Social Science & Medicine 72 (2011) 1948–1955

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Effects of the World Bank's maternal and child health intervention on Indonesia's poor: Evaluating the safe motherhood project☆

John Baird, Steven Ma, Jennifer Prah Ruger*

Yale University, 60 College Street, New Haven, CT 06520, United States

ARTICLE INFO

Article history:
Available online 25 May 2010

Keywords:
Maternal and child mortality
World Bank
Indonesia
Safe motherhood project
Development policy
Impact evaluation

ABSTRACT

This article examines the impact of the World Bank's Safe Motherhood Project (SMP) on health outcomes for Indonesia's poor. Provincial data from 1990 to 2005 was analyzed combining a difference-in-differences approach in multivariate regression analysis with matching of intervention (SMP) and control group provinces and adjusting for possible confounders. Our results indicated that, after taking into account the impact of two other concurrent development projects, SMP was statistically significantly associated with a net beneficial change in under-five mortality, but not with infant mortality, total fertility rate, teenage pregnancy, unmet contