TRENDS AND QUALITY OF MATERNAL HEALTHCARE IN INDONESIA BY ECONOMIC STATUS AND REGION

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ABSTRACT

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Background: Indonesia has implemented several maternal health programs aiming to improve access to maternal healthcare:1) the Village Midwives, 2) the Alert Campaign, and 3) the Social Health Insurance (SHI) Program. However, differences in maternal healthcare utilization by family wealth and region persist. This dissertation's aims address: 1) the progress in skilled delivery in relation to the initiation of maternal health programs; 2) the progress in antenatal care (ANC) in relation to the initiation of the SHI; and 3) the contribution of select socio-demographic factors in the gaps of skilled delivery utilization in Indonesia.

Methods: Data from the Indonesian Demographic and Health Survey (IDHS), obtained from repeated cross-sectional surveys with multistage sampling, were analyzed. For the first aim, six rounds of IDHS data were used (n=105,176 live births from 84,022 women who gave birth in 1986-2012). For the second aim three rounds of IDHS data were used (n=36,598 live births and women who gave birth in 2001-2012). For the third aim the IDHS 2012 was used (n=16,083 live births from 14,013 women). We considered several socio-demographic factors that might influence maternal healthcare utilization in our analyses. Segmented logistic regression analyses using STATA survey (svy) were conducted to assess progress in skilled delivery and ANC. The regression-based decomposition method using STATA mvdcmp was used to identify the contribution of each factor in the gap of skilled facility delivery (SFD) utilization by family wealth.

Results: Following the Village Midwife Program, there was a significant yearly increase in skilled birth attendance (SBA), aOR per year= 1.12, (95% CI 1.08-1.15), but not in SFD. There also were significant yearly increases in SBA and SFD after SHI initiation. The *increasing* trends of SFD following SHI were more evident among women of low socioeconomic status (SES) and women living in Java Bali. We also observed increasing yearly trends of ANC 4 visits utilization after SHI implementation, aOR per year =1.11 (95%CI 1.01, 1.21), but not in ANC 8 visits. However, the trends were not significantly different from the trends that predated SHI initiation. After 2008, there were decreasing trends of ANC 4 visits across family wealth and regions, which might be caused by data artifact or real events. In the decomposition analyses, approximately 69.7% of the SFD gaps by family wealth in Java Bali, 61.6% in the more populated other islands, and 54.6% in the less populated other islands could be attributed to the differences in characteristics. The decomposition methods classify the contribution of differences in characteristics (i.e. different distribution of characteristics) and differential effect/responses by groups. Across all regions, the predominant contributors to the gap in SFD utilization were differences in the distribution of education level, area of residence, and parity between the lower and higher family wealth quintiles. Meanwhile, the most predominant factor in differential effect across the three regions is unmeasured factors.

Conclusions: There were positive changes in the progress of skilled delivery and antenatal care after the initiation of maternal health programs in Indonesia. Differences in maternal characteristics between the lower and higher family wealth groups in Indonesia were the main contributors to the persisting differences by family wealth in skilled facility delivery. These findings can be the basis for designing specific and targeted programs to improve maternal healthcare utilization across different family wealth groups and regions in Indonesia.

To my family.

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KEY TO ABBREVIATIONS

ANC	Antenatal Care
FB	Facility Birth
IDHS	Indonesian Demographic and Health Survey
LMCIs	Low-Middle Income Countries
MMR	Maternal Mortality Ratio
МОН	Ministry of Health
PCA	Principal Component Analyses
PNC	Postnatal Care
SBA	Skilled Birth Attendance
SES	Socioeconomic Status
SFD	Skilled Facility Delivery
SHI	Social Health Insurance
WHO	World Health Organization

CHAPTER 1. INTRODUCTION

1.1. Background

Indonesia ranks fifth in the highest number of maternal mortality, i.e., death during the period of pregnancy, childbirth, or 42 days after delivery (1). Additionally, almost half of Indonesian women reported maternal morbidity during pregnancy and/or labor (2). One strategy to reduce maternal mortality and morbidity is to improve maternal healthcare use (utilization). Compared to other low-middle income countries (LMICs) and other Southeast Asian countries, the maternal healthcare utilization in Indonesia is relatively low (3). The increasing economic inequality (4) and geographical conditions present challenges to improving the equal distribution and quality of maternal healthcare in Indonesia (5,6).

To improve access and distribution of maternal healthcare, the Indonesian government has implemented several national-level maternal health programs (7–9). These programs include the provision of midwives to villages (the Village Midwives Program), the Alert Campaign Program, and the Social Health Insurance Program for the poor and near-poor population. Each of the programs has a specific and distinct aim: the Village Midwives Program aims to improve physical access to healthcare, the Alert Campaign Program aims to improve awareness and engagement of the community in maternal health, and the Social Health Insurance (SHI) Program aims to reduce financial barrier in accessing healthcare, particularly for poor and nearpoor women (7–9).

Previous studies have reported increasing coverage of maternal healthcare in Indonesia since early 1990s (10,11). However, few have examined the increase in relation to the initiation of different maternal health programs in Indonesia. Furthermore, the significant increase in maternal healthcare utilization was not adequately matched by a significant reduction in maternal

mortality ratio (MMR) (3). In 2012, the estimated MMR in Indonesia was still relatively high, approximately 360 deaths/ 100,000 live births (12,13). Most of the maternal deaths happened in women of low socioeconomic status and women who lived in the least developed region in Indonesia (13). There also were differences in maternal healthcare utilization by family wealth and region. Women of low SES and women living in the less developed region in Indonesia were less likely to use maternal healthcare (5,13). Furthermore, despite the implementation of the different maternal health-directed programs in Indonesia, persisting differences of maternal healthcare utilization by family wealth and geographic region were still observed (14). Therefore, an assessment of how the progress in maternal healthcare utilization in relation to maternal health program initiation differs by socioeconomic groups and geographic location in Indonesia is needed. Furthermore, understanding the factors that contribute to the persisting gap in maternal healthcare utilization between the lower and higher SES group is also crucial.

1.2. Specific Aims

The specific aims of this dissertation are to examine the following within Indonesia:

- Progress in skilled delivery by family wealth and region in relation to the initiation of different maternal health programs
- 2. Progress in antenatal care (ANC) visits by family wealth and region in relation to the initiation of the Social Health Insurance program
- **3.** The contribution of certain socio-demographic factors in the gaps of skilled delivery utilization by family wealth, within the different regions

CHAPTER 2. LITERATURE REVIEW

2.1. Maternal Health

Maternal health remains a challenge in public health, specifically in developing countries. Maternal health covers a period of pregnancy, delivery, and postpartum (six weeks after delivery) (15). During this period, women experience biological and psychological changes and complications can result in death. Globally, there were an estimated 275,000 maternal deaths in 2015 (16). Approximately 99% of maternal deaths happened in low or low-middle income countries (17). Furthermore, in this setting, around 2% of women experience severe maternal complications and almost 50% of women report experiencing some form of morbidity during pregnancy, delivery, or postpartum (18–20).

The high prevalence of infectious disease and the lack of screening methods for noncommunicable disease are thought to be some of the main reason for the high maternal mortality and morbidity. In addition, the high prevalence of anemia among women of reproductive age adds to the problem. The high mortality and morbidity are amplified by the lack of infrastructure and healthcare providers in these countries. Previous studies have documented lower coverage and quality in maternal healthcare in developing countries relative to high-income countries (21,22). The lack of adequate healthcare facilities and providers makes early detection and immediate treatment for mothers less likely, particularly in a time of emergency (23,24).

2.1.1. Maternal mortality

Maternal mortality is defined as "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental cause" (25). The cause of maternal mortality can be classified into direct causes and

indirect causes. The major direct causes of maternal mortality includes hemorrhage, hypertensive disorders in pregnancy, and infection. Whereas, the indirect causes include HIV-infection, underlying medical conditions including anemia, chronic disease exacerbated by pregnancy, and other diseases (17). There are differences in the causes of maternal deaths and morbidity between developed and developing countries. In developed countries, hypertensive disorders and non-communicable disease become some of the major cause of maternal morbidity and mortality. Whereas in developing countries infection or sepsis and haemorrhage are the main cause of mortality and morbidity (26).

2.1.2. Maternal morbidity

Maternal morbidity is defined as any health condition attributed to and/or complicates pregnancy and childbirth that has a negative impact on a woman's well-being and/or functioning (27). Although morbidity and mortality are closely related, reports have suggested the importance of extending the programs to include prevention and reduction of maternal morbidity. It is estimated that for each maternal mortality, there are 20-30 women with acute or chronic morbidity, which often leads to disability (28). The disability can affect not only the women but also the newborn and family. The additional social and economic cost of the disability signifies the importance of addressing this problem (29,30).

Previous studies reported that 1.7-2.0% of women had severe maternal complications (18,19), while 50.1-53.0% of women had non-life threatening maternal morbidity (20). A hospital-based study in rural Tanzania found that the most prevalent severe maternal morbidity included hypertensive disorders, obstructive labor hemorrhage, and abortion-related complication (31). Whereas in a community-based study in rural Malawi and Pakistan, studies reported a higher prevalence of infection-related morbidity, with approximately one-third of

women experienced this morbidity during the maternal period (20). Several important risk factors for severe maternal morbidity include: 1) obstetric factors, which include parity (32,33) and history of complications in previous pregnancy (19,32–34), and 2) socio-demographic and healthcare factors including younger (19,35,36) or older age (19,32,34–36), poverty (33,37), and less contact with healthcare provider (33,37,38).

2.2. Maternal Healthcare Utilization

The relatively high maternal mortality and morbidity specifically in developing countries present a challenge for intervention. One important strategy is an improvement in coverage and quality of maternal healthcare (39). Previous studies have reported that women who have routine access to healthcare during maternal period have better pregnancy outcome (33,37,38). Access to healthcare increased women's knowledge and awareness of their conditions and improved healthy behavior during pregnancy (40,41). Having skilled healthcare provider during delivery and giving birth in healthcare facility also improves outcome, specifically for high-risk pregnancy. Timely management of delivery and postpartum complications in healthcare settings reduce unnecessary deaths caused by delay in a medical intervention during an emergency (42).

In the maternal period, women have multiple contacts with healthcare provider. During pregnancy, routine prenatal or antenatal care (ANC) is an important service received by the women and is one important component of maternal health. According to World Health Organization (WHO), ANC is defined as the care provided by skilled health-care professionals to pregnant women to ensure the best health conditions for both mother and baby during pregnancy. ANC includes risk identification; prevention and management of pregnancy-related or concurrent diseases; and health education and health promotion (43).

With the characteristics of ANC which requires routine multiple contacts with ANC provider, there are at least two main ways that ANC quality was assessed: 1) assessment of timing and frequency, which often indicates as adequacy, and 2) assessment of the components or content of ANC, which often include timing of the services provided. There has been several standard or criteria developed to assessed adequacy in antenatal care frequency and timing: Kessner index (44), Kotelchuck index (44,45), and WHO standard of ANC visits (46). In low-middle income countries including Indonesia, the WHO standard for ANC visits has been widely used. Research on ANC quality that assesses the timing and frequency of ANC visits often used this standard as the criteria to define adequacy in ANC visits.

The WHO standard of ANC visits has these criteria: one visits during the first trimester, one visits during the second trimester, and two visits during the third trimester. The WHO standard of 4 visits (WHO 4 visits) only classified those meeting the criteria and those who do not meet the criteria. In 2016, the WHO updated their recommendation of ANC visits frequency, by increasing the number of ANC from four to eight visits. Also, the WHO also changed the word 'visit' to 'contact' which infer more interactive and comprehensive care (43). This new standard recommended the first ANC contact within the 12 weeks' gestation, with following contacts taking place at 20, 26, 30, 34, 36, 38 and 40 weeks' gestation (47). In Indonesia, the Ministry of Health (MOH) has recommended a standard procedure for maternal health services, including for ANC. The minimum standard for ANC required four standard visits as recommended by WHO (48,49).

Meanwhile, during delivery, there are two important services: skilled birth attendance (SBA) and facility birth (FB). Skilled Birth Attendance (SBA) is defined as " Delivery by accredited health professionals (midwives, doctors, or nurses) who have been educated and

trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth, and the immediate postnatal period, and in the identification, management, and referral of complications in women and newborn" (50). Facility Birth (FB) is defined as " A birth occurring in health facility of any level from community health center through tertiary facility" (51). After delivery, postpartum women are also recommended to have routine healthcare services. Postnatal Care (PNC) can be defined as " Postnatal check-up by a health professional within 24 hours of delivery followed by at least three additional postnatal contacts are recommended for all mothers and newborns, on day 3 (48–72 hours), between days 7–14, and six weeks after birth" (52).

2.2.1. Trends in healthcare utilization

Previous studies in LMCIs that have assessed the trends in maternal healthcare utilization showed improvement in coverage of different key maternal healthcare indicators, i.e., skilled delivery, antenatal and postnatal care (53). However, there were inconsistencies when looking at the rates by socioeconomic and geographic factors. Several studies found that increasing coverage was followed by the decrease in rich-poor differences in maternal healthcare utilization (21,54–58). Meanwhile, studies in India, Ethiopia, and Nigeria have shown faster improvement in rich women which resulted in a growing gap between rich and poor women (59–61). Also, less focus was aimed at understanding how the progress happened throughout the years and how maternal health programs influenced the changes in healthcare utilization.

The WHO has emphasized the importance of accelerating the equal distribution and access to quality maternal healthcare (62). Therefore, it is important to not only assess progress in coverage but also evaluating the distribution of healthcare by SES and geographic location, and concurrently, assessing factors that might influence these changes.

2.2.2. Determinants of maternal healthcare utilization

Factors related to healthcare utilization can be classified to individual, community, and health provider factors (53,63–65). Individual factors include age, parity, medical needs, cultural and health beliefs, availability of resources, perceived quality of healthcare, and previous experience with a healthcare provider. Community level factors include cultural and health beliefs, community support, and distance or geographical condition to healthcare. Whereas healthcare provider factors include availability and quality resources, including equipment, healthcare professionals, and infrastructure (53,63–65).

Higher economic status and education level were related to higher probability of accessing maternal healthcare (66). Barriers to accessing maternal healthcare for women from low socioeconomic status (SES) were mostly associated with cost, limited resources, as well as health and social belief due to poor education (11,60). There are several potential mechanisms of how SES can affect maternal healthcare utilization: 1) financial resources, 2) physical access to resources (geographical), 3) health belief, knowledge, and perception. First, financial barrier, which includes mainly healthcare and transportation cost, is an important potential mechanism of maternal healthcare utilization inequality by SES (51,67). Figure 2.1. depict the interplay between the individual, family, and community level variable for utilization of maternal healthcare, which include the availability and distribution of resources, healthcare financing, referral system, and legislation (Figure 2.1).



Figure 2.1. The conceptual framework of maternal healthcare determinants (D'ambruoso, 2009).

2.2.3. Maternal healthcare utilization in Indonesia

In Indonesia, the government has implemented several national level program to improve maternal healthcare utilization (68). These programs include village midwives provision, *Suami Siaga* (husband's empowerment), and health insurance programs (69–71). The Village Midwife Program (1991) has improved the SBA utilization, with the highest benefit in poor women (11). Higher midwives density also increased the odds for C-section and SBA (72). However, previous reports showed persistent economic and geographic differences in healthcare utilization in Indonesia (5,73). Also, there was limited information on how this program affects other maternal healthcare services uptake, nor utilization in different regions.

In 1998, the Indonesian government initiated a program to improve awareness on maternal health (Alert Campaign). It started with the *Suami Siaga* (Alert Husband) Program which aimed

to improve husband's awareness on maternal health (14). This program was expanded to *Desa Siaga* (Alert Village) in 2006 (69). To address the financial barrier to healthcare, the government had also initiated the Asuransi Kesehatan untuk yang Miskin (Askeskin) or the Social Health Insurance (SHI) Program in October 2004. This program initially targeted the poor and was then expanded to the near-poor population. In 2012, it was reported that 37% of citizen had insurance membership, either through the national SHI scheme, employer or civil servant scheme, or private insurance (13). In the lower SES group, SHI is the predominant health insurance scheme (13,71). With the goal of achieving Universal Health Coverage (UHC) in Indonesia, information on how the SHI program affects progress in maternal healthcare utilization is needed (9).

To date, information on the effect of these programs on skilled delivery utilization is limited. Previous studies reported an increase in SBA utilization (71) and facility birth (71,74) with Social Health Insurance Program. However, these studies did not address the differences in utilization by SES and region, nor the effect of health insurance on progress in antenatal care. Therefore, they provided limited understanding on how health insurance affects healthcare utilization in other SES groups in the different region of Indonesia, and different other maternal healthcare services, i.e., antenatal care (ANC) and/or postnatal care (PNC).

Each of this program has distinct characteristics, aims, and target. The village midwife program aims to address the physical barrier of maternal healthcare by providing access to midwife within the village in Indonesia (7). This program is especially important in rural and remote area of Indonesia, where distance is a major barrier to accessing maternal healthcare, particularly during delivery (67,75). The Alert Campaign Program which engaged husband, family, and community in maternal health, aims to share the responsibility of maternal healthcare (76). The Alert Campaign primarily focuses on ensuring that each woman has the necessary support during their pregnancy and delivery, particularly, in accessing necessary antenatal care visits, skilled delivery, and postnatal care (8,77). The SHI program addresses the financial barrier to maternal healthcare among the poor and near-poor women in Indonesia (70).

Despite the national level program implementation, the rollout, as well as the capacity to implement each of the program, differ by region, as well as by individual and community characteristics. Particularly, for a program that requires an active participation of stakeholders, i.e., the Alert Campaign Program. The increasing demand of maternal healthcare due to increased physical access, awareness, and financial capacity needs to be met with adequate healthcare resources. The differences in healthcare availability and capacity across the different region in Indonesia (24,78), present an opportunity to assess the effect of these programs on trends of healthcare utilization in different SES groups and region.

2.3. Research Gaps

The three aims of this dissertation address specific research gaps in maternal healthcare utilization in Indonesia. First, this dissertation aims to examine the progress in skilled delivery utilization in relation to the initiation of three maternal health programs in Indonesia: the Village Midwives, the Alert Campaign, and the Social Health Insurance (SHI). Previous studies that examined Indonesia' trends in maternal healthcare utilization often did not directly consider the timing of different maternal health programs that were implemented (10,11). Studies that did assess maternal healthcare utilization in relation to the maternal health programs were cross-sectional (71,72,74,79,80). Hence, these studies provided limited understanding of whether and how the progress in maternal health utilization changed after each program was initiated.

Second, this dissertation aims to examine the progress in antenatal care (ANC) visits in Indonesia. For this aim, the World Health Organization (WHO) recommendation of a minimum of four (4) antenatal care visits (ANC 4 visits) will be used as the standard (46). This standard also has been adopted by the Indonesian Ministry of Health (MOH) (49,81,82). The ANC 4 visits standard o incorporates the timing and frequency of ANC visits: one visit during the first trimester, one visit during the second trimester, and two visits during the third trimester. A previous study that examined progress in ANC utilization in Indonesia did not use the WHO standard, and therefore, had limited information on timing and frequency of ANC visits (10). Timing and frequency of ANC visits are important factors in ANC adequacy, which is often included in the assessment of ANC quality (44,45,83). In addition, there has been limited evidence of the progress of ANC 4 visits in relation to the implementation of maternal health programs in Indonesia.

Third, this dissertation aims to assess the contribution of different socio-demographic and pregnancy-related factors in the differences of skilled facility delivery (SFD) utilization by family wealth group. The persisting gaps in maternal healthcare utilization across different family wealth groups and regions in Indonesia warrant further investigations into the contributing factors (10,13). In this aim, a decomposition method to assess the contribution of socio-demographic and pregnancy-related factors in the gap in SFD by family wealth was used. In addition to the individual socio-demographic and pregnancy-related factors, the analyses also included a community-level variable that might influence the gap in SFD utilization by family wealth, including the availability of healthcare provider and fertility rate in the area.

2.4. Study Aims /Hypotheses

The specific aims of this dissertation are to examine the following within Indonesia:

 Progress in skilled delivery by family wealth and region in relation to the initiation of different maternal health programs

Hypothesis:

- 1.1. The rate of increase in skilled delivery in poor women is different from richer women, with steeper increase in poor women after implementation of maternal health programs in Indonesia
- 1.2. The rate of increase in skilled delivery in poor women is different from richer women within the three different region in Indonesia, with steeper increase in the more develop regions
- Progress in antenatal care (ANC) visits by family wealth and region in relation to the initiation of the Social Health Insurance (SHI) Program

Hypothesis:

- 2.1. The rate of increase in ANC visits in poor women is different from richer women, with steeper increase in poor women after implementation of SHI in Indonesia
- 2.2. The rate of increase in ANC visits in poor women is different from richer women within the three different region in Indonesia, with steeper increase in the more develop regions

 The contribution of certain socio-demographic factors in the gaps of skilled delivery utilization by family wealth, within the different regions

Hypothesis:

Socio-demographic factors contribute to the gaps in skilled delivery utilization by family wealth, within the different region in Indonesia

CHAPTER 3. THE PATH TO SKILLED DELIVERY IN INDONESIA: TRENDS IN SKILLED DELIVERY AND MATERNAL HEALTH PROGRAM INITIATION

3.1. Abstract

Skilled birth attendance (SBA) and skilled facility delivery (SFD) are important strategies to improve maternal health, particularly in low-middle income countries. In Indonesia, where the prevalence of SBA and SFD have been historically low (35.1% and 20.3% respectively in the 1980s), intervention programs were implemented over the past three decades that might increase SBA and SFD. This study assesses changes in SBA and SFD prevalence following three programs, the Village Midwife (1991), the Alert Campaign (1998), and the Social Health Insurance (SHI) Program (2005).

We used data from six rounds of the Indonesian Demographic and Health Survey (IDHS) covering 105,176 live births from 1986 to 2012. In these data, we measure SBA and SFD (defined here as a facility birth). Using segmented logistic regression in STATA survey (svy) procedure we analyzed: 1) the immediate change (shift in odds of SBA or SFD immediately after each program initiation); and 2) annual trends (change in odds of SBA or SFD per year after each program initiation). We adjusted analyses for socio-demographic characteristics and, in subsequent models, stratified by maternal family wealth and region.

Following the Village Midwife Program, there was a significant *yearly increase* in SBA, aOR per year= 1.12, (95%CI 1.08-1.15), but not in SFD, aOR per year= 1.02, (95%CI 0.99-1.06). After the Alert Campaign there were *immediate increases* in SBA and SFD, aOR=1.30, (95%CI 1.01-1.65), aOR =2.13, (95%CI 1.67-2.74) respectively, and *yearly increases* in SBA and SFD. Significant *yearly increases* in SBA and SFD also were observed after SHI initiation. Differences by family wealth and region were noted particularly for SFD (interaction term

p<0.05). The *increasing trends* of SFD following SHI were more pronounced among women of low socioeconomic status (SES) and women living in Java Bali.

In Indonesia, the annual trend in the proportion of skilled birth attendance and facility deliveries increased following the initiation of maternal health programs. However, the magnitude of these trends varied by women's family wealth and region.

3.2. Introduction

Indonesia is the fourth most populated country in the world; in 2017 there were an estimated 260 million people, 49.6% of which were women. Approximately 54.2% of the women were of reproductive age (84). Globally, Indonesia ranks fifth in the highest number of maternal deaths, which includes deaths during pregnancy, childbirth, and 42 days after delivery (1). Additionally, almost half of Indonesian women reported maternal complications during pregnancy and/or labor (2). Prior studies find that skilled birth attendance (SBA) and giving birth at a healthcare facility (skilled facility delivery, SFD) reduces maternal mortality and maternal morbidity. Motivated by the historically low prevalence of SBA and SFD in Indonesia (35.1% and 20.3% respectively in the 1980s), the government implemented different interventions to improve utilization of SBA and encourage women to deliver at healthcare facilities. These interventions included: 1) Village Midwives Provision; 2)*The Siaga/Alert Campaign* (community empowerment); and 3) Social Health Insurance Programs, SHI (14,69–71).

Though studies have reported overall improvements in SBA and SFD (10,11), few have compared the effects of specific programs or described how these programs impact utilization across socioeconomic and geographic groups. Furthermore, persistent economic and regional differences in maternal healthcare utilization have also been reported (5,73). Indonesia's

increasing economic inequality (4) and its' geographical conditions present challenges to achieving an equal distribution of maternal healthcare (5,6).

This study evaluates Indonesia's progress in SBA and SFD utilization following each of three maternal health programs. Changes in SBA and SFD are further examined by women's socioeconomic status (SES) and by their region to identify groups experiencing the greatest and least progress from these programs.

3.3. Methods

3.3.1. Study design and participants

This study uses data from six rounds of Indonesia Demographic and Health Surveys (IDHS), i.e., 1991, 1994, 1997, 2002, 2007, and 2012. These repeated cross-sectional surveys with multistage sampling designs were conducted to obtain a nationally representative sample of Indonesia. For maternal and reproductive health, the IDHS collected data from women of reproductive age (15-49 years old) who had at least one birth in five years preceding the IDHS survey year. This study included women who gave birth from 1986 through 2012 (n=84,134) and included a total of 112,075 live births. There were missing data from 112 women (0.1%), and 6,899 (6.2%) live births. Therefore, our analyses were conducted on 105,176 live births from 84,022 women.

3.3.2. Variables and measurements

3.3.2.1. Intervention programs

In this study, we examined changes in SBA and SFD trends after the initiation of three separate maternal health programs. The first program, the Village Midwives Provision Program, was implemented at national scale in 1991. During 1991-1998, the government sent over 50,000

midwives to the villages. A longitudinal study on 312 communities in Indonesia found an increasing prevalence of village midwives from 9.6% in 1993 to 50.3% in 2000 (85). The second program, the Alert Campaign Program, started with the Alert Husband campaign in 1998 with the goal of improving husband's involvement in their wife's pregnancy and delivery. The program evolved to Alert Village which involved families and communities in birth preparedness (76). The third national level program was the implementation of Asuransi Kesehatan untuk yang Miskin (Askeskin) or the national Social Health Insurance (SHI) scheme. The SHI was initiated in 2005 and covered the poor, then was expanded for wider coverage in 2008 to cover poor and near-poor (9). The aim was to accelerate progress toward universal health coverage (9,86).

3.3.2.2. Outcome variables

We evaluated two indicators of maternal healthcare utilization during delivery, skilled birth attendance (SBA) and skilled facility delivery (SFD). Skilled birth attendance was defined as delivery attended by a health care professional, either physician, midwife, or nurse. SFD was defined as birth assisted by an SBA at a healthcare facility, either hospital, primary health care setting, or health clinic. SBA and SFD were self-reported by the women as part of the IDHS Survey.

3.3.2.3. Covariates

We considered multiple self-reported socio-demographic variables that could affect healthcare utilization, i.e., mother's age, parity, level of education, and family wealth. In particular, we were interested in women's economic status, defined as family wealth, because we thought the impact of intervention programs on SBA and SFD might vary by family wealth (effect modifier). The family wealth variable incorporated indicators of assets, i.e. house and/or land ownership, water supply, latrine type, vehicle, and electronics ownership. Principal

Component Analyses (PCA) was used to obtain the family wealth quintiles within each IDHS survey year at the household level.

We also examined community-level variables, i.e., region, areas or type of residence (rural/urban), and provincial level fertility rate; these data were obtained from the Indonesian National Bureau of Statistics data. Region was of interest as a potential effect modifier, and for this study we divided Indonesia into three regions based on population density: 1) Java-Bali, which has the highest population density in Indonesia (>500/km²); 2) the more populated other Islands (population density above national average of 112/km², but <500/km²); and 3) the less populated Islands (population density above national average of 112/km²).

3.3.3. Statistical Analyses

We used STATA survey (svy) procedure to incorporate sampling weights in IDHS. Chisquare tests were used to assess the differences in proportion of demographic characteristics and SBA/SFD utilization between groups. Segmented logistic regression models illustrated the progress in SBA and SFD utilization, with each segment representing the period after a particular intervention program was initiated.

The segmented analyses assumed linear yearly trends of SBA and SFD utilization and allowed changes in intercept (immediate change) as well as slope changes (annual trends) after the initiation of the program (Model 1). Interactions between annual trends (slope) and family wealth were examined in a second set of analyses (Model 2). To assess differences in SBA and SFD utilization by family wealth in each region, we used stratified analyses with the 'subpop' option in STATA svy and modeled interactions between annual trends (slope) and family wealth (Model 3) by region. To further depict the trends of SBA and SFD, we presented the weighted proportion of SBA and SFD utilization per year overlaid with the average of the predicted

probability obtained from the segmented logistics regressions of the same year (Figure 3.2 and 3.3). The predicted probabilities from Model 2 were used to obtain an overall estimate of SBA and SFD in Indonesia by wealth (Figure 3.2.a and 3.3.a), while predicted probabilities from Model 3 were used to obtain the estimates of SBA and SFD by wealth and region (Figure 3.2.b-d and 3.3.b-d).

Figure 3.1. Illustration of segmented regression showing the possibility for 1) intercept changes (immediate changes after the program implementation) and 2) slope changes (changes in annual trends after the program implementation)



3.4. Results

There have been significant socio-demographic changes in Indonesia from IDHS 1991 to IDHS 2012 (Table 3.1). The mean age at birth increased significantly from 26.1 to 28.0 years, and mean parity declined significantly from 3.1 to 2.2. There also were significant changes in family wealth distribution; the proportion of women considered low SES decreased throughout the IDHS survey years and the proportion of women categorized as high SES increased. The

proportion of women completing secondary school and receiving a college-level diploma increased as did the proportion of women living in urban areas. The percent of women having SBA deliveries increased significantly from 35.1% in IDHS 1991 to 83.7% in IDHS 2012. After having a slight decrease in SFD from 20.3% in IDHS 1991 to 17.1% in IDHS 1994, SFD showed increasing trends through IDHS 2012 (63.5%).

