 of 13914 households (response rate: 99.1%) was randomly selected from 819 PSUs for 2003 and
20 a sample of 13764 households (response rate: 99.3%) was randomly selected from 794 PSUs for
21 2008. Detailed descriptions of the study design and methods of data collection are accessible
22 online in household survey reports. [13 – 16]

1 2 3 1 **Subjects** 4 5 6 2

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8 3 The numbers of women interviewed were as follows: 1993, $n = 15029$; 1998, $n = 13983$; 2003, n
9 4 = 13633; and 2008, $n = 13594$. The average response rate was 98%. The subjects we included in
10 5 the analysis were women aged 15-49 years who had a live birth within one year, resulting in final
11 6 sample sizes of 1707 in 1993, 1513 in 1998, 1325 in 2003, and 1209 in 2008.
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15 16 17 18 19 20 8 **Study Variables** 21 22 9

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24 10 Three dependent variables were measured in the present study: (1) at least four antenatal
25 11 consultations; (2) assistance by professional health personnel during delivery—either a doctor,
26 12 nurse, or midwife, excluding traditional birth attendants (*hilot*), relatives, or friends; and (3)
27 13 whether the birth occurred at home or in a medical facility (public or private).
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36 15 The Demographic and Health Survey (DHS) wealth index is defined as a composite measure of a
37 16 household's relative economic status by using the data in the DHSs. It is calculated by using data
38 17 on a household's ownership of selected assets such as television or car, persons per sleeping
39 18 room, ownership of agricultural land, domestic servant and other country specific items. [17] The
40 19 asset quintile was derived from this DHS wealth index score of women who had a live birth
41 20 within one year categorized into lowest, second, middle, fourth and highest, in respective survey
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3 1 Other independent variables were type of residence (urban or rural), woman's age (< 20, 20 – 29,
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5 2 30 – 39, ≥ 40), birth order (1, 2, 3, ≥ 4), and educational level of woman and her partner (none,
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7 3 primary, secondary, higher).
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13 **Ethical Review**

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17 7 As protocols for all demographic health household surveys, the four PDHS were submitted for
18 8 ethical reviews to the ICF Institutional Review Board (Calverton, MD) and an institutional
19 9 review board or ethics review panel in the Philippines for approving research studies on human
20 10 subjects. [18]
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29 **Statistical Analysis**

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34 14 Changes in the socio demographic profile and use of ANC, SBA, and MEDFAC of the
35 15 population were analyzed from household survey data in 1993, 1998, 2003, and 2008. Tests for
36 16 trends were performed using the Mantel–Haenszel linear-by-linear association chi squared test.
37 17 Crude and adjusted odds ratios between each dependent variable and all of the independent
38 18 variables were assessed by multivariate logistic regression analysis. Complex household survey
39 19 design was taken into account in all analyses using a sampling weight. All the missing data were
40 20 excluded in the analysis. All analyses were performed using StataMP 11 Statistical Software
41 21 (Stata Corp., College Station, TX).
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3 1 Inequalities of each outcome variable according to the wealth index were estimated using the
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5 2 concentration index. It is defined as twice the area between the concentration curve and the line
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8 3 of equality (the 45-degree line) and was used to determine the magnitude of inequality. A
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10 4 concentration index of 0 indicates perfect equality. A measure of 1 (or -1) indicates perfect
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13 5 inequality. [19, 20]
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1 RESULTS

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3 There were changes in socio demographic profile of the population from 1993 to 2008. (Table 1)

4 The percentage of women with secondary and higher education increased during this period from
5 58.7% in 1993 to 74.6% in 2008. A corresponding increase was also observed in the percentage
6 of partners who finished secondary and higher education from 57.4% in 1993 to 70.7% in 2008.

7 The percentage of women who have four or more children declined from 39.9% in 1993 to
8 31.7% in 2008.

Table 1 Socio demographic characteristics and childbirth history of women aged 15-49 years, per survey year, Philippines, 1993-2008

