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Do Women Increase Their Use of Reproductive Health Care When It Becomes More Available? Evidence from Indonesia

Elizabeth Frankenberg [Associate Professor],

Terry Sanford Institute of Public Policy, Duke University, 302 Towerview Road, RH 110, Durham, NC 27705

Alison Buttenheim [Postdoctoral fellow],

Office of Population Research, Princeton University

Bondan Sikoki [Director], and

SurveyMeter, Yogyakarta, Indonesia

Wayan Suriastini [Associate Director]

SurveyMeter, Yogyakarta, Indonesia

Elizabeth Frankenberg: e.frankenberg@duke.edu

Abstract

Data from the Indonesia Family Life Survey are used to investigate the impact of a major expansion in access to midwifery services on women's use of antenatal care and delivery assistance. Between 1991 and 1998, Indonesia trained some 50,000 midwives, placing them in poor communities that were distant from health-care centers. We analyze information from pregnancy histories to relate changes in the choices that individual women make across pregnancies to the arrival of a trained midwife in the village. We show that regardless of a woman's educational level, the placement of village midwives in communities is associated with significant increases in women's receipt of iron tablets and in their choices about care during delivery—changes that reflect their moving away from reliance on traditional birth attendants. For women with relatively low levels of education, the presence of village midwives has the additional benefit of increasing use of antenatal care during the first trimester of pregnancy. The results of the study suggest that bringing services closer to women can change their patterns of use.

Disparities between developing and developed countries are large for many health outcomes, but the difference in levels of maternal mortality is immense. Of the estimated 585,000 pregnancy-related deaths per year, 99 percent occur in developing countries (Ray and Salihu 2004). Maternal mortality is relatively rare in the developed world because most women have access to the medical techniques that prevent maternal deaths. In the developing world, however, making these techniques available on an as-needed basis is a complex undertaking, largely because obstetric emergencies are difficult to predict and often require surgical interventions and blood transfusions that typically are not available in health clinics offering basic services.

The complexity of emergency obstetric care notwithstanding, the likelihood of improvements in health outcomes for women in developing countries rises with improvements in the quality and availability of health care that women receive during pregnancy and delivery. Large-scale training programs for traditional birth attendants (TBAs) and expansions of reproductive health-care services are common strategies adopted to address maternal mortality and morbidity, neonatal mortality, and low birthweight. Such measures can only be effective, however, if women actually use the trained providers or new services, and they do not always do so. Evaluations of a TBA training program in the Gambia, for example, found that program impact was low because the providers who were trained assisted at few births (Greenwood et al. 1990; Dehne et al. 1995).

In this study, we examine the relationship between access to health-care services and women's use of antenatal and delivery care in Indonesia, where a major expansion in midwifery services took place during the 1990s. Our goal is to assess the extent to which the expansion in access to better-quality services was accompanied by changes in women's use of antenatal care, in the content of that care, and in their choices about the place of delivery and type of childbirth assistance.

A key problem that we confront is that public health investments are not likely to be located at random with respect to health outcomes. If programs are carefully targeted, they will be placed where health outcomes are poor and use of services is low. Failure to take account of nonrandom placement generally leads to biased estimates of the impact of the investment (Angeles et al. 1998).

In this study, we analyze data from the Indonesia Family Life Survey (IFLS), a rich longitudinal survey, to evaluate whether government efforts to provide improved health care have an impact. Specifically, we consider the Village Midwife program, which was initiated in the 1990s and is estimated to have posted some 50,000 midwives throughout the country (Sweet et al. 1995; Gani 1996; Kosen and Gunawan 1996). To measure the effect of the introduction of a midwife into a community on health-service use, we draw upon the “quasi-experiment” that occurred in Indonesia by comparing changes in healthcare use over sequential pregnancies among women in “treated” communities (those that gained a midwife during this period) with such changes for women in “control” communities that did not gain a midwife.

The Importance of Antenatal and Delivery Care

Maternal mortality is widely recognized as a leading cause of premature death and disability among women of childbearing age in developing countries (Lopez et al. 2006). The maternal mortality ratio (MMR) exhibits the greatest disparity between developed and developing countries of all the commonly used human development indicators (Mora and Nestel 2000).¹ The global MMR currently stands at around 400 deaths per 100,000 live births, resulting in more than half a million maternal deaths each year (WHO 2007). The Safe Motherhood Initiative, launched in 1987 by the United Nations in cooperation with international

¹Disparities between rich and poor countries in access to professional delivery care are also immense (Houweling et al. 2007).

maternal-child health organizations, has focused considerable policy and empirical attention on the determinants of maternal mortality. Millennium Development Goal 5 calls for reducing the maternal mortality ratio by three-fourths between 2000 and 2015.

The main proximate causes of maternal mortality include hemorrhage, infection, unsafe abortions, eclampsia/hypertension, and obstructed labor (WHO et al. 1999), most of which can only be addressed by adequate emergency obstetric care. A systematic review of successful interventions to reduce maternal mortality (Gay et al. 2003) identifies appropriate antenatal care, including provision of iron supplementation during pregnancy and skilled attendance at delivery, as important complements to a functioning emergency obstetric-care-delivery system. Indeed, the proportion of deliveries assisted by a professional attendant is typically used as a progress indicator for maternal mortality because of the difficulties of measuring maternal mortality directly and because professional attendance at delivery is assumed to reduce the number of maternal deaths (Houweling et al. 2007).

The role that antenatal care can play in reducing maternal mortality and morbidity is contested, because many of the complications listed above that lead to maternal death cannot be predicted during antenatal care and because few rigorous empirical studies of antenatal care have demonstrated its effectiveness (Carroli et al. 2001). Strong evidence, however, points to the roles of the timing of antenatal care and of some components of its content in improving maternal health outcomes directly (Rooney 1992; Villar and Bergsjö 1997; Jowett 2000). The provision of iron tablets during pregnancy, for example, has been shown to reduce the risk of becoming anemic, which is an important risk factor for hemorrhage and cardiac failure during delivery (Carroli et al. 2001; Reveiz et al. 2007).

Blood-pressure measurements and urinalysis performed during antenatal care visits can be used to screen pregnant women for hypertensive disorders of pregnancy (including pre-eclampsia and eclampsia) and to refer the woman to seek medical attention if the condition appears (Carroli et al. 2001). Identifying pregnancy-related hypertension requires at least one blood-pressure reading before the twentieth week of pregnancy. This requirement provides support for at least one early or first-trimester antenatal care visit (Carroli et al. 2001).

In the course of routine antenatal care, women can be screened and treated for sexually transmitted and urinary tract infections that may lead to preterm birth or may complicate delivery, and tetanus toxoid inoculations can be administered. Both of these interventions are considered highly effective (Jowett 2000). Several other indirect infectious causes of maternal mortality and morbidity, including HIV/AIDS, hepatitis, malaria, and tuberculosis, can also be detected and treated during antenatal care visits.

If a basic obstetric history is collected during antenatal care, women at risk for complicated deliveries can be referred to health centers and hospitals. In late pregnancy, antenatal visits can help to identify women at risk for difficult deliveries (including cephalopelvic disproportion and breech or transverse presentation) so that they can be directed to appropriate delivery care. Skilled midwives may even undertake external cephalic version to

convert a breech presentation to a normal head-down presentation, preventing complications during labor (Carroli et al. 2001).

A final important function of antenatal care visits is to encourage women to choose medically oriented delivery care, that is, “skilled attendance” (Gay et al. 2003; Barber 2006). The case for skilled attendance at delivery is strong. Skilled attendants include midwives, doctors, and nurses with proficiency in managing normal deliveries and diagnosing, managing, or referring obstetric complications (WHO et al. 1999). A review of the evidence in support of skilled assistance at delivery suggests that 16–33 percent of all maternal deaths could be avoided through prevention of the four main life-threatening obstetric complications—obstructed labor, eclampsia, sepsis, and hemorrhage—by skilled attendants (Graham et al. 2001).

Pregnant women, therefore, appear to benefit from antenatal care and skilled attendance at delivery. This finding leads to the important questions of whether the provision of maternal care services increases the use of services, and for which groups.

Factors Affecting Use of Antenatal Care and Delivery Services

Several studies have considered how women's use of antenatal care has changed over a period during which aspects of the service environment are known to have changed at the macro level. Using data from rural China, for example, Short and Zhang (2004) document changes in service use between 1988 and 1997, a period during which health-care services moved increasingly from governmental to private control. Over this period, women's use of antenatal care, their propensity to deliver in a hospital, and their propensity to deliver with the help of trained attendants all rose, despite privatization. In Indonesia, the proportion of live births for which delivery was assisted by a health professional increased almost twofold between 1986 and 2002 (Hatt et al. 2007), the period during which the Village Midwife program was implemented. The interpretation that the program succeeded in improving outcomes is consistent with the facts, although this study did not link women's behaviors directly to access to the program midwives.

