FAMILY PLANNING, COMMUNITY HEALTH INTERVENTIONS AND THE MORTALITY RISK OF CHILDREN IN INDONESIA

DISSERTATION

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By

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ABSTRACT

In the last four decades, Indonesia has experienced rapid declines in infant and child mortality alongside active government interventions. The Indonesian government instituted a small family norm through an extensive family planning program and improved access to primary health care through various community based programs. Using the Indonesian Family Life Survey (IFLS), my dissertation studies the impact of two major government programs on the decline in mortality rates: (1) the national family planning program introduced in 1970 which is regarded to have been very successful in increasing contraceptive prevalence and (2) the village midwife program initiated in 1989 that trained and placed over 50,000 midwives in villages across the country.

The first two chapters describe the nature of the family planning program in Indonesia and empirically examine the relationship between the program and the risk of infant and child mortality. Access to modern contraceptives gives couples better control over the fertility process, allowing them to avoid unwanted pregnancies and enabling them to plan better for a desired number and age composition of children. This affects child survival through improvements in the mother's health and the resources allocated toward the upbringing of children. First, using the difference in the timing of introduction of the family planning program in two sets of provinces, I use a difference-in-difference approach to show that mortality rates of children fell in provinces where the family planning program was introduced. Second, I examine the relationship between

contraceptive acceptance by the woman and the likelihood of survival of subsequent births. A bivariate probit framework is used to overcome the bias that would arise in a single equation framework due to correlation between contraceptive use and unobserved individual characteristics of the woman. The results show a 5 percent reduction in the risk of child mortality after a woman has used contraceptives, but there is no such effect of contraceptive use on infant mortality.

The third chapter estimates the impact of the village midwife program on infant mortality. Trained midwives placed in villages through the program provided antenatal, intrapartum and postpartum assistance to village women who would otherwise have relied on traditional birth attendants for help during the birth process. Prior studies on the village midwife program have shown general improvements in women's health and birth-weights of newborns, but have not directly examined the impact of the program on the birth process, which was the primary objective of the program. I estimate the program effect by aggregating mortality outcomes at the district level and taking district fixed effects approach to overcome the bias due to non-random placement of these midwives. The results show that the program is associated with lower neonatal mortality rates, but it had no effect on post-neonatal mortality, which suggests an improvement in the birth process as neonate deaths are primarily caused by infections related to the birth process.

Dedicated to my parents

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INTRODUCTION

Every year approximately 10 million children die around the world before they reach the age of 5 (Black, Morris, and Bryce, 2003). Most of these deaths are confined to developing countries and are primarily due to preventable causes. One of the objectives of the Millennium Development Goals (MDGs) set by the United Nations is to reduce the number of child deaths to a fourth of the 1990 figure by the year 2015. Since most countries are committed to lowering the incidence of child deaths, it is important to understand the determinants of infant and child mortality and whether policy interventions play a role in lowering their occurrence. My dissertation studies the role of government policies in the reduction of mortality rates of children by drawing upon the experience of Indonesia, a country that has seen a remarkable drop in mortality rates of children and increases in the levels of economic development alongside the implementation of an extensive family planning program and various community health interventions in the last four decades.

Indonesia is an ethnically heterogeneous archipelago nation with over 13,600 islands and more than 100 languages, and is also the fourth most populous country in the world. It was one of the poorest countries in the world in the 1960s with a per capita income of about US$50 and with 60% of the population living below the poverty line in 1970 (World Bank, 1996). It has undergone rapid economic growth since the 1970s and

	Period			
	1965-1970	1975-1980	1985-1990	1995-2000
Bangladesh	159.4	138	104.2	70.6
India	145	129	94.5	76.2
Indonesia	144.1	106.4	69.8	49.5
Malaysia	49.6	33.8	17	11.6
Nigeria	154.4	134.8	121.3	116.7
Pakistan	137.6	117.8	98.5	85.4
Philippines	87.9	70.3	52.2	34.4
Republic of Korea	57.5	30	14.3	7.2
Sri Lanka	68.2	44.5	27.1	19.1
Thailand	74.5	56.3	37.8	23.2

Source: UN Population Division 2004 estimates

Table 1: Infant Mortality Rates for Select Countries (per 1000 live births)

poverty rates have fallen with less than 20% of the population living below the poverty line in 2000. Similarly, Indonesia started with very high infant and child mortality rates in the 1960s, but has made significant improvements in this area in the last four decades. Table 1 presents figures for infant mortality for Indonesia in relation to a number of countries. Although Indonesia had one of the highest infant mortality rates in the 1960s, comparable to India, Pakistan and Nigeria, it fares better than these countries today. Indonesia also introduced an extensive family planning program in 1970, which was followed by a rapid increase in the contraceptive prevalence rate in the country. Furthermore, Indonesia has introduced various community health measures including a program in the 1990s to introduce trained midwives in village across the country to assist women during delivery. This development experience makes Indonesia an important case

study to analyze the role of family planning programs and community health interventions on the reduction of mortality rates of children.

The study of Indonesia is also aided by the availability of the Indonesian Family Life Survey (IFLS), an extensive longitudinal dataset that has been conducted in three waves with the first in 1993, followed by waves in 1997 and 2000. Over 7000 households were interviewed in the first wave and tracked over time. The IFLS collected detailed information on household and individual characteristics including education, marriage, assets, consumption, and the use of health facilities from various respondents as well as pregnancy and contraception information from ever-married women. Furthermore, the IFLS collected information at the community level through interviews with village-heads and heads of community organizations including the heads of various community health and education facilities. The availability of community level data is a salient feature of the IFLS that is not found in many surveys of this scale from developing countries, which allows us to identify the introduction of various government programs in the community and therefore evaluate their effects on the community.

The first part of the dissertation focuses on the nature of the family planning program in Indonesia and presents an empirical study on its impact on infant and child survival. Direct involvement of the government to achieve lower fertility rate through a national family program to increase contraceptive prevalence and institute a small family norm has been unique to the demographic experience of developing countries as compared to the demographic transition process in European countries where fertility reduction took place without such major government family planning programs (Pritchett, 1994). Since the primary objective of the family planning programs was to

lower fertility rates, much of the debate on the importance of the family planning programs has been on their effect on lowering fertility rates. This dissertation will instead focus on the potential role of the family planning program in lowering infant and child mortality rates by increasing contraceptive prevalence in societies where effective modern means to regulate fertility were not available prior to their introduction.

Access to modern contraceptive methods provides couples with the ability to control the fertility process better, thereby lowering the likelihood of unwanted pregnancies. Avoidance of excess fertility and better spacing of births can lead to better health outcomes for children, as the couple can avoid having a stock of children that places excessive pressure on the economic resources available to the household. The main causes of death for a child in its early infancy also differ from those in its later childhood. Given the differences in the main causes of death over the lifecycle of a child, another question of interest is whether contraceptive use has a differential impact on infant and child mortality. As the main causes of death in early infancy are primarily related to the birth process, while deaths in later childhood are usually indirectly related to malnutrition and other environmental factors, it is likely that the increase in contraceptive prevalence will have a larger impact on child mortality than infant mortality.

The first chapter describes the nature of the family planning program in Indonesia and how it was able to expand its operations to reach villages across the country. While contraceptives were not widely available in the country when the program was started, over 50 percent of eligible women were using some modern method within a span of 20 years after the introduction of the program. The chapter describes the phases of

introduction of the program in Indonesia, the organizational structure of the family planning coordinating body, and how the program expanded to villages with active participation of community members.

Chapter 2 empirically examines the relationship between the family planning program and the reduction of infant and child mortality rates in Indonesia. Two separate methods are used to evaluate this relationship. First, a difference-in-difference approach is taken making use of the difference in timing of introduction of the program in two sets of provinces. Aggregate mortality rates for the two sets of provinces and their fluctuations over time are compared to the timing in introduction of the program in these provinces. The relative fall in mortality rates of children in these provinces coincide with the period of introduction of the family planning program suggesting a relationship between program introduction and the decline in mortality rates of children.

Second, the relationship between the mortality risk for each birth and whether or not the woman has used contraceptives prior to the birth is examined. Such an empirical investigation is complicated by the endogeneity of contraceptive use. The decision to become a contraceptive acceptor is a choice made by the woman and it may reflect various characteristics of the woman that are not observed in the data. If these unobserved characteristics are also driving the mortality risk of children then a single equation empirical framework would lead to biased results on the effect of contraception on the mortality risk of children. In order to overcome some of the biases associated with the endogeneity of contraceptive use, a bivariate probit framework is used with an equation specified for the mortality risk of children and the other for the likelihood for the woman to have used contraceptives prior to birth. In order to identify the model, the

presence of a community contraceptive distribution center is used as an exclusion restriction. These distribution centers made it easier to obtain contraceptives without having to travel to the community health center, and it increased the likelihood of contraceptive use by lowering the transaction costs of using them. So it is likely that these distribution centers affected the likelihood of contraception, but did not directly affect the mortality risk of children, thereby making it a valid instrument for identification.

The results suggest a relationship between family planning and the likelihood of child deaths, but there is no relationship with infant mortality. As deaths in later childhood are primarily due to infectious diseases with malnutrition as an underlying cause that increases the susceptibility of children. The results suggest that the availability of modern contraceptives that allowed better fertility regulation and lower the likelihood of unwanted pregnancies, and consequently allowing parents to realize their desired number as well as the age composition of children allowed for better resource allocation and higher quality of children. While early infant mortality is primarily related to the birth process, and as long as women do not have easy access to health facilities and continue to give birth in the house with high reliance on traditional birth attendants, the infant mortality risk of such births will remain high whether or not the births are planned.

Chapter 3 extends on the issue of safe motherhood in Indonesia and studies the impact of a major initiative to provide access to skilled delivery assistants for rural women across Indonesia on the risk of infant deaths. The village midwife program that was initiated in 1989, placed over 50,000 midwives in villages across the country by 1997. These midwives had three years of nursing training and an additional year of midwifery training prior to being placed in the villages. A majority of women in

Indonesia give birth in the house and traditional birth attendants were the primary delivery assistant for a large fraction of such births in rural areas prior to the introduction of the program. After the introduction of the program, the percentage of births delivered by skilled birth attendants has increased relative to those by traditional birth attendants. Since the major causes of neonatal deaths, i.e. death in the first month of life, are due to factors related to maternal health and the birth process, a program that provided rural women with easy access to skilled birth attendants for prenatal, intrapartum, and postnatal care could have improved the likelihood of infant survival through improvement in maternal and neonatal health as well as through better services provided during delivery that lowered the likelihood of neonatal infections and better management of birth complications.

Using the retrospective pregnancy histories of ever-married women from all three waves of the IFLS, the trends in the use of birth facilities and delivery assistance between 1989 and 1999 in Indonesia are presented in Chapter 3, which show a clear movement towards use of trained midwives away from the use of traditional birth attendants. The empirical analysis on the impact of the program on infant mortality risk is complicated by the fact that the program was not randomly assigned to the various villages, and those villages without access to midwives and further away from community health centers were targeted. Furthermore, it is difficult to estimate a causal impact of the use of midwives or trained delivery assistant, or the delivery of births in hospitals related to the house because these reflect choices made by the women and may be correlated with the unobserved individual characteristics of the women or the unobserved pregnancy risks faced by the women that may determine the type of services that they choose, leading to

biased estimates on the effect of services on mortality risk. The effect of the program on mortality risk is instead estimated by aggregating the mortality figures at the district level and then controlling for district specific effects. The results suggest that the program effort is associated with the reduction in infant mortality in Indonesia primarily through the reduction in neonatal mortality, while there was no effect of the program on post-neonatal mortality.

This dissertation contributes towards the study of the determinants of infant and child mortality and the role of government interventions in lowering their incidence. The declines in child mortality rates experienced by some of the industrializing countries in recent times have been rapid as compared to the experiences of Western European countries where the demographic transition process started earlier but were drawn over a longer period of time. The results presented in this dissertation on the case of Indonesia, a developing country that has made substantial progress in lowering mortality rates of children, suggest that the introduction of the family planning program and community health initiatives contributed towards the decline in the mortality rates of children.

CHAPTER 1

THE INDONESIAN FAMILY PLANNING PROGRAM

1.1 Introduction

This chapter provides an overview of the family planning program in Indonesia and its expansion over time to explain its contribution in increasing the contraceptive prevalence rate in the country. The coordinating agency responsible for family planning was established in 1970. It set up provincial and district level offices as it expanded across the country over time and resembled a full-fledged government department in itself. The program was introduced systematically across the country in three phases and covered all provinces by the third five-year development plan in the mid-1980s. The program initially started with a clinic-based approach where it functioned out of community health centers at the sub-district level but then moved towards a community-based approach with active participation of community leaders, village organizations, and a system of volunteers which expanded the reach of the program to people in villages across the country.

Although the family planning program was set up with the objective of initiating a small family norm and it sought to increase the number of contraceptive acceptors, the program also had a social welfare component besides having the responsibility for the distribution of contraceptives. As the program expanded, it integrated itself with other

health and development initiatives in the villages and it should also be credited for its contribution in developing a community-based health activity to provide nutrition information and primary health care. The activities of the family planning program in Indonesia has been more than just in the spread of contraception, but also towards improving the health and wellbeing of families across the country.

The next section discusses the historical background in the formation of the National Family Planning Coordinating Board that is responsible for coordinating the implementation of the family planning program. Section 1.3 discusses the phases of introduction of the family planning program in the different provinces and the movement from a clinic-based approach to a community-based one. Section 1.4 describes some of the features of the community model and the nature of participation of community organizations and volunteers in the program. Section 1.5 discusses the integration of the family planning program with the community nutrition initiative that eventually led to the formation of the integrated village health posts.

1.2 BKKBN: The Family Planning Coordinating Body

The government outlook on the population issue during the Sukarno era (1945-1967) in the post-independence phase of Indonesian history was characterized by a pro-natalist stance with no attempt to institute a national family planning program (Hull 2003; Sarwono, 2003). Contraceptive services were provided by the private sector, especially the Indonesian Family Planning Association (PKBI – *Perkumpulan Keluarga Berencana Indonesia*) which was founded in 1957. The association initially provided family planning services through clinics with mother and child health services in Jakarta and then spread to other parts of Java and Bali. They were not widely spread and were

restricted primarily to urban areas without a reliable re-supply of contraceptives. In 1964, the PKBI had 59 family planning clinics supported by 28 physicians and 60 midwives, with 4980 people using services from their clinics in that year (Sarwono, 2003).

The approach to population policy changed with the change in government in the late 1960s. After President Suharto came to power in Indonesia in 1967, his government instituted five-year development plans (REPELITAs: See Glossary) to promote economic development. The planning effort was spearheaded by BAPPENAS, the National Economic Planning Commission, which was headed by Professor Nitisastro Widjojo, a demographer/economist who also placed population issues on the development agenda (Suyono, Hendrata, and Rohde, 1995). President Suharto signed the World Leaders Declaration on Population in 1967 and a commission was formed by the Minister of Social Welfare the following year to elevate family planning to a national program and to institute a government body to develop a national family planning program. An interim semi-governmental body, the National Institute for Family Planning (LKBN – *Lembaga Keluarga Berencana Nasional*) was formed in October 1968.

The LKBN sought to expand family planning services by integrating it into the Department of Health's clinics. However, progress was initially slow as only those doctors who were members of the PKBI would integrate such services and LKBN lacked the administrative influence to be an effective agency (Sumbung, Pandjaitan, et al., 1984). During this interim period, the goals and objectives of the family planning program were more clearly defined and plans were made to strengthen the administration and organization of the program. The primary goal set for the family planning program was to institutionalize "a small, happy, prosperous family" norm by promoting fertility

limitations as a means to improve the quality of life. Second, a demographic goal was set to reduce the 1970 crude birth rate by 50% by 1990, which meant a drop from 44-46 births per 1000 population to 22-23 births per 1000 by 1990. Since it had a social welfare goal, the family planning program was viewed more than just a program for contraceptive delivery, and it was integrated with programs from the Health Department as well as other government departments, such as Agriculture, Religion, Information, and Transmigration (Sumbung, Pandjaitan et al., 1984).