Table 3.1	. Demographic c	haracteristics	, SBA an	d SFD amo	ong IDHS re	espondents	1991-201	2	
								-	

Characteristics	1991	1994	1997	2002	2007	2012	P value
Total women	11610	14875	13731	13265	15334	15207	84022
Total live births	15694	19477	17444	16030	18645	17886	105176
Continuous variable (weight	ted mean, SE)						
Age	26.2 (0.5)	26.6 (0.5)	26.9 (0.5)	27.5 (0.5)	27.7 (0.5)	28.1 (0.5)	0.01
Parity	3.1 (0.2)	3.0 (0.2)	2.8 (0.2)	2.5 (0.1)	2.4 (0.1)	2.2 (0.1)	0.02
Categorical variable (weight	ted %, SD)						
Age							
< 20 years	13.5 (0.4)	13.6 (0.4)	11.8 (0.4)	8.6 (0.4)	8.6 (0.3)	7.0 (0.5)	<.001
20-35 years	78.2 (0.5)	76.5 (0.5)	77.8 (0.5)	79.0 (0.5)	79.3 (0.5)	79.3 (0.4)	
> 35 years	8.3 (0.3)	10.0 (0.3)	10.4 (0.3)	12.4 (0.4)	12.1 (0.4)	13.7 (0.4)	
Parity							<.001
1	27.2 (0.6)	29.9 (0.6)	32.1 (0.6)	34.5 (0.7)	34.9 (0.6)	38.4 (0.6)	
2	21.9 (0.5)	22.0 (0.5)	24.1 (0.6)	27.5 (0.7)	27.8 (0.6)	30.3 (0.6)	
>2	50.9 (0.6)	48.1 (0.6)	43.9 (0.6)	38.0 (0.7)	37.3 (0.6)	31.2 (0.2)	
Twin births							
Singleton	98.6 (0.1)	98.5 (0.1)	98.2 (0.2)	98.4 (0.2)	98.8 (0.1)	98.4 (0.1)	
Twin	1.4 (0.1)	1.5 (0.1)	1.8 (0.1)	1.6 (0.1)	1.2 (0.1)	1.6 (0.1)	
Family wealth							0.003
Poorest	22.2 (0.5)	21.9 (0.5)	21.5 (0.5)	22.4 (0.5)	21.4 (0.5)	20.5 (0.4)	
Poorer	21.0 (0.5)	21.2 (0.5)	21.1 (0.5)	19.3 (0.6)	19.9 (0.5)	19.5 (0.5)	
Middle	20.5 (0.5)	20.0 (0.5)	20.1 (0.5)	20.2 (0.6)	20.0 (0.5)	19.9 (0.5)	
Richer	20.0 (0.5)	19.2 (0.5)	19.9 (0.6)	19.6 (0.6)	19.5 (0.5)	21.0 (0.5)	
Richest	16.3 (0.5)	17.6 (0.4)	17.4 (0.5)	18.4 (0.6)	19.1 (0.5)	19.1 (0.5)	
Education							<.001
Primary school/less	77.7 (0.5)	71.6 (0.5)	66.5 (0.6)	53.1 (0.7)	44.4 (0.6)	34.0 (0.6)	
Secondary school	20.4 (0.5)	25.5 (0.5)	30.0 (0.6)	40.9 (0.7)	47.7 (0.6)	54.1 (0.6)	
College and higher	1.9 (0.2)	2.9 (0.2)	3.5 (0.2)	6.0 (0.3)	7.9 (0.3)	11.9 (0.4)	
Region*							<.001
Java Bali	59.2 (0.6)	60.7 (0.5)	59.1 (0.6)	59.2 (0.7)	57.2 (0.6)	56.5 (0.5)	
More populated other islands	22.3 (0.4)	21.7 (0.4)	22.8 (0.4)	24.1 (0.5)	21.6 (0.4)	21.6 (0.4)	
Less populated other islands	18.5 (0.3)	17.6 (0.3)	18.2 (0.3)	16.7 (0.3)	21.2 (0.4)	21.9 ().3)	
Area							<.001
Urban	29.0 (0.6)	28.4 (0.6)	27.3 (0.6)	46.8 (0.7)	42.0 (0.6)	49.7 (0.6)	
Rural	71.0 (0.6)	71.6 (0.6)	72.7 (0.6)	53.2 (0.7)	58.0 (0.6)	50.3 (0.6)	
Healthcare utilization							
SBA	35.1 (0.5)	40.1 (0.5)	49.1 (0.6)	66.9 (0.6)	73.0 (0.5)	83.7 (0.4)	<.001
SFD	20.3 (0.4)	17.1 (0.4)	20.1 (0.4)	40.3 (0.6)	46.5 (0.6)	63.5 (0.5)	<.001

		Skilled Birth Attendance		Safe Facili	ty Delivery
Variable	n live births	Crude Odds Ratio	Adjusted Odds Ratio (a)	s Crude Odds Adjusted Ratio Ratio	
Immediate Change					
In 1991 (Village Midwife)		1.03 (0.93-1.14)	0.99 (0.88-1.11)	0.91 (0.80-1.03)	0.82 (0.71-0.95)
In 1998 (Alert Campaign)		1.35 (1.06-1.71)	1.30 (1.01-1.65)	1.92 (1.52-2.42)	2.13 (1.67-2.74)
In 2005 (SHI)		1.05 (0.92-1.19)	1.03 (0.88-1.20)	1.04 (0.93-1.16)	1.05 (0.92-1.21)
Annual Trends		. ,	. ,	. ,	. ,
1986-1990	19195	1.03 (0.99-1.07)	1.04 (1.00-1.08)	0.96 (0.92-1.01)	0.95 (0.91-0.99)
1991-1997	33460	1.12 (1.09-1.15)	1.12 (1.08-1.15)*	1.07 (1.04-1.10)*	1.02 (0.99-1.06)*
1998-2004	24722	1.06 (1.02-1.10)	1.07 (1.02-1.11)	1.05 (1.01-1.09)	1.07 (1.03-1.11)
2005-2012	27799	1.15 (1.11-1.18)*	1.15 (1.12-1.19)*	1.16 (1.13-1.19)*	1.21 (1.17-1.24)*

Table 3.2. Multivariable segmented logistic regression for safe facility delivery (SFD) and Skilled Birth Attendance (SBA) in Indonesia

a) Model adjusted for age, parity, family wealth, level of education, twin pregnancy, provincial fertility rate, region and area of residence (rural/urban)

*) Significant different in annual trends compared to annual trends in the previous period

3.4.1. The Village Midwife Program (1991)

The multivariable segmented logistic model showed a significantly *increasing annual trend* in SBA utilization, aOR per year =1.12 (95%CI 1.08, 1.15), but not in SFD, aOR per year =1.02 (95%CI 0.99, 1.06) after 1991, the year of the Village Midwife program initiation (Table 3.2). These annual trends were significantly higher than trends before the Village Midwife program began (p <0.05). In models that included interaction terms for family wealth, (Table 3.3, Figure 3.2 and 3.3), there were no significant *immediate changes* in SBA or SFD after the start of the Village Midwife program. There were, however, significant *increasing trends* for SBA utilization, and the trend increases were more pronounced among women of lower SES compared to women of higher SES (effect modification p < 0.05). Although not significant, there also were *increasing trends* of SFD, particularly for the lower four quintiles of family wealth.

Analyses assessing region and family wealth suggested there also were geographic differences in SBA and SFD trends (effect modification by region p < 0.05). The *increasing annual trends* in SBA and SFD were more pronounced in the more-populated and less-populated regions compared to Java Bali. In these more-populated and less-populated regions, annual trend

increases were greatest among women of lower SES compared to women of higher SES (Appendix 2).

3.4.2. The Alert Campaign (1998)

Following the Alert Campaign there was a significant increase in SBA and SFD utilization *immediately after initiation*, adjusted Odds Ratio (aOR) =1.30 (95%CI 1.01, 1.65), and aOR = 2.13 (95%CI 1.67, 2.74) respectively (Table 3.2), and ongoing, there were significant *increasing trends* in both SBA and SFD. In models with family wealth interaction terms, there was a significant *immediate* change in SFD utilization, aOR= 2.11 (95%CI 1.65, 2.72), but the *immediate* change in SBA was not statistically significant (Table 3.3). There were *increasing trends* in SBA and SFD utilization, particularly among women in the lowest three family wealth quintiles.

By region, there were increasing *immediate* changes in SBA after the Alert Campaign in Java Bali and in less populated other islands. This immediate change was not observed in morepopulated other islands (Appendix 1). By contrast, the *immediate* increase in SFD was observed in both Java Bali and the more-populated other islands (Appendix 2). Although not significant, there were *increasing annual trends* in SBA and SFD utilization after Alert Campaign Program in all regions in Indonesia (Appendix 1-2, Figure 2-3).

3.4.3. The SHI program (2005)

There were significant *increasing trends* in SBA and SFD after the SHI program; these trends were more pronounced than those following the Alert Campaign (Table 3.2). The *annual trends* after the SHI initiation were significantly higher than those in the period that predated SHI initiation (1998-2004). In models with family wealth interaction terms there were no significant *immediate* changes in SBA and SFD after SHI initiation. However, there were significant

increasing annual trends for both SBA and SFD, particularly SFD utilization. Women in the

three middle quintiles of family wealth had the higher increase in SBA, while women in the

lowest four quintiles had higher increasing annual trends of SFD (Table 3.3).

Table 3.3. Multivariable survey logistic regression for Skilled Birth Attendance (SBA) and Skilled Facility Delivery (SFD) with family wealth interaction

		S	BA	SFD		
Variable	h live births	Crude Odds Ratio	Adjusted Odds Ratio ^(a)	Crude Odds Ratio	Adjusted Odds Ratio ^(a)	
Immediate Change						
In 1991 (Village Midwife)		1.03 (0.91-1.16)	0.92 (0.87-1.12)	0.87 (0.76-1.33)	0.81 (0.70-0.94)	
In 1998 (Alert Campaign)		1.46 (1.38-1.88)	1.25 (0.98-1.60)	2.36 (1.84-3.03)	2.11 (1.65-2.72)	
In 2005 (SHI)		1.07 (0.93-1.24)	1.03 (0.89-1.21)	1.08 (0.95-1.22)	1.23 (1.11-1.37)	
Trends in family wealth						
1986-1990		**	**	**	**	
Poorest	4474	1.08 (0.99-1.18)	1.08 (0.99-1.17)	1.12 (0.97-1.30)	1.12 (0.96-1.29)	
Poorer	4027	1.14 (1.06-1.24)	1.14 (1.05-1.23)	1.11 (0.98-1.26)	1.10 (0.97-1.24)	
Middle	3735	1.05 (0.99-1.12)	1.02 (0.96-1.09)	1.02 (0.93-1.10)	0.98 (0.90-1.07)	
Richer	3591	1.05 (0.99-1.12)	1.03 (0.96-1.10)	0.96 (0.90-1.03)	0.92 (0.86-0.99)	
Richest	3368	1.03 (0.95-1.13)	1.02 (0.96-1.08)	0.91 (0.84-0.97)	0.90 (0.84-0.97)	
1991-1998		**	**	**	**	
Poorest	9366	1.18 (1.13-1.24)	1.15 (1.09-1.20)	1.08 (1.01-1.17)	1.04 (0.97-1.12)	
Poorer	6619	1.17 (1.12-1.22)	1.14 (1.09-1.19)	1.13 (1.07-1.20)	1.06 (0.99-1.10)	
Middle	6155	1.16 (1.12-1.21)*	1.13 (1.08-1.18)*	1.12 (1.07-1.17)	1.04 (0.99-1.10)	
Richer	5630	1.10 (1.05-1.15)	1.09 (1.04-1.14)	1.07 (1.02-1.11)*	1.02 (0.98-1.07)	
Richest	5690	1.04 (0.98-1.10)	1.02 (0.96-1.08)	1.04 (0.99-1.09)*	0.99 (0.95-1.04)	
1998-2004		**	**	**	**	
Poorest	8015	1.03 (0.99-1.08)*	1.05 (1.01-1.10)*	1.05 (1.00-1.11)	1.08 (1.02-1.14)	
Poorer	4820	1.07 (1.02-1.12)*	1.07 (1.01-1.12)	1.07 (1.02-1.12)	1.08 (1.03-1.14)	
Middle	4060	1.08 (1.02-1.14)	1.08 (1.02-1.15)	1.05 (1.00-1.10)	1.06 (1.01-1.12)	
Richer	3868	1.09 (1.02-1.16)	1.07 (0.99-1.14)	1.04 (0.99-1.09)	1.04 (0.98-1.09)	
Richest	3959	1.06 (0.98-1.15)	1.07 (0.98-1.16)	1.08 (1.02-1.13)	1.10 (1.05-1.16)*	
2005-2012		**	**	**	**	
Poorest	8441	1.12 (1.08-1.17)*	1.11 (1.07-1.16)*	1.22 (1.17-1.28)*	1.21 (1.16-1.27)*	
Poorer	5552	1.21 (1.15-1.27)*	1.20 (1.14-1.26)*	1.25 (1.19-1.30)*	1.24 (1.19-1.30)*	
Middle	4987	1.20 (1.16-1.28)*	1.18 (1.11-1.26)	1.18 (1.13-1.24)*	1.18 (1.13-1.23)*	
Richer	4606	1.20 (1.11-1.30)	1.20 (1.10-1.31)	1.22 (1.16-1.29)*	1.24 (1.17-1.10)*	
Richest	4213	1.20 (1.11-1.30)	1.11 (0.98-1.26)	1.06 (1.00-1.13)	1.06 (1.00-1.13)	

a) Obtained from model 2 (family wealth-time segments interaction), adjusted for age, parity, twin pregnancy, level of education, provincial fertility rate, region and area of residence (rural/urban)

*) Significant different in annual trends compared to annual trends in the previous period for each family wealth quintile group

**) Significant family wealth-time segments interaction (significant different in annual trends by family wealth), p < 0.05

Looking at family wealth and within the region, there were significant increases in yearly trends for SBA and SFD utilization in all regions and all quintiles of family wealth. For both SBA and SFD, the highest increase in annual trends was observed in women living in Java-Bali, particularly among women of low SES (Appendix 1-2, Figure 2-3). For women of low SES living in Java-Bali, the increasing annual trends after SHI initiation were significantly different from trends of the previous period (1998-2004).

3.5. Discussion

This study demonstrates the progress (through 2012) towards skilled delivery in Indonesia, with increasing trends in utilization of SBA and SFD after implementation of the three maternal health programs. Though we observed positive changes after program initiation across all family wealth and region, the magnitude of change in SBA and SFD differed by family wealth and region. After the initiation of a program aimed directly at improving distance/physical access to skilled healthcare, the Village Midwives Program, we observed the greatest increase in the progress of SBA and SFD utilization for women of lower SES, particularly women living in the more and less-populated other islands of Indonesia. Following the initiation of the Social Health Insurance (SHI) Program, aimed at reducing financial barriers to skilled deliveries, the greatest magnitude of change was also observed in women of lower SES, but particularly women living in Java-Bali, the most populated islands in Indonesia.