With respect to differentials in patterns of use by women's characteristics, correlational studies from all parts of the world consistently reveal that women in urban areas and women with more education and higher household incomes are more likely to obtain antenatal care and use skilled attendants at delivery (Abbas and Walker 1986; Elo 1992; Ellencweig et al. 1993; Raghupathy 1996; Toan et al. 1996; Bolam et al. 1998; Addai 2000; Celik and Hotchkiss 2000; Bloom et al. 2001; Navaneetham and Dharmalingam 2002; Anwar et al. 2005; Barber 2006). These effects remain significant when other factors such as parity, health insurance, access to care, and quality of care are controlled.

In Indonesia, research shows that in the period before the economic crisis of 1998, among women who delivered at home, those from better-off households (as measured by asset-ownership quartiles) were significantly more likely to have delivery assistance from trained providers than were those from economically more deprived households (Thind and Banerjee 2004). Other work (Hatt et al. 2007) documents a relatively greater increase over time in the use of trained attendants during delivery among women in the poorest two

quintiles of wealth distribution (as measured by asset ownership) than among women in the middle quintile. Over the same period, however, the rise in rates of cesarean delivery (presumably, in many cases, in response to an emergency) was much higher for women from the top quintile than for poorer women.

In general, governments that are considering investments in new services in hopes of improving health outcomes need to know whether the new services will be used. The Village Midwife program in Indonesia provides a compelling case study with which to address this question.

The Village Midwife Program in Indonesia

Socioeconomic development in Indonesia has occurred at a rapid pace since the 1960s. From 1967 to 1997, Indonesia's gross domestic product (GDP) per capita increased by almost 5 percent per year. At the same time, Indonesia achieved nearly universal enrollment in primary school and substantial increases in secondary-school enrollment. Since the early 1960s, several indicators of health status in Indonesia also have shown major improvements. The infant mortality rate has declined steadily, and by the mid-1990s life expectancy surpassed 60 years. By 2000, the infant mortality rate was down to 35 deaths per 1,000 births, from 142 deaths per 1,000 births in 1965 (BPS and ORC Macro 2003)

Gains in the area of maternal mortality have been considerably less impressive. Most estimates of maternal mortality for Indonesia in the 1990s put rates on a par with those in India and Bangladesh, although GDP per capita in Indonesia at that time was about 50 percent higher than it was in India and about two times higher than Bangladesh (Sarwono et al. 1997). Estimated at 390–650 deaths per 100,000 live births at various points during the 1980s and 1990s, Indonesia's maternal mortality rate was the highest of any member of the Association of Southeast Asian Nations (Mukti 1996; Handayani et al. 1997; UNICEF 2000a and 2000b).

In the late 1980s, Indonesia's Ministry of Health (MOH) began to train and post midwives to villages throughout the country in an effort to increase exponentially women's access to antenatal care and safe delivery services (MOH [Indonesia] 1994; Kosen and Gunawan 1996; Handayani et al. 1997). The Government of Indonesia planned to provide a midwife to every nonmetropolitan village or township between 1990 and 1996 (MOH [Indonesia] 1994). Typically midwives were recruited from three-year nursing academies and received one additional year of midwifery training (Sweet et al. 1995). By 1998, 54,000 midwives had been trained; between 1986 and 1996 the number of midwives per 10,000 population increased more than tenfold from 0.2 to 2.6 (Hull et al. 1998; MOH [Indonesia] 2000).

The village midwife's duties center on providing health and family planning services, working with traditional birth attendants, and referring complicated obstetric cases to health centers and hospitals. Moreover, she serves as a health-care resource in her community and is encouraged to seek out patients and visit them in their homes and to develop collaborative relationships with traditional village midwives (MOH [Indonesia] 1994).

Expansion of the Midwife Program

Table 1 summarizes the nature of the program's expansion, as measured by three waves of the Indonesia Family Life Survey community-facility surveys, which were conducted in 1993, 1997, and 2000. Access to the Village Midwife program is measured by using an indicator of whether a midwife was practicing in the community in each of the survey years. The IFLS reflects the dramatic expansion of the village midwife program documented in the literature about the Indonesian health system. In 1993, fewer than 10 percent of IFLS communities had a village midwife; by 1997 this proportion had increased to 46 percent, and by 2000 the proportion was 50 percent. Over the four-year period between the 1993 and the 1997 survey waves, more than one-third of IFLS communities gained a village midwife. After 1997, expansion of the program slowed dramatically. By 2000, an additional 10 percent of communities had village midwives, but 6 percent of communities reported that the village midwife was no longer present. These results reflect the success of the program early on in placing midwives in underserved communities, but also the potential difficulty in retaining midwives in remote areas.

Trends in Use of Antenatal Care and Delivery Assistance

Figure 1 presents trends over time in four outcomes related to use of reproductive health care. The figure is based on an analytical sample of 4,501 women interviewed as part of IFLS who experienced 7,108 pregnancies during the 13 years between 1988 and 2000 (data are combined from pregnancy histories collected in 1993 data are combined from pregnancy histories collected in 1997, and 2000). On average, the mothers in this sample have about six years of education and are almost 30 years old.

We consider four outcomes related to use of care during pregnancy: whether a woman received any antenatal care, whether she received antenatal care during her first trimester, whether she received iron tablets during her pregnancy (these data are available only from the 1997 and 2000 surveys), and whether she gave birth either in a medically oriented facility or was attended by a practitioner with medical training (the alternative is that the woman delivered in a home setting with the assistance of family members or a traditional birth attendant).

For all of the indicators, the proportion of women choosing to obtain health care has risen over time. Even in 1988 most women (80 percent) received some antenatal care during their pregnancy. By 2000, the proportion had risen to 94 percent. The increase is more dramatic for receipt of care during the first trimester of pregnancy. The proportion of women obtaining antenatal care during the first trimester rose from 54 percent to 77 percent over this period. The increase over time in the number of those who received iron tablets (tracked from 1992 to 2000) is smaller: from 79 percent in 1992 to about 87 percent in 2000. A substantial improvement is observed in the proportion of women receiving professional assistance during delivery. In 1988, only about 44 percent of deliveries were classified as medically assisted; by 2000, the proportion was about 62 percent.

Methods

As described above, our data are drawn from three rounds of the Indonesia Family Life Survey, an ongoing panel survey of individuals, households, communities, and facilities. The IFLS conducted interviews in 321 enumeration areas in 13 of Indonesia's 26 provinces and represents about 83 percent of the Indonesian population. The enumeration areas are small, survey-defined clusters of households located within 312 administrative areas known as *desa* (villages) or *kelurahan* (townships), of which there are more than 62,000 in Indonesia. We refer to *desa* and *kelurahan* collectively as “villages.” In this study, we use the term “community” to designate both an IFLS enumeration area and the larger administrative area (“village”) in which it is located.

The first round of data (IFLS1, collected in 1993) included interviews with 7,224 households (Frankenberg and Karoly 1995). In 1997, we conducted a second survey (IFLS2) in which we sought to reinterview all IFLS1 households (and all members of these households), as well as a set of target members of IFLS1 households in 1993 who had migrated by 1997 (Frankenberg and Thomas 2000). In 2000, we conducted a third wave of the survey (IFLS3), using the same relocation goals and protocols. Both IFLS2 and IFLS3 succeeded in reinterviewing about 95 percent of IFLS1 households and about 92 percent of the individuals who were of eligible age for this study.

The IFLS questionnaire covers a broad array of topics. In each wave of the survey, women of reproductive age were asked an extensive range of detailed questions about their pregnancies, including questions concerning the receipt and timing of antenatal care services and about choices regarding care at the time of delivery for births that occurred in the preceding five years.

Statistical Approach

One approach to pinpointing the effect of health-care services on outcomes is to examine the relationship between spatial variation in program availability or strength and spatial variation in health-care-seeking behaviors. When data are available from only one point in time, however, the association between access to care and such behaviors cannot identify the direction of causality. Services may be provided at a particular location in response to the demand for those services, or people who want services may move to places where they are provided (Rosenzweig and Wolpin 1986 and 1988). In either case, the relationship is governed by a common unobserved factor that yields a spurious correlation between access to services and health outcomes.

Interventions may also target communities with particular attributes or particular types of individuals. If targeting is based on characteristics that cannot be fully controlled in the regression, and if those unobserved characteristics are correlated with the outcome of interest, estimated effects of the intervention will be biased. For example, if government services are provided to communities where health status is relatively poor, the estimated impact of those services on a particular health outcome will be biased negatively unless all characteristics that underlie placement of the program are controlled. The issue of selective program placement is important in the context of health policies in Indonesia in general

(Frankenberg 1992; Pitt et al. 1993; Gertler and Molyneaux 1994) and with respect to the Village Midwife program in particular (Frankenberg and Thomas 2001; Frankenberg et al. 2005).

Following an approach we have employed in other work that evaluates the effects of an expansion in access to midwifery services and health outcomes in Indonesia (Frankenberg and Thomas 2001; Frankenberg et al. 2005), we adopt a quasi-experimental approach in which “treated” villages are those to which a midwife was assigned and “control” villages are those that did not receive midwives. Specifically, we take advantage of pregnancy's being a repeated event for which we have longitudinal data that spans the period during which midwives were introduced.