In order to meet these goals, it was decided that a non-departmental and non-ministerial level body that was directly responsible to the President should be established to coordinate the program. As a result, the National Family Planning Coordinating Board (BKKBN – *Badan Kordinasi Keluarga Berencana Nasional*) was formed in 1970 to replace the LKBN. Although BKKBN was set up with the role of coordinating activities of line departments, from the onset, it was much more than a coordinating agency (Hull 1994). It received external funding from donors to build a strong bureaucracy that was capable of handling logistics, training and promotional tasks that were believed to be beyond the task of existing departments (Hull, 1994). Its staff became involved in setting up and running research and action projects and it directly hired fieldworkers for motivational activities to increase the number of contraceptive users. As it continued to grow over time, it resembled a department in itself, with its success creating conflict with the Department of Health as it encroached upon its areas of operation (Hull, 1994).

The ability of BKKBN in increasing contraceptive services and users is attributed to its successful involvement of all levels of government as well as community institutions, with much local involvement in the planning and implementation of the

program within the guidelines set at the central level to account for the ethnic heterogeneity of Indonesia (Hull, 2003). Instead of relying on a single unit of government, BKKBN was able to involve the vertical structure of government to promote the family planning program. With President Suharto himself committed to the program, lower level leadership was motivated to be involved in the program (Hull, 2003). As the performances of local administrators were also judged on the basis of family planning performance of the local units under their control, family planning achievement became an important area of emphasis. Another feature of the program was the setting of targets, especially in the number of new contraceptive acceptors. The targets were set at the central level and were followed through by lower administration units, with each unit giving lower units incentives to reach the specified targets (Hull 2003).

1.2.1 Service Statistics System

One of the factors associated with the effectiveness of the Indonesian family planning program is its service statistics system that allowed for rapid feedback of the performance of the program in the field. Soon after its formation, BKKBN started operating a service statistics system in 1971 to monitor the progress of the program. Information was sent from the field to the central office in Jakarta on a monthly basis, which was then processed by computers to generate feedback reports that were sent back to the local areas allowing for continual program evaluation. This also allowed the central BKKBN officials to track the progress of the program at the local levels. As each clinic had to apply to the district office to be designated as an official family planning clinic after having trained staff, equipment and supplies in place, each of these clinics was assigned a unique clinic code for all reports. As part of the service statistics system, the

clinics reported aggregate measures of number of new acceptors and contraceptives services provided on a monthly basis. Besides tracking the progress of the program at the local level, it also facilitated the management of the stock of contraceptives required for various localities and aided in the logistics of distribution of contraceptives.

For each new acceptor who came to the clinic for contraceptives, an acceptor card was completed with general characteristics of the woman, such as her age and the type of contraceptive chosen. These acceptor cards were sent to Jakarta and a random sample of 10% of all cards was analyzed on a quarterly basis to analyze the general characteristics of the acceptors and to verify the number of new acceptors reported in the monthly clinic report (Suyono, 1976). Similarly, various aspects of follow-up visits by the acceptor were also recorded in a separate card and sent to the center to be processed. The information from the clinics was processed in Jakarta to generate monthly feedback reports at the district level on clinic activities, the number of new acceptors, ranking of the districts in the province based on the percentage of clinics reporting on time and by the number of new acceptors per 1000 married women, and also on the distribution of the stock of contraceptives at the provincial and district levels.

The system of continual feedback about performance also served to motivate local communities who became familiar with their family planning figures, such as contraceptive prevalence and the number of eligible women in their localities, as well as their family planning performance relative to other communities. As the feedback reports also ranked the districts based on their reporting and contraceptive usage, it provided an incentive to local administrators to improve their performance. However, the BKKBN service statistics system has also been criticized for its shortcomings in the data collection

mechanism as there seem to have been instances of over-reporting and the contraceptive prevalence rate as computed by BKKBN was higher than the figures based on census data (Streatfield, 1985).[1]

1.3 Phases of Program Introduction

The family planning program spread systematically across the Indonesian archipelago, with the initial introduction in the islands of Java and Bali during Repelita I, the first five-year development plan (1969/70-1973/74), followed by the introduction across Sumatra and select provinces in the outer islands in the second five-year development plan (Repelita II), and finally to all provinces by the third five-year development plan (Repelita III). Initially the program relied on the Department of Health clinics to provide contraceptive services. Since it became apparent that this approach did not reach the majority of the target group of women, a community-based approach was undertaken to spread the family planning program at the village level.

1.3.1 Family Planning in the Early Years: The Clinic-Based Approach

In the early years of the family planning program, it was implemented through the Department of Health clinics which were at the sub-district level. Mother and Child Health Centers (BKIA: *Balai Kesehatan Ibu dan Anak*) had been built in the 1950s and 1960s, which were expanded in the 1970s with an extended list of services to create the Community Health Centers (Puskesmas: *Pusat Kesehatan Masyarakat*) with the aim of establishing one in each of the 3500 subdistricts in Indonesia (Rohde, 1993). Ideally,

[1] Streatfield (1985) finds that the 1980 contraceptive prevalence rate was 32.2 percent according to the service statistics system, while it was 27.2 percent according to the census. Part of the difference is also due to the difference in the number of eligible women used to compute the prevalence rate, with the service statistics system using a smaller denominator. Using the census figure for the number of eligible women, the prevalence rate from the service statistics is 30.2 percent.

each Puskesmas includes a medical team headed by a doctor, though as of 1980 half the Puskesmas did not have a physician (Rohde, 1993). The Puskesmas provide general out-patient services, family planning services, health education programs, and other preventative and curative services. By 1974, family planning services were available through 2500 clinics in Java and Bali (Suyono, Pandi, et al., 1976).

In 1972, family-planning field workers (PLKB – *Petugas Lapangan Keluarga Berencana*) were trained to motivate and provide services to couples. Initially they worked out of the clinics, so their reach was confined to clients that were already motivated users of contraceptives. In 1974, a decision was made to base the PLKB in the villages instead at the clinic (Lubis, 2003). This allowed the fieldworker to have direct contact with eligible couples in the villages to motivate them to become contraceptive acceptors and supply them with contraceptives within the privacy of their homes (Lubis, 2003).

1.3.2 Community-Based Approach to Family Planning

Since the clinic-based approach primarily relied on clients coming to them to seek contraceptive services, a community-based approach was undertaken to increase awareness of family planning concepts and contraceptive use in the villages themselves as well as to develop a system of re-supply at the village level. By the mid-1970s, the program became oriented towards the pill and to condoms to a lesser extent, both of which depend on re-supply for effective use, while IUDs were declining in popularity (Suyono, Pandi, et al, 1976). In order to avoid "plateauing" in contraceptive prevalence as experienced by other national family planning programs, it was decided that the program needed to move from the clinic to the villages so that services could be made

convenient and contraceptive re-supply simplified in order to prolong contraceptive use (Suyono, Pandi, et al, 1976).

A link in a village was established for resupply of contraceptives from a clinic through the fieldworker. The village contraceptive distribution center (VCDC) involved a village volunteer known as the Village Family Planning Management Assistant (PKKBD – *Pembantu Pembina Keluarga Berencana Desa*), who was usually a member of the village head's staff. The fieldworker made monthly visits to the PPKBD with contraceptive supplies from the clinic. Recordkeeping at the village level allowed for the village family planning to be part of the service statistics system used to monitor and track the progress of the program. Furthermore, village acceptors formed 'clubs' to motivate others and share experiences regarding their use, and within these clubs, community members volunteered to distribute monthly supply of contraceptives to the other participating households. Volunteers within these community based groups also spread the contraceptive message and recruited other acceptors without much use of BKKBN resources besides the provision of regular and reliable supply of free contraceptives (Suyono, Hendrata, and Rohde, 1995). The community-based family planning clubs, called *Kelompok akseptor* (acceptor clubs), were responsible for motivating over half of new contraceptive acceptors during the 1970s and a majority of pill and condom users were supplied through them (Suyono, Hendrata, and Rohde, 1995).

Given the heterogeneity of various communities across Indonesia, acceptor groups varied from community to community, and as they were run by community volunteers, they were able to adapt to the specific needs of the community participants. For instance, the *Banjar*, a traditional system of community gathering to discuss

community related issues, was used to promote the family planning concept and increase the number of acceptors in Bali (Suyono, Pandi, et al., 1976).

1.3.3 Geographical Spread of the Program

Given the geographical makeup of Indonesia and the logistical challenge of covering all the provinces at once, the program was introduced in the various provinces in different phases. During the first five-year development plan (1969/70-1973/74), the program was only introduced in the six provinces of Java and Bali, since these provinces had better infrastructure in place and were also the most populated of all the provinces and were of the highest priority[2]. The program was primarily introduced as a clinic-based program with outreach activities by family planning fieldworkers. During the second five-year plan (1974/75-1978/79), the program was introduced in 10 other provinces referred to as Outer-Islands I. These provinces were: Aceh, North Sumatra, West Sumatra, South Sumatra, Lampung, North Sulawesi, South Sulawesi, South Kalimantan, West Kalimanatan, and West Nusa Tenggara. During this time, the program in Java and Bali moved to the community-based approach. Since the provinces in Outer Islands I were relatively sparsely populated and with greater distances between villages as compared to the provinces in Java and Bali, it was decided that the use of fieldworkers would not be feasible there as it had been in Java and Bali (Lubis, 2003). Instead the program relied on the administrative structure and program responsibility was given to local government officials who were given training to be able to carry out family planning activities (Lubis, 2003). The family planning program covered the remaining

[2] The five provinces in Java are West Java, Jakarta, Central Java, Yogyakarta, and West Java, while Bali is a province in itself.

Indonesian provinces, classified as Outer-Island II, during the third-five year plan (1979/80 – 1983/84).

Table 1.1 shows the increase in the number of contraceptive acceptors over time in the three sets of provinces. By the end of the first five-year plan, contraceptive usage was mostly confined to the six provinces in Java and Bali where the family planning program was active with 1.6 million users. By the end of the second five-year plan, the provinces under the classification of Outer-Island I were reached by the BKKBN, while Java and Bali moved to the community-based approach and experienced a rapid increase in number of acceptors reaching to over 5 million users. The family planning program was finally introduced in Outer-Islands II in the third five-year plan, and the number of contraceptive users in both Java-Bali and Outer-Island I also increased significantly during this phase. While there were 1.6 million users confined to Java and Bali at the end of the first five-year plan, the number of contraceptive users had increased to over 19 million by 1989 covering all the provinces of Indonesia and constituting about 59 percent of eligible couples (BKKBN, 1992).

		Period			
		1973/74	1978/79	1983/84	1989/90
Java-Bali	Target			8000	12949.3
	Achievement	1680.7	5001.8	10776.2	12336.5
Outer Islands 1	Target			1200.5	4761.6
	Achievement		539.7	3137.2	4543.5
Outer Islands 2	Target			300	1368.8
	Achievement			509.1	1645.3
Indonesia	Target			9500.5	19079.7
	Achievement	1680.7	5541.5	14422.5	18525.3

Notes:
Java-Bali: West Java, Central Java, Yogyakarta, East Java, Jakarta and Bali.

Outer-Islands I: DI Aceh, North Sumatra, West Sumatra, South Sumatra, Lampung, West Nusa Tenggara, West Kalimantan, South Kalimantan, North Sulawesi, and South Sulawesi.

Outer Islands II: Riau, Jambi, Bengkulu, East Nusa Tenggara, Central Kalimantan, East Kalimantan, Central Sulawesi, South East Sulawesi, Maluku, Irian Jaya, East Timor.

Source: BKKBN (1992)

Table 1.1: BKKBN Achievement of Current Contraceptive Users' Target (in '000s)

1.4 Village Family Planning

One of the salient features of the Indonesian family planning program was the development of a village based program with active voluntary participation by local residents who became involved in providing information about family planning, motivating other couples to become contraceptive users, and aiding in the distribution of contraceptives. Initially, the program relied on the family planning field workers (PLKB) to visit villages to provide information about family planning, but as the program matured, it turned increasingly towards community participation in sustaining and spreading the program. Approximately one out of every 80 villagers does some work for the family planning program every month without payment (Hamidjoyo and Chauls, 1996). BKKBN's ability to undertake the community-based approach was aided by the involvement of the Family Welfare Movement (PKK) and a network of community leaders and volunteers, known as *kaders* (cadres).

1.4.1 The Family Welfare Movement (PKK)

The Family Welfare Movement, PKK (*Pembinaan Kesejahteraan Keluarga*), is a nationwide government-backed organization set up with the aim of improving the role of women beyond the traditional household and childbearing responsibilities. It was initially set up to improve household skills, then expanded to income generation, and later to encompass a wide range of educational, economic, social, political and cultural matters (Hamidjoyo and Chauls, 1995). Their activities are based on 10 programs: i) practice of

Pancasila[3]; ii) development of *gotong royong*, mutual self-help; iii) food; iv) clothing; v) household management; vi) education and vocational skills; vii) health; viii) cooperatives; ix) environment; and x) planning, which includes family planning (Hamidjoyo and Chauls, 1995).

The membership in the PKK is voluntary, and the wives of government officials usually head the movement in each unit, with the wife of the governor heading the unit at the provincial level and the wife of the village-head heading the organization at the village level. Local women are organized into 10-20 household units called *Dasa Wisma*, and each unit meets on a monthly basis to discuss the 10 main programs. The activities are implemented by the PKK volunteers who are assigned responsibility to each activity. Monthly village level meetings which are highly visible to the community are held to discuss the various programs and the volunteers make reports on the achievements of their respective programs. Given their wide reach in villages across the country, the involvement of the PKK was essential in moving the family planning program from the clinics to the community (Hull, 2003).

1.4.2 Family Planning Kaders

Kaders are part of a recognized structure of volunteers that help in the management and implementation of the program. They are mostly women, leaders in their communities, usually the wife of the village head or other government officials, and receive no payment for their work (Hamidjoyo and Chauls, 1995). The kader system was started in the late 1970s, with the creation of the Village Family Planning Management

[3] Pancasila refers to the five basic principles formulated at the time of independence that guide the Indonesian state. They are: i) belief in one God; ii) just and civilized humanity; iii) unity of Indonesia; iv) democracy guided through deliberations and consensus; and iv) social justice for all Indonesians.

Assistant (PPKBD) with the initial role as distributor of contraceptives in the village, but later they took the role in the promotion of the family planning program and became the managers of the village family planning program (Hamidjoyo and Chauls, 1996). Under the PPKBD at the sub-village level are the sub-PPKBDs who are the chief kaders at that level. Within the sub-village there are also a number of kaders that are responsible for the implementation of various aspects of the integrated family planning program. There are usually four kaders responsible for the *posyandu*, a monthly community health activity which will be described later in the chapter, and others that are responsible for the development programs integrated with the family planning program such as the development of Family with Children under Five (BKB: See Glossary) and the income-generating project (UPPKA: See Glossary).

1.4.3 Other Volunteers

Besides these kaders, there are other volunteers that do not fall under the formal kader structure. The "acceptor clubs" are usually social clubs of women who are contraceptive users which is also open to non-acceptors. The members of these clubs also act as volunteers that help in the implementation of the family planning program and other development programs in the village. These clubs also act as forums for members to discuss different family planning methods and share their experiences using them, including if they experienced side effects. Such discussions were meant to motivate new acceptors as well as to motivate current users to continue using them (Hamidjoyo and Chauls, 1995). As a further incentive, women using contraception and who have not been pregnant for at least five years qualify for a "KB Lestari" award and receive a certificate and medal. They also receive training from fieldworkers to motivate neighbors and

thereby become part of the volunteer network of the family planning program (Hamidjoyo and Chauls, 1995).

1.4.4 Rakor Desa: Monthly Coordination Meetings

The coordination and management of the family planning program at the village level is done through monthly meetings called *Rakor Desa*.[4] Every month a meeting is held in the village to evaluate the achievements of the family planning program in the past month, discuss problems regarding implementation of the program and propose solutions, and plan activities for the following month. These meetings are chaired by the village head while the family planning fieldworker (PLKB) acts as the assistant and makes preparations and helps conduct the meetings. The other participants include the heads of sub-villages, PPKBD, sub-PPKBDs, other kaders, PKK members, community leaders and other medical personnel. The meetings involve presentations with highly visible charts with last month's targets and achievements and the targets for the following month. The performance of each sub-village is also compared and the highest and lowest achieving sub-villages are singled out and asked to explain their achievements, which serves to reinforce the notion that the village heads are responsible for the success of the program rather than the PLKB or the PPKBD and the sub-PPKBDs (Hamidjoyo and Chauls, 1996).

1.5 Integrated Approach to Family Planning

As the BKKBN was set up as a coordinating body it integrated its activities with government programs from various departments, especially the Department of Health. While the emphasis of the Department of Health was service provision through a system

[4] The term *Rakor Desa* is derived from *Rapat* meaning meeting and *Koordinasi* meaning coordination.

of hospitals and health centers, their reach was limited to the usage of these facilities, while the family planning program through its network of fieldworkers involved in motivational activities at the community level had a wider reach which contributed towards setting up a community-based health initiative at the sub-village level.

1.5.1 Nutrition and Family Planning

Women Welfare Associations, *PKK*, were already present in most villages when the community-based family planning approach was implemented, which helped in the formation of the contraceptive acceptors clubs. After the 1973 National Nutrition Survey showed large extent of malnutrition of children in Indonesia, the government made tackling malnutrition a major policy goal, and a village level approach was undertaken with the PKK organizing monthly weighing of children and educating women on nutrition and growth to promote child health (Rohde, 1993). These monthly activities involved weighing children, plotting weight on growth cards to keep track of growth in subsequent visits, discussion of nutrition and child growth, and preparation of a common community meal for the participating children. The Department of Health tried to extend monthly PKK activities by introducing the village Family Nutrition Improvement Program (UPGK: See Glossary) with a standardized set of activities and training with the involvement of staff from nearby health center. By 1979, the UPGK had expanded to about 800 villages (Rohde, 1993).

BKKBN saw a potential in these monthly activities to further spread the family planning message and recruit new acceptors. During the third five-year plan (1979/80 - 1983/84), when nutrition was at the forefront of the development objective, the involvement of BKKBN and the Department of Health led to the extension of the

monthly weighing and nutrition education activities to over 80,000 weighing posts in 41,000 villages (Rohde, 1993). Family Planning Field Workers (PLKB: See Glossary) were retrained on child growth monitoring, nutrition and oral rehydration issues to organize, establish and supervise the village posts called KB-Gizi (Nutrition).

1.5.2 From Nutrition Posts to the Posyandu

By late 1984, there were over 80,000 posts providing basic nutrition and growth monitoring services to about 10 million children (Rohde, 1993). The fourth five-year development plan (1984/85 – 1988/89) expanded the scope of activities in these nutrition posts and they were called Village Integrated Health Posts (Posyandu*: Pos Pelayanan Terpadu*). Besides providing weighing services and nutrition information, vitamin A capsules, iron tablets and oral rehydration salts, and the distribution of contraceptives with the participation of village volunteers, these posts were also attended by a worker from the nearest health center to provide basic medical care and supply a limited number of essential drugs. The posyandu is now the core activity for community participation of the family planning program as it is conducted by the same set of volunteers that are also responsible for the family planning program (Hamidjoyo and Chauls, 1995). Since it is organized with the help of volunteers, the program does not incur large costs in running them and most of the funds come from the community itself.

The posyandus are run with a five-tables system, where each table is responsible for a particular activity and the tables are arranged in the following order: registration, weighing of children under 5, recording of weight on a standard growth chart, motivation through information on how to improve child health if the child is underweight, and finally some basic medical services such as immunization and minor medical treatment.

The aim in the development of these posts was to offer a wide range of services and to expand the posyandu system to all villages in all provinces with a target of 100 children per post (Rohde, 1993). By the mid-1990s, there were approximately 225,000 posyandus being held every month averaging one per sub-village (Hamidjoyo and Chauls, 1995). All posyandus have the first four tables, but only about 20 percent have the fifth table due to a shortage of medical staff, but workers from the health center are usually rotated so that each posyandu can have a fifth table every four or five months (Hamidjoyo and Chauls, 1995).

1.6 Summary

This chapter described the introduction of the family planning program in Indonesia and highlighted some of its features to provide an insight into its functioning and to explain its effectiveness in propagating the family planning message and increasing the number of contraceptive acceptors within a short period of time. The discussion shows that the family planning was able to make use of the government administrative structure and the existing community institutions along with a network of volunteers for the implementation of the program. Besides the motivation of contraceptive users, the family planning program was also integrated with other health and development activities, and given its reach into the villages it was able to contribute towards the formation of the community-based integrated health post.

The next chapter will examine the relationship between the family planning program and the reduction in infant and child mortality in Indonesia using data from the Indonesian Family Life Survey (IFLS). First, the effect of the program on aggregate mortality rates will be examined using the difference in timing of introduction of the

program in two sets of provinces, and secondly, the relationship between contraceptive use and the mortality risk of subsequent births will be explored.

CHAPTER 2

THE FAMILY PLANNING PROGRAM AND THE MORTALITY RISK OF CHILDREN

2.1 Introduction

Indonesia is regarded as one of the countries with a family planning program that was very effective in increasing contraceptive usage and lowering the fertility rate within a short period of time. Total fertility rate for Indonesia for 1971-1975 was 5.2 while it had dropped to 2.7 by 1995-97. Similarly, the usage of modern contraceptives was about 17% for married women between ages 15-49 in 1976, but had increased to about 51% percent for 1997. Between the same time periods, the infant mortality rate has fallen from 145 to 52 deaths per 1000 live-births, while the child mortality rate has fallen from 218 to 70 deaths for 1000 live-births (BPS, 1998). In the three decades since the introduction of the family planning program, Indonesia has also seen an increase in school enrollment, rise in income levels, increase in life expectancy, and increase in the age of marriage, all indicative of rise in the level of economic development. There is considerable debate whether the reduction in the fertility rate is the outcome of a successful family planning program or whether the change in fertility behavior is the outcome of economic development which led to the reduction in the demand for children and the subsequent adoption of contraceptives to realize smaller desired family size (Gertler and Molyneaux

1994; Pritchett, 1994; Freedman, 1997; Tsui, 2001). Whether the family planning program induced a desire for smaller families or filled an existing demand for contraceptives, there can be little debate that it made contraceptives widely available and increased contraceptive prevalence. This chapter analyzes another question which is part of the debate on the effects of family planning programs: do these programs have an impact on infant and child mortality?

Access to modern contraceptive methods provides couples with the ability to control the fertility process better, thereby lowering the likelihood of unwanted pregnancies. Avoidance of excess fertility and smaller deviations from the optimal spacing between births can lead to better health outcomes for children, as the couple can avoid having a stock of children which places excessive pressure on the household budget constraint. Another question of interest is whether the increase in prevalence of contraceptive use has differential impacts on infant and child mortality as the main causes of death differ for a child in its early infancy and later childhood. As the reduction of infant and child mortality is a major policy goal in developing countries, the relationship between contraceptive use and mortality risk has important policy implications.

The empirical analysis is conducted using the 1993 round of the Indonesian Family Life Survey (IFLS). The IFLS is an extensive survey that collected information on a wide array of socioeconomic variables including the fertility history for married women. Besides information at the individual and household levels, information on various aspects of the community was also collected. The wide range of questions on the survey allows us to control for a larger set of determinants of infant and child mortality risk, which will mitigate the impact of the omitted variable bias in the empirical analysis.

Usually, empirical studies on infant mortality are hindered due to small sample sizes with few realizations of infant deaths that produce insignificance of estimated coefficients. The sample used in this chapter consists of over 13 thousand births, of which there were 1201 infant deaths.

Two different approaches are taken to study the impact of the family planning program on mortality risk of children. First, a direct approach is used to estimate the impact of the program by using the different phases of the introduction of the program in different provinces across Indonesia. Since the program was first introduced in the provinces of Java and Bali and then introduced in provinces in the outer islands in the next five year phase, this difference in timing of program introduction allows for a difference-in-difference approach to estimate the program effect by aggregating outcomes at the provincial level. Second, the relationship between contraceptive acceptance by an individual and the subsequent mortality risk of births is investigated. A proximate determinants framework is specified with contraceptive acceptance as a choice variable that affects mortality outcomes. Since a single equation framework to estimate such a relationship leads to biased results due to the endogeneity of contraceptive use, this relationship is estimated using a bivariate probit structure controlling for province and period effects. The results suggest that women who have used contraceptives prior to a birth have a lower child mortality risk for that birth, but no such relationship exists when solely considering the risk of infant mortality.

The next section motivates the role of family planning and contraceptive use on mortality risk of children. Section 2.3 gives a brief overview of the Indonesian family planning program. Section 2.4 discusses the difference-in-difference approach and the

results using aggregated provincial mortality rates. Section 2.5 involves the bivariate probit framework to study the relationship between contraceptive acceptance and mortality risk. Section 2.6 concludes with a discussion of the results and potential for future research.

2.2 Role of Family Planning on Mortality Risk of Children

Demographic studies have shown that there are higher mortality risks associated with shorter spacing between births, for low age of mother at birth, and first order and higher order births (Bongaarts, 1987). The negative impact of closely spaced births on infant and child mortality arises due to maternal depletion and competition for limited resources to be devoted to each child (Hobcraft, McDonald and Rutstein, 1985). Successive childbearing without enough time for recovery can physically deplete the mother, leading to infants with lower birth weight, who are more vulnerable to disease. Closely spaced births also lead to competition in the allocation of resources between children.

In a situation where modern contraceptives are not available, some amount of birth spacing can also be attained through breast-feeding. The infecundable period following birth averages about 1.5 months without lactation, but with continued breastfeeding, the infecund period can be extended up to two years (Bongaarts, 1978). In developing countries like Indonesia, breast-feeding is common, which provides a natural means to space births. Higher levels of development are also associated with reduction in the duration of breast-feeding, which shortens the infecundable period, whereby contraceptive use becomes more important in effectively spacing between births.

According to Bongaarts (1987), family planning programs could also lead to an increase in the infant mortality rate due to changes in family building practices as contraceptive prevalence increases in a society. Mortality risks are high for births of first order, births of high order, births in low ages, and short spacing between births. As a country moves to higher levels of contraceptive prevalence, the proportion of births in each of these excess mortality risk categories changes. It is likely that lower infant mortality due to fewer higher order births and fewer births at low maternal ages could be offset by high mortality risk due to high proportion of first order births and lower birth orders with small amount of spacing between them.

Potter (1988) highlights three other ways that family planning programs could affect infant and child mortality. First, in the initial stages of the family planning program, it is likely that the increase in contraceptive usage will be among educated women at a higher socioeconomic bracket, who are low risk women. The share of births of these women would fall relative to the rest of the population thereby the overall infant mortality rate may not fall. As the program matures and a larger number of women become contraceptive users, the infant mortality rate could fall. Second, the increase in contraceptive prevalence due to family planning programs would give women with high mortality risks the ability to avoid births. And third, it is also likely that as couples have fewer children, there is a change in family relationships with parents investing more per child, thereby reducing the likelihood of death.

This chapter will look at the aggregate variation in mortality rates over time as well as the infant and child mortality risks of individual births and their relationship with contraceptive acceptance. Parents derive lifecycle costs and benefits from children and

make fertility decisions conditional on the constraint placed by their income stream. As the natural fertility process is characterized by uncertainty in the probability of conception, access to modern contraceptive methods provides a couple with the means to control this process more effectively. Given that children are durable goods and costly in their earlier years, unplanned births can place severe pressure on the ability of the family to allocate the necessary resources for raising children, thereby lowering the quality of the stock of children and increasing their mortality risk. A couple that is better able to control the fertility process has a lower likelihood of observing deviations from its desired number of births and the optimal spacing between them, and consequently faces a lower mortality risk for children, ceteris paribus.

The main causes of infant and child deaths in developing countries are acute respiratory diseases, diarrhea, and infectious diseases. A large fraction of neonatal deaths are due to infections related to the birth process itself as most rural areas lack health facilities that provide sanitary conditions and trained staff to supervise the birth process, making the childbearing process risky for mother and child. Post neonatal deaths are also primarily caused by infectious diseases, but their incidence is indirectly related to environmental factors and malnutrition of children. Given the differences in the major causes of death at the neonatal stage and during later infancy and childhood, contraceptive use could affect infant and child mortality differently.

Since early infant deaths are primarily related to the birth process, the role of contraceptive use in reducing the likelihood of infant deaths is through the avoidance of risky births by the mother and the improvement in maternal health due to adequate spacing between births. Contraceptive use could have a larger effect in the case of child

mortality as mortality in later ages is influenced by the allocation of resources towards the upbringing of the child. Unplanned pregnancies and the subsequent deviation from the optimal timing and spacing of births could affect the ability of families, especially those with fewer means, to allocate necessary resources to raise healthy children. As long as there is no significant improvement in the conditions in which the birth process takes place, the risk of death in early infancy remains high whether or not the pregnancy is planned. However, the choice of couples to control the fertility process through the use of contraceptives could effectively avoid unwanted pregnancies and avoid a situation of suboptimal age distribution of children or excess fertility, allowing adequate allocation of resources to children and lowering the child mortality risk. Hence it is likely that in the initial stages of development, the increase in contraceptive prevalence will lower child mortality to a greater extent than infant mortality.

Studying the role of family planning programs can be complicated by the non-randomness in the allocation of program resources which leads to biased estimates of the impact of program variables on outcomes of interest. Prior studies on the relationship between family planning and fertility have highlighted that if programs are placed in the area where there is high demand for contraceptives, it leads to overestimation of the program effect, while targeting of such programs to areas that have historically low usage of contraceptives and high birth rates leads to an underestimate of program effect on contraceptive use and fertility rates (Rosenzweig and Wolpin, 1986). Gertler and Molyneaux (1994) take into account that family planning program effort may be directed towards areas of greatest need in Indonesia. They use a fixed effects approach to control for nonrandom program placement to estimate the impact on community birth rates using

community level data from 1982 to 1987. Their results suggest that economic development explains most of the fertility decline in Indonesia, while family planning program effort working through the contraceptive use channel explains only a small part of the fertility decline.

The fixed effects approach only controls for the bias due to selective placement of program if allocation decisions are based only on time invariant community characteristics not observed by the researcher. However, if program placement rules change over time, the fixed effects approach does not rectify the problem caused by endogeneity. In a subsequent paper, Molyneaux and Gertler (2000) specify the family planning resource allocation rule across the districts in Indonesia, and show that it depends on the demand for contraceptive supplies in the adjoining districts. Each administrative unit has a specified allocation for the year to distribute to lower units and the distribution of resources across districts will depend on the relative demand for contraceptive supplies among them. Variables reflecting the demand situation in surrounding districts are used as instruments to control for the endogeneity problem caused by time-varying program placement rules.

The time-frame for study in Molyneaux and Gertler (2000) is from 1986 to 1994, which is over 15 years since the inception of the family planning program when the program was already mature. They show that allocation of family planning program expenditures to districts varies over time and is responsive to demand for contraceptives in the locality. The analysis in this chapter, on the other hand, uses retrospective pregnancy histories to study the impact of the program at the time of its introduction. To overcome the problem of targeted program placement, a difference-in-difference

approach is used with aggregated mortality outcomes to estimate the impact by taking the difference in the timing of introduction of the program in various provinces. The problem of endogeneity would be more severe in the above mentioned studies that estimate the impact of family planning on fertility as the government placement rule would be guided by the prevailing contraceptive prevalence rate. Furthermore, it is difficult to disentangle the direction of causality as women who want to limit fertility may be more likely to use family planning methods, so it is difficult to identify whether the family planning program led to a decline in fertility rates or whether other factors led to a reduction in demand of children, which in turn led women to become contraceptive acceptors. This chapter studies the mortality risk of individual births, so the problem of endogeneity lies in the correlation of unobserved individual characteristics that affects mortality with the likelihood of contraceptive acceptance. This is accounted for using a multi-equation empirical framework which will be discussed in Section 2.5.