Indicator	1993 n=1707 %	1998 n=1513 %	2003 n=1325 %	2008 n=1209 %
Residence				
Urban	48.8	46.3	50.0	46.9
Rural	51.2	53.7	50.0	53.1
Woman's Education				
None	2.3	1.8	1.9	1.2
Primary	39.0	29.9	27.8	24.2
Secondary	37.4	39.7	42.5	50.3
Higher	21.3	28.6	27.8	24.3
Partner's Education				
None	1.9	1.6	2.0	1.9
Primary	40.8	33.4	31.8	27.5
Secondary	37.3	36.7	40.1	45.0
Higher	20.1	28.3	26.1	25.7
Wealth Index				
Lowest	20.2	20.0	20.0	20.0
Second	19.8	20.0	20.1	20.0
Middle	20.0	20.0	20.0	20.1
Fourth	20.0	20.1	19.9	20.1
Highest	20.0	19.9	20.0	19.8
Woman's Age				
<20	5.6	6.1	7.2	8.2
20-29	53.7	53.7	53.3	53.5
30-39	35.6	35.1	34.4	32.5
≥40	5.2	5.1	5.1	5.8
Birth Order				
1	22.6	24.5	27.7	28.5
2	20.7	21.1	23.6	24.6
3	16.8	19.6	15.5	15.2
≥4	39.9	34.8	33.2	31.7

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4 1 **Figure 1 shows that the** utilization of ANC and MEDFAC increased from 53.4% in 1993 to
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6 2 74.8% in 2008 and from 30.7% in 1993 to 46.3% in 2008, respectively. However, there is a
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8 3 limited change in utilization of SBA from 55.5% in 1993 to 63.3% in 2008.
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1 **Figure 1** Total percentage of antenatal care use, skilled birth attendance and delivery in a
2 medical facility, 1993-2008
3 **—◆—** Antenatal care, **··■··** Skilled birth attendance, **-▲-** Delivery at medical facility

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3 1 As shown in Table 2, from 1993 to 2008, the rates of utilization of ANC, SBA and MEDFAC
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6 2 were higher for women who were educated, better off, resided in an urban area, and those with
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8 3 educated partners than among their poorer and less educated counterparts. There was a decline in
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10 4 the odds ratio of women in highest wealth quintile compared to the lowest in ANC from 1993 to
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12 5 2008. The adjusted odds ratio (OR) for antenatal-care use when comparing the highest wealth
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14 6 index quintile with the lowest quintile declined from 1993 to 2008: 3.43 (95% confidence
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16 7 interval (CI) 2.22-5.28) to 2.87 (95%CI 1.31-6.29). On the other hand, the adjusted OR for the
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18 8 other two outcome indicators by the wealth index widened from 1993 to 2008: 9.92 (95%CI
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20 9 5.98-16.43) to 15.53 (95%CI 6.90-34.94) for skilled birth attendance; and 7.74 (95%CI 4.22-
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22 10 14.21) to 16.00 (95%CI 7.99-32.02) for delivery in a medical facility.
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1 **Table 2** Adjusted odd ratios of the association between **wealth index** and socio demographic characteristics and antenatal care, skilled birth attendance or delivery in medical facility of women age 15-49 years,
 2 Philippines, 1993(n=1707), 1998(n=1513), 2003(n=1325), 2008(n=1209)