Our findings corroborate previous reports showing positive effects of maternal health programs on the utilization of skilled deliveries. After implementation of the Village Midwife program in Indonesia, Hatt et al. observed increasing SBA and C-section utilization, (11), while other studies reported increasing odds of reproductive healthcare (85,87). In our study, we showed the influence of the Village Midwives Program on SBA was more pronounced in the less densely populated region. In these regions, geographical and physical access are important barriers to healthcare utilization (6,88). A greater density of midwives, particularly in rural areas,

is an important factor in improving SBA utilization during delivery (72,89). Although less pronounced, there were also increasing trends of SFD utilization, particularly in women of lower SES. Provision of village midwives were usually followed by formation of village health post, which might attract women to deliver at health facility (i.e. village health post) due to its proximity (7). Therefore, the Village Midwives Program significantly accelerated the progress in skilled deliveries utilization in these less developed regions.

There were significant immediate increases in SBA and SFD utilization after the Alert Campaign Program (1998), which persisted even after adjustment for socio-demographics factors. These observed changes may be 'artifacts' of the survey methodology or represent real immediate change. Questions on delivery experience differed between the first three IDHS (1991, 1994, 1997) and the later three IDHS (2002, 2007, 2012). The three more recent IDHS included probing questions and more classification of persons assisting delivery and place of delivery. Furthermore, the three more recent IDHS required the interviewer to write the specific location of the delivery, whereas the previous IDHS did not. The five-year interval of the more recent IDHS surveys might also have contributed to the observed immediate increase; women who gave birth in 1998 had to recall their experience 4-5 years later in the IDHS survey. Though we did not see a similar occurrence in the other IDHS survey years, the possibility of recall bias cannot be excluded. If the immediate changes in SBA and SFD were the result of study design, we would expect the effect to be consistent across all family wealth and region subgroups. However, we mainly observed these immediate changes in the more developed region where improved awareness on the importance of facility delivery is met with the relatively higher availability and proximity to a healthcare facility. This might suggest that in fact, the immediate change was real.
Though there were immediate increases in SBA and SFD utilization after the Alert Campaign Program, thereafter the SBA and SFD annual trends were non-significant. One explanation is that this program had a short term effect in increasing SBA and SFD utilization, but did not have a long term effect. Another probablity, is that this program overlapped with an economic crisis in Indonesia which started in 1998. Previous studies have reported that the economic crisis reduced household expenditures in Indonesia, including for healthcare expenses (90–92). In addition, the social safety net that was immediately implemented to protect the poor was not well targeted (92,93). Other studies evaluating the Alert Campaign Program have found it increased awareness of the importance of maternal healthcare among husbands and communities (8,14), and increased husband's presence during antenatal care visits, but had no significant effect on SFD (80).

Our findings are in agreement with other studies (94,95) showing significant progress in SBA and SFD utilization in all regions of Indonesia after implementation of the SHI, which was designed to reduce financial barriers in accessing healthcare for poor and near-poor populations in Indonesia. By examining this progress across regions, we were able to detect the greatest annual increase in SBA and SFD utilization in Java-Bali islands compared to other islands.

Our study demonstrated differences in trends of SBA and SFD by family wealth and within different regions of Indonesia. Previous studies assessing trends in maternal healthcare utilization in LMCIs have produced inconsistent results when considering the socioeconomic status and geographic factors. Several studies have reported that increasing utilization of maternal healthcare utilization (21,54–58). By contrast, studies in India, Ethiopia, and Nigeria observed faster improvement in maternal healthcare utilization by rich women which resulted in a growing gap between rich and

poor women (59–61). Our study showed increasing coverage of SBA and SFD utilization, with faster improvement in the lower SES groups. The improvement was particularly pronounced after the initiation of the pro-poor program, i.e., the SHI. The faster progress in the lower SES groups might reduce gaps in skilled deliveries between the lower and higher SES groups and move Indonesia towards the goal of achieving equal distribution in skilled delivery (62).

With the consideration of family wealth and region in our analyses, our finding can further guide policy makers in designing targeted interventions to the vulnerable population, i.e. those who have shown slower progress in healthcare utilization. In relation to initiation of the Universal Health Coverage (UHC) program in 2014 (78), special consideration should be given to women living outside of Java-Bali who have shown slower progression in skilled delivery compared to women living in Java-Bali. In these other regions, we have shown that programs that can further reduce physical barriers and improve the accessibility of healthcare are crucial, in addition to reducing the financial barrier to skilled deliveries.

This study has several limitations worth noting. First, we used repeated cross-sectional surveys with self-reported questionnaires. The accuracy of self-reported SBA and SFD might vary by economic or education level, or by the interval between the year of delivery and year of survey. Although delivery is an important life event and it is not likely respondents forget where they gave birth or who helped them during the delivery, we cannot totally exclude this possibility. Second, the observed changes in SBA and SFD after a program implementation cannot confidently be attributed to the program because other important events/changes during the period might also influence healthcare utilization. Although we have adjusted for different socio-demographic factors that might affect SBA and SFD, there might still be persisting factors that affect utilization during this period.

Despite this limitation, this study makes important contributions. First, it describes changes in healthcare utilization following each of three maternal health programs by using segmented regression analyses which produce a clearer understanding of the changes in relation to timing of program initiation; this approach provides an opportunity to observe a baseline trend (preintervention slope) and compare it to the trend after the program (post-intervention slope). Second, it considers family wealth and regions in Indonesia, thereby providing information on groups experiencing the greatest and least changes following the initiation of the three programs we examined. Third, it examines progress in skilled deliveries following three national-level maternal health programs in Indonesia: one aimed at reducing physical barriers to healthcare, particularly in rural and remote areas; another designed to improve awareness and promote shared responsibility in maternal health; and a third aimed at reducing financial barriers to healthcare particularly for poor and near-poor population. Documenting the distinct characteristics of the three programs and how each might have affected different groups in Indonesia provides information for future program planning.

3.6. Conclusion and Further Recommendation

There were increasing annual trends of skilled birth attendance and skilled facility delivery in Indonesia from 1986-2012. These increases were more pronounced after the initiation of the Village Midwife and SHI Programs. There were differences in the progress of SBA and SFD utilization by family wealth and region, with the greatest changes experienced by women of lower SES. Women in the less populated regions in Indonesia had greater changes following programs that improved physical access to healthcare. Following the initiation of programs designed to reduce financial barriers to skilled deliveries, the greatest changes in annual trends of SFD and SBA utilization were observed in the most populated region in Indonesia i.e. Java-Bali. These findings indicate the needs to further improve physical access to maternal healthcare particularly outside of Java-Bali, while simultaneously improving financial capability by providing SHI scheme for women with lower SES. Further research to assess the interplay between different factors affecting skilled deliveries is also important, particularly to promote equal distribution of healthcare utilization by socioeconomic and geographic condition in Indonesia.



poorest * poorer 🔺 middle 🔸 richer 🔹 richest — poorest — poorer — middle — richer — richest

Figure 3.2. Annual trends of SBA utilization by family wealth and region a Annual trends of SBA utilization by family wealth in Indonesia

b Annual trends of SBA utilization by family wealth in Java Bali





d. Annual trends of SBA by family wealth in less populated other islands



Notes:

The vertical lines represent the year of the program initiation (i.e. Village Midwives (1991), Alert Campaign (1998), and Social Health Insurance (2005))

The dots represent the weighted proportion of SBA utilization in the family wealth group per year

The lines represent the weighted average of predicted probability from Model 2 and 3





poorest * poorer * middle • richer • richest - poorest - poorer - middle richer richest



b. Annual trends of SFD by family wealth in Java Bali

🔹 poorest 🗶 poorer 🔺 middle 🔸 richer 🔹 richest — poorest — poorer — middle — richer — richest



Figure 3.3 (cont'd) c. Annual trends of SFD by family wealth in more developed other islands





d. Annual trends of SFD by family wealth in less developed other islands

Notes:

The vertical lines represent the year of the program initiation (i.e. Village Midwives (1991), Alert Campaign (1998), and Social Health Insurance (2005))

The dots represent the weighted proportion of SFD utilization in the family wealth group per year

The lines represent the weighted average of predicted probability from Model 2 and 3

CHAPTER 4. INDONESIA'S SOCIAL HEALTH INSURANCE PROGRAM AND TRENDS IN ANTENATAL CARE BY FAMILY WEALTH AND REGION

4.1. Abstract

In 2012, almost 96% of Indonesian women received at least one antenatal care (ANC) visits. However, fewer women received the recommended four ANC visits (ANC 4 visits) at the appropriate time. Furthermore, there were differences in ANC 4 visits utilization by family wealth and region. This study assesses progress in ANC 4 visits (longstanding WHO minimum) by family wealth and region in relation to the initiation of Social Health Insurance (SHI) Program in Indonesia (2005), and considers progress in ANC 8 visits, the new WHO recommendation introduced in 2016.

We analyzed data from the three most recent rounds of the Indonesian Demographic and Health Survey (IDHS) covering 36,598 women who gave birth between 2001-2012. Using segmented logistic regression in STATA survey (svy) procedure we analyzed: 1) the immediate change (shift in odds of SBA or SFD after each program's initiation); and 2) annual trends (change in odds of SBA or SFD per year after each program's initiation). We adjusted analyses for certain socio-demographic characteristics and, in subsequent models, stratified by maternal family wealth and region.

Following the SHI initiation there was a significant increasing annual trend in ANC 4 visits from 2005-2008, aOR per year =1.11 (95%CI 1.01, 1.21), but not in ANC 8 visits, aOR per year =1.00 (95%CI 0.89, 1.13). Th increasing annual trend in ANC 4 was not statistically different from the annual trend before SHI initiation (p > 0.05). In segmented analyses, ANC 4 peaked in 2008, then was a decreasing annual trend between 2008 to 2012 (aOR per year 0.91, 95%CI 0.87-0.95). When evaluating a potential interaction by family wealth, the significant increase from 2005 to 2008 was most evident in the lower family wealth groups. Stratifying by region, the pattern was similar across the regions. The level of ANC 8 visits was low across different family wealth groups and region in Indonesia, with less than 30% of women receiving the new standard of ANC 8 visits.

Our study found short-term positive increase after the initiation of the SHI Program in Indonesia, which were followed by decreasing trends. Although we cannot confidently exclude data artifact, the decreasing trends and the low level of ANC 8 visits in Indonesia warrant concern and new interventions.

4.2. Introduction

Globally there have been reports of the discrepancy between improvement in coverage of maternal healthcare and the outcome of maternal health (96,97). Several countries, including Indonesia, have seen a significant increase in healthcare utilization but shown relatively slower improvement in maternal health indicators, particularly, maternal mortality (98–100). These discrepancies might reflect a gap between fast improvement in healthcare utilization which is not matched by an improvement in quality (101), and also an unequal distribution of maternal healthcare (62). Antenatal Care (ANC) is one of the key healthcare indices during the maternal period. ANC provides an opportunity for women to have contact with a healthcare provider for primary prevention or early detection of maternal complications (40,102,103). Timing and frequency, often referred to as adequacy, of ANC visits are important indicators to be considered (104–106). In low and middle-income countries (LMCIs), including in Indonesia, the most widely used standard for timing and frequency of ANC is the WHO recommendation (49,81,82,107). This recommendation was introduced in the early 1990s and required a minimum

of four ANC visits (ANC 4 visits), with at least one visit during the first trimester, one visit during the second trimester, and two visits during the third trimester (46).

Although almost 96% of pregnant women in Indonesia had at least one ANC visit during pregnancy in 2012, only 77% completed the recommended ANC 4 visits (10,13). This suggests that much more work needs to be done to evaluate and address the adequacy of ANC visits. In addition, previous studies have reported significant differences in ANC utilization by family wealth and region (10,73). However, these studies captured ANC at one-time point with a variety in the measurement of ANC visits, or were less focused on assessing the timing of the ANC visits. With the initiation of Social Health Insurance (SHI) Program in Indonesia in 2005, it is important to examine changes in the proportion of births with ANC 4 visits over time and how trends in the proportion might differ by socioeconomic status and geographic region. In 2016, the WHO updated the recommendation for ANC by increasing the number of visits to eight visits (43). Therefore, assessment of ANC 8 visits goal in Indonesia is also needed for program recommendations. This study examines the progress of antenatal care visits in Indonesia in relation to SHI initiation and compares progress across maternal family wealth groups and region.

4.3. Methods

4.3.1. Setting and participants

This study uses data from three rounds of Indonesia Demographic and Health Surveys (IDHS), i.e., 2002, 2007, and 2012. These repeated cross-sectional surveys with multistage sampling designs were conducted to obtain a nationally representative sample of Indonesia. The IDHS collected data from women of reproductive age (15-49 years old) who had at least one

birth in five years preceding the IDHS survey year. This study included women who gave birth from 2001 through 2012 (n= 37,850), with information on ANC visits on their index birth (the most recent birth). There were relatively low missing data on ANC visit (n missing=1,252 6.4%). Our analytic sample consists of 36598 women.

4.3.2. Variables and measurements

4.3.2.1. Social Health Insurance Program

In 2005, the Indonesian government initiated the Asuransi Kesehatan untuk yang Miskin (Askeskin) or the national Social Health Insurance (SHI) scheme for the poor. The SHI is a national-level program that initially covered the poor, and was then expanded for wider coverage in 2008 to cover poor and near-poor. The aim was to accelerate progress toward universal health coverage in Indonesia (9,86). This study assessed the progress of ANC 4 visits, particularly, whether there were changes after the initiation of SHI program.

4.3.2.2. Dependent Variables

Indonesia adopted the WHO standard for frequency and timing of ANC visits, which required four antenatal care visits during pregnancy: once during the first trimester, once during the second trimester, and twice during the third trimester (107,108). In 2016, the WHO updated the ANC recommendation by requiring a minimum of eight ANC visits. These visits include the first contact in the first 12 weeks' gestation, with subsequent contacts at 20, 26, 30, 34, 36, 38 and 40 weeks' gestation (43). However, due to the data collection methods in IDHS, these criteria can only be implemented as follows: the first contact in the first trimester, two visits in the second trimester, and five visits in the third trimester (Table 1). In this study, we examined progress in the coverage of ANC 4 visits before and after the initiation of SHI and assessed if the

progress differs by family wealth and region. Also, this study provides a description of ANC 8 visits coverage in Indonesia.

Table 4.1. WHO standards ANC criteria

	Number of Visits						
	First trimester	Second trimester	Third trimester	Total			
Prior to 2016	1	1	2	4			
After 2016	1	2	5	8			

4.3.2.3. Covariates

Our analyses considered several self-reported socio-demographic and pregnancy-related factors that might influence the completion of ANC 4 visits, i.e., mother's age at birth, parity, level of education, pregnancy complications, and family wealth. We excluded women who had missing data on covariates (n = 78 (0.22%)We were particularly interested in economic status, defined as family wealth, as a potential effect modifier. The family wealth variable incorporated indicators of assets, i.e., house and/or land ownership, water supply, latrine type, vehicle, and electronics ownership. Principal Component Analyses (PCA) was used to obtain the family wealth quintiles within each IDHS survey year at the household level.

We also examined community-level variables, i.e., region, areas or type of residence (rural/urban), and provincial level fertility rate; these data were obtained from the Indonesian National Bureau of Statistics data (109). Region was of interest as a potential effect modifier. For this study, we divided Indonesia into three regions based on population density: 1) Java-Bali, which has the highest population density in Indonesia (>500/km2); 2) the more populated other Islands (population density above national average of 112/km2, but <500/km2); and 3) the less populated Islands (population density above national average of 112/km2).