2.3 The Family Planning Program and Aggregate Mortality Trends

Given the systematic spread of the family planning program in five year phases across the archipelago, the impact of the family planning program on mortality will be estimated using a direct approach. During the first five year plan (1970-1974), the family planning program was only introduced in the 6 provinces of Java and Bali. The program extended to another 10 provinces, which were classified as Outer Islands I, in the next phase (1975-79), and finally covered the remaining provinces (classified as Outer Islands II) during the third phase (1980-84). This systematic introduction of the family planning program allows us to estimate the effect of the family planning program using a difference-in-difference strategy by aggregating mortality outcomes at the province level.

The Indonesian Family Life Survey (IFLS) consists of households drawn from 13 provinces: six in Java and Bali and seven from those in Outer Islands I. None of the provinces that fall in the Outer Island II category where the family program was introduced in the third phase were covered in the survey. Henceforth, I will refer to the six provinces in Java and Bali as *Java-Bali* and the seven provinces from Outer Islands I covered in the IFLS as *Outer-Islands* for convenience. Using the retrospective fertility history of ever-married women from the IFLS, the mortality rates of children for each province is computed for five periods corresponding to the different phases of the family planning program: 1960-1969, 1970-1974, 1975-1979, 1980-1984, and 1985-1989. Mortality rates for the provinces are computed as the number of deaths per 1000 live births in the province for each five year period. Infant mortality, child mortality and neonatal mortality are defined as death before the age of one year, five years, and one month, respectively.

Table 2.1 presents the sample mortality rates from the IFLS for the six provinces in Java-Bali and the seven provinces in the Outer-Islands. Both Java-Bali and the provinces in the Outer-Islands show a decline in mortality rates over time. However, Java-Bali as a whole is clearly a superior health producer as it continues to have lower mortality rates over time relative to the Outer-Islands. There is also a wide variation in the child and infant mortality rates across the provinces as shown on Table 2.2. The mortality rates in West Java, West Sumatra, West Nusa Tenggara, and South Kalimantan are higher than in the rest of the country. There is also a difference between urban and rural places. Jakarta and Yogyakarta, which are more urban, have lower infant and child mortality rates.

	Full Sample			Java-Bali			Outer-Islands		
Period	Live Births	Infant Mort	Child Mort	Live Births	Infant Mort	Child Mort	Live Births	Infant Mort	Child Mort
1960-1969	1155	116.9	169.7	706	111.9	169.9	449	124.7	169.3
1970-1974	2023	106.3	150.8	1166	87.5	125.2	857	131.9	185.5
1975-1979	3132	91.6	117.2	1760	82.4	106.3	1372	103.5	131.2
1980-1984	3696	82.3	108.5	2115	70.9	89.4	1581	97.4	134.1
1985-1989	3364	77.3	92.2	1844	66.2	75.4	1520	90.8	112.5
All periods	13370	89.8	118.1	7591	78.8	102.9	5779	104.3	138.1

Notes:
Mortality rates are defined as the number of deaths per 1000 live births.
Java-Bali consists of the provinces of Jakarta, West Java, Central Java, Yogyakarta, East Java, and Bali.
Outer-Islands consist of the provinces of North Sumatra, West Sumatra, South Sumatra, Lampung, West Nusa Tenggara, South Kalimantan, and South Sulawesi.

Table 2.1: Sample Mortality Rates

	Live Births	Infant Mortality Rate	Child Mortality Rate
Jakarta	1316	56.9	78.3
W. Java	2123	122	160.2
Central Java	1568	65.7	91.8
Yogyakarta	485	41.2	51.6
E. Java	1467	69.5	81.1
Bali	632	61.7	79.1
N. Sumatra	1219	69.7	100.9
W. Sumatra	774	100.8	135.7
S. Sumatra	818	66	100.2
Lampung	668	89.8	116.8
W. Nusa Tenggara	924	180.7	232.7
S. Kalimantan	630	147.6	173
S. Sulawesi	746	88.5	115.3

Note: Mortality rates defined as the number of deaths per 1000 live births. The sample consists of live births between 1960 to 1989 of ever-married women respondents in IFLS93.

Table 2.2: Sample Provincial Mortality Rates

If the family planning program did affect the mortality risk of children, we should observe a relative decline in mortality rates in the provinces of Java-Bali compared to the provinces in the Outer-Islands during the period 1970 to 1974 when the family planning program was only introduced in Java and Bali. In the subsequent period, as the family planning program is introduced in the provinces in the Outer-Islands, the mortality rate in these provinces should fall in relation to Java and Bali. Figure 2.1 plots the period specific aggregated child mortality rates for Java-Bali and the Outer-Islands. We do observe a fall in the child mortality rate in Java-Bali for the period 1970-74 compared to

the preceding decade, while there is no noticeable decline for the Outer-Islands for the same period. The Outer-Islands, however, observe a decline in mortality rates in the subsequent period which also coincides with the introduction of the family planning program in those provinces.

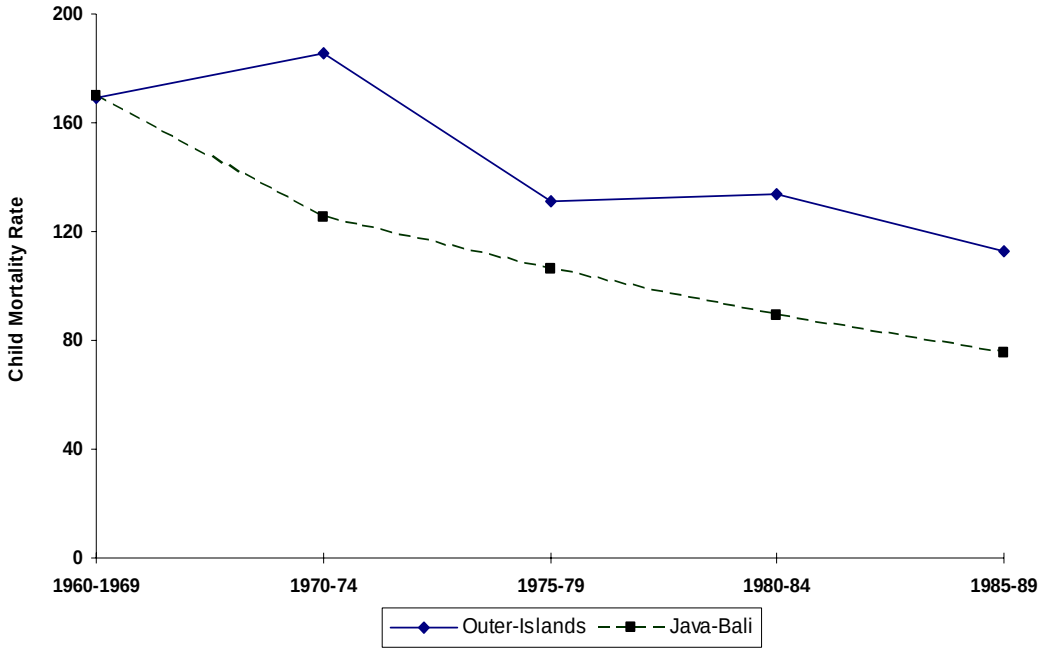

Figure 2.1: Child Mortality Rates for Java-Bali and the Outer-Islands

The differences in the mortality rates in the Outer-Islands compared to Java-Bali are plotted in Figure 2.2. The trends support the story that the introduction of the family planning program had a positive impact on mortality rates of children. The relative mortality rate in the Outer-Islands increased in the period 1970-1974 when the program was only ongoing in Java-Bali. With the introduction of the program in the Outer-Islands in the period 1975-1979, the relative mortality rates in these provinces as a whole fell. As the family planning program matured throughout the country in the subsequent periods,

the fluctuations in relative mortality between the two sets of provinces are not as strong, with a relative improvement in the mortality situation in Java-Bali compared to the Outer-Islands.

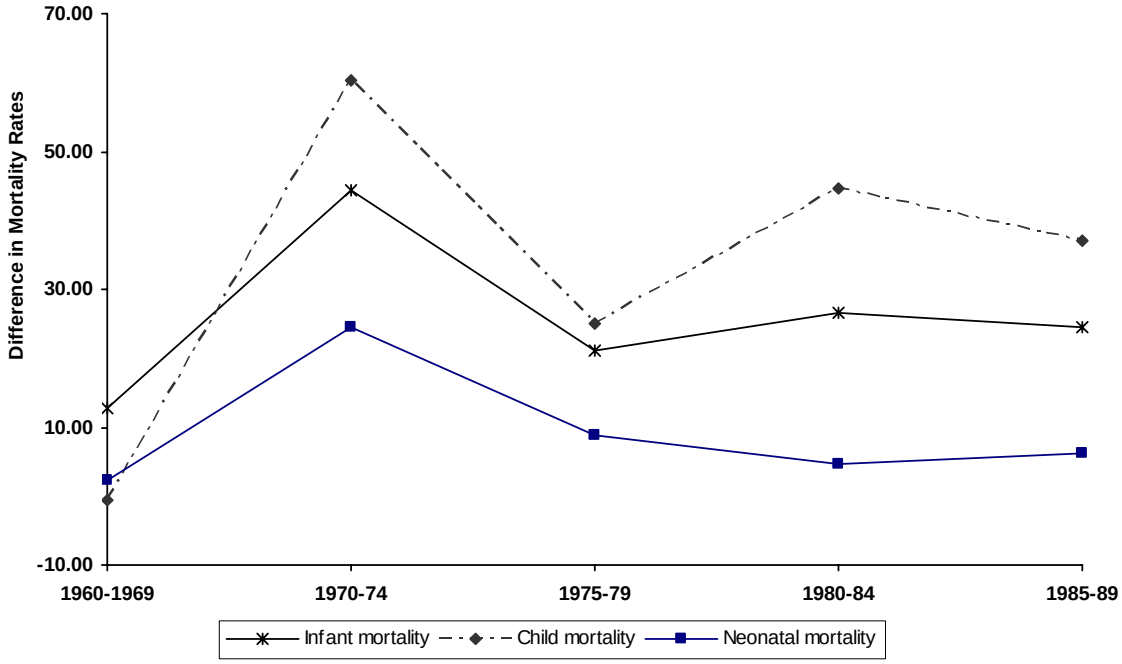

Figure 2.2: Difference in Mortality Rates for Births in the Outer-Islands and Java-Bali

I will use a difference-in-difference approach to test whether there is a significant effect of the introduction of the family planning program by comparing mortality rates in Java-Bali relative to the Outer-Islands during the first phase of the family planning program. The second test is to see whether the introduction of the family planning program in the Outer-Islands led to a relative improvement in their mortality position compared to Java Bali. If there is indeed an effect of the family planning program on mortality outcomes, it is also of interest whether the effect is greatest during the initial stages of introduction of the program, or as the program matures over time.

The evolution of the family planning program over time should also be considered when analyzing the empirical results. The program changed from a clinic based approach to a community based approach over time. During the second phase when the program was first introduced in the Outer-Islands as a clinic-based program, Java-Bali had moved to a community-based approach with an emphasis on involving community institutions to take a direct role in promoting the concept of the small family norm and increasing contraceptive acceptance. The community-based approach was undertaken in the Outer-Islands only during the third phase of the family planning program. It is likely that the relative improvement in the mortality outcomes in the Outer-Islands compared to Java-Bali due to the introduction of the program may be lower due to the increase in intensity of the program in Java-Bali during that phase.

2.3.1 Empirical Model of Aggregate Trends

The sample used in this analysis consists of live births born between 1960 and 1989 reported in the retrospective fertility history of ever-married women in IFLS93, giving us 13370 observations after taking into account inconsistent responses. The births are divided into five periods based on year of birth corresponding to the different phases of the family planning program: 1960-1969, 1970-1974, 1975-1979, 1980-1984, and 1985-1989. The births are divided into the provinces where they took place and mortality rates for the provinces are computed as the number of deaths per 1000 livebirths in each period. Given the 13 provinces covered in the IFLS, we get 65 province/period cells for the empirical analysis.

The impact of the program is estimated using the following specification:

$$Mortality_{pt} = \beta_1 JavaBali_p \times \tau_{70-74} + \beta_2 JavaBali_p \times \tau_{75-79} + \beta_3 JavaBali_p \times \tau_{80-84} + \beta_4 JavaBali_p \times \tau_{85-89} + \beta_5 \delta_p + \beta_6 \tau_t + \varepsilon_{pt}$$

where $Mortality_{pt}$ is the mortality rate for province p in period t, $JavaBali_p$ is the dummy for whether the province is in Java-Bali, and τ_{70-74}, τ_{75-79}, τ_{80-84},and τ_{85-89} are dummies for the corresponding five year periods. δ_p and τ_t refer to the set of province and period dummies, respectively.

β_1 is equivalent to the difference-in-difference estimate of the effect of the program on the treated during the first phase, which is Java-Bali in this case. β_2, β_3, and β_4 give the difference in mortality rates in Java-Bali in relation to the Outer-Islands in periods 1975-79, 1980-84, and 1985-89, respectively. β_1-β_2 gives the effect of the introduction of the family planning program in the Outer-Islands during 1975-79. The period and province dummies in the specification account for period-specific and time-invariant province specific effects.

A shortcoming in this approach is that it does not account for any time varying province specific effects. If the provinces were undergoing changes that led to differing mortality trends, such factors would not be accounted for. Furthermore, the introduction and extension of the family planning program went hand in hand with the five-year development plans initiated by the Indonesian government that set various development goals for each five year period. The results of the impact of the family planning program in the above analysis will be confounded by other development factors if the regional emphasis of the development plans coincided with that of the family planning program.

For instance, if the government placed heavy emphasis in implementing development activities in Java and Bali during the first five year development plan and the Outer-Islands during the second five year plan, then β_1 would not only reflect the impact of the family planning program, but also of those development programs focused in Java-Bali during 1970-74. However, those concerns should be mitigated in this case because the other five year development plans had a national scope, while the family planning program expanded in a systematic manner. The first five year development plan focused on rice self sufficiency, providing grants to communities to build infrastructure, and increase industrial development. The five year development plans also sought to reduce regional disparities by giving grants directly to the provinces, districts and villages, and it is less likely that these projects would have a systematically disproportionate effect on one region over another that coincided with the expansion of the family planning program.

2.3.2 Results for Model of Aggregate Trends

The results are presented in Table 2.3 for each mortality category. They show that mortality rates declined in both Java-Bali and Outer-Islands coinciding with the introduction of the family planning program in these provinces. The introduction of the family planning program led to a reduction in infant mortality by 39 per 1000 live births, child mortality by 53 per 1000 live births and neonatal mortality by 23 per 1000 live births in Java-Bali. Only the coefficients for child mortality are statistically significant at the 10 percent level. The relative advantage in mortality rates of Java-Bali falls for 1975-79 period after the introduction of the program in the Outer-Islands. The impact of the

introduction of the program in the Outer-Islands, given by β_1-β_2, is a fall in infant mortality by 34, a fall in child mortality of 45 and neonatal mortality of 25 per 1000 live births, which is similar to the impact of the program in Java-Bali in the previous period. The results also show wide provincial variation in mortality rates (not reported in Table 2.3), with Yogyakarta being a superior health producer, while West Java, West Nusa Tenggara, and South Kalimantan have higher mortality rates of children.

An additional shortcoming of this methodology is that it does not account for any compositional change in demographic aspects in the sample. Any provincial demographic trends such as delaying marriage and age at first birth, and parity levels of women that affect mortality risk are not accounted for. In the next section, an empirical framework analyzing individual births will be used to study the relationship between contraceptive acceptance and the mortality risk faced by subsequent births of the woman controlling for various demographic factors.