Indicator	Antenatal Care				Skilled Birth Attendance				Delivery at medical facility															
	1993	1998	2003	2008	1993	1998	2003	2008	1993	1998	2003	2008												
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Residence																								
Urban	1.29*	1.02, 1.62	1.44**	1.08, 1.93	1.70***	1.26, 2.28	0.99	0.71, 1.38	2.59**	2.03, 3.31	3.08**	2.27, 4.18	3.21***	2.37, 4.34	2.11**	1.52, 2.93	3.12***	2.35, 4.12	2.43**	1.77, 3.35	1.90***	1.41, 2.56	1.47*	1.07, 2.02
Rural (Reference)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Woman's Education																								
None	0.58	0.27, 1.26	0.55	0.21, 1.45	0.25**	0.09, 0.71	0.08***	0.02, 0.36	0.17*	0.05, 0.65	0.70	0.21, 2.39	0.22**	0.08, 0.66	0.66	0.14, 3.21	0.17	0.02, 1.94	0.48	0.11, 2.00	0.09*	0.01, 1.01	0.82	0.09, 7.51
Primary	0.54**	0.37, 0.79	0.46***	0.29, 0.74	0.53**	0.34, 0.85	0.38***	0.21, 0.68	0.43**	0.27, 0.67	0.67	0.39, 1.12	0.48**	0.30, 0.78	0.69	0.40, 1.19	0.58**	0.38, 0.88	0.52*	0.31, 0.86	0.44***	0.28, 0.70	0.60	0.35, 1.03
Secondary	0.67*	0.47, 0.95	0.65*	0.44, 0.97	0.69	0.46, 1.03	0.59**	0.36, 0.96	0.58*	0.38, 0.88	0.86	0.56, 1.34	0.57	0.37, 0.89	0.89	0.56, 1.41	0.59**	0.41, 0.84	0.54**	0.37, 0.78	0.49***	0.34, 0.70	0.77	0.53, 1.13
Higher (Reference)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Partner's Education																								
None	0.39*	0.16, 0.94	0.30*	0.10, 0.85	0.41	0.16, 1.05	0.55	0.19, 1.58	0.09*	0.01, 0.71	0.02**	0.00, 0.20	0.22**	0.08, 0.61	0.06*	0.01, 0.61	0.28	0.03, 2.54	¶(omitted)		0.11	0.01, 1.11	¶(omitted)	
Primary	0.53***	0.36, 0.78	0.67	0.43, 1.03	0.54**	0.34, 0.86	0.65	0.37, 1.13	0.65	0.42, 1.02	0.47*	0.29, 0.78	0.53**	0.33, 0.86	0.41**	0.23, 0.71	0.36***	0.23, 0.55	0.30**	0.19, 0.42	0.55*	0.34, 0.87	0.50*	0.30, 0.83
Secondary	0.74	0.52, 1.05	0.75	0.52, 1.09	0.68	0.45, 1.02	0.75	0.45, 1.24	0.74	0.50, 1.11	0.78	0.51, 1.19	0.66	0.43, 1.04	0.66	0.40, 1.07	0.58**	0.41, 0.83	0.46**	0.32, 0.65	0.72	0.50, 1.04	0.85	0.57, 1.27
Higher (Reference)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Woman's Age																								
<20	0.91	1.02, 1.62	0.45**	0.27, 0.74	1.12	0.66, 1.90	0.91	0.52, 1.58	0.93	0.54, 1.61	0.70	0.39, 1.26	0.89	0.52, 1.53	0.92	0.51, 1.66	0.88	0.46, 1.71	0.73	0.34, 1.57	0.70	0.41, 1.20	0.74	0.42, 1.31
20-29 (Reference)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
30-39	1.29	0.98, 1.69	1.86***	1.34, 2.58	1.20	0.86, 1.66	1.42	0.98, 2.04	1.17	0.86, 1.60	1.59*	1.10, 2.29	1.31	0.92, 1.89	1.54*	1.03, 2.30	1.36	0.98, 1.91	1.26	0.85, 1.85	1.46**	1.03, 2.07	1.59*	1.05, 2.40
≥40	1.41	0.84, 2.39	1.66	0.94, 2.91	0.87	0.46, 1.62	0.92	0.49, 1.70	1.96*	1.07, 3.57	1.56	0.81, 2.99	0.87	0.42, 1.83	3.12*	1.48, 6.58	1.96	0.97, 3.97	2.02	0.98, 4.15	1.04	0.47, 2.32	3.44**	1.69, 6.98
Birth Order																								
1 (Reference)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
2	0.76	0.55, 1.06	0.88	0.60, 1.30	0.84	0.57, 1.25	0.79	0.50, 1.27	0.76	0.53, 1.11	0.61*	0.40, 0.93	0.76	0.49, 1.17	0.87	0.57, 1.33	0.53***	0.35, 0.78	0.52*	0.33, 0.80	0.50***	0.34, 0.74	0.56*	0.37, 0.84
3	0.64*	0.45, 0.93	0.64*	0.42, 0.97	0.92	0.59, 1.45	0.55**	0.33, 0.92	0.50**	0.33, 0.76	0.75	0.47, 1.18	0.69	0.42, 1.13	0.61	0.36, 1.02	0.36***	0.23, 0.55	0.72	0.44, 1.16	0.45***	0.29, 0.70	0.37**	0.23, 0.61