4.3.3. Statistical Analyses

We used STATA survey (svy) procedure to take account of the sampling design in IDHS. Chi-square tests were used to assess the differences in proportion between groups. Segmented logistic regression models illustrated the progress in ANC 4 visits, before and after SHI initiation. Due to the observed decreasing trends after 2008 in our descriptive analyses, we add another segment. Therefore, there are three different segments in the analyses: before 2005, between 2005 and 2008, and after 2008. The analyses assessed: 1) immediate change, evaluated as shift in odds of ANC 4 visits immediately after program initiation and reflected in intercept change from before to after initiation; and 2) annual trends, measured as change in odds of ANC 4 visits per year after SHI initiation with a comparison of pre to postintervention slopes. These two approaches are depicted in Figure 4.1.





The segmented analyses assumed linear yearly trends of ANC 4 visits and allowed changes in intercept (immediate change) as well as slope changes (annual trends) after the initiation of the program, as well as after 2008 (Model 1). Interactions between annual trends (slope) and family wealth were examined in the second set of analyses (Model 2). To assess differences in ANC 4 visits utilization by family wealth in each region, we used stratified analyses with the 'subpop' option in STATA svy and modelled interactions between annual trends (slope) and family wealth by region (Model 3). To further depict the trends of ANC visits, we presented the weighted proportion of ANC visits utilization per year overlaid with the average of the predicted probability obtained from the segmented logistics regressions of the same year (Fig 4.3). The predicted probabilities from Model 2 were used to obtained an overall estimates of ANC visits in Indonesia by wealth (Fig 4.3.a), while predicted probabilities from Model 3 were used to obtained the estimates of SBA and SFD by wealth and region (Fig 4.3.b-d).

4.4. Results

There were significant socio-demographic changes in Indonesia from IDHS 2002 to IDHS 2012 (Table 4.1). The mean age at birth increased significantly from 27.6 to 28.0 years, and mean parity declined significantly from 2.5 to 2.2. There were no significant changes in family wealth distribution between the three IDHS. However, the proportion of women completing secondary school and receiving a college-level diploma increased significantly, as did the proportion of women living in urban areas. In unadjusted analyses, the percent of women having ANC 4 visits increased significantly from 68.3% in IDHS 2002 to 77.7% in IDHS 2012. Meanwhile, there was no statistically significant difference in proportion of births with ANC 8 visits between the three IDHS survey years(Table 4.2).

There were significant increases in utilization of any ANC and ANC 4 visits, but not for ANC 8 visits throughout the three IDHS in Indonesia (Table 4.2). However, significant

differences of ANC utilization by family wealth were observed in the three IDHS survey years,

both for ANC 4 visits and ANC 8 visits (p < 0.05, Figure 4.2).

Table 4.2	2. Demographic	characteristics,	ANC	Visits among	IDHS	2002,	2007	, 2012 rest	pondents
	<i>i i i</i>			1	,			, ,	

Characteristics	IDHS 2002	IDHS 2007	IDHS 2012	P value
Total women	6317	15160	15121	36598
Continuous variable (weighted mean, SE)				
Age	27.6 (0.8)	27.9 (0.5)	28.2 (0.5)	<.001
Parity	2.5 (0.5)	2.4 (0.1) [′]	2.2 (0.1) [´]	<.001
Fertility Rate	2.6 (0.9)	2.7 (1.0)	2.6 (0.6)	0.011
Categorical variable (weighted %, SD)				
Age (weighted %, SD)				<.001
< 20 years	9.1 (0.6)	8.0 (0.4)	7.0 (0.3)	
20-35 years	77.6 (0.9)	78.7 (0.5)	78.6 (0.5)	
> 35 years	13.3 (0.8)	13.3 (0.4)	14.4 (0.4)	
Parity	()	· · · ·		<.001
1	32.6 (1.0)	34.6 (0.6)	37.6 (0.6)	
2	29.4 (1.0)	28.8 (0.6)	31.9 (0.6)	
>2	38.0 (1.0)	36.6 (0.6)	30.5 (0.5)	
Twin births (weighted %, SD)		, , ,		0.288
Singleton	99.0 (0.2)	99.3 (0.1)	99.2 (0.1)	
Twin	1.0 (0.2)	0.7 (0.1)	0.83 (0.1)	
Self-report pregnancy complications	7.8 (0.5)	10.6 (0.4)	12.8 (0.4)	<.001
(weighted %, SD)				
Family wealth (weighted %, SD)*				0.531
Poorest	22.0 (0.8)	21.4 (0.5)	20.4 (0.4)	
Poorer	18.8 (0.8)	19.8 (0.5)	19.5 (0.5)	
Middle	19.8 (0.9)	20.1 (0.5)	19.9 (0.5)	
Richer	20.1 (0.9)	19.5 (0.5)	21.1 (0.5)	
Richest	19.2 (0.9)	19.2 (0.5)	19.1 (0.5)	
Level of Education				<.001
Primary school/less	50.1 (1.1)	44.3 (0.6)	34.0 (0.6)	
Secondary school	43.4 (1.1)	47.8 (0.6)	54.0 (0.6)	
College and higher	6.5 (0.5)	7.9 (0.3)	12.0 (0.4)	
Region				<.001
Java Bali (PD > 500/km²)*	56.5 (1.0)	57.4 (0.6)	56.7 (0.5)	
112 < PD < 500	25.4 (0.8)	21.5 (0.4)	21.6 (0.4)	
PD < 112	18.1 (0.5)	21.1 (0.4)	21.8 (0.3)	
Area (weighted %, SD)				<.001
Urban	46.7 (1.1)	42.1 (0.6)	49.8 (0.6)	
Rural	53.3 (1.1)	57.9 (0.6)	50.2 (0.6)	
Antenatal Care (ANC) visits*				
Any ANC	95.2 (0.5)	95.8 (0.2)	96.9 (0.2)	<.001
ANC WHO (4 visits)	68.3 (1.0)	70.7 (0.6)	77.7 (0.5)	<.001
ANC WHO (8 visits)	20.5 (0.9)	21.2 (0.6)	20.2 (0.5)	0.438



Figure 4.2. Any ANC, ANC 4 visits, ANC 8 visits utilization by family wealth and IDHS in Indonesia

Table 4.3 showed that after SHI initiation in 2005, there was a significant increasing

annual trend in ANC 4 visits utilization after adjusting for multiple covariates, aOR per year

=1.11 (95% CI 1.01, 1.21), but not in ANC 8 visits, aOR per year =1.00 (95% CI 0.89, 1.13).

However, these annual trends were not significantly higher than trends before the SHI program

began (p > 0.05).

maomesia					
Variable		ANC WH	O 4 visits	ANC 8	Visits
		Crude	Adjusted	Crude	Adjusted
Immediate Change					
In 2005		0.82 (0.67-0.99)	0.85 (0.69-1.05)	1.00 (0.78-1.28)	1.17 (0.90-1.51)
In 2008		1.34 (1.10-1.64)	1.41 (1.14-1.74)	1.06 (0.83-1.36)	1.09 (0.83-1.44)
Annual Trends					
2001-2005	12422	1.06 (1.00-1.14)	1.07 (1.00-1.14)	1.01 (0.93-1.09)	0.97 (0.89-1.05)
2005-2008	10505	1.10 (1.01-1.19)	1.11 (1.01-1.21)	0.99 (0.89-1.10)	1.00 (0.89-1.13)
2008-2012	14064	0.93 (0.89-0.97)	0.91 (0.87-0.95)	0.95 (0.90-1.00)	0.96 (0.90-1.02)

Table 4.3. Multivariable segmented logistic regression for ANC 4 visits and ANC 8 visits	s in
ndonesia	

Models were adjusted for age, parity, family wealth, level of education, twin pregnancy, pregnancy complication, provincial fertility rate, provincial desa siaga presence, area of residence (rural/urban), and region

After an immediate increase in ANC 4 visits in 2008 (aOR 1.41, 95%CI 1.14-1.74), a decreasing annual trend in ANC 4 visits was observed between 2008 through 2012 (aOR per year 0.91, 95%CI 0.87-0.95). There was no significant increase in annual trend of ANC 8 visits after SHI initiation in 2005. In 2008, although not significant, there also was an immediate increase in ANC 8 visits, followed by a decreasing trend in ANC 8 visits from 2008 through 2012 (Table 4.3). This trend however, was not statistically significant.

Variable	N	Crude OR (95%CI)	aOR (95%CI)
Immediate change		· · ·	
In 2005 (SHI initiation)		0.81 (0.67-0.99)	0.85 (0.70-1.05)
In 2008 (SHI expansion)		1.37 (1.11-1.69)	1.40 (1.13-1.74)
Annual Trends		ι <i>γ</i>	· · · ·
2001-2005			
Poorest	3686	1.00 (0.92-1.08)	1.00 (0.92-1.09)
Poorer	2461	1.10 (1.00-1.21)	1.09 (1.00-1.20)
Middle	2128	1.13 (1.02-1.26)	1.12 (1.00-1.24)
Richer	2064	1.09 (0.99-1.20)	1.06 (0.96-1.18)
Richest	2083	1.08 (0.93-1.26)	1.07 (0.92-1.24)
2005-2008			· · · · · · · · · · · · · · · · · · ·
Poorest	3100	1.16 (1.04-1.29)	1.17 (1.05-1.30)
Poorer	2123	1.03 (0.91-1.16)	1.03 (0.91-1.17)
Middle	1858	1.07 (0.93-1.23)	1.09 (0.94-1.26)
Richer	1758	1.08 (0.94-1.24)	1.12 (0.97-1.30)
Richest	1666	1.10 (0.92-1.31)	1.13 (0.95-1.35)
2008-2012		*	*
Poorest	4051	0.89 (0.83-0.95)	0.87 (0.82-0.93)
Poorer	2852	0.99 (0.92-1.08)	0.98 (0.90-1.06)
Middle	2609	0.95 (0.86-1.05)	0.92 (0.83-1.02)
Richer	2423	0.93 (0.84-1.04)	0.89 (0.79-0.99)
Richest	2129	0.88 (0.77-1.00)	0.85 (0.75-0.97)

Table 4.4. Multivariable survey logistic regression for ANC 4 visits with family wealth interaction

Model is adjusted for age, parity, level of education, twin pregnancy, pregnancy complication, provincial fertility rate, provincial presence of desa siaga, area of residence (rural/urban), and region

We further analyzed the progress in ANC 4 visits by family wealth and region. In models with family wealth interaction terms (Table 4.4 and Figure 4.3.), the increasing annual trend between 2005-2008 in ANC 4 visits was most evident in the lowest family wealth quintile (aOR per year 1.17, 95%CI 1.05-1.30). From 2008 to 2012 there were decreasing annual trends for ANC 4 visits which were most pronounced in the lowest and highest family wealth quintiles

(Table 4.4). Looking at family wealth groups within regions, a similar pattern of ANC 4 visits was observed for all regions in Indonesia: there were increasing annual trends between 2005-2008, which were then followed by decreasing annual trends after 2008 (Figure 3, Appendix 3).

4.5. Discussion

This study demonstrates increasing annual trends of ANC 4 visits after SHI initiation in 2005, which were then followed by decreasing trends in ANC 4 visits after 2008. The increase within the first three years of the program (2005-2008) was most evident in women of low family wealth After an immediate increase in ANC 4 visits utilization in 2008, the annual trends were decreasing across all family wealth quintiles and all region in Indonesia. This study also showed no significant changes in trends of ANC 8 visits , with relatively low levels of utilization across different family wealth groups in Indonesia.

Our findings are in agreement with previous research that showed increasing ANC utilization in Indonesia during the period covered by this study (10). By using segmented regression, we were able to show an increase in the annual trends of ANC 4 visits before and after initiation of SHI. This increase happened in the first three years after program initiation and was most evident in women of the lowest family wealth quintile, who are the target for SHI. These results corroborate previous studies that showed increased odds of ANC in women who had SHI, particularly in women of low SES (74). SHI, initiated in 2005, was designed to reduce financial barriers to accessing healthcare for the poor, with expansion to the near-poor population in 2008 (9,70). By using the WHO standard for ANC care to determine ANC completion, our study adds the timing component of ANC visits.

There was a significant immediate increase in ANC 4 visits utilization in 2008, after the SHI expansion, which persisted even after adjustment for socio-demographics factors, suggesting the presence of increase despite the changing socio-demographic factors. Following this immediate increase, decreasing trends were observed between 2008 through 2012. This pattern may be a result of 'artifacts' due to the survey methodology or represent real events. The five-year interval of the IDHS surveys might have contributed to the observed immediate increase; women who gave birth in 2008 had to recall their pregnancy experience 4-5 years later in the IDHS 2012 survey. Though we did not see a similar occurrence for IDHS 2007, nor when we conducted the same analyses for other maternal health services i.e. skilled birth attendance (SBA) and skilled facility delivery (SFD) the possibility of artifacts cannot be excluded. Interestingly, we observed this immediate change across the different regions in Indonesia. By contrast, SBA and SFD increased after SHI initiation in 2008 (data not shown).

Taking the caveats into account, if the decreasing trends from 2008 are real one potential explanation could be the lack of provider capacity to match the increasing demand of ANC utilizationafter the expansion of SHI in 2008 to the near-poor population. This is particularly true in the less populated region and rural areas in Indonesia which already had limited capacity, including lack of basic infrastructure, transportation, and human resources to provide optimum ANC, SBA and SFD. (78,110).

The decreasing trends in ANC 4 visits that we observed in this study warrant further investigation. Conducting similar analyses with longitudinal data might elucidate a more accurate pattern of ANC utilization over time. Nevertheless, the decreasing trend in ANC 4 visit is worth noting, along with the observed low level of ANC 8 visits across all family wealth and

region in Indonesia and significant differences by family wealth within the three IDHS survey years. Although the ANC 8 visits recommendation is not yet adopted by the Indonesian government as the standard for ANC, the low level of ANC 8 visits and the decreasing trends in ANC 4 visits utilization are potential targets for future interventions. Special consideration should be given to increasing the level of ANC 8 visits for all women. Examining the determinants of ANC 8 visits in comparison to the determinants of ANC 4 visits may shed light on barriers . Therefore, when the ANC 8 visits recommendation is adopted, necessary information for program intervention is available. Acceleration of the increase of ANC 4 visits and ANC 8 visits utilization for women of low SES to achieve equal distribution of ANC is also crucial. Particularly in relation to initiation of the Universal Health Coverage (UHC) program in 2014 (78). In this study, we have shown the short-term positive changes that happened after initiation of SHI, specifically, for women of low SES. However, programs that aim to improve access to healthcare by reducing financial barriers should be complemented by improving the capacity of healthcare providers (78,111).

This study has several limitations worth noting. First, the observed changes in ANC after a program implementation cannot confidently be attributed to the program because other important events/changes during the period might also influence ANC utilization. There might still be persisting factors that affect utilization during this period, even after adjustment for socio-demographic factors that affect ANC utilization. Second, we used repeated cross-sectional surveys with self-reported questionnaires. The accuracy of self-reported ANC visits might vary by economic or education level, or by the interval between the year of pregnancy and year of survey. Although we only limit our analyses on the most recent birth (index birth), we cannot confidently exclude the possibility of recall bias.