	Infant Mortality	Child Mortality	Neonatal Mortality
Java-Bali*τ_{70-74}	-39.405	-53.042	-23.706
	(28.743)	(32.202)	(21.056)
Java-Bali*τ_{75-79}	-5.076	-7.213	1.222
	(22.413)	(28.022)	(12.291)
Java-Bali*τ_{80-84}	-14.719	-32.589	6.198
	(21.022)	(26.433)	(13.172)
Java-Bali*τ_{85-89}	-15.968	-27.197	-0.441
	(24.702)	(28.873)	(15.832)
τ_{60-69}	excluded	excluded	excluded
τ_{70-74}	15.567	21.571	7.065
	(24.521)	(29.029)	(16.353)
τ_{75-79}	-22.105	-39.161	-24.31
	(20.375)	(25.593)	(11.781)
τ_{80-84}	-26.446	-34.041	-23.969
	(18.789)	(24.478)	(10.856)
τ_{85-89}	-30.979	-54.091	-23.2
	(22.264)	(26.572)	(14.702)
Constant	105.704	155.562	54.517
	(14.577)	(17.329)	(9.58)
N	65	65	65
R^2	0.72	0.74	0.66

Notes: Robust Standard Errors in Parenthesis. τ are the period dummies. *Java-Bali* refers to the six provinces in the islands of Java and Bali: Jakarta, West Java, Central Java, Yogyakarta, East Java, and Bali. *Outer-Islands* consist of North Sumatra, West Sumatra, South Sumatra, Lampung, West Nusa Tenggara, South Kalimantan, and South Sulawesi. Controls for provinces included in the regression. West Java, West Nusa Tenggara, and South Kalimantan have significantly higher mortality rates.

Table 2.3: Difference-in-Difference Results

2.4 Contraceptive Acceptance and Subsequent Birth Outcomes

2.4.1 A Reduced Form Empirical Model

The relationship between contraceptive acceptance and mortality outcomes for children is modeled using a mortality production function in line with the proximate determinants approach (Schultz, 1984; Mosley and Chen, 1984). The mortality risk for each birth faced by a woman is dependent on demographic variables, economic endowments of the household including education and income, regional and community characteristics that reflect the level of development, as well as unobserved health endowments of the mother. Furthermore, contraceptive usage by the woman is assumed to be a proximate determinant of the mortality process. Individuals choose whether or not to contracept, and this choice depends on some of the endowments and community characteristics that affect the mortality process, as well as prices and availability of contraceptives in the locality.

Estimating the relationship between contraceptive use and infant and child mortality using a single equation estimation procedure generates biased estimates due to the potential endogeneity of contraceptive use. There are two possible scenarios working in opposite directions that could lead to biased estimates. First, it is likely that there may be intrinsic qualities in each woman not captured by education that makes her a low infant mortality risk individual. Those same qualities may also make her one who is more likely to seek information on various contraceptives techniques and apply one that is most suited for her needs. Such a scenario implies that low mortality risk women select themselves into being contraceptive users, thereby the estimate of the impact of contraceptive use on mortality can be biased. Second, it is also likely that women who

consider themselves to be in the high mortality risk category may be more likely to use contraceptives in order to avoid unplanned births as their perceived probability of infant death is high. Such unobserved health endowments of women and unmeasured ability leads to correlation between contraceptive use and the error term in a single equation model, so a multiple equation model for contraceptive use and mortality allowing for correlation between the error structures is required to overcome the bias.

A reduced form bivariate probit model is used to empirically test the relationship between contraceptive use and mortality outcomes. The mortality production function is expressed as a function of demographic and economic determinants as well as the contraceptive usage of the woman and is expressed as follows:

$$m_{ij}^{*} = X_1\beta_1 + \gamma c_{ij} + \mu_p + \delta_t + e_{ij}, \qquad m_{ij} = 1\left[m_{ij}^{*} > 0\right]$$

where m_{ij}^{*} is the mortality risk experienced for birth i by woman j in province p in period t. X_1 is a set of exogenous variables that reflect individual, household, and community level economic and demographic characteristics. These variables include the age of the mother at time of birth, education level of the mother, whether the household is in a rural area, availability of piped water and sewage system, health care services in the area etc. c_{ij}, is an indicator variable for whether or not woman i used contraceptives prior to the birth of child j. The coefficient on the contraceptive use variable captures the impact of contraceptive usage on mortality risk controlling for other economic and demographic factors. The contraceptive function for the mother is also determined by individual, household, and community characteristics, as well as the price and ease of availability of contraceptives.

$$c_{ij}^{*} = X_2\beta_2 + \mu_p + \delta_t + \upsilon_{ij}, \qquad c_{ij} = 1\left[c_{ij}^{*} > 0\right]$$

where c_{ij}^{*} is the likelihood of contraception by woman i prior to birth j and X_2 is a set of exogenous variables that influence the contraception decision.

The sample of births used for the empirical analysis encompasses births over three decades and across the Indonesian archipelago. In order to control for heterogeneity due to geographical location, dummies are created for the 13 provinces included in the IFLS. Provinces may differ due to cultural differences, geographical characteristics that could potentially affect the incidence of diseases, and differences in health and development infrastructure The province effect is captured by μ_p for each province, p. Mortality risk could also be affected by the general increase in the level of economic development over time, so 5 period dummies are used to control for the general rise in residual technology over time. The period effects are captured by δ_t and the sample has been divided into five periods: 1960-69, 1970-74, 1975-79, 1980-84, and 1985-89. The province dummy for Central Java and the period dummy for births before 1975 have been excluded in the empirical specification, so the coefficients should be interpreted relative to births in Central Java and in periods prior to 1975.

In the data we observe whether a child i born to woman j survived past its first or fifth year. Infant mortality is given by m_{ij}=1, when a child death is realized at or before it is one year old, and m_{ij}=0, when the child survives past the first year. Similarly, child mortality is defined based on whether the child dies at or before its fifth year. Infant and child deaths are assumed to be generated by a mortality production function given by a latent variable model such that infant/child death is realized (m_{ij}=1) when $m_{ij}^{*} \geq 0$. Similarly, using the responses on when the woman first used modern contraceptives, we

can observe for each birth whether or not the woman has had prior contraceptive usage. Using the latent variable model, contraceptive use for woman *j* prior to the birth of child *i* is observed (c_{ij}=1) when $c_{ij}^{*} \geq 0$. The error terms follow a standard normal distribution and are potentially correlated with each other such that Var(e_{ij})=Var(υ_{ij})=1 and Cov(e_{ij}, υ_{ij})=ρ. The estimation procedure for the model involves maximizing the likelihood function based on the joint distribution of the error terms. The likelihood function is the sum of the log of probabilities of realizing a particular combination of mortality experience and contraceptive use for the entire sample of births,

$$L(\beta_1, \beta_2, \gamma, \mu, \delta) = \sum \log P(m_{ij} = 1, c_{ij} = 1) + \sum \log P(m_{ij} = 1, c_{ij} = 0) + \\ + \sum \log P(m_{ij} = 0, c_{ij} = 1) + \sum \log P(m_{ij} = 0, c_{ij} = 0)$$

Identification of the model requires an exclusion restriction, a variable included in X_2 but not in X_1. Information on whether or not a family planning post was established in the village prior to the birth is the exclusion restriction for identification in this model. Family planning posts were set up in villages in order to make contraceptives more accessible to the population, and hence they are likely to have lowered the transaction costs of obtaining contraceptives for residents. The establishment of the family planning posts directly affects contraceptive use and can only affect infant and child mortality through contraceptive use, so it provides an exclusion restriction to identify the model.

2.4.2 Data

The IFLS survey consists of detailed interviews with the household head and their spouse and other select members of the household including children. At the household level, detailed data was collected on household consumption, income, assets, as well as household characteristics. Information was also collected from individuals on education,

employment, marriage, migration, health status, knowledge and use of contraceptives, and fertility, which also includes a retrospective history of pregnancies. Another unique feature about the IFLS is that it also collected community level information, which included information on public and private facilities available for health care and schooling. These interviews were conducted with the village heads, midwives, heads of village organizations, and responsible authorities at the various facilities. The community data also includes questions on water and sanitation, transportation, and the date of introduction of facilities and government programs in the community.

The sample for the empirical analysis is restricted to birth between 1960 and 1989 using the responses of ever-married women in IFLS93. After deleting observations with inconsistent responses, the sample consists of a total of 13370 live births from 4010 women. There were 1201 realized infant deaths, i.e. deaths of children at or before the age of one and 378 cases of the child dying between the ages of one and five. For the entire sample, the infant mortality rate is about 89 per 1000 live births, while the child mortality rate (death before the age of five) is 118 per 1000 live births.

Education dummies are created for various education levels attended by the woman and her husband. Four levels of education are used: primary, junior secondary, senior secondary, and college. In Indonesia, primary education consists of the first six years of school, while junior and senior secondary levels consist of three years each, and college refers to post-high school education both in universities or technical colleges. Husband's level of education is used to proxy for household income level.

Two measures of access to contraception and health facilities in the community are used in the empirical analysis: posyandus and family planning posts In order to make contraceptives more easily accessible, family planning posts (also known as village contraceptive distribution centers or Pos KB) were set up in villages to facilitate the distribution of contraceptives to the local population. Posyandus are community health posts which are not permanently staffed. They are usually monthly activities with participation of health workers from nearby community health centers and they provide mother and child services and also distribute contraceptives. The information on family planning posts and posyandus were obtained from the responses of village-heads and heads of the PKK (women's organization) in the village from IFLS93 and IFLS97.

Some respondents were not able to provide information on when the first family planning post or posyandu was set up in the village and in some cases there was inconsistency between the responses of the village-head and the head of PKK in the community. In order to construct the list of dates of the introduction of family planning clinics and posyandus, missing values in the village-head responses were supplemented with responses from the head of PKK. When both responses were available and not consistent with one another, the mean of the two values was taken. The IFLS93 was the primary source to construct the date of introduction of these facilities. For those communities with missing or inconsistent values in both the village-head and head of PKK responses in IFLS93, the IFLS97 responses were used to get the years of first introduction of these facilities.

The measure for contraceptive use is only confined to the usage of four modern methods: pills, IUD, implants, and injections. Only these methods were included because their use is controlled by the woman and they provide effective contraception for the medium or long term. The IFLS allows us to create various measures of contraceptive use. One is simply whether the woman has ever used contraceptives till the time of the survey. The survey also collected information on when the woman first used various types of modern contraceptives and where she obtained the method. Based on these responses, the first time that the woman used one of these four methods can be obtained. The empirical analysis will use this as the cutoff date for her use of modern contraceptives.

Provincial per capita income is obtained from BPS (1990). The regional per capita income excluding oil related products for 1983 and 1989 are used to calculate the annual regional economic growth. Using this growth rate, the figures for regional per capita income for the previous periods are imputed at five year intervals.

Table 2.4 gives the means and standard deviations of the variables used in the empirical analysis. For the sample of live births, 11 percent died before the age of 5, while 9 percent of births led to death before the age of 1. About 1 percent of the births led to multiple births, i.e. twins, and the sample is evenly divided into boy and girl births. 21 percent of the births took place after the introduction of the posyandu in the village, while 40 percent of births took place after a family planning post was introduced in the village. However, only 13 percent of the births took place after the woman had used one of the four modern contraceptive methods.

	N	Mean	Std. dev.
Infant mortality	13370	0.089	0.286
Child mortality	13370	0.118	0.323
Birth age	13370	23.77	5.65
Male	13370	0.503	0.5
First birth	13370	0.293	0.455
Parity	13370	1.854	1.939
Prior infant mortality	13370	0.174	0.379
Tobacco	13370	0.06	0.238
Multiple births	13370	0.014	0.119
Rural	13370	0.537	0.499
Sewage	13370	0.217	0.412
Piped water	13370	0.171	0.376
Log provincial per capita income	13370	5.736	0.53
Posyandu	13370	0.215	0.411
Family planning post	13370	0.404	0.491
Contraceptive use	13370	0.132	0.339
Woman's education			
Primary	13370	0.577	0.494
Jr. secondary	13370	0.107	0.309
Sr. secondary	13370	0.078	0.268
College	13370	0.018	0.133
Husband's education			
Primary	13370	0.486	0.499
Jr. secondary	13370	0.112	0.315
Sr. secondary	13370	0.107	0.309
College	13370	0.039	0.195

Notes: The sample consists of births between 1960 and 1989 of ever-married women from IFLS93. Contraceptive use refers to whether the woman has used one of four modern methods (pills, IUD, implants, and injections) prior to the birth. Posyandus are activities held once a month in the village by the Dept. of Health along with the family planning field-workers. The posyandu variable is a dummy for whether a posyandu exists in the village prior to the birth.

Table 2.4: Descriptive Statistics

	Infant Mortality		Child Mortality		Contraceptive Use	
	Marginal Effects	S.E.	Marginal Effects	S.E.	Marginal Effects	S.E.
Birth age	-0.011	(0.003)	-0.016	(0.003)	0.011	(0.003)
Birth age sq	0.000	(0.000)	0.0002	(0.000)	0.000	(0.000)
Male	0.016	(0.004)	0.012	(0.005)		
First birth	0.022	(0.007)	0.014	(0.008)	-0.109	(0.004)
Parity	0.004	(0.002)	0.006	(0.002)	0.009	(0.001)
Prior mortality experience	0.064	(0.009)	0.058	(0.009)	-0.024	(0.004)
Multiple births	0.177	(0.033)	0.197	(0.035)		
Tobacco	0.018	(0.01)	0.026	(0.012)		
Rural	0.011	(0.005)	0.008	(0.006)	-0.009	(0.004)
Sewage	-0.004	(0.006)	-0.006	(0.007)		
Piped water	-0.009	(0.007)	-0.01	(0.009)		
Posyandu	-0.019	(0.007)	-0.026	(0.008)	0.01	(0.006)
Family planning post					0.015	(0.005)
Log province per capita income	-0.031	(0.028)	-0.029	(0.033)	0.028	(0.028)

Table 2.5: Single Equation Probit Results

Table 2.5 (continued)

	Infant Mortality		Child Mortality		Contraceptive Use	
	Marginal Effects	S.E.	Marginal Effects	S.E.	Marginal Effects	S.E.
Woman's education						
Primary	-0.006	(0.006)	-0.005	(0.007)	0.062	(0.006)
Jr. secondary	-0.026	(0.008)	-0.032	(0.01)	0.176	(0.019)
Sr. secondary	-0.049	(0.008)	-0.059	(0.01)	0.198	(0.024)
College	-0.052	(0.012)	-0.063	(0.017)	0.151	(0.036)
Husband's education						
Primary	-0.004	(0.007)	-0.01	(0.008)	-0.013	(0.008)
Jr. secondary	-0.032	(0.008)	-0.045	(0.009)	-0.002	(0.009)
Sr. secondary	-0.013	(0.01)	-0.032	(0.011)	-0.005	(0.009)
College	-0.014	(0.015)	-0.042	(0.015)	0.025	(0.015)
Contraceptive use	0.006	(0.008)	-0.001	(0.009)		
N	13370		13370		13352	
Pseudo R^2	0.081		0.081		0.233	

Notes: Robust standard errors in parenthesis. Sample consists of live births between 1960 and 1989 for ever-married women in IFLS93. Province and period fixed effects included in the empirical specification, but are not reported. Missing values for education, husband's education, posyandu and family planning post are accounted for using dummies. Contraceptive use refers to the use of one of four modern methods (pills, IUD, implants, and injection) prior to birth.

2.4.3 Results

The results from a single-equation probit framework are presented in Table 2.5, while the bivariate probit results for infant mortality and contraceptive use are presented in Table 2.6 and results for the case of child mortality are presented in Table 2.7. The dependent variable for each of the mortality equations is a dummy indicating whether the child survived the first year or the fifth year for the case of infant and child mortality, respectively. The set of regressors include demographic variables such as the age of the mother at the time of birth, whether the child is male, and the order of birth. A dummy to indicate whether the woman has had prior infant mortality experience is included to capture woman specific mortality risks and a dummy for tobacco use is also included as a proxy for the health of the mother. Variables are included for whether or not health facilities are accessible to the community at the time of birth. Posyandu is a dummy for whether or not these health activities exist in the village at the time of birth. Similarly, Family planning post is a dummy for whether or not a family planning distribution center exists in the community at the time of birth. Contraceptive use is a dummy for whether or not the woman has had prior use of the four modern methods of contraceptives by the time of birth. Dummies are also included to control for province and period effects.