≥4	0.41 ***	0.30, 0.58	0.36 ***	0.24, 0.54	0.56 **	0.36, 0.87	0.53 **	0.32, 0.88	0.47* **	0.32, 0.69	0.31* **	0.20, 0.49	0.51 **	0.31, 0.82	0.47* *	0.28, 0.80	0.32 ***	0.21, 0.49	0.41* **	0.25, 0.67	0.28 ***	0.18, 0.45	0.23* **	0.13, 0.38
Wealth Index																								
Lowest (Reference)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Second	1.09	0.79, 1.50	1.21	0.86, 1.70	0.85	0.59, 1.24	1.48	0.99, 2.20	2.00* **	1.38, 2.89	1.99* **	1.34, 2.96	2.06 ***	1.36, 3.13	1.74* *	1.14, 2.64	2.11 **	1.16, 3.83	1.88* *	1.07, 3.29	2.15 **	1.25, 3.71	1.79* *	1.05, 3.05
Middle	1.26	0.89, 1.78	1.85 **	1.26, 2.72	0.77	0.51, 1.16	1.25	0.80, 1.96	3.30* **	2.26, 4.83	4.05* **	2.63, 6.24	2.95 ***	1.88, 4.64	3.43* **	2.18, 5.34	2.83 ***	1.58, 5.07	2.31* *	1.29, 4.14	3.01 ***	1.73, 5.22	3.46* **	2.02, 5.91
Fourth	1.68 **	1.16, 2.43	2.25 ***	1.45, 3.52	1.12	0.70, 1.81	2.06 **	1.19, 3.57	4.71* **	3.11, 7.13	7.17* **	4.33, 11.86	4.87 ***	2.90, 8.19	7.20* **	4.22,1 2.30	4.50 ***	2.50, 8.13	4.29* **	2.38, 7.74	4.07 ***	2.32, 7.13	6.09* **	3.41, 10.89
Highest	3.43 ***	2.22, 5.28	3.54 ***	1.98, 6.33	2.44 **	1.31, 4.54	2.87 **	1.31, 6.29	9.92* **	5.98, 16.43	12.29 ***	6.22, 24.27	6.98 ***	3.62, 13.46	15.53 ***	6.90, 34.94	7.74 ***	4.22, 14.21	7.55* **	3.95, 14.44	6.98 ***	3.76, 12.94	16.00 ***	7.99, 32.02

* p<0.05; ** p<0.01; *** p<0.001

Adjusted for residence, woman's education, partner's education, women' age and birth order.

¶All subject in this category did not deliver in medical facility and removed from analysis.

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3 1 Figure 2 shows that there was a marked reduction in inequality of ANC from 1993 to 2008.
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5 2 Although gradients of its use among women with no education and women with higher
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7 3 education widened from 1993 to 2008, the gradients of ANC use among women with primary
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9 4 education and women with higher education as their highest educational attainment decreased
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11 5 from a difference of 40.4% in 1993 to 31.6% in 2008. A marked reduction was seen among
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14 6 women in the highest quintile compared to those in the lowest quintile, with a difference of
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16 7 48.2% in 1993 decreasing to 35.0% in 2008. A reduction in the concentration index from
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18 8 1993 to 2008 of ANC was observed.
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1 **Figure 2** Trends in the percentage of antenatal care use by (a) woman's education, (b)
2 partner's education, (c) **wealth index**, 1993-2008

3 Part a: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

4 Part b: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

5 Part c: -◆- Lowest -■- Second, -▲- Middle, ···×··· Fourth, -×- Highest

6 Note: Concentration Index 0.19, 95% CI 0.16 to 0.21 in 1993; Concentration Index 0.18, 95%
7 CI 0.16 to 0.21 in 1998; Concentration Index 0.12, 95% CI 0.09 to 0.14 in 2003;
8 Concentration Index 0.09, 95% CI 0.07 to 0.11 in 2008

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3 1 Figure 3 shows the limited changes in the inequality of SBA from 1993 to 2008. A reduction
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5 2 was observed in the gradient of SBA in comparison between women with no education and
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7 3 those with higher education with a difference of 76.6% in 1993 decreasing to 70.7% in 2008.
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10 4 Reverse direction of the difference was observed between women in the highest quintile
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12 5 compared to those in the lowest quintile from a difference of 69.1% in 1993 increasing to
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14 6 71.1% in 2008. A reduction in the concentration index from 1993 to 2008 of SBA was
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16 7 observed, however the concentration index obtained was larger than that of ANC.
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1 **Figure 3** Trends in the percentage of skilled birth attendance by (a) woman's education, (b)
2 partner's education, (c) **wealth index**, 1993-2008

3 Part a: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

4 Part b: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

5 Part c: -◆- Lowest, -■- Second, -▲- Middle, ···×··· Fourth, -×- Highest

6 Note: Concentration Index 0.26, 95% CI 0.24 to 0.29 in 1993; Concentration Index 0.29, 95%
7 CI 0.26 to 0.31 in 1998; Concentration Index 0.22, 95% CI 0.20 to 0.24 in 2003;
8 Concentration Index 0.24, 95% CI 0.21 to 0.27 in 2008