Despite these limitations, this study makes important contributions. First, it describes changes in ANC visits by using segmented regression analyses which produce a clearer understanding of the changes in relation to the timing of program initiation; this approach provides an opportunity to observe a baseline trend (pre-intervention slope) and compare it to the trend after the program (post-intervention slope). Second, it considers family wealth and regions in Indonesia, thereby providing information on groups experiencing the greatest and least positive changes from SHI. Third, it describes the current level and distribution of ANC 8 visits, a new WHO recommendation for ANC. This information can provide guidelines for future targeted intervention.

4.6. Conclusions

This study found a short-term positive increase in ANC 4 visits after SHI initiation in 2005, followed by a peak of ANC utilization in 2008 and a decreasing trend thereafter through 2012. These findings can have multiple interpretations. Although we cannot confidently exclude the possibility that the decline is an artifact, the decreasing trends in ANC 4 visits utilization may be real and of concern. Further research using longitudinal data or other repeated crosssectional surveys might provide more insights into the true pattern of the progress in ANC 4 visits utilization. Our study also found a low level of ANC 8 visits utilization across the family wealth quintiles, with no significant changes, even after SHI initiation. Therefore, strategies to improve ANC utilization across different family wealth quintiles are needed. In addition to programs that aim to reduce financial barrier to ANC, improvement in the capacity and equal distribution of are needed.



Figure 4.3. Proportion of ANC 4 visits by family wealth and region a. Proportion of ANC 4 visits by family wealth in Indonesia

b. Proportion of ANC 4 visits by family wealth in Java Bali





d. Proportion of ANC 4 visits by family wealth in less populated other islands



Notes:

The vertical lines represent the year of the initiation of the Social Health Insurance (SHI) Program (2005)

The dots represent the weighted proportion of ANC 4 visits in the family wealth group per year

The lines represent the weighted average of predicted probability from Model 2 and 3

CHAPTER 5. DECOMPOSITION ANALYSES OF THE GAPS IN SKILLED FACILITY DELIVERY BY FAMILY WEALTH IN INDONESIA

5.1. Abstract

Despite the increasing coverage of skilled facility delivery (SFD) in Indonesia, we still observed persistent gaps in SFD utilization by family wealth. This study examines the contribution of different individual and community factors in the gaps of SFD utilization between the lower and higher family wealth group in Indonesia.

This study analyzed 16,083 live births from 14,013 women who were interviewed in the last round of Indonesian Demographic and Health Survey conducted in 2012 (IDHS 2012). Using the regression-based decomposition method (STATA mvdcmp), we examined the contribution of several socio-demographic factors, pregnancy-related factors, and health provider ratio to the gap in SFD utilization by family wealth within the three regions in Indonesia. The contribution of these factors can be further classified into: 1) differences of characteristics, i.e. differences in distributions of the factors that were examined, and 2) differences in effects, i.e., differences in coefficients of the regression which show the effect of each factors in the lower and higher wealth quintiles groups.

The gap in SFD utilization by family wealth persisted across the three regions in Indonesia, with the biggest gap in the less populated other islands (37%). Approximately 69.7% of the SFD gap by family wealth in Java Bali, 61.6% in the more populated other islands, and 54.6% in the less populated other islands was explained by differences in individual and community characteristics. For the differences in characteristics, the predominant factors accounting for the gap in SFD utilization across the three region in Indonesia were maternal education level, area of residence, and parity. Outside of Java Bali, insurance membership was

also shown as a significant contributor to the SFD gap by family wealth. Meanwhile, for the differential in effects, the unmeasured variables were the most predominant factor across the three region. Intervention to address these differences targeting women of the lower family wealth group is needed. Also, future research with the inclusion of other potential variables contributing to the gaps in SFD utilization is needed for more specific program recommendation.

5.2. Introduction

Accelerating equal distribution and access to maternal healthcare, including skilled facility delivery (SFD), is one of the key strategies to improve maternal health (62,112). Factors related to healthcare utilization can be grouped as individual-level, community-level, and more specifically, healthcare provider factors. Individual-level factors include age, parity, medical needs, cultural and health beliefs, availability of resources, perceived quality of healthcare, and previous experience with a healthcare provider (53,63–65). Community-level factors include cultural and health beliefs, community support, and distance or geographical conditions to access healthcare. Healthcare provider factors are availability and quality of resources, including equipment, healthcare professionals, and infrastructure (53,63–65).

Despite the improvement in SFD coverage and decreasing rich-poor gap in facility delivery utilization in Indonesia (10), differences in SFD utilization by economic status persist (10,13,113). Women of lower SES are less likely to access maternal healthcare, including skilled facility delivery. Barriers to accessing maternal healthcare for women from low the socioeconomic status (SES) group are mostly associated with cost, health and social beliefs due to poor education, and limited resources, i.e. proximity and availability of healthcare providers (11,51,60,73). In Indonesia there are differences in health facility and health provider

distributions by geographic location (114,115). Furthermore, as an archipelagic nation, geographical conditions become a major barrier to accessing healthcare, especially, in rural and remote areas (88,116).

Previous studies have reported gaps in facility delivery utilization by family wealth and region in Indonesia (10,13,113). However, few have further identified the factors that contribute to the gap in SFD utilization between wealth across the three regions in Indonesia. Therefore, to achieve equal access between different family wealth groups, it will be important to understand the contribution of different socio-demographic factors to the gaps of SFD in the different regions of Indonesia. This study aims to: 1) describe the persisting gap in SFD utilization by wealth across the three regions in Indonesia, and 2) quantify the contribution of certain socio-demographic factors in the gaps in SFD utilization for intervention recommendation.

5.3. Methods

5.3.1. Study design and participants

Indonesia is the fourth most populated country in the world. In 2017, the population consists of over 260 million people, 49.64% of which are women. Approximately 54.2% of the women are of reproductive age (84). This study used data from the last round of Indonesia Demographic and Health Surveys (IDHS) conducted in 2012. The IDHS is a cross-sectional survey with multistage sampling designs conducted to obtain a nationally representative data of Indonesia. In 2012, the Ministry of Health (MOH) of Indonesia and the National Population and Family Planning Board (BKKBN) with consultation by ICF International collaborated to conduct the IDHS. The IDHS collected data from women of reproductive age (15-49 years old) who had at least one birth in five years preceding the IDHS survey year. In IDHS 2012, 15,226 women

were eligible. However, there were missing data on 1213 women (7.9%). Therefore, our analytic sample consisted of 16,083 live births from 14,013 women.

5.3.2. Variables and measurements

5.3.2.1. Outcome variables

We evaluated skilled facility delivery (SFD), defined as birth assisted by a skilled birth attendance (SBA) at a healthcare facility, either hospital, primary health care setting, or health clinic (117). SFD was self-reported by the women as part of the IDHS Survey.

5.3.2.2. *Exposure variables*

Our main exposure of interest was family wealth. The family wealth variable incorporated indicators of assets, i.e. house and/or land ownership, water supply, latrine type, vehicle, and electronics ownership. Principal Component Analyses (PCA) was used to obtain the family wealth quintiles at the household level within the 2012 IDHS survey year. The family wealth quintiles were further classified into two groups: the lower two quintiles (Q1-2) and the higher three quintiles (Q3-5). This classification was based on the most current national policy on health insurance, which targeted the poor and near-poor in Indonesia (9).

5.3.2.3. Covariates

We considered multiple groups of variables that could influence SFD utilization, and might explain the differences in SFD utilization by family wealth group. These included: 1) selfreported socio-demographics variables that were not contained in the family wealth latent variable, i.e., family wealth, maternal education level , insurance membership, and distance to a healthcare facility; 2) self-reported pregnancy-related factors, i.e., age at birth, parity, twin pregnancy, knowledge of danger signs during maternal period and pregnancy complication; 3) community-level variables, i.e., region, areas or type of residence (rural/urban), and provincial level fertility rate obtained from the Indonesian National Bureau of Statistics data; and 4) health provider ratio. Health provider ratio is defined as the number of a healthcare provider for maternal services (physicians, midwives, nurses) per 10,000 population (118). The health provider ratio was constructed at the provincial level for each year by calculating the number of physicians, nurses, and midwives to the number of population from 2007-2012. Data on population are available through Biro Pusat Statistik or the Statistical Bureau of Indonesia. Data on healthcare providers (physician, nurses, midwives) are available from the Indonesian health profile from the Ministry of Health of Indonesia.

Region was of interest as a potential effect modifier, and for this study we divided Indonesia into three regions based on population density: 1) Java-Bali, which has the highest population density in Indonesia (> $500/km^2$); 2) the more populated other Islands (population density above national average of $112/km^2$, but $<500/km^2$); and 3) the less populated Islands (population density above national average of $112/km^2$).

5.3.3. Statistical Analyses

Analyses were conducted within the three regions in Indonesia. STATA survey (svy) Chisquare tests were used to assess the differences in proportion between groups. STATA survey (svy) ANOVA were used to assess differences in means between groups. Differences in proportion and means by family wealth were analyzed within the three different regions in Indonesia. Svy logistic regressions were used to analyse the effect of family wealth and health provider ratio on SFD utilization. We used the regression-based Oaxaca-Blinder decomposition methods (119) and the "mvdcmp" extension in STATA to further quantify the contribution of each factors. The decomposition methods classified the contribution into two parts: 1) differences in characteristics, i.e., the differences attributable to differences in the distribution of

the characteristics that were examined, and 2) differences in effects/responses, i.e., differences attributable to differences in the regression coefficients which represents the effect/responses of each covariate that we considered in the analyses between the lower and higher wealth quintiles groups (120).

5.4. Results

Within the three geographic regions in Indonesia, there were socio-demographic differences between the lowest family wealth two quintiles of family wealth (Q1-2) and the three higher family wealth quintiles (Q3-5) (Table 5.1). In all three regions, women of the higher quintiles (Q3-5) had fewer children and delivered at older ages compared to women of the lower quintiles (Table 5.1). The proportion of women delivering their child before 20 years of age was significantly higher in women of Q1-2 compared to women of Q3-5. There also was a significantly higher proportion of women with more than three children among women of lower family wealth quintiles compared to women of the higher family wealth quintiles. There were no significant differences in twin pregnancy between women of Q1-2 and women of Q3-5. There also a Q3-5 in Java Bali, but in the other islands, women of the higher family wealth quintiles reported higher pregnancy complications (Table 5.1).

There were significant differences in socio-demographic factors between women of Q1-2 and women of Q3-5 in all three regions in Indonesia. Women of the lower family wealth quintiles were less educated, predominantly lived in rural areas, and more likely to report distance as a big problem in accessing healthcare (Table 5.1). Health insurance membership differed significantly between women of Q1-2 and Q3-5 in the other islands but was not

significantly different in Java Bali. Skilled facility delivery (SFD) were significantly higher

among women of Q3-5 in all the three regions in Indonesia (Table 5.1).

Variable	Java	Bali	More populated other		Less populated other	
			islands		islands	
	Q1-2	Q3-5	Q1-2	Q3-5	Q1-2	Q3-5
Total women	915	2821	1788	1715	4168	2606
Total live births	1020	3094	2071	1946	4979	2973
Continuous (mean, SE)						
Age	27.5 (0.3)	28.5 (0.2)	27.5 (0.2)	28.5 (0.2)	27.6 (0.1)	28.4 (0.1)
Parity	2.2 (0.1)	2.0 (0.0)	2.5 (0.1)	2.1 (0.0)	2.7 (0.0)	2.2 (0.0)
Health Provider Ratio	11.0 (0.2)	12.0 (0.1)	17.0 (0.2)	17.6 (0.2)	22.5 (0.2)	23.1 (0.2)
Categorical (weighted%, SD))				· ·	
Age						
< 20 years	11.5 (1.3)	4.7 (0.4)	7.7 (0.7)	4.3 (0.5)	10.0 (0.5)	5.7 (0.5)
20-35 years	73.5 (1.9)	81.4 (0.9)	79.0 (1.2)	81.9 (1.0)	75.1 (0.7)	80.8 (0.9)
> 35 years	15.0 (1.6)	13.8 (0.9)	13.2 (1.0)	13.8 (0.9)	14.9 (0.7)	13.5 (0.8)
Parity						
1	41.8 (1.8)	41.6 (1.0)	35.8 (1.2)	39.0 (1.3)	32.1 (0.8)	37.1 (1.1)
2	27.6 (1.7)	35.6 (1.0)	26.4 (1.0)	29.7 (1.0)	25.6 (0.7)	28.7 (0.9)
>2	30.6 (1.9)	22.8 (1.0)	37.8 (1.4)	31.3 (1.4)	42.3 (0.9)	34.1 (1.1)
Twin						
Singleton	97.9 (0.8)	98.3 (0.4)	98.7 (0.4)	98.6 (0.4)	97.9 (0.3)	98.8 (0.3)
Twin	2.1 (0.8)	1.7 (0.4)	1.3 (0.4)	1.4 (0.4)	2.1 (0.3)	1.2 (0.3)
Education	. ,			. ,		. ,
Primary school/less	61.6 (2.3)	22.8 (1.3)	45.3 (1.8)	14.5 (1.0)	52.3 (1.3)	14.4 (0.9)
Secondary school	37.7 (2.3)	59.4 (1.5)	51.3 (1.7)	64.8 (1.4)	43.2 (1.2)	58.2 (1.3)
College and higher	0.7 (0.3)	17.7 (1.5)	3.4 (0.5)	20.7 (1.3)	4.5 (0.4)	27.4 (1.3)
Area						
Urban	30.8 (2.5)	72.5 (1.3)	24.3 (1.5)	56.1 (1.7)	15.9 (0.9)	55.5 (1.7)
Rural	69.2 (2.5)	27.5 (1.3)	75.7 (1.5)	43.9 (1.7)	84.1 (0.9)	44.5 (1.7)
Distance is a big problem	13.4 (1.7)	5.8 (0.6)	16.0 (1.5)	7.6 (0.8)	22.8 (1.2)	7.0 (0.6)
Insurance	31.7 (2.2)	35.6 (1.5)	28.3 (1.4)	35.6 (1.6)	40.0 (1.3)	51.2 (1.5)
Knowledge on danger	47.8 (2.4)	70.1 (1.4)	47.8 (1.7)	62.4 (1.6)	40.9 (1.2)	65.4 (1.3)
signs						
Pregnancy complication	12.1 (1.3)	13.5 (0.8)	10.9 (0.9)	15.0 (1.0)	11.2 (0.6)	13.5 (0.9)
SFD	59.1 (2.7)	82.8 (1.3)	44.8 (2.1)	72.7 (1.8)	27.4 (1.3)	64.5 (1.5)

Table 5.1. Socio-demographic characteristics of women, by region

The differences were significant for most of the within region comparison between the lower two quintiles and the higher three quintiles

Non-significant different by family wealth were observed for twin (all region), insurance (Java-Bali), and pregnancy complication (Java Bali)

Table 5.2 showed the results of survey logistic regression assessing the association between family wealth, health provider ratio, and SFD utilization. The result showed a significant effect of family wealth on SFD utilization, which persisted even after adjustment for health provider ratio and socio-demographic factors (Table 5.2). Higher health provider ratio significantly increases SFD utilization in the more developed region, i.e., Java Bali and more populated other islands but was not statistically significant in the least populated region of Indonesia.