The results on the impact of demographic variables are as expected. Infant and child mortality risks have a quadratic relationship with the age of the mother at birth. Mortality risk is high at low birth ages and increases again for a woman's later ages. The likelihood of infant mortality is higher for male births, which conforms to the relative biological weakness of the male child at birth, and also suggests that sex preferences in terms of selective discrimination against the girl child is not prevalent in Indonesia. The

first birth has a higher likelihood of infant mortality than non-first births, while mortality risk also increases for higher parity births. The first birth has about a 0.018 higher probability of infant death than non-first births. However, when considering child mortality, the mortality risk for first birth is not significantly higher. This may reflect the effect of experience in conducting the birth process. Inadequate knowledge about how to provide effective care for new-born babies due to lack of prior experience may increase the mortality rate among newborns.

The individual health of the woman and the mortality risk that she faces are proxied with dummies for tobacco usage and whether she has experienced infant mortality in earlier births. The estimated coefficients for both these variables are significant and positively related to infant and child mortality risk.

Provincial per capita income and husband's education level are used as proxies for community and household income levels, respectively. Husband's education level is significant and negatively related to mortality risk, while provincial per capital income is not significant but has a negative coefficient. The effect of the introduction of piped water or a sewage system to the community is not significant. Out of the thirteen provinces in the sample, the provinces of West Sumatra, West Java, West Nusa Tenggara, South Kalimantan, and South Sulawesi are low health achievers with significantly higher infant and child mortality rates relative to the other provinces.

As in other studies on infant and child mortality, the education level of the woman is negatively related to infant and child mortality risk. Higher levels of education are associated with lower mortality risks, but the coefficient for primary school is not

significant, implying that there is no significant change in mortality risk for women who attend primary school in relation to women with no formal education.

There is a significant effect of posyandus on the health outcomes of children. These monthly activities conducted at the village level involve weighing of children and providing basic nutrition advice to mothers, and also involve the participation of staff from the community health centers which are at the subdistrict level. The family planning program also uses these posyandus for distribution of contraceptives. The results show lower infant and child mortality risks after the introduction of the posyandu in the community.

For the contraceptive use equations given in column (2) on Tables 2.6 and 2.7, access to posyandus and family planning posts increases the likelihood of the woman using contraceptives. Higher educated women are more likely to use contraceptives, but there is no relationship between contraceptive use and husband's education, unless the husband attends college, which then predicts a higher likelihood of contraceptive use.

Comparing the coefficients of contraceptive use in the mortality equations in Tables 2.6 and 2.7 suggest differential impacts of contraceptive use on mortality risks of children of various ages. The results suggest that there is no significant relationship between contraceptive use and infant mortality. Most importantly, a Wald test to test the null hypothesis that correlation between the error terms, ρ, is zero cannot be rejected for the infant mortality case. Unobserved individual factors related to infant mortality are not related to the decision to contracept, hence the bivariate probit framework is not necessary when only considering infant mortality.

	Infant Mortality			Contraceptive Use		
	Coeff.	S.E.	Marginal Effects	Coeff.	S.E.	Marginal Effects
Constant	0.625	(1.065)		-4.752	(1.234)	
Birth age	-0.079	(0.019)	-0.011	0.091	(0.025)	0.011
Birth age sq	0.001	(0.000)	0.0001	-0.002	(0.000)	-0.0002
Male	0.114	(0.032)	0.016			
First birth	0.127	(0.052)	0.018	-1.224	(0.072)	-0.108
Parity	0.034	(0.015)	0.005	0.078	(0.012)	0.009
Prior mortality experience	0.377	(0.047)	0.063	-0.224	(0.045)	-0.024
Multiple births	0.079	(0.105)	0.177			
Tobacco	0.117	(0.063)	0.018			
Rural	0.079	(0.039)	0.011	-0.078	(0.036)	-0.009
Sewage	-0.03	(0.047)	-0.004			
Piped water	-0.065	(0.055)	-0.009			
Posyandu	-0.14	(0.058)	-0.018	0.083	(0.045)	0.01
Family planning post				0.125	(0.041)	0.015
Log province per capita income	-0.209	(0.203)	-0.029	0.238	(0.229)	0.028

Table 2.6: Bivariate Probit - Infant Mortality and Contraceptive Use

Table 2.6 (continued)

	Infant Mortality			Contraceptive Use		
	Coeff.	S.E.	Marginal Effects	Coeff.	S.E.	Marginal Effects
Woman's education						
Primary	-0.029	(0.045)	-0.004	0.543	(0.053)	0.061
Jr. secondary	-0.185	(0.078)	-0.023	0.892	(0.069)	0.175
Sr. secondary	-0.441	(0.106)	-0.047	0.948	(0.08)	0.196
College	-0.535	(0.217)	-0.051	0.758	(0.125)	0.15
Husband's education						
Primary	-0.029	(0.053)	-0.004	-0.11	(0.063)	-0.013
Jr. secondary	-0.262	(0.078)	-0.031	-0.018	(0.077)	-0.002
Sr. secondary	-0.102	(0.081)	-0.013	-0.046	(0.08)	-0.005
College	-0.095	(0.127)	-0.012	0.178	(0.099)	0.025
Contraceptive use	-0.137	(0.188)	-0.018			
N	13370					
ρ	0.102	(0.107)				

Wald Test of $\rho=0$; $\chi^2(1)=0.899$, prob>$\chi^2=0.343$

Notes: Robust standard errors of the estimated coefficients are in parenthesis. Sample consists of live births between 1960 and 1989 for ever-married women in IFLS93. Province and period fixed effects included in the empirical specification, but are not reported. Missing values for education, husband's education, posyandu and family planning post are accounted for using dummies. Contraceptive use refers to the use of one of four modern methods (pills, IUD, implants, and injection) prior to birth.

	Child Mortality			Contraceptive Use		
	Coeff.	S.E.	Marginal Effects	Coeff.	S.E.	Marginal Effects
Constant	0.798	(0.988)		-4.717	(1.23)	
Birth age	-0.091	(0.018)	-0.016	0.09	(0.025)	0.011
Birth age sq	0.001	(0.000)	0.0002	-0.001	(0.000)	-0.0002
Male	0.071	(0.029)	0.013			
First birth	0.042	(0.049)	0.008	-1.227	(0.072)	-0.108
Parity	0.04	(0.013)	0.007	0.078	(0.012)	0.009
Prior mortality experience	0.277	(0.044)	0.055	-0.224	(0.045)	-0.024
Multiple births	0.753	(0.101)	0.197			
Tobacco	0.135	(0.058)	0.026			
Rural	0.042	(0.036)	0.007	-0.079	(0.036)	-0.009
Sewage	-0.033	(0.043)	-0.006			
Piped water	-0.056	(0.051)	-0.01			
Posyandu	-0.143	(0.054)	-0.024	0.084	(0.045)	0.01
Family planning post				0.127	(0.041)	0.015
Log province per capita income	-0.142	(0.188)	-0.025	0.235	(0.228)	0.028

Table 2.7: Bivariate Probit - Child Mortality and Contraceptive Use

Table 2.7 (continued)

	Child Mortality			Contraceptive Use		
	Coeff.	S.E.	Marginal Effects	Coeff.	S.E.	Marginal Effects
Woman's education						
Primary	-0.009	(0.041)	-0.002	0.544	(0.053)	0.062
Jr. secondary	-0.16	(0.072)	-0.026	0.89	(0.069)	0.174
Sr. secondary	-0.389	(0.098)	-0.055	0.949	(0.08)	0.197
College	-0.465	(0.205)	-0.061	0.758	(0.125)	0.15
Husband's education						
Primary	-0.061	(0.049)	-0.011	-0.112	(0.063)	-0.013
Jr. secondary	-0.294	(0.071)	-0.045	-0.02	(0.077)	-0.002
Sr. secondary	-0.201	(0.076)	-0.032	-0.049	(0.08)	-0.006
College	-0.268	(0.125)	-0.04	0.175	(0.099)	0.024
Contraceptive use	-0.31	(0.174)	-0.047			
N	13370					
ρ	0.177	(0.099)				

Wald Test of $\rho=0$; $\chi^2(1)=3.023$, prob>$\chi^2=0.082$

Notes: Robust standard errors of the estimated coefficients are in parenthesis. Sample consists of live births between 1960 and 1989 for ever-married women in IFLS93. Province and period fixed effects included in the empirical specification, but are not reported. Missing values for education, husband's education, posyandu and family planning post are accounted for using dummies. Contraceptive use refers to the use of one of four modern methods (pills, IUD, implants, and injection) prior to birth.

The bivariate probit estimates for child mortality and contraceptive use equations, however, give different results. First, the Wald test for no correlation between the error terms can be rejected, suggesting that unobserved individual characteristics affecting child mortality risks are also correlated with the likelihood to use contraceptives. Second, the coefficient on contraceptive use in the mortality equation is negative and significant at the 0.1 level. Prior contraceptive use lowers child mortality risk of individual births by almost 5 percent. Comparing the results from the single equation probit framework with that from the bivariate framework, the single equation model underestimates the effect of contraceptive use on the mortality risk of children.

The results from this framework give the net effects of contraceptive use on mortality risk of children, but do not identify the mechanism through which contraception affects child survival. The multifaceted approach taken by the family planning program to expand in rural communities led to its integration with other development programs and initiatives by the health department which could potentially confound the results. If women who became contraceptive users were also likely to get better nutrition information and benefit from mother and child health services, the contraception coefficient may not only be capturing the effect of fertility regulation on mortality risk but also the effects of better nutrition and involvement in other health activities. Since the nutrition program morphed into the posyandu system which also provided weighing services to children and other primary health care, controlling for whether or not the posyandu has been introduced in the community at the time of birth should account for some of the confounding effects of the nutrition channel within this framework.

2.5 Conclusion

This chapter examined the role of the Indonesian family planning program on infant and child mortality risk using the IFLS. A difference-in-difference approach taking into account the different times of introduction of the program suggests an improvement in mortality rates of children after program introduction. The results are significant for the case of child mortality but not for infant and neonatal mortality. Furthermore, the relationship between contraceptive acceptance by a woman and mortality rate of subsequent births was modeled using the proximate determinants framework. A bivariate probit structure was used to account for the potential correlation between unobserved individual characteristics and contraceptive use. The existence of a family planning post in the community was used for identification. The results show that contraceptive use is not associated with infant mortality, but associated with child mortality. Furthermore, the introduction of community health posts, posyandus, led to a reduction in the mortality rates of children. As in prior studies on mortality of children, a large part of the reduction in mortality risk is associated with the level of education of the mother and demographic variables.

The findings in this chapter imply that the introduction of family planning programs during the early stages of economic development contributed to the improvements in child survival rates in these societies. Ease of access to modern contraceptives gave couples better control over the fertility process. By lowering the likelihood of unwanted births, contraceptive use would have allowed couples to avoid excess fertility and space births effectively. This would have led to better allocation of resources in the upbringing of children, thereby lowering the likelihood of child

mortality. Even though longer duration of spacing between births through use of modern contraceptives could lead to improvements in the mother's health at the time of delivery and subsequently improve the health of the infant, the empirical results in this chapter suggest that there was no reduction in infant mortality risk associated with contraceptive use. Since a majority of Indonesian women in rural areas give birth in their houses without access to skilled help, they face high infant mortality risk due to factors related to birth practices. In such a scenario, infant mortality risk will remain high whether or not couples have the ability to plan births using modern contraceptives. This suggests that significant reduction in infant mortality in developing countries also requires improvements in the environment in which births take place alongside access to modern contraceptives.

Building upon this research, another topic of interest is the relationship between infant/child mortality and fertility. The decline in fertility rates experienced by a society during the demographic transition is considered to be an outcome of declining mortality rates. From a public policy standpoint, an understanding of the relationship between mortality and fertility in developing countries has implications on the importance of provisions of public health services that affect child mortality, as this could subsequently affect household fertility behavior. This dissertation does not attempt to answer the question of how fertility responds to infant and child mortality. Given its historically high infant and child mortality rates and a rapid decline in the last four decades, Indonesia makes a good candidate to study this relationship between the risk and realization of child mortality and fertility behavior.

The next chapter further examines the role of the birth process on the risk of infant mortality and the impact of an ambitious government safe motherhood initiative on infant survival. Indonesia introduced over 50,000 midwives in villages across the country with the objective of lowering the maternal mortality rate during the 1990s. There is little evidence on the effectiveness of this program in meeting its objective. The next chapter evaluates whether such a community-based initiative to provide access to skilled birth attendants lowers the incidence of infant mortality.

CHAPTER 3

THE VILLAGE MIDWIFE PROGRAM AND THE REDUCTION IN INFANT MORTALITY

3.1 Introduction

Following the Nairobi conference in 1987, the issue of safe-motherhood gained prominence in Indonesia which led to the implementation of a village midwife program that trained and placed over 50,000 midwives in villages across the country by 1997. As in many developing countries, a majority of village women in Indonesia give birth in their houses relying on traditional birth attendants and midwives for help during delivery making the birth process risky for both mother and child. As maternal health and health care as well as infections contracted during the birth process are important causes of neonatal deaths, a program to introduce skilled birth attendants in villages across Indonesia could have had an impact not only on maternal mortality, but also on the likelihood of infant survival by improving maternal health and the environment in which births take place. This chapter studies the impact of the village midwife program on infant mortality in Indonesia.

There is little evidence as to how effective the village midwife program has been in improving birth outcomes. Prior studies have shown an improvement in women's health through increase in body mass index associated with the introduction of the

program, as well as improvements in nutrition of children (Frankenberg and Thomas, 2001; Frankenberg, Suriastini, and Thomas, 2005). This chapter examines the role of the program in improving the mortality outcomes of infants. Since the main causes of death of neonates are related to maternal health, complications through pregnancy and the birth process, and the care provided to neonates, it is likely that the placement of skilled birth attendants in villages with limited access to health facilities and heavy reliance on traditional birth attendants would cause a decline in infant mortality through reduction in the incidence of neonatal deaths. Safe motherhood initiatives have not emphasized reductions in infant mortality as their primary objective, and this chapter analyzes if such initiatives on improving maternal health through community based approaches as the one undertaken in Indonesia can play an additional role in lowering untimely deaths of children.

Conducting empirical analysis on the role of birth facilities on mortality outcomes is difficult because regressing mortality outcomes on the delivery place or choice of help during the delivery process will lead to biased estimates, as these reflect choices made by the individuals which may be correlated with unobserved individual characteristics. Instead, the program effect is estimated based on the period when a midwife was introduced in the community. But this adds the complication of selective placement of programs in the communities based on community characteristics. The government was more likely to introduce midwives in communities that needed them most, making program placement non-random. To overcome the bias generated by such targeted placement of programs, the program effect will be estimated by aggregating mortality

rate at the district level and taking community fixed effects to account for endogenous program placement.

The empirical analysis in this chapter is conducted using pregnancy information from all three waves of the Indonesian Family Life Survey (IFLS), which provide detailed information on each pregnancy including the use of health facilities by the woman during the pregnancy. The IFLS also collected information at the community level, interviewing the village-head and head of Family Welfare Associations (PKK) about various aspects of the community and the introduction of government programs in the village, and interviews were also conducted with staff of health and educational facilities in the community. These responses allow us to identify when a village midwife was introduced in a particular community, making it possible to evaluate the program. The results suggest that the village midwife program caused a reduction in neonatal mortality, but there is no relationship between the program and post-neonatal mortality.

The next section provides a brief description of the village midwife program in Indonesia, followed by a discussion on the causes of the death of children in developing countries and the role community based programs such as the village midwife program could play in lowering the mortality rates of children. Section 3.4 discusses some of the prior studies on the effect of the village midwife program in Indonesia on maternal and child health. Section 3.5 describes the IFLS and the sample used in the empirical analysis in this chapter, followed by a discussion on the descriptive trends in mortality rates and use of birth services in Indonesia as shown by the IFLS sample used in this study. Section 3.6 discusses the empirical methodology and the results.

3.2 The Village Midwife Program

The village midwife program (bidan di desa) began in 1989 with the aim of making midwives available in all the 68,000 villages in Indonesia to provide women with prenatal care during pregnancy and assistance during delivery. When the program began, there were 13,000 midwives available to village women in Indonesia (World Bank, 1991). By the end of the 1996/1997 budget year, 52,042 midwives were in place, covering 96 percent of the 54,120 villages that had needed midwives in 1989 (Shiffman, 2003). The program was implemented primarily by the Ministry of Health with cooperation with other ministries, especially the Ministry of Home Affairs and Ministry of Women's Roles, and with support from various international donor agencies, such as the World Bank, UNICEF, WHO, and AusAid.

The midwives were recruited from three-year nursing academies and were given an additional year of midwifery training. Once assigned to the community, the midwives were paid a salary for three to six years by the government. They were then expected to start private practice after having built a client base in the village. They had public practice during normal working hours, and were allowed to practice privately after hours. The midwives played a role in promoting community participation in health, providing health and family planning services, working with traditional birth attendants, and referring complicated cases to health centers and hospitals (Frankenberg and Thomas, 2001). Village midwives also had contacts with the community in various other settings which allowed them to impart information on nutrition, food preparation, sanitation and other health-promoting behaviors to the community members.

It is likely that the introduction of midwives in villages led to positive health outcomes in the communities. By providing help during the childbirth process to women who would have otherwise relied on traditional birth attendants, the midwives would have improved the environment in which women give birth in villages, especially in those communities that did not have easily accessible health facilities. By encouraging prenatal checkups and referring clients to hospitals and puskesmas (community health centers) in the case of complications, the presence of a midwife in the community could have helped women seek timely help and avoid complicated births in the house, which could have lowered infant mortality risk.

3.3 Causes of Childhood Deaths

Every year about 10 million children die before the age of 5 years, mostly in developing countries, of which about 37 percent die at the neonatal stage (Black, Morris, and Bryce, 2003). Based on WHO estimates of causes of death of children for 2000-2003, the main causes of death beyond the neonatal stage are due to pneumonia, diarrhea, and malaria which account for 19, 17 and 8 percent, respectively, of all childhood deaths (Bryce, Boschi-Pinto, Shibuya, and Black, 2005). Of the 4 million children that die during the neonatal stage, it is estimated for 2000 that the direct causes of such death are mainly due to birth asphyxia (23%), preterm birth (27%), congenital abnormalities (7%) and infections (36%). Breaking down the neonatal deaths due to infections, sepsis and pneumonia are the direct cause of 26% of such deaths, while tetanus and diarrhea are responsible for 7% and 3%, respectively (Lawn, Cousens, and Zupan, 2005). However, the extent of deaths caused by infections at the neonatal state varies between countries. Countries with high neonatal mortality rates (over 45) have a higher proportion of

neonatal deaths caused by infections, almost 50 percent, while those with low neonatal mortality rates have lower incidence of such deaths, less than 20 percent of deaths due to sepsis and pneumonia, with negligible tetanus and diarrhea related deaths (Lawn, Cousens, and Zupan, 2005).

According to the WHO estimates for causes of childhood deaths in Indonesia for 2000-2003, neonatal deaths constitute 38 percent of the total, followed by diarrhea (18%), pneumonia (14%), and measles (5%). Deaths due to malaria and HIV/AIDS are negligible. The main causes of neonatal deaths are preterm birth, birth asphyxia, and severe infections, which include pneumonia, sepsis, and meningitis among others. Neonatal tetanus and diarrhea, which are the easily preventable causes of neonatal deaths, each constitute only 1 percent of total neonatal deaths, suggesting that Indonesia has been successful in close to eradicating such deaths among neonates.

Besides the direct causes of death, the major underlying cause of child deaths, especially at the post-neonatal stage, is undernutrition of children which increases their susceptibility to infectious diseases (Black, Morris, and Bryce, 2003). While at the neonatal state, low birthweight of infants, primarily caused by short gestation periods and intrauterine growth retardation, is an important indirect cause of death (Lawn, Cousens, and Zupan, 2005).

The breakdown of both direct and indirect causes of child deaths suggests that improvements in maternal health, the birth process, and care provided to neonates play an important role in lowering the risk of neonatal mortality, while nutrition of children is a major determinant of mortality risk at the post-neonatal phase. The placement of village midwives in communities without easy access to health facilities would have improved

the mortality situation through their influence on these underlying causes of infant deaths. Given their training, these midwives would have been more effective than the traditional birth attendants at providing antenatal, intrapartum and postnatal care. By lowering the reliance on traditional birth attendants in villages, the presence of midwives would have led to better prenatal care, earlier detections of birth complications and timely referrals to health facilities, and provided better care for neonates which are likely to have lowered neonatal mortality. Furthermore, the presence of midwives could have played an important role in lowering the incidence of tetanus infections of neonates through the use of a sterilized knife to cut the umbilical cord after birth, a practice that traditional births attendants may have been more negligent about. The midwives effect on post-neonatal mortality would be through their involvement in community health activities, promoting vaccination, and providing better nutrition information to parents. Since the quality of nutrition of children is also driven by the economic status of households, the midwives' influence will primarily be on the factors responsible for deaths of neonates, so the village midwife program is likely to have a larger effect on the reduction of neonatal mortality than on post-neonatal mortality.

3.4 Literature Review

Frankenberg and Thomas (2001) study the impact of the midwife program on adult health as well as birth-weights of children using the IFLS1 and IFLS2. Since the midwives were not placed randomly, and were more likely to be assigned in poorer communities and in those that were at a greater distance from health centers, testing the impact of the policy needs to take the endogeneity of program placement into consideration. They use a quasi-experiment comparing the health status in communities

that gained a village midwife with those that did not. Since midwives are likely to affect the health of women more than that of men, women are considered the treatment group and changes in their health are compared with changes in health of other adults in the same community. They use adult BMI (body mass index) as the health outcome variable of interest.

Furthermore, they consider the impact of the village midwife program on birth-weights of children. They use community fixed effects and controls for pregnancy-specific, mother-specific variables. The results suggest that birth-weights in a community after the introduction of a midwife are greater than before. However, not all births are weighed in Indonesia, and births in the presence of medical staff are more likely to be weighed than those delivered at home with the help of a traditional birth attendant. Their analysis does not account for this possible sample selection of births.

Frankenberg, Suriastini, and Thomas (2005) analyze the impact of the midwife program on the nutrition of children. Their dependent variable is z-scores for children's height for age created by comparing the height of children in the IFLS sample with the NCHS anthropometric reference for a well-nourished child of the same age and sex. As midwives also provided basic preventive care and nutrition information, immunization, and some basic curative cares, it is likely the village midwife program would have an effect on children health. In order to account for the potential selective placement of midwives into communities, they look at the difference in outcomes for various cohorts of children surveyed in IFLS1 and IFLS2 that had varying degrees of exposure to the midwife program. Their results suggest that the nutrition status of children that had full

exposure to the midwife program is better than those in the same cohort in communities with lower level of exposure to the program.

Both these studies look at health outcomes for adults and children using IFLS1 and IFLS2, but do not directly study the impact of the midwife program on the birth process itself, which was in fact the main objective of the midwife program. Their sample is restricted to the first two waves of the IFLS. It is likely that the impact of the program will be stronger as the midwives spent more time in the village and establish themselves in the communities rather than the periods immediately following their placement. Including responses from IFLS3 would allow us to study the longer run impact of the program. Furthermore, if the midwives made a positive impact on improving survival of infants, their results would underestimate the true impact of the program on child health, as it would imply that the program increased survival rates of children with lower health status.

3.5 Data

The Indonesian Family Life Survey (IFLS) is an ongoing longitudinal survey and has been conducted in three main waves conducted so far: in 1993, 1997, and 2000. For IFLS1, the first wave of the survey conducted in 1993, various members of 7224 different households were interviewed, totaling over 22,000 individuals. The households were drawn from 312 different enumeration areas from 13 out of the 27 provinces in Indonesia, which represent 83 percent of the Indonesian population. The re-contact rates were high for the IFLS with 94.4% IFLS1 households re-contacted in IFLS2, while 95.3% were re-contacted in IFLS3. Nearly 91% of IFLS1 households were interviewed in all three waves.

In each wave of the IFLS, detailed information was collected about various aspects of the pregnancy, such as prenatal visits, place of delivery, and assistance during delivery for those pregnancies that ended within 5 years prior to the survey. The sample of pregnancies used for the empirical analysis in this chapter is drawn from all three waves of the IFLS and restricted to those with detailed information about delivery help and place, and to those that ended in a live birth, while stillbirths and miscarriages are excluded. The mortality outcomes are based on responses on whether the child is still alive, and if not, when or at what age it died. Based on these responses, infant mortality is defined as death within one year of birth, while neonatal mortality is defined as death prior to end of the first month after birth.

Another unique feature about the IFLS is that it collected community level information, which included information on public and private facilities available for health care and schooling. These interviews were conducted with the village heads, heads of village organizations, and authorities at the various community educational and health facilities. The community data also includes questions on the date of introduction of government programs in the community. This feature of the IFLS facilitates evaluation of government interventions and also allows us to control for various community characteristics in the empirical analysis.

The village head and head of women's welfare organization (PKK) were asked about the presence of a village midwife in the community and when she was placed in the village in both the IFLS2 and IFLS3. Their responses were used to determine the year of the introduction of the program in a particular community. In cases where the responses of the village head and the PKK were not consistent, the average of the two was taken. In

cases where information was missing in the IFLS2, responses from IFLS3 were used to determine the year of introduction. Using IFLS2 and IFLS3, we are also able to determine if a midwife left the community, which allows us to create a time series of when a particular community was served by a village midwife.

3.5.1 Descriptive Trends

A descriptive analysis of mortality outcomes and delivery mechanisms using information on pregnancy histories of ever-married women from the three waves of the IFLS gives an overall picture of mortality situation in Indonesia and the trends in the usage of reproductive health facilities. The figures show a general decline in infant mortality rates in Indonesia during the 1990s, except during the Indonesian financial crisis in 1997-1998 which caused a stall in the rate of decline. The mortality and use of delivery facilities figures are also presented for the sample consisting only of those communities where midwives were introduced in order to compare their initial conditions and the trends in mortality outcomes and usage of birth facilities in relation to the entire sample. This will also provide an insight into how the village midwife program was targeted to a particular community. The descriptive figures show that a majority of Indonesian women continue to give birth in their house while a large fraction of women continue to rely on traditional birth attendants, and the mortality risks associated with such births are high. However, the trends suggest that the reliance in traditional birth attendants is falling with an increase in midwife-assisted deliveries. The data also show that the areas where the village midwives were introduced had mortality figures that were higher than on average, and they had a higher reliance on traditional birth attendants.

	All Years	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
A. Full sample[a]													
Number of live births	8001	313	665	651	622	744	769	545	758	800	733	599	802
Infant mortality	50.5	79.9	60.2	66.1	61.1	64.5	52.0	33.0	42.2	40.0	43.7	50.1	32.4
Neonatal mortality	24.6	41.5	28.6	30.7	30.5	34.9	29.9	14.7	19.8	15.0	19.1	23.4	17.5
Post-neonatal mortality	25.9	38.3	31.6	35.3	30.5	29.6	22.1	18.3	22.4	25.0	24.6	26.7	15.0
B. Communities with village midwives[b]													
Number of live births	5466	194	451	430	414	464	546	384	523	564	514	422	560
Infant mortality	57.1	82.5	84.3	72.1	62.8	73.3	51.3	44.3	42.1	51.4	44.7	54.5	44.6
Neonatal mortality	25.1	30.9	42.1	27.9	24.2	36.6	23.8	18.2	21.0	17.7	15.6	26.1	23.2
Post-neonatal mortality	32.0	51.5	42.1	44.2	38.6	36.6	27.5	26.0	21.0	33.7	29.2	28.4	21.4

Notes:

- a) Sample of live births from IFLS1, IFLS2, and IFLS3
- b) Sample of live births from enumeration areas (EAs) where village midwives were placed under the program
- Infant mortality rate defined as number of deaths before age 1 per 1000 live births. Neonatal mortality defined as deaths during the first month per 1000 live births, while post-neonatal mortality rate is defined as the number of deaths after the first month and before the end of the first year

Table 3.1: Sample Mortality Rates

	All years	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
A. Full sample[a]													
Number of live births	7943	309	660	646	617	738	761	535	755	794	729	598	801
House	57.5	63.8	65.5	64.1	63.4	58.9	62.4	57.9	56.2	52.9	50.5	52.0	48.7
Hospital	14.2	12.0	12.4	10.8	11.7	13.8	12.1	13.3	15.8	16.5	17.0	15.7	16.9
Puskesmas	3.7	3.2	4.1	3.6	3.9	3.8	3.7	4.5	3.2	3.7	3.0	3.5	4.1
Midwife' office	19.8	13.3	12.6	15.0	15.4	18.4	16.8	19.6	21.1	22.5	25.7	25.9	25.7
Physician's office	2.1	2.9	2.1	2.2	1.6	1.5	1.8	2.4	1.9	2.0	1.8	1.8	3.4
TBA's office	1.6	1.6	1.2	1.1	1.5	1.2	2.0	2.2	1.9	2.3	1.9	1.0	1.1
B. Communities with village midwives[b]													
Number of live births	5421	190	446	427	411	462	540	375	520	560	510	421	559
House	68.2	79.5	77.8	73.3	74.5	73.8	73.1	68.5	64.6	63.9	60.4	61.3	58.1
Hospital	9.5	5.3	7.4	7.0	7.5	6.3	8.0	9.1	12.5	11.3	12.5	11.2	11.6
Puskesmas	2.7	2.1	3.4	3.0	2.9	2.4	3.5	3.2	2.1	2.0	1.8	2.9	3.2
Midwife' office	15.8	7.4	7.4	10.8	10.7	13.0	11.5	14.9	17.3	19.3	21.8	23.5	23.6
Physician's office	1.1	1.1	1.1	1.6	0.7	0.6	1.1	1.6	1.2	0.7	1.4	0.5	2.0
TBA's office	1.7	1.6	0.9	0.7	1.2	1.5	1.9	2.7	2.3	2.7	2.2	0.7	1.4

Notes:
a) Sample of live births from IFLS1, IFLS2, and IFLS3
b) Sample of live births from enumeration areas (EAs) where village midwives were placed under the program.

Table 3.2: Percentage of Births by Delivery Place

Table 3.1 presents the infant mortality rates along with their breakdown into neonatal and post-neonatal mortality for the entire sample of live births between 1988 and 1999 using the three waves of the IFLS. Furthermore, the mortality breakdown is also presented after the sample is restricted to births in those communities where village midwives were placed. For the overall sample of 8001 live births, the infant mortality rate for the 1988 to 1999 period is about 50 per 1000 live births, with about half these deaths taking place at the neonatal stage. There is a general decline in the infant mortality rate over time, but a stall in the fall in mortality rates for births in the later half of the 1990s, which is the time of the Indonesian financial crisis.

Table 3.2 presents the breakdown of the births based on their place of delivery. A majority of women in Indonesia continue to give birth in either their own house or the house of a family member. Although the percentage of such births has seen a small decline over the years, it continues to be the most common practice. 57 percent of births took place in the house during the sample period, followed by births in the office of the midwife or the village delivery post with about 20 percent, which has seen the most significant increase over the period. Only 14 percent of births were delivered in hospitals.

The communities that were targeted by the village midwife program were also ones that had lower access to birth facilities. This is apparent from the figures in Table 3.2, as these communities have a larger fraction of births in the house and have lower than average reliance on the use of hospitals and midwife services. However, over the course of the sample period, there has been a significant increase in the fraction of births at the office of the midwife, suggesting that the program may have had an impact on the choice of services by women.

	All years	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
A. Full sample [a]													
Number of live births	7939	309	660	646	616	738	761	537	753	793	728	598	800
Physician	8.6	5.5	6.5	4.8	7.5	8.5	7.0	7.6	9.2	9.5	10.7	10.4	12.6
Midwife	44.7	36.9	34.1	40.7	36.2	42.4	41.1	43.6	47.5	48.9	51.4	51.3	55.0
Nurse	1.3	1.3	1.4	0.6	1.0	1.2	0.9	1.3	2.9	1.5	1.9	0.5	0.9
TBA	41.1	51.5	53.6	48.6	49.7	43.5	47.0	43.4	36.4	36.6	32.1	33.4	27.8
Other	4.3	4.9	4.4	5.3	5.7	4.3	3.9	4.1	4.0	3.5	3.8	4.3	3.8
B. Communities with village midwives [b]													
Number of live births	5422	190	446	427	410	462	540	377	519	560	511	421	559
Physician	5.2	0.0	2.5	3.3	4.1	4.3	3.9	5.6	6.0	6.1	6.1	8.3	8.6
Midwife	38.0	25.3	26.5	30.7	28.0	30.5	34.8	35.8	41.0	42.7	47.9	47.5	51.9
Nurse	1.3	1.6	1.6	0.7	1.0	1.5	0.6	1.1	3.3	1.4	2.2	0.2	0.9
TBA	50.6	67.4	65.5	59.0	60.2	58.4	56.5	53.6	44.9	45.7	39.7	39.2	34.2
Other	4.8	5.8	4.0	6.3	6.6	5.2	4.3	4.0	4.8	4.1	4.1	4.8	4.5

a) Sample of live births from IFLS1, IFLS2, and IFLS3
b) Sample of live births from enumeration areas (EAs) where the village midwives were placed under the program

Table 3.3: Percentage of Births by Primary Assistance during Delivery

	Full Sample[a]				Communities With Village Midwives[b]			
	Number of live births	Infant mortality	Neonatal mortality	Post-neonatal mortality	Number of live births	Infant mortality	Neonatal mortality	Post-neonatal mortality
A. By delivery place								
House	4567	60.7	24.1	36.6	3695	63.3	24.1	39.2
Hospital	1129	52.3	41.6	10.6	514	64.2	46.7	17.5
Puskesmas	293	30.7	20.5	10.2	147	34.0	20.4	13.6
Midwife' office	1571	26.7	15.3	11.5	855	31.6	17.5	14.0
Physician's office	166	18.1	12.0	6.0	62	32.3	16.1	16.1
TBA's office	126	31.7	15.9	15.9	91	33.0	11.0	22.0
B. By primary birth assistance								
Physician	679	63.3	48.6	14.7	283	91.9	60.1	31.8
Midwife	3552	32.1	16.6	15.5	2063	34.9	16.0	18.9
Nurse	104	76.9	48.1	28.8	73	82.2	41.1	41.1
TBA	3265	67.4	27.9	39.5	2744	69.6	27.3	42.3
Other	339	56.0	26.5	29.5	259	65.6	34.7	30.9

Notes:

- a) Sample of live births from IFLS1, IFLS2, and IFLS3
- b) Sample of live births from enumeration areas (EAs) where village midwives were placed under the program
- Infant mortality rate defined as number of deaths before age 1 per 1000 live births. Neonatal mortality defined as deaths during the first month per 1000 live births, while post-neonatal mortality rate is defined as the number of deaths after the first month and before the end of the first year

Table 3.4: Mortality Rates by Delivery Place and Primary Assistance during Delivery

A large fraction of births in Indonesia continue to take place with the traditional birth attendants (TBA) as the primary help for delivery. However, the percentage of such births has declined over the years, with midwife-assisted births increasing as a percent of the total. Traditional birth attendants were the primary source of delivery attendance in the early-1990s, but their significance has declined relative to midwives since the mid-90s. For the entire sample, 41 percent of the births were TBA-assisted, while 45 percent were midwife-assisted.

The figures also show that the program was targeted to communities that were underserved by trained health workers. The program communities had higher reliance on TBA than average, with over 50 percent of births delivered by TBAs. However, these communities had a faster decline in the percentage of TBA-assisted births, while they had a faster increase in the percentage of midwife-assisted births, especially in the later half of the 1990s, which suggests that women switched away from TBAs to trained midwives with the introduction of the village midwife program.

The mortality rates by the place of delivery and the primary source of delivery assistance are presented in Table 3.4. Infant mortality rates are highest for births delivered in the house followed by those delivered in hospitals, with rates of 60.7 and 52.3, respectively. The infant mortality rates for births delivered in puskesmas (community health centers) and midwife's offices are significantly lower, 30.7 and 26.7, respectively. These figures become more informative when broken down into neonatal mortality and post-neonatal mortality. The highest neonatal mortality rates are for births in hospitals followed by those delivered in houses. Post-neonatal mortality rates are highest for those born in the house, with little variation among those born in hospitals,

puskesmas, or midwives' offices, while those born in physician's office have the lowest post-neonatal mortality rates. The high rates of neonatal mortality for hospital births could either be due to referral of high risk pregnancies, so women with birth complications are being selected into the sample, or it could also reflect shortcomings in the services provided in hospitals, which cannot be disentangled in the present analysis. The mortality figures are slightly higher when the sample is restricted to communities covered by the village midwife program, with higher overall post-neonatal mortality rates for all categories, which probably reflect the lower level of economic development of places chosen for placement of village midwives.

Infant mortality rates also vary by the type of delivery assistance. The rates for births delivered by midwives are lower than those for any other form of delivery assistance. The infant mortality rate for births delivered by midwives is 32.1 versus those delivered by physicians, nurses, and TBA, which are 63.3, 76.9 and 67.4, respectively. When infant deaths are categorized as neonatal and post-neonatal deaths, the mortality rates for midwife-assisted births remain low in both categories, while there is variation in the two categories for physician- and nurse-assisted births compared to TBA-assisted births. Physician and nurse-assisted births have high neonatal mortality rates, but post-neonatal mortality rates are similar to midwife-assisted births. TBA-assisted births, on the other hand, have lower neonatal mortality rates compared to physician and nurse-assisted births. While the post-neonatal mortality rate is highest for TBA-assisted births compared to the others. The neonatal mortality rates associated with different types of delivery assistance may reflect the quality of prenatal care, delivery services, and intrinsic maternal health as well as the selection of high risk birth towards physician- and nurse-

assisted deliveries. While post-neonatal mortality associated with each category may primarily reflect an income effect, as non-referral physician deliveries are most likely to be to higher income women, while TBA-assisted births have a selection of lower income women who raise children with fewer resources and lower quality of nutrition, increasing their susceptibility to childhood diseases.

The infant mortality rates are higher for each type of provider for the sample restricted to communities where midwives were introduced, suggesting that the program was targeted to areas with characteristics that lead to higher mortality rates of children. However, the higher mortality rates seem to be due mostly to higher post-neonatal mortality.

3.6 Empirical Analysis

Estimating the impact of midwives on mortality risk of children is complicated by the fact that women choose the facilities where they give birth and the type of assistance during delivery. That choice may reflect various characteristics of the individual that are not observed in the data, hence an empirical framework regressing the mortality outcome of births for women against the choice of birth facility or services will lead to biased estimates. Furthermore, there is unobserved frailty of each birth that would affect the choice of services. As is apparent from the descriptive trends presented above, mortality rates are higher for births that were delivered in hospitals and also for those delivered by physicians and nurses. These probably reflect the choice by women with high frailty to use those particular services or that the women with birth complications are being referred to hospitals and physicians, thereby leading to higher mortality rates associated with them.

Furthermore, estimating the impact of the village midwife program on mortality risks of children is complicated by the fact that the midwives were not randomly assigned to the villages. Poorer communities and those communities that were further away from health centers were likely to be targeted under this program earlier than other communities (Frankenberg and Thomas, 2001). The program effect estimated by directly regressing mortality outcomes against the presence of midwives in the community will be biased as the placement of a midwife in a particular community may be dependent on unobserved community characteristics.

In order to overcome the bias due to unobserved heterogeneity at the individual and community levels, the programmatic effect will be estimated by aggregating birth outcomes at the kabupaten (district) level for each year. Using the timing of placement of midwives in each community, the fraction of communities in each kabupaten with a village midwife can be obtained. A kabupaten fixed effect is used to account for unobserved heterogeneity across the districts that could be correlated with the program placement rule.

$$M_{jt} = \beta_0 + \beta_1 MW_{jt} + \alpha_j + \varepsilon_{jt}$$

where M_{jt} is the mortality rate for births in time t in kabupaten j. MW_{jt} is the fraction of communities in kabupaten j with midwives in year t. α_j is the time-invariant kabupaten specific effect. The sample is further restricted to those communities that received village midwives in order to reduce unobserved heterogeneity across the communities.

	(A) Infant Mortality			(B) Neonatal Mortality			(C) Post-Neonatal Mortality		
	Fixed Effects (1)	Between Effects (2)	Random Effects (3)	Fixed Effects (4)	Between Effects (5)	Random Effects (6)	Fixed Effects (7)	Between Effects (8)	Random Effects (9)
Fraction of communities with a village midwife	-19.112	18.138	-16.824	-11.384	6.515	-10.098	-7.728	11.623	-6.385
	(10.243)	(38.975)	(9.919)	(6.767)	(23.986)	(6.527)	(8.015)	(28.105)	(7.710)
Constant	68.309	51.081	67.142	30.515	21.801	29.816	37.794	29.281	37.224
	(6.526)	(18.242)	(7.271)	(4.311)	(11.226)	(4.586)	(5.106)	(13.154)	(5.383)
N	1137	1137	1137	1137	1137	1137	1137	1137	1137
Number of kabupatens	107	107	107	107	107	107	107	107	107
R-squared	0.003	0.002	0.002	0.003	0.001	0.002	0.001	0.002	0.001
F-stat	3.48	0.22		2.83	0.07		0.93	0.17	
Wald chi-sq			2.88			2.39			0.69
Hausman test	$\chi^2(1)=0.80$; prob>$\chi^2=0.371$			$\chi^2(1)=0.52$; prob>$\chi^2=0.472$			$\chi^2(1)=0.38$; prob>$\chi^2=0.539$		

Notes:
Dependent variables aggregated period-specific mortality rates at the Kabupaten level expressed as deaths per 1000 live births. Standard errors in parentheses.

Table 3.5: Regression Results with Kabupaten Specific Effects

	(A) Infant mortality		(B) Neonatal mortality		(C) Post-neonatal mortality	
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction of communities with village midwife	16.032	9.590	10.305	9.815	6.335	0.491
	(19.581)	(17.491)	(12.687)	(11.409)	(15.040)	(13.486)
1990	-26.156		-24.098		-2.335	
	(19.894)		(13.165)		(15.569)	
1991	-25.289		-14.585		-10.888	
	(20.172)		(13.346)		(15.783)	
1992	-11.582		-11.244		-0.702	
	(20.014)		(13.242)		(15.660)	
1993	-24.258		-19.968		-4.774	
	(20.313)		(13.426)		(15.880)	
1994	-50.914		-33.606		-17.410	
	(22.976)*		(15.139)*		(17.912)	
1995	-54.674		-20.748		-34.696	
	(24.905)*		(16.367)		(19.371)	
1996	-55.645		-41.899		-14.637	
	(25.719)*		(16.876)*		(19.976)	
1997	-52.556		-34.894		-18.284	
	(27.122)		(17.779)*		(21.048)	
1998	-50.286		-34.056		-17.423	
	(27.380)		(17.943)		(21.242)	
1999	-50.215		-39.149		-11.870	
	(27.583)		(18.074)*		(21.398)	
Time trend		-4.430		-3.368		-1.164
		(2.420)		(1.584)*		(1.874)
Constant	86.437	84.665	44.009	43.204	42.702	41.854
	(12.552)**	(12.002)**	(8.133)**	(7.782)**	(9.639)**	(9.194)**
N	1137	1137	1137	1137	1137	1137
Number of Kabupatens	107	107	107	107	107	107
R-Square	0.009	0.005	0.01	0.006	0.005	0.001
Wald chi-sq	10.66	6.22	11.84	6.92	5.13	1.07

Notes: Standard errors in parentheses. * significant at 5%; ** significant at 1%

Table 3.6: Random Effects Controlling for Time Specific Effects

3.6.1 Results

The results are presented for aggregate period-specific kabupaten infant mortality rate as the dependent variable, and then for neonatal and post-neonatal mortality rates separately. The results for fixed effects, between effects, and random effects models are presented to account for within-kabupaten effects, between-kabupaten effects and effects associated with a combination of both. The fixed effect model captures the within-kabupaten variation in mortality risks associated with changes in midwife availability over time in the kabupaten, while the between-effect estimator captures the variation across kabupatens with different levels of program effort.

Panel (A) presents the results for the aggregate infant mortality rate at the kabupaten level. The increase in coverage of the village midwife program in the kabupaten is associated with a significant reduction in the infant mortality rate. While the cross-sectional variation in mortality rates across the kabupatens associated with the midwife program is not significant.

Breaking up the aggregate infant mortality rates into the neonatal and the post-neonatal components and estimating their relationship with program effort gives different results for the two. The program effect is significant for neonatal mortality but not for post-neonatal mortality, which supports the argument that the community-based reproductive health efforts affected the mortality risk of children during early infancy through improvements in the health of the mother and by providing a safer environment for births, thereby lowering neonatal mortality risks. The role of midwives in improving post-neonatal mortality would have been through promoting vaccination and better

nutrition of children, but the results suggest that the midwife program did not play a major role in this area.

The Hausman test suggests that we cannot reject the null hypothesis of no correlation between the random effects term and the regressor capturing program effort in the kabupaten. The random effects estimator is consistent in this specification and is not very different from the estimates for the fixed effects specification, which makes it preferable given its efficiency.

Table 3.6 presents the estimates for the kabupaten random effects specifications that include controls for period specific effects using a time trend and time dummies separately. The addition of period specific effects leads to loss of significance of the effect of the midwife program, whereas there is a significant fall in infant and neonatal mortality associated with time. Similarly, there is an association between the post 1994 periods and the reduction in infant and neonatal mortality, but there is no significant association with post-neonatal mortality. Given the correlation between the coverage of the midwife program and time, it is difficult to identify other factors besides the program that would cause a fall in infant mortality primarily through the fall in neonatal mortality. As the causes of death are different at the neonatal stage compared to the post-neonatal stage, post-neonatal mortality rates could be lowered through immunization and provision of nutrition information, while reduction in neonatal mortality would require improvement in the birth process and neonatal care, which are more difficult to implement at the rural level. The significant fall in neonatal mortality and not post-neonatal mortality coinciding with the introduction of the midwife program does suggest

that the program has led to improvements in the birth process for rural women in Indonesia.

3.7 Conclusion

Reducing the number of child deaths is a major policy objective in developing countries. Since neonatal deaths constitute a significant portion of such deaths, it is important to understand their determinants and propose effective policy measures to lower their incidence. This chapter studies the role of the village midwife program in Indonesia in lowering the incidence of infant mortality using the Indonesian Family Life Survey (IFLS). Mortality outcomes are aggregated at the community level and program effect is estimated using community fixed effect to account for non-random program placement. Although the primary purpose of this community-based program was to promote safe-motherhood and lower maternal mortality, the results suggest an association between the program and lower neonatal mortality rates, but there has been no significant effect on post-neonatal deaths. Since the causes of death at the neonatal stage are due to the birth process and maternal health, the findings suggest that the community based safe motherhood initiative such as the one in Indonesia can help in lowering neonatal mortality rates through improving the environment in which women give birth in rural areas.

GLOSSARY

Bappenas	*Badan Perencanaan Pembangunan Nasional* (National Development Planning Board)
BKKBN	*Badan Kordinasi Keluarga Berencana Nasional* (National Family Planning Coordinating Board)
BPS	*Biro Pusat Statistik* (Central Bureau of Statistics)
IUD	Intra-Uterine Device
LKBN	*Lembaga Keluarga Berencana Nasional* (National Family Planning Institute)
MDG	Millennium Development Goals
PKBI	*Perkumpulan Keluarga Berencana Indonesia* (Indonesian Family Planning Association)
PKK	*Pembinaan Kesejahteraan Keluarga* (Family Welfare Movement)
PLKB	*Petugas Lapangan KB* (Family Planning Fieldworker)
Posyandu	*Pos Pelayanan Terpadu* (Integrated health services post)
PPKBD	*Pembantu Pembina Keluarga Berencana Desa* (Village Family Planning Management Assistant)
Puskesmas	*Pusat Kesehatan Masyarakat* (Community health center)
Repelita	*Rencana Pembangunan Lima Tahun* (Five-year development plan)

UPGK	*Usaha Perbaikan Gizi Keluarga* (Family Nutrition Improvement Program)
UPPKA	*Usaha Peningkatan Pendapatan Keluarga Akseptor* (Income-generating program for family planning acceptors)

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