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3 1 Figure 4 shows the changes in inequality of MEDFAC from 1993 to 2008. As shown in the
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5 2 figure, the gradient of MEDFAC between women with no education and those with higher
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7 3 education widened from a difference of 60.4% in 1993 to 67.0% in 2008. The same
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9 4 increasing direction for difference in use between women in the highest quintile compared to
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11 5 those in the poorest quintile, with a difference of 59.5% in 1993 decreasing to 75.6% in 2008.
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14 6 A reduction in the concentration index from 1993 to 2008 of MEDFAC was observed,
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16 7 however the concentration index obtained was also large in comparison to ANC.
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1 **Figure 4** Trends in the percentage of delivery at medical facility by (a) woman's education,
2 (b) partner's education, (c) **wealth index**, 1993-2008

3 Part a: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

4 Part b: -◆- None, -■- Primary, ···▲·· Secondary, -×- Higher

5 Part c: -◆- Lowest -■- Second, -▲- Middle, ···×··· Fourth, -×- Highest

6 Note: Concentration Index 0.41, 95% CI 0.38 to 0.45 in 1993; Concentration Index 0.41, 95%
7 CI 0.38 to 0.44 in 1998; Concentration Index 0.34, 95% CI 0.31 to 0.37 in 2003;
8 Concentration Index 0.35, 95% CI 0.32 to 0.38 in 2008

1 DISCUSSION

2 This is the first study to describe the time trends in the inequalities of maternal health care
3 utilization in the Philippines. The analysis of four nationally representative PDHS survey data
4 sets ranging over a period of 16 years from 1993 to 2008 and showed a substantial increase in
5 antenatal coverage and limited improvement in professional delivery care. Furthermore, our
6 findings demonstrated reduction in the inequality of ANC use through time suggesting
7 coverage of women in the lowest quintile or possibly decreased coverage for the wealthier
8 quintile. The study also provided evidence of persistence of inequality in SBA and MEDFAC
9 indicating minimal professional delivery care among women under lowest socioeconomic
10 conditions.

11
12 Our findings are in the line with evidence on 25 low income countries referred inequalities on
13 institutional delivery rates as well as a weak health system and lack of skilled birth workers
14 as the main barriers of use. [21] Marked underutilization of SBA has been noted among poor
15 women in many studies. [22-23] However, one study conducted in India reported low
16 utilization of both ANC and SBA among poor women through time despite of governmental
17 interventions. [24]

18
19 The increase of proportion of antenatal coverage from 1993 to 2008 was greater than that of
20 proportion of births attended by skilled health personnel or that of delivery at a medical
21 facility. Over the last several decades, the Philippine government has launched maternal
22 health projects and programs to improve women's health. These were implemented alongside
23 extensive health system reforms across the country on health financing, health regulation,
24 health service delivery, and good governance in health following decentralization of health
25 care services. [25] A study indicated that implementation areas that have intensively adopted

1 the health system-wide reforms have improved overall maternal health outcomes compared to
2 those that have not adopted. However, the poorly developed health information systems and
3 lack of referral emergency care facilities in remote coastal and isolated mountain
4 communities were the challenges that remain to be addressed. [26]

5
6 The results of the present study indicated reductions in the inequality of ANC use. This
7 translates to substantial ANC use among women under lowest living standard quintile. This
8 can be explained by improvements in both the health care system and in the socio
9 demographic profile of the population. The **PhilHealth** has been reported to increase uptake
10 and standards of ANC. [27] Improvements in the quality of services in health care institutions
11 through accreditation and the covering of financial costs by insurance contributed to the
12 increased use of ANC by Filipino women regardless of socio demographic status. [27, 28]
13 There was also an increase in the total number of midwives and rural (*barangay*) health units
14 through the years, which addressed the problems of distance and lack of availability of health
15 workers and ANC facilities. [29] Moreover, positive changes in socio demographic and
16 demographic profiles, such as increases in educational status of women and their partners,
17 better economic status of women, and decreased fertility, may also explain the observed
18 reductions in the inequality of ANC use. [30]

19
20 Inequalities in SBA and MEDFAC persist in the Philippines despite health system-wide
21 efforts and improvements in the socio demographic profile of the population. After 16 years,
22 the majority of Filipino women from lowest living standard quintile continue to deliver at
23 home without professional assistance. In the Philippines, financial, transportation, absence of
24 companion to health facility, and treatment of health professionals to disadvantaged women
25 are major barriers that must be addressed to increase the rate of hospital delivery. [31] The