Variable N		Crude OR (a)	aOR (b)	aOR (c)
Java Bali				
Family wealth				
Quintile 1-2	1020	Ref	Ref	Ref
Quintile 3-5	3094	3.34 (2.57-4.32)	3.53 (2.71-4.61)	1.75 (1.34-2.29)
Provider ratio		-	1.20 (1.14-1.25)	1.15 (1.09-1.21)
More populated other Islands			· · · ·	х <i>,</i>
Family wealth				
Quintile 1-2	2071	Ref	Ref	Ref
Quintile 3-5	1946	3.30 (2.70-4.02)	3.27 (2.68-4.00)	1.86 (1.51-2.29)
Provider ratio		-	1.02 (1.00-1.04)	1.03 (1.01-1.05)
Less Populated Other Islands				
Family wealth				
Quintile 1-2	4979	Ref	Ref	Ref
Quintile 3-5	2973	4.80 (4.05-5.69)	4.79 (4.04-5.67)	2.28 (1.93-2.70)
Provider ratio		-	1.01 (0.99-1.02)	1.00 (0.99-1.01)

Table 5.2. Survey Logistic regression of SFD utilization by family wealth and health provider ratio

a) Unadjusted model of SFD by family wealth

b) Unadjusted model of SFD by family wealth and provider ratio

c) SFD utilization by family wealth and provider ratio adjusted for age, parity, level of education, twin pregnancy, pregnancy complication, knowledge of danger signs during maternal period, insurance, distance to healthcare, provincial fertility rate, and area of residence (rural/urban)

Figure 5.1 demonstrated the absolute differences in SFD utilization between women of the lower quintiles (Q1-2) and the women of the higher quintiles (Q3-5) in the three regions. The differences in SFD utilization were more pronounced in the less populated other islands (37%) compared to the more populated other islands (28%) and Java Bali (23.7%). Table 3 showed the decomposition results quantifying the contribution of each socio-demographic, pregnancy-related factors as well as health provider ratio in the differences of SFD utilization by family wealth.



Figure 5.1. The proportion of SFD by family wealth in the three regions of Indonesia

Table 5.3 present the result from the decomposition analyses. In all regions, the gap in SFD between the lower and higher family wealth quintiles were mostly due to differences in characteristics, mainly, differences in the distribution of level of education, urban/rural area of residences, and parity between the lower and higher family wealth quintiles. Had the characteristics between women of Q1-2 and women of Q3-5 been similar, the gap in SFD utilization would have been decreased by 69.7% in Java Bali, 61.6% in the more populated other islands, and 54.6% in the less populated other islands.

When looking into the individual factors, in all three regions, maternal differences in level of education, residential area, and parity were the largest contributors to the absolute differences in SFD utilization between the lower and higher family wealth quintiles. In addition to the factors above, in the more populated other islands and less populated other islands, differences in the proportion of women with insurance also made a significant contribution to the gap in SFD utilization. Fertility rate and healthcare provider ratio were significant contributors to the SFD gap by family wealth in Java-Bali and the more populated other islands (Table 5.3). In Java Bali, reducing the proportion women from Q1-2 who had less than primary school education (61.6%) to the same level of women of Q3-5 (22.8%), might reduce the gap in SFD utilization by 18.3%.

Variable Java Bali More populated other Less populated other islands islands % % % Absolute Absolute Absolute contribution contributio contribution contributio contribution contribution (SE) n (SE) n (SE) Due to Differences in 13.9 (1.4) 59.6 17.2 (1.2) 61.6 20.3 (1.5) 54.6 **Characteristics** Age < 20 0.5 (0.2)* 2.1 0.4 (0.1)* 1.6 0.7 (0.1)* 1.8 -0.0 (0.1) -0.1 0.0 (0.1) 0.2 20-35 -0.0(0.0)-0.2 >35 -0.4 -0.2 (0.0)* -0.6 -0.1 (0.0)* 0.1 (0.0)* 0.3 Parity 0.6 (0.1)* 2.6 2.1 (0.4)* 7.5 1.3 (0.5)* 3.5 Twin 0.0 (0.0) 0.1 0.1 (0.0)* 0.3 -0.3 (0.1)* -0.9 Education Primary school/less 4.3 (0.6)* 18.3 1.4 (0.7)* 5.0 4.4 (0.8)* 11.8 0.5 Secondary school -0.4(0.6)-1.6 0.4 (0.2) 1.6 0.2 (0.2) College and higher -3.7 (3.1)* 9.2 0.2 (0.4) 0.8 2.4 (0.4)* 6.3 17.9 30.6 26.4 Area 4.2 (0.8)* 8.5 (0.7)* 9.8 (0.8)* Distance is a big problem -0.1 (0.2) -0.5 0.5 (0.3) 2.0 0.3 (0.6) 0.8 0.0 (0.0) Insurance 0.2 0.9 (0.2)* 3.3 0.7 (0.2)* 1.9 Knowledge on danger 0.7 (0.4) 6.1 2.7 3.1 1.7 (0.4)* 1.0 (0.5) signs 0.4 0.7 Pregnancy complication 0.1 (0.0)* 0.2 (0.1) 0.6 0.3 (0.0)* Health Provider Ratio 1.5 (0.2)* 6.3 0.3 (0.1)* 0.9 -0.1 (0.1) -0.3 Fertility 0.5 (0.2)* 2.3 0.4 (0.0)* 1.3 -0.1 (0.4) -0.3 Due to Differences in 45.4 9.4 (2.4) 40.4 10.7 (2.0) 38.4 16.9 (1.9) Response Age < 20 0.3 (0.6) 1.3 -0.4 (0.4) -1.0 -0.5 (0.4) -1.7 20-35 -1.2 (2.5) -5.0 -0.1(2.5)-0.4 1.7 (1.6) 4.5 >35 -0.2 (0.8) -0.7 0.8 (0.6) 2.9 0.2 (0.5) 0.6 Parity -1.4(0.4)-6.0 -2.7(3.9)-9.7 2.3 (2.9) 6.2 -0.2 (0.3) -0.8 -0.0 (0.3) -0.1 0.7 (0.3) 1.9 Twin Education Primary school/less -11.0 (4.0)* -46.9 1.6 (1.6) 5.6 -0.4 (1.2) -1.0 -6.9 (2.5)* -29.5 -1.4 Secondary school 1.5 (1.6) 5.2 -0.5 (0.8) 0.3 (0.1)* 1.1 -0.2 (0.2) -0.7 0.1 (0.1) 0.2 College and higher Area 0.6 (1.4) 2.7 -7.6 (6.6) -27.1 0.3 (0.4) 0.8 -0.3 (1.0) 1.3 1.7 (0.9) 0.0 (0.9) 0.1 Distance is a big problem -6,1 3.0 -0.8 (1.5) 3.5 0.8 (1.1) -4.9 Insurance -1.8(1.0)Knowledge on danger -7.6 3.8 (1.7)* 13.5 -0.4 (1.1) -1.0 -1.8 (2.1) signs 0.2 0.2 Pregnancy complication -0.7 (0.1) -3.0 0.0 (0.5) 1.1 (0.4) Health Provider Ratio -6.1 (8.3) -26.1 0.2 (4.9) 0.9 -6.1 (3.4) -16.5 Fertility -5.8 (8.6) -25.0 -36.7 (9.8)* -131.5 8.1 (0.4)* 21.9 Constant 42.9 (16.9)* 183.7 51.5 (13.6)* 184.5 13.0 (0.6)* 35.0

Table 5.3. Decomposition results of differences in SFD utilization by family wealth in three regions (absolute and relative contribution of determinants)

*) present significant contribution of the corresponding factor on the gap in SFD utilization by family wealth (p < 0.05)

Meanwhile, differences in responses (the factors' differential effect on the lower family wealth quintiles and higher family wealth quintiles) were less dominant. The results (Table 5.3) indicated that if certain socio-demographic and pregnancy-related factors were similar across the family wealth quintiles, the gap in SFD utilization would have decreased by 40.3% in Java Bali, 38.4% in the more populated other islands, and 45.4% in the less populated other islands. In all three regions in Indonesia, unmeasured variables were the major contributor for the gap in SFD utilization due to responses/effects, between the lower and higher family wealth quintiles. The differential effects of unmeasured variables (i.e. other variables that were not included in the decomposition analyses) were represented by the 'constant' (Table 5.3). In addition, education has significant differential effects in Java Bali, while fertility has significant differential effects in the other two regions, and knowledge of pregnancy danger signs had significant differential effects in the more populated other islands (Table 5.3).

5.5. Discussion

This study showed persisting differences (gaps) in SFD utilization between the lower family wealth quintiles (Q1-2) and higher family wealth quintiles (Q3-5), with significant differences in determinants of SFD distribution across family wealth group and regions. The gaps in SFD utilization were most prominent in the less developed region and were predominantly explained by the differences in characteristics between women of Q1-2 and women of Q3-5, particularly, differences in the distribution of level of education, rural/urban area of residences, and parity. In all three regions, the factors that predominantly contributed to family wealth differences in SFD were level of education, area of residence, and parity. While

the constants, which represent the differential responses of unmeasured variables, were the predominant contributor of differences due to responses.

Despite the significant improvement in skilled delivery utilization, this study showed the persisting gap in SFD utilization by family wealth in Indonesia. This finding corroborates previous studies, which showed that despite having a significant increase in the proportion of facility delivery, differences by family wealth were still observed (5,10). We further showed the differences in the magnitude of the gaps in SFD utilization between the three different regions in Indonesia. Java Bali, the most populated and developed region in Indonesia, showed the smallest family wealth group differences in SFD utilization. While the least developed region, i.e., the less populated other islands in Indonesia, had the biggest differences in SFD utilization across family wealth groups. In this region, the proportion of women reporting distance as big problem was highest, indicating the geographical challenge in healthcare access and distribution. Previous studies have reported distance to healthcare as a major barrier to skilled delivery, particularly in rural area and Eastern Indonesia (6,75).

We were also interested in looking at the influence of health provider ratio on SFD utilization. The health provider ratio was most strongly associated with SFD utilization in Java Bali and the more populated other islands. Across all regions, health provider density was relatively low compared to the WHO former standard of 28 provider/10000 population, and even much lower compared to the current WHO standard of 44 provider/10000 population (118). Previous studies have reported the unequal distribution of specialists and physicians in Indonesia, with scarcity in rural areas and less populated region of Indonesia (121,122). Therefore, there is a possibility that despite having the highest health provider density, the type of provider who is available in the less developed other islands might not be adequate for

maternal healthcare, especially for management of emergency cases. Due to data limitation, we were unable to differentiate the type of provider, i.e. physicians, midwives, and nurses. Therefore, future research which aims to assess the adequacy of health provider ratio by type and the association with other maternal healthcare utilization, i.e. antenatal care (ANC) and postnatal care is needed. In the fully adjusted model, the inclusion of socio-demographic and pregnancy-related variables reduced the magnitude of family wealth quintiles effect on SFD utilization. This suggests these factors contribute to differences in SFD utilization by family wealth quintiles.

In the decomposition analyses, education was shown to be the most prominent factor in all three regions. Additionally, knowledge of maternal complications was relatively low across the three regions in Indonesia. In our descriptive analyses, we found that women from the lower wealth quintiles reported lower maternal complications. These findings might be caused by differences in reporting maternal complications between women of higher and lower wealth quintiles. In previous studies, education and antenatal care (ANC) consultation reportedly increase knowledge of danger signs during pregnancy, as well as skilled delivery (67,72,123– 125). With the high proportion of ANC utilization (13), provision of more detailed ANC consultation, i.e. information on pregnancy danger signs and birth preparedness might be an effective in addressing the gaps due to the differential proportion of education level. Specific interventions to address rural/urban areas are also needed since residential area was shown to be an important contributing factor across all regions. Differences in the availability and quality of healthcare facility, physical access, and health beliefs between rural and urban areas might be the underlying factors that contribute to residential areas gaps in SFD utilization (24,89,126). Studies are needed to further address differences in SFD by urban and rural areas and the contributing factors; this information would help develop specific program recommendations.
This study is subject to several potential limitations. First, the self-reported nature of the DHS, which is susceptible to information bias. Particularly, due to differences in reporting by socio-demographic factors and by the gap between the delivery year and the survey year. Second, the use of cross-sectional data in our analyses limits the ability to infer causation, due to the lack of temporality. Therefore, our results should be cautiously regarded as an association of different factors to SFD utilization. The DHS data limit our analyses to only some socio-demographic and pregnancy-related factors and there may be other important covariates not measured in this study. Although we have included other factors, i.e. health provider ratio and fertility rate, we were unable to include other variables that might affect SFD utilization, for example, maternal healthcare quality, cultural perceptions and beliefs.

Despite the limitations, this study makes important contributions. First, this study was able to identify the different characteristics that might contribute to gaps in SFD utilization and estimate their relative importance. Second, the use of individual and community level data provided information on the contribution of each factor in the gap of SFD utilization between the lower and higher family wealth quintiles. Third, this study analyzed the gap in SFD utilization by region, thereby providing more specific information on factors influencing the gaps within regions. Targeted interventions to address these differences for each region in Indonesia can, therefore, be designed for more effective programs or policy.

5.6. Conclusions

The gaps in SFD between the lower and higher family wealth group were observed across the three regions in Indonesia, with a higher magnitude in the less populated region. Differences in the level of education, area of residence, and parity contribute significantly to the gap in SFD

utilization by family wealth. Outside of Java Bali, insurance membership also contribute to the gap in SFD utilization. Differential responses of unmeasured confounding were also shown to be an important contributor to the gap in SFD utilization by family wealth.

To address the contribution of education on the gap of SFD utilization by family wealth, inclusion of focus antenatal care consultation might be an effective method, particularly for women of low socioeconomic status. Meanwhile, improving the healthcare resources in rural areas to match those in urban areas is also important to reduce the gap in SFD utilization attributed to area of residence. With the relatively high contribution of unmeasured confounding, future studies that include other determinants of SFD utilization need to be conducted. These other determinants of SFD utilization might include, but not limited to, healthcare quality, type of healthcare provider, and cultural belief.

CHAPTER 6. SUMMARY

6.1. Major Findings

Using the Indonesian Demographic and Health Survey (IDHS, this study examined the progress of the key indicators of maternal healthcare utilization in relation to the initiation of maternal health programs in Indonesia. In addition, the study identified the contribution of socio-demographic and pregnancy-related factors to gaps of skilled facility delivery utilization between the lower and higher family wealth groups. We found increasing annual trends in skilled birth attendance (SBA) and skilled facility delivery (SFD) after the initiation of three maternal health programs in Indonesia. In our analyses, we observed an increase in annual trends of SBA and SFD utilization across all family wealth groups and regions. Women of low socio-economic status had the greatest change in SBA and SFD utilization after initiation of the Village Midwives and Social Health Insurance (SHI) Programs. Following the implementation of the Village Midwives Program, which aimed to reduce the physical barrier to healthcare, we observed the greatest increase in the progress of SBA and SFD utilization in the less populated region. In this region, distance is a major barrier to accessing healthcare. After initiation of a program that aimed at reducing financial barrier, i.e. SHI, the greatest increase in the progress of SBA and SFD utilization was observed in Java Bali, the most populated and developed region in Indonesia.