In this study, we estimate a model that includes an individual fixed effect. The fixed-effects model has been used extensively in the program-evaluation literature (for a discussion, see Heckman and Robb 1985). We contrast behaviors during pregnancies that occurred when no village midwife was present in the community with behaviors during pregnancies that occurred after the arrival of a midwife. Because a secular trend may exist in health-care-seeking behavior and because pregnancies that occurred relatively early will be more likely to predate the arrival of the program, we also include an indicator of time.

Formally, the model that we estimate can be specified as follows:

$$Y_{ict} = \beta_0 + \beta_1 M_{ct} + \beta_2 X_{it} + \beta_3 X_{ct} + \beta_4 TIME + (\mu_c + \nu_i + \varepsilon_{ict}),$$

where Y_{ict} is an outcome for woman i in community c at time t , M_{ct} is an indicator of whether a midwife is available, X_{it} is a set of characteristics specific to that woman at time t , and X_{ct} is a set of characteristics specific to the community at time t . In addition, we include a variable measuring year of conception ($TIME$) to capture secular time trends in outcomes. In this model, μ_c represents fixed but unobserved community-level factors and ν_i represents fixed but unobserved individual-level factors. These unobserved factors are eliminated from the model by the inclusion of the individual fixed effect. In this model, ε_{ict} is an individual- and time-specific idiosyncratic error term. We estimate logistic regression models for each of the four binary outcomes presented in Figure 1.

The coefficient of key interest is β_1 , which indicates whether the pregnancy took place in a village in which a program midwife was present at either the time of conception (for outcomes related to antenatal care) or at the time of birth (for care received during delivery). Access to a midwife is indicated with a dichotomous variable set to one if the midwife was present in the village by the relevant date and set to zero otherwise.

In the fixed-effects specifications, we do not control for time-invariant characteristics of the mother such as her educational level, because characteristics that do not change will drop out of fixed-effects models. We do control for time-varying characteristics such as level of monthly household expenditure per capita (logged) and for community resources and infrastructure: the average household expenditure per capita within the community, whether

a public phone is available, and whether the main road is paved. Data for these attributes are available in 1993, 1997, and 2000, but pregnancies occur throughout the period. Each pregnancy was matched to the most temporally proximate information on household expenditure and community infrastructure.

In the fixed-effects specifications, for a woman to contribute information to the coefficient estimation, she must have experienced two or more pregnancies across which her behavior on the outcome of interest varied. Many women do not change their behavior across pregnancies. The number of women and the number of pregnancies they contribute differ by outcome, ranging from 290 women with 729 pregnancies for medically oriented delivery, to 106 women with 240 pregnancies for receipt of iron tablets. Three principal limitations to this method can be observed. First, if the characteristics that determine the placement of midwives vary over time (that is, if program managers were basing placement decisions on one set of factors in the early 1990s and on another set of factors in the mid-1990s), then a fixed-effects strategy will not address the issue of nonrandom program placement. Second, the strategy requires either longitudinal or retrospective data. Third, we cannot estimate the main effects of women's characteristics of potential interest that do not change over time, such as educational level. The third limitation is of least concern given that our focus is on evaluating program impact rather than describing the role of women's characteristics in their choices concerning maternal health care. Moreover, in an additional specification, we have included interaction terms between women's characteristics and the availability of a midwife, which tests whether the program impact varies by level of maternal education.

Results

In earlier work (Frankenberg and Thomas 2001), we presented results that suggest that during the 1990s village midwives were placed in communities that were relatively poor and underserved in terms of health, transportation, and communication infrastructure. We re-estimated models of the presence of a village midwife, adding a variable measuring the proportion of children delivered at home with the assistance of a traditional birth attendant during the period from 1988 to 1991 (before the village midwives were deployed). The coefficient for this variable is positive and significant in both 1997 and 2000, suggesting that midwives were disproportionately likely to be assigned to villages in which decisions regarding care during delivery were generally traditional. These results (not shown), together with our earlier published research, confirm the importance of the statistical strategy that we describe above, which eliminates the influence of time-invariant but unobserved community and individual characteristics associated both with use of reproductive health care and with access to a village midwife.

Table 2 presents results both from logistic regressions and from the specifications that include a mother-specific fixed effect. The question of greatest interest for this research is the sign and significance level of the coefficients associated with the availability of a village midwife, which are displayed in the first row of the table. Columns 1–4 display the results for the logistic regressions of reproductive health outcomes as a function of midwife availability. For each of the outcomes related to antenatal care—receipt of any antenatal care, receipt of care in the first trimester, and receipt of iron tablets during pregnancy—the

coefficient for availability of a midwife is positive and statistically significant. For the choice of medically oriented delivery care, however, the coefficient for midwife availability is negative and statistically significant. A priori, that village midwives simultaneously have a positive effect on choices related to antenatal care and a negative effect on choices related to delivery appears unlikely. Instead, these results may arise if unobserved individual or community characteristics, such as a greater degree of traditionalism in the villages where midwives were posted, bias all the coefficients downward.

The results from the specifications that include a mother-specific fixed effect are presented in Columns 5–8. For three of the four outcomes (all but receipt of care in the first trimester), the coefficients increase substantially in size. The coefficients are not as precisely estimated, however, and because the standard errors are larger, the effects of access to a midwife on receiving antenatal care (at all or during the first trimester) are no longer statistically significant at standard levels. Access to a village midwife does have a positive and statistically significant impact on receipt of iron tablets during pregnancy and a positive and marginally statistically significant effect ($p = 0.07$) on receiving medically oriented delivery care. Notice that the sign on the coefficient for the latter variable reverses from the logistic regression to the fixed-effects specification, revealing that access to a midwife shifts from being associated with a decreased to an increased likelihood of use of medical care during delivery. A woman is about 1.7 times more likely to receive a medically oriented delivery when a village midwife is available than when one is not (in contrast to the first specification, where presence of a midwife was significant but negative). This reversal of sign strongly supports the interpretation that the coefficients for the village midwife's effect are negatively biased in the logistic regression—that is, estimates from the logistic regression understate the impact of access to a village midwife on outcomes related to reproductive health care because of unobserved features that are positively correlated with the midwife's presence and negatively correlated with service use. The fixed-effects specifications eliminate these unobserved characteristics to reveal far more positive, albeit relatively less precisely estimated, program impacts. Indeed, our results regarding the correlates of placement of village midwives indicate that midwives were more likely to be assigned to communities in which, before the program began, women's reliance on TBAs for delivery was high. Therefore, the counterintuitive result in column 4 of Table 2 arises because of reverse causality: the high reliance on TBAs drives the presence of a program midwife, rather than the presence of a program midwife driving the choice to deliver without professional medical assistance.²

In the results presented in Table 2, we do not control for maternal education, which does not change over time. In the fixed-effects framework, educational level can be made to interact with the measures of access to a midwife to explore whether program impact varies by educational level. It is unclear whether access to a program midwife will make more of a difference in the behaviors of relatively better-educated women, who may be better equipped to understand the benefits of medically oriented services, or in the behaviors of poorly educated women, for whom a change in access may put modern midwifery services

²The coefficients for the other time-varying covariates also change upon inclusion of an individual fixed effect. The coefficients are less precisely estimated in the fixed-effects specification, and far fewer are statistically significant at conventional levels.

in reach (geographically, financially, and/or psychologically) for the first time. The program may have had the same impact for all women, regardless of their educational level.

The results for the specification that includes interactions between maternal education and access to a program midwife are presented in Table 3. For each outcome, the main effect of access to a village midwife is statistically significant and positive (except for receipt of iron tablets during pregnancy, which is positive but only marginally significant [$p = 0.10$]). The interaction between access to a village midwife and level of maternal education, presented in the second row of the table, is negative for each outcome, although it is statistically significant only for receiving antenatal care during the first trimester (and marginally significant for receiving any antenatal care [$p = 0.09$]). The negative interaction term is consistent with the interpretation that access to village midwives has a stronger effect on receipt of antenatal care among women with relatively low levels of education than among their better-educated counterparts. This differential impact by level of education is not statistically significant for receipt of any antenatal care, receipt of iron tablets, or use of medically oriented delivery care. For these outcomes, access to a village midwife was important regardless of the mother's level of education.

Conclusion

Using statistical methods that are commonly applied in the program-evaluation literature, this study shows that the placement of medically trained midwives in communities in Indonesia has resulted in changes to women's patterns of health-care use during pregnancy and delivery relative to the patterns observed for women in communities lacking program midwives. In particular, women are more likely to have received iron tablets during pregnancy and somewhat more likely to deliver either in a medically oriented facility or with the assistance of a medically trained provider. Among women with relatively low levels of education, additional benefits accrue from access to a village midwife in their increased likelihood of receiving antenatal care during the first trimester of pregnancy (and marginally accrue for receiving any antenatal care).