1 majority of unskilled home deliveries among Filipino women occur near hospitals, and
2 financial burden associated with hospital delivery is the main concern regardless of
3 socioeconomic status. In 2009, families from the lowest 30% income group, delivery at a
4 hospital would consume a minimum of 6.6% – 24.3% of the family's total annual income.
5 [32, 33] This indicates that catastrophic financial costs are responsible for the decision by
6 poorer Filipino women to deliver at home, even if they are close to health facilities in
7 addition to low educational status and rural residence. PhilHealth coverage is low with only
8 42% of families with at least one family member is enrolled in 2004. [34] Furthermore, the
9 out of pocket expenditure as percentage of private expenditure on health has increased from
10 77.2% in 2000 to 83.6% in 2010. [35]

11
12 There are number of strengths in this study. The study used four nationally representative
13 samples obtained by the DHSs commonly used as data sources in literatures worldwide. A
14 national sample of women aged 15-49 years were collected to obtain a sufficient sample size
15 for each survey year. Selection of the women who had live births only within one year as the
16 subjects of the individual surveys sharpened the comparison of the data of four different years.
17 This reduced the magnitude of recall bias by the respondents. All four PDHSs followed strict
18 data quality checks through pre testing, translation of questionnaires to local dialect,
19 interviewer training, and duplicate data entry. It also employed standardized questionnaire
20 format which are carefully developed to ascertain accurate response and information from the
21 participants. The analysis used the DHS wealth index, a systematically developed composite
22 index to measure economic status of the subjects among the DHS samples. The study used
23 relevant measurements of inequity, the concentration index, which measures the long term
24 trends in inequalities in utilization of critical maternal health care interventions in the
25 Philippines which is important for future health policy.

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5 2 There should be a caution in interpreting trends of maternal health care use by the DHS
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7 3 wealth index since it is an index to show a relative position measured by a composite
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10 4 economic status indicator among the subjects of the particular year and country. Therefore
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12 5 the scores of wealth index in different years are not comparable.
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16 7 Our study implies the need to research solutions to reduce inequality in SBA and delivery at a
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18 8 medical facility, and to determine the factors responsible for the persistence of inequality in
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20 9 SBA and delivery at a medical facility despite government and non-governmental efforts.
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22 10 Recognizing reproductive health as a basic right of women regardless of socio demographic
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24 11 status is important in formulating national policy and programs to address inequality in
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26 12 maternal health service utilization.
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6
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10 6

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12 8

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14 10 The authors declare that they have no competing interests.
15 11

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17 13

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21 17

22 18

23 19 **CONTRIBUTORSHIP**
24 20

25 21

26 22 FM and KN conceptualized and designed the study. FM obtained and FM and MK analyzed
27 23 the data. FM, KN, MK, and KS structured and edited the manuscript. All authors approved
28 24 the final manuscript.
29 25

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31 27 **DATA SHARING**
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34 30 There are no additional unpublished data from the study.
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1
2
3 **REFERENCES**
4