We also found a short term increase of ANC 4 visits during the first three years after the initiation of the SHI program (2005-2008). As this program targeted the poor population, the greatest increase in ANC 4 visits utilization was observed mainly in women of low socioeconomic status. Following an immediate increase in ANC 4 visits utilization in 2008, there were decreasing annual trends. This period coincides with the expansion of the SHI to near-poor

population and the change in data source, i.e. IDHS survey years. Data on ANC visits before 2008 (2001-2007) were obtained from IDHS 2002 and IDHS 2007, while data on ANC visits in the year of 2008-2012 were obtained from IDHS 2012. The decreasing trends might be a data artifact due to differences in survey implementation, or represent real changes. Due to the nature of IDHS data, we have limited ability to disentangle this issue. Future studies that use longitudinal data from Indonesia might provide better insights into trends of ANC 4 visits utilization after SHI initiation in 2005. In relation to the new WHO recommendation of ANC 8 visits, we found that family wealth the proportion of women who received the standard ANC 8 visits were low across all family wealth groups and regions.

In our regression-based decomposition method we showed that differences in certain maternal characteristics were major contributors for the gap in SFD utilization between the lower and the higher socioeconomic group. Across the three regions, the predominant factors contributing to this gap included education level, urban/rural area, and parity. Addressing differences in these characteristics could decrease the gaps in SFD utilization by more than half. Outside of Java Bali, insurance membership also made a significant contribution to the gap in SFD utilization. family wealth

Our study addressed several research gaps in maternal healthcare utilization in Indonesia. First, we assessesed progress in skilled delivery and antenatal care in relation to the initiation of different maternal programs in Indonesia. Previous studies that have examined the trends in maternal healthcare utilization did not incorporate the initiation of several maternal health programs in the analyses. Our use of segmented regression to assess the trends after the initiation of the maternal health programs provided insights into how the trends changed after each program was implemented. We used the WHO standard for antenatal care visits (ANC 4 visits)

during the time period of the study, which considers not only the frequency but also the timing of ANC visits, and assessed the newer WHO recommendation for ANC, ANC 8 visits. By using decomposition methods, we also is gained insights into the predominant factors that contribute to the gap in SFD utilization by family wealth groups. This information can motivate specific recommendations for targeted interventions.

6.2. Implications and Future Direction

The findings of this dissertation provide insights into the progress of maternal healthcare in relation to the initiation of several nationwide maternal health programs in Indonesia. These findings indicate the need to further improve physical access to maternal healthcare particularly outside of Java-Bali, while simultaneously improving financial capability, particularly for women of lower SES. We observed the greatest change in annual trends of skilled delivery among women of low social economic status, suggesting a decreasing gap in skilled delivery utilization between lower and higher socioeconomic groups.

In the decomposition analyses, we further investigated the contribution of different sociodemographic and pregnancy-related factors in the gap of SFD utilization between the lower and higher socioeconomic group. The identification of the contributors to the gap in SFD utilization can be the basis for tailoring targeted interventions to achieve equal distribution and access to SFD. The identification of education level as a predominant contributor in the gap in SFD utilization indicates the need to increase knowledge on the importance of facility delivery. Also, our results support expanding programs that reduce the financial barrier to healthcare that is often experienced by women with low levels of education. Area of residence also was shown to be an important contributor to gaps in SFD utilization. The underlying contribution might

include the urban/rural differences in availability, accessibility, and proximity of healthcare facility, quality of healthcare and type of healthcare provider, and cultural beliefs of healthcare. The analyses showed parity as an important contributor. It has been well established that women with higher parity are less likely to access maternal healthcare, including skilled delivery. The inclusion of a birth preparedness plan during ANC visits for these women can be a feasible strategy, particularly with the high proportion of women who receive at least one ANC in Indonesia.

We observed a decreasing trend in ANC utilization from 2008-2012. Although we cannot exclude the possibility of a data artifact, both the decreasing trends in ANC 4 visits utilization and the relatively low level of ANC 8 visits utilization across all family wealth groups and region, warrant further investigation and intervention. Analyses on other nationally representative surveys in Indonesia might provide more insights into the trends in ANC utilization. Nevertheless, strategies to improve ANC utilization across different family wealth quintiles are needed. In addition to programs that aim to reduce financial barrier to ANC, improvement of healthcare capacity and distribution are crucial to match the demand of maternal healthcare. APPENDIX

Appendix 1. Survey Logistics Regression of SBA by Wealth and Region

	Java Bali ^{b)}		More populated ^{b)}		Less populated ^{b)}	
Variable	n live	aOR (95%CI)	n live	aOR (95%CI)	n live	aOR (95%CI)
	births	()	births		births	· · · · ·
Immediate Change						
In 1991		0.92 (0.74-1.15)		1.07 (0.91-1.27)		0.93 (0.80-1.08)
In 1998		1.69 (1.16-2.46)		0.88 (0.59-1.32)		1.50 (1.18-1.90)
In 2005		1.14 (0.86-1.50)		1.00 (0.82-1.22)		0.93 (0.81-1.07)
Annual Trends						
1986-1990		**		**		**
Poorest	851	1.33 (1.10-1.61)	1602	1.03 (0.92-1.15)	2021	0.95 (0.84-1.07)
Poorer	852	1.27 (1.08-1.50)	1463	1.09 (0.99-1.20)	1712	1.08 (0.97-1.19)
Middle	934	1.04 (0.93-1.16)	1236	1.11 (1.02-1.21)	1565	0.97 (0.89-1.04)
Richer	1164	1.11 (1.00-1.24)	1087	1.04 (0.95-1.14)	1340	0.90 (0.83-0.98)
Richest	1501	1.05 (0.92-1.19)	868	1.15 (0.98-1.35)	999	0.92 (0.81-1.04)
1991-1998		**		**		**
Poorest	1201	1.06 (0.97-1.16)	2470	1.23 (1.15-1.31)*	5695	1.16 (1.10-1.22)*
Poorer	1307	1.06 (0.98-1.15)	2135	1.24 (1.17-1.31)*	3177	1.16 (1.11-1.22)
Middle	1533	1.06 (1.00-1.13)	1833	1.18 (1.10-1.27)	2789	1.20 (1.14-1.27)*
Richer	1922	1.02 (0.96-1.09)	1502	1.18 (1.09-1.28)	2206	1.18 (1.12-1.24)*
Richest	2337	0.96 (0.89-1.05)	1318	1.01 (0.85-1.19)	2035	1.13 (1.04-1.22)*
1998-2004		**		**		**
Poorest	652	1.06 (0.96-1.16)	2228	1.06 (0.98-1.14)*	5135	1.03 (0.99-1.08)*
Poorer	1038	1.06 (0.97-1.17)	1504	1.07 (1.00-1.15)*	2278	1.03 (0.98-1.08)*
Middle	1281	1.07 (0.99-1.17)	1193	1.07 (0.97-1.18)	1586	1.04 (0.98-1.11)*
Richer	1678	1.05 (0.96-1.14)	950	1.05 (0.95-1.17)	1240	1.00 (0.93-1.07)*
Richest	2256	1.05 (0.95-1.17)	785	1.03 (0.83-1.28)	918	0.92 (0.83-1.03)*
2005-2012		**		**		**
Poorest	625	1.28 (1.14-1.44)*	2033	1.14 (1.05-1.23)	5783	1.06 (1.02-1.10)
Poorer	1027	1.28 (1.16-1.42)*	1609	1.16 (1.08-1.23)	2916	1.11 (1.06-1.17)
Middle	1375	1.21 (1.10-1.33)	1394	1.21 (1.09-1.34)	2218	1.09 (1.01-1.18)
Richer	1740	1.21 (1.09-1.35)	1153	1.31 (1.01-1.56)	1713	1.17 (1.06-1.29)*
Richest	2170	1.08 (0.94-1.25)	852	1.32 (1.01-1.73)	1191	1.21 1.05-1.39)*

Table 7.1. Survey logistics regression results of SBA by wealth within the three regions in Indonesia

b) Obtained from model 3 (wealth-time segments interaction within each region), adjusted for age, parity, twin pregnancy, level of education, provincial fertility rate, and area of residence (rural/urban)

*) Significant different in annual trends compared to annual trends in the previous period for each wealth quintile group
**) Significant wealth-time segments interaction (significant different in annual trends by wealth), p < 0.05

Appendix 2. Survey Logistic Regression of SFD by Wealth and Region

	n live			SFD		
Variable	births	Java Bali ^{a)}		More populated ^{a)}		Less populated ^{a)}
	n live	aOR (95%CI)	n live	aOR (95%CI)	n live	aOR (95%CI)
	births	(/	births		births	(<i>)</i>
Immediate Change						
In 1991		0.73 (0.57-0.93)		0.91 (0.76-1.09)		0.85 (0.70-1.03)
In 1998		3.08 (2.13-4.44)		1.61 (1.06-2.43)		1.20 (0.84-1.72)
In 2005		1.06 (0.85-1.32)		1.08 (0.90-1.31)		1.10 (0.94-1.30)
Annual Trends						
1986-1990 Decreat	054		4000		0004	4 00 (0 04 4 00)
Poorest	851	1.35 (0.97-1.86)	1602	0.98 (0.82-1.15)	2021	1.02 (0.81-1.28)
Poorer	852	1.24 (0.96-1.58)	1463	0.95 (0.83-1.08)	1/12	1.20 (1.00-1.43)
Middle	934	1.00 (0.87-1.15)	1236	0.97 (0.88-1.07)	1565	1.02 (0.88-1.17)
Richer	1164	0.95 (0.85-1.06)	1087	0.89 (0.80-0.98)	1340	0.96 (0.86-1.07)
Richest	1501	0.91 (0.81-1.02)	868	0.86 (0.76-0.98)	999	0.98 (0.89-1.09)
1991-1998		**		**		**
Poorest	1201	0.98 (0.85-1.12)	2470	1.12 (1.02-1.23)	5695	1.06 (0.96-1.18)
Poorer	1307	1.00 (0.90-1.11)	2135	1.12 (1.03-1.22)	3177	1.11 (1.02-1.20)
Middle	1533	1.01 (0.93-1.10)	1833	1.04 (0.97-1.11)	2789	1.15 (1.08-1.23)
Richer	1922	0.99 (0.93-1.06)	1502	1.05 (0.98-1.13)*	2206	1.10 (1.03-1.17)
Richest	2337	0.95 (0.89-1.02)	1318	1.05 (0.97-1.14)*	2035	1.09 (1.01-1.17)
1998-2004		**		**		**
Poorest	652	1.12 (1.00-1.25)	2228	1.03 (0.95-1.12)	5135	1.09 (1.02-1.17)
Poorer	1038	1.09 (1.00-1.20)	1504	1.05 (0.98-1.13)	2278	1.03 (0.97-1.10)
Middle	1281	1.05 (0.97-1.13)	1193	1.07 (0.97-1.17)	1586	1.04 (0.97-1.11)
Richer	1678	1.02 (0.95-1.10)	950	0.99 (0.91-1.08)	1240	1.03 (0.96-1.11)
Richest	2256	1.16 (1.08-1.24)*	785	0.95 (0.85-1.06)	918	0.96 (0.88-1.05)
2005-2012		**		**		**
Poorest	625	1.37 (1.21-1.54)*	2033	1.15 (1.07-1.23)	5783	1.19 (1.14-1.25)
Poorer	1027	1.38 (1.26-1.51)*	1609	1.16 (1.09-1.23)	2916	1.22 (1.16-1.28)*
Middle	1375	1.27 (1.18-1.37)*	1394	1.09 (1.01-1.17)	2218	1.13 (1.07-1.19)
Richer	1740	1.34 (1.23-1.45)́*	1153	1.17 (1.08-1.27) [*]	1713	1.10 (1.03-1.16)
Richest	2170	1.03 (0.95-1.11)	852	1.18 (1.06-1.32)*	1191	1.15 (Ì.07-1.23)́*

Table 7.2. Survey logistics regression results of SFD by wealth within the three regions in Indonesia

a) Obtained from model 3 (wealth-time segments interaction within each region), adjusted for age, parity, twin pregnancy, level of education, provincial fertility rate, and area of residence (rural/urban)

*) Significant different in annual trends compared to annual trends in the previous period for each wealth quintile group
**) Significant wealth-time segments interaction (significant different in annual trends by wealth), p < 0.05

Appendix 3. Survey Logistic Regression of ANC 4 Visits by Wealth and Region

Variable				ANC 4 visits		
		Java Bali		More populated		Less populated
				other islands		other islands
Immediate	n	aOR (95%Cl)	n	aOR (95%CI)	n	aOR (95%CI)
Change						
In 2005		0.85 (0.59-1.21)		0.77 (0.58-1.03)		1.02 (0.82-1.26)
In 2008		1.23 (0.82-1.85)		1.44 (1.06-1.96)		1.50 (1.17-1.92)
Annual Trends						
2001-2005		*				
Poorest	314	0.90 (0.73-1.11)	951	1.08 (0.94-1.23)	2421	1.00 (0.91-1.09)
Poorer	524	1.09 (0.93-1.29)	737	1.15 (1.01-1.31)	1200	1.01 (0.91-1.11)
Middle	668	1.15 (0.97-1.35)	591	1.12 (0.95-1.31)	869	1.03 (0.92-1.16)
Richer	903	1.05 (0.91-1.21)	475	1.19 (1.00-1.41)	686	0.93 (0.81-1.07)
Richest	1219	1.00 (0.84-1.20)	382	1.41 (1.03-1.92)	482	0.86 (0.73-1.02)
2005-2008		*		*		
Poorest	224	1.44 (1.10-1.89)	766	1.31 (1.11-1.56)	2110	0.93 (0.83-1.06)
Poorer	370	1.08 (0.82-1.41)	618	1.14 (0.97-1.35)	1135	0.96 (0.84-1.08)
Middle	516	1.20 (0.93-1.56)	512	1.12 (0.91-1.39)	830	0.93 (0.80-1.07)
Richer	667	1.21 (0.95-1.53)	436	1.34 (1.05-1.70)	655	0.90 (0.75-1.07)
Richest	865	1.29 (0.99-1.69)	355	1.01 (0.76-1.35)	446	0.95 (0.78-1.18)
2008-2012		*		*		*
Poorest	336	0.85 (0.71-1.01)	973	0.90 (0.80-1.01)	2742	0.87 (0.81-0.93)
Poorer	584	1.04 (0.88-1.24)	820	0.92 (0.82-1.04)	1448	0.93 (0.85-1.02)
Middle	749	0.93 (0.78-1.12)	712	0.96 (0.84-1.11)	1148	0.87 (0.78-0.97)
Richer	956	0.91 (0.78-1.08)	598	0.76 (0.64-0.89)	869	0.95 (0.83-1.08)
Richest	1128	0.82 (0.69-0.99)	407	0.89 (0.72-1.11)	594	0.96 (0.82-1.13)

Table 7.3. Survey logistics regression results of ANC 4 visits by wealth within the three regions in Indonesia

Model is adjusted for age, parity, level of education, twin pregnancy, pregnancy complication, provincial fertility rate, provincial presence of desa siaga, and area of residence (rural/urban)

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