These results emerge when we use a “treatment– control” framework, comparing changes over time for the “treated” (those in villages to which a midwife was assigned) with changes over time for the “controls” (those in villages to which a midwife was not assigned). According to the results from models that ignore time-invariant unobserved individual and community factors, however, the associations between program access and use of antenatal care are different. For three outcomes, the program's effects appear to be much smaller. For the choice to use medically oriented delivery services the program appears to be detrimental.

Our approach is a standard method of program evaluation that relies on data gathered over time on both access to the program and on women's choices regarding antenatal and delivery care. Such data are becoming more widely available, as surveys on women's health and fertility increasingly include pregnancy histories and a service-availability module. Accordingly, our approach can be replicated using other data sets. We note, however, that the fixed-effects approach does not address biases that arise when the program's placement decisions are made on the basis of community characteristics that change over time.

Our finding of positive effects of the program on choices related to antenatal care and delivery is consistent with our earlier work demonstrating that the Village Midwife program had a positive effect on health outcomes both for women of reproductive age and for children who had access to a midwife for all of their early childhood (Frankenberg and Thomas 2001; Frankenberg et al. 2005). Our results are also consistent with other evaluations of the Village Midwife program that found increases in access to skilled attendants for childbirth and increases in the proportion of women who mentioned village midwives as an important source of information (Koblinsky et al. 2000; Ronsmans et al. 2001).

Other research on the Indonesian program has focused on how it might be made even more effective. Ronsmans and her colleagues (2001) look specifically at two districts where government-trained midwives were compared with midwives who had received additional training in communication skills and in life-saving obstetric interventions, both of which were found to be important for the effectiveness of the midwives. Another district-based initiative has increased the use of village midwife services by paying traditional birth attendants to refer pregnant women and to help midwives with postpartum care (Analen 2007).

Our results indicate that access to a village midwife led to larger increases in the use of antenatal care for women with relatively low levels of education than for those with higher levels of education. We did not find a difference by educational level in women's propensity to choose a medical delivery or in their receipt of iron tablets. Cross-sectional analyses of the correlates of use of maternal care almost universally find higher use among women of higher status. Our results show that increasing access to midwifery services had a greater impact on use of antenatal care among women with low levels of education than among better-educated women, and in this way served to reduce socioeconomic disparities in this use.

Our results are similar to the finding of a study by Hatt and her colleagues (2007) that shows that trends in Indonesia in use of reproductive health care differ across socioeconomic levels in ways that are consistent with the interpretation that the Village Midwife program reduced socioeconomic differences. The authors observe a similar narrowing of the education (and income) gap among the women who obtained skilled assistance in maternal health care over the period during which the Village Midwife program expanded in Indonesia.

Achadi and colleagues (2007) examine how characteristics of the midwives themselves (rather than characteristics of their clients) are associated with use of reproductive health care. Undergoing childbirth with the help of a health professional becomes more likely as the duration of a midwife's assignment to a village increases, and is more likely for women who live in villages where the midwives work at a health center rather than serving as village midwives. The idea that a midwife's effectiveness depends on her own characteristics is intuitively compelling; indeed, Makowiecka and her colleagues (2008) show that midwives' characteristics vary considerably between remote and urbanized areas. Devising a methodological strategy that corrects for potential biases for nonrandom placement of midwives with certain characteristics to some areas and midwives with other characteristics

to other areas is difficult, however. If the most effective and experienced midwives are more successful at being posted to areas where the demand for their services is higher, the correlation between experience and success at attracting clients will be upwardly biased.

Our main results focus on the effects of women's access to a village midwife, rather than on the effects of a midwife's characteristics on women's use of skilled assistance during pregnancy and delivery. We find that placing village midwives in communities is associated with marginally significant increases in women's receipt of iron supplements during pregnancy and with a slightly greater likelihood of their obtaining medically oriented delivery care. To the extent that the timing and content of antenatal and delivery care are important to the improvement of maternal health indicators, as suggested by the evidence discussed in the introduction of this study, Indonesia's Village Midwife program is likely to improve reproductive-health outcomes, perhaps bringing the most improvement for women with the least education.

We conclude that Indonesia's national effort to improve access to reproductive health care has increased women's use of skilled assistance during pregnancy and delivery. Our findings and approach are relevant for other countries considering programs to increase access to midwives or to other providers trained in the provision of reproductive health care. First, the program succeeded nationally in a country characterized by a tremendous degree of cultural and ecological diversity, suggesting its potential benefit across a range of settings in other countries. Second, because the program was implemented nationally, it required levels of resources that were feasible to marshal across the country as a whole and within the existing system; it was not a small effort involving unsustainably high inputs. Finally, the methods of evaluation that we have used here can be replicated if surveys that include pregnancy histories and a service-availability module are conducted once or twice within the time frame in which an expansion of care occurs.

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Figure 1. Percentage of women who used reproductive health-care services, by year, Indonesia
Source: Indonesia Family Life Survey.

Table 1
Percentage of communities with access to a village midwife (N = 312 communities) and with other characteristics, by survey year, Indonesia

Characteristic	1993	1997	2000
Communities with a village midwife	9.6	46.3	50.3
Community changes in access to midwife			
Gained a midwife since previous survey	—	36.8	10.2
Lost a midwife since previous survey	—	0.0	6.4
Community development indicators			
Main road paved	63.9	84.0	84.0
Public phone available	42.9	51.1	64.6
Average level of monthly expenditure (Rp)	88,137	202,763	164,064

— = Not applicable.

Source: Indonesia Family Life Survey (IFLS).

Table 2
Multivariate regressions showing association between women's access to a village midwife and their use of reproductive health care, by selected individual, household, and community characteristics, Indonesia

Characteristic	Logistic regression ^a				Individual fixed effects			
	Received any antenatal care	Received antenatal care in first trimester	Received iron tablets during pregnancy	Medically oriented delivery ^b	Received any antenatal care	Received antenatal care in first trimester	Received iron tablets during pregnancy	Medically oriented delivery ^b
Pregnancy-specific indicators								
Village midwife available by conception	0.22* (0.11)	0.47** (0.07)	0.28** (0.09)	-0.23** (0.07)	0.49 (0.33)	0.20 (0.20)	1.14* (0.51)	0.52 (0.29)
Date of conception	-0.05** (0.01)	-0.04** (0.00)	0.00 (0.01)	-0.08** (0.00)	0.17** (0.04)	0.15** (0.03)	0.18 (0.09)	0.16** (0.04)
Time-varying household characteristic								
Expenditure per capita	0.79** (0.08)	0.60** (0.05)	0.24** (0.07)	0.66** (0.05)	0.17 (0.23)	0.14 (0.14)	0.03 (0.28)	0.14 (0.19)
Time-varying community characteristics								
Expenditure level	0.67** (0.13)	0.40** (0.08)	0.09 (0.10)	0.92** (0.09)	-0.39 (0.38)	0.01 (0.22)	-0.98 (0.59)	-0.32 (0.30)
Main road paved	0.10 (0.11)	0.16* (0.07)	0.29* (0.12)	0.88** (0.08)	-0.32 (0.40)	0.10 (0.26)	-0.29 (0.59)	0.14 (0.36)
Public phone available	0.75** (0.14)	0.40** (0.08)	0.07 (0.11)	0.80** (0.08)	0.95 (0.50)	0.09 (0.27)	-0.85 (0.54)	-0.12 (0.38)
Number of observations	7,105	7,097	3,911	6,730	7,105	7,097	3,911	6,730

* Significant at p 0.05;

** p 0.01.

^a Standard errors adjusted for clustering among women.

^b Availability of village midwife measured at time of birth rather than at conception.

Note: Standard errors are presented in parentheses.

Table 3
Multivariate logistic regression showing interactions between respondents' education and their access to a village midwife, by selected individual, household, and community characteristics, Indonesia

Characteristic	Received any antenatal care	Received antenatal care in first trimester	Received iron tablets during pregnancy	Medically oriented delivery ^a
Pregnancy-specific indicators				
Village midwife available by conception	0.98* (0.45)	0.63* (0.30)	1.47 (0.90)	0.93* (0.47)
Village midwife available by respondent's years of education	−0.12 (0.07)	−0.08* (0.04)	−0.05 (0.11)	−0.07 (0.06)
Date of conception	0.17** (0.04)	0.15** (0.03)	0.17 (0.09)	0.16** (0.04)
Time-varying household characteristics				
Per capita expenditure	0.18 (0.23)	0.13 (0.14)	0.03 (0.28)	0.13 (0.19)
Time-varying community characteristics				
Main road paved	−0.42 (0.41)	0.05 (0.26)	−0.30 (0.60)	0.11 (0.36)
Public phone available	1.01* (0.50)	0.10 (0.27)	−0.78 (0.56)	−0.08 (0.38)
Expenditure level	−0.41 (0.38)	0.13 (0.22)	−0.99 (0.59)	−0.33 (0.30)

* Significant at $p = 0.05$;

** $p = 0.01$.

^a Availability of village midwife measured at time of birth rather than at conception. Individual-level fixed effects are included.

Note: Standard errors are presented in parentheses.