- 5 1. Commission on information and accountability for Women's and Children's Health.
6 Keeping promises, measuring results. World Health Organization; 2011. Available
7 from:
8
9
10 http://www.everywomaneverychild.org/images/content/files/accountability_commissi
11 [on/final_report/Final_EN_Web.pdf](http://www.everywomaneverychild.org/images/content/files/accountability_commission/final_report/Final_EN_Web.pdf) (accessed March 2012).
12
13
14
15
16 2. Thomsen S, Hoa Dt, [Målqvist M](#), et al. Promoting equity to achieve maternal and
17 child health. *Reprod Health Matters* 2011;**19**(38):176-82.
18
19
20 3. Barros AJ, Ronsmans C, Axelson H, et al. Equity in maternal, newborn and child
21 health interventions in countdown to 2015: a retrospective review of survey data from
22 54 countries. *Lancet* 2012;**379**(9822):1225-33.
23
24
25 4. Zere E, Kirigia JM, Duale S, et al. Inequities in maternal and child health outcomes
26 and interventions in Ghana. *BMC Public Health* 2012;**12**:252.
27
28
29 5. Wirth M, Sacks E, Delamonica E, et al. "Delivering on the mdgs?": equity and
30 maternal health in Ghana, Ethiopia and Kenya. *East Afr J Public Health*
31 2008;**5**(3):133-41.
32
33
34 6. Silal SP, Penn Kenana L, Harris B, et al. Exploring inequalities in access to and use of
35 maternal health services in South Africa. *BMC Health Serv Res* 2012;**12**(1):120.
36
37
38 7. Asian Development Bank Operations Evaluation Department. Project performance
39 evaluation report in the Philippines. Asian Development Bank; 2007. Available from:
40 <http://www.adb.org/sites/default/files/27010-PHI-PPER.pdf> (accessed January 2013)
41
42
43 8. WHO, UNICEF, UNFPA, The World Bank. Trends in maternal mortality 1990-2010:
44 WHO, UNICEF, UNFPA and The World Bank estimates. Geneva: World Health
45 Organization; 2012. Available from:
46
47
48
49
50
51
52
53
54
55
56
57
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59
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- 1
2
3 1 <http://www.unfpa.org/webdav/site/global/shared/documents/publications/2012/Trends>
4
5 2 [in_maternal_mortality_A4-1.pdf](#) (accessed March 2012).
6
7 3 9. [Lavado](#) RF, Lagrada LP. Are Maternal and Child Care Programs Reaching the
8
9 4 Poorest Regions in the Philippines? Philippine Institute for Developmental Studies.
10
11 5 2008 Nov; Discussion Paper Series No. 2008-30.
12
13 6 10. Demographic and Health Surveys [Internet]. Calverton: Macro International.
14
15 7 Available from: <http://www.measuredhs.com/> (accessed July 2011).
16
17 8 11. Rutstein SO, Rojas G. Guide to DHS statistics. Calverton, MD: ORC Macro,2003.
18
19 9 12. Croft T. DHS Data Editing and Imputation. Calverton, MD: ORC Macro International.
20
21 10 13. National Statistics Office (NSO) [Philippines] and Macro International Inc. (MI).1994.
22
23 11 National Demographic Survey 1993. Calverton, Maryland: NSO and MI.
24
25 12 14. National Statistics Office (NSO)], Department of Health (DOH) [Philippines] and
26
27 13 Macro International Inc. (MI).1999. National Demographic Survey 1998. Manila:
28
29 14 NSO and MI.
30
31 15 15. National Statistics Office (NSO) [Philippines], and ORC Macro. 2004. National
32
33 16 Demographic Survey 2003. Calverton, Maryland: NSO and ORC Macro.
34
35 17 16. National Statistics Office (NSO) [Philippines], and ICF Macro. 2009. National
36
37 18 Demographic Survey 2008. Calverton, Maryland: National Statistics Office and ICF
38
39 19 Macro.
40
41 20 17. Rutstein, SO, Kiersten J. 2004. The DHS Wealth Index. DHS Comparative Reports
42
43 21 No. 6. Calverton, Maryland: ORC Macro
44
45 22 18. Filmer D, Pritchett LH. Estimating wealth effects without expenditure data or tears:
46
47 23 an application to educational enrollments in states of India. *Demography* 2001,
48
49 24 **38**(1):115-132.
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 1 19. O'Donnell O, van Doorslaer E, Wagstaff A, et al. Analyzing health equity using
4
5 2 household survey data: a guide to techniques and their implementation. Washington,
6
7 3 D.C: The World Bank; 2008. Available from:
8
9 4 [http://siteresources.worldbank.org/INTPAH/Resources/Publications/459843-
10
11 5 \[1195594469249/HealthEquityFINAL.pdf\]\(http://siteresources.worldbank.org/INTPAH/Resources/Publications/459843-1195594469249/HealthEquityFINAL.pdf\) \(accessed July 2011\).12
13
14 6 20. Wagstaff A. The concentration index of a binary outcome revisited. *J Health Econ*
15
16 7 2011;**20**\(10\):1155-60.
17
18 8 21. \[Limwattananon S\]\(#\), \[Tangcharoensathien V\]\(#\), \[Sirilak S\]\(#\). Trends and inequities in where
19
20 9 women delivered their babies in 25 low-income countries: evidence from
21
22 10 Demographic and Health Surveys. *Reprod Health Matters* 2011;**19**\(37\):75-85.
23
24 11 22. Zere E, Oluwole D, Kirigia JM, et al. Inequalities in skilled attendance at birth in
25
26 12 Namibia: a decomposition analysis. *BMC Pregnancy Childbirth* 2011;**11**:34.
27
28 13 23. Collin SM, Anwar I, Ronsmans C. \[A decade of inequality in maternity
29
30 14 care: antenatal care, professional attendance at delivery, and caesarean section in
31
32 15 \\[Bangladesh \\\(1991–2004\\\)\\]\\(#\\). *Int J Equity Health* 2007 Aug;**6**:9.
33
34 16 24. Pathak PK, Singh A, Subramanian SV. Economic Inequalities in maternal health care:
35
36 17 prenatal care and skilled birth attendance in India, 1992-2006. *PLoS One*
37
38 18 2010;**5**\\(10\\):e13593.
39
40 19 25. Lakshminarayanan, R. Decentralisation and its implications for reproductive health:
41
42 20 the Philippines experience. *Reprod Health Matters* 2003;**11**\\(21\\):96-107.
43
44 21 26. Huntington D, Banzon E, Recidoro ZD. A systems approach to improving maternal
45
46 22 health in the Philippines. *Bull World Health Organ* 2012;**90**\\(2\\):104-110.
47
48 23 27. Kozhimannil KB, Valera MR, Adams A, et al. The population-level impacts of a
49
50 24 national health insurance program and franchise midwife clinics on achievement of
51
52
53
54
55
56
57
58
59
60\]\(#\)](http://siteresources.worldbank.org/INTPAH/Resources/Publications/459843-1195594469249/HealthEquityFINAL.pdf)

- 1 prenatal and delivery care standards in the Philippines. *Health Policy* 2009;**92**(1):55-
2 64.
- 3 28. Quimbo SA, Peabody JW, Shimkhada R, et al. Should we have confidence if a
4 physician is accredited? A study of the relative impacts of accreditation and insurance
5 payments on quality of care in the Philippines. *Soc Sci Med* 2008;**67**(4):505-10.
- 6 29. Department of Health. Vital, Health and Nutrition. Manila; National Statistical
7 Coordination Board; 2012. Available from:
8 http://www.nscb.gov.ph/secstat/d_vital.asp (accessed Mar 2012).
- 9 30. Simkhada B, Teijlingen ER, Porter M, et al. Factors affecting the utilization of
10 antenatal in developing countries: a systematic review of the literature. *J Adv Nurs*
11 2008;**61**(3):244-60.
- 12 31. Sobel HL, Oliveros YE, Nyunt US. Secondary analysis of a national health survey on
13 factors influencing women in the Philippines to deliver at home and unattended by a
14 healthcare professional. *Int J Gynaecol Obstet* 2010;**111**(2):157-60.
- 15 32. National Statistics Office. 2004 Annual Poverty Indicators Survey (APIS)
16 (Preliminary Results). Manila:National Statistics Office; 23 Sept 2005. Available
17 from: [http://www.census.gov.ph/content/2004-annual-poverty-indicators-survey-apis-](http://www.census.gov.ph/content/2004-annual-poverty-indicators-survey-apis-preliminary-results)
18 [preliminary-results](http://www.census.gov.ph/content/2004-annual-poverty-indicators-survey-apis-preliminary-results) (accessed Jan 2013).
- 19 33. Ericta CN. Families in the bottom 30 percent income group earned 62 thousand pesos
20 in 2009. Manila:National Statistics Office; 4 Feb 2011. Available from:
21 <http://www.census.gov.ph/data/pressrelease/2011/ic09frtx.html> (accessed Mar 2012).
- 22 34. Tsolmongerel T. Costing study for selected hospitals in the Philippines. March 2009
23 Available from:
24 [http://www.doh.gov.ph/sites/default/files/Costing%20Study%20for%20Selected%20](http://www.doh.gov.ph/sites/default/files/Costing%20Study%20for%20Selected%20Hospitals%20in%20the%20Philippines.pdf)
25 [Hospitals%20in%20the%20Philippines.pdf](http://www.doh.gov.ph/sites/default/files/Costing%20Study%20for%20Selected%20Hospitals%20in%20the%20Philippines.pdf) (accessed Mar 2012).

- 1
2
3 1 35. Global Health expenditure Database. Philippines National Expenditure on Health
4
5 2 (Philippine Peso) 1995-2010. World Health Organization; 2012. Available from:
6
7 3 http://apps.who.int/nha/database/StandardReport.aspx?ID=REP_WEB_MINI_TEMP
8
9 4 [LATE_WEB_VERSION&COUNTRYKEY=84655](http://apps.who.int/nha/database/StandardReport.aspx?ID=REP_WEB_MINI_TEMP_LATE_WEB_VERSION&COUNTRYKEY=84655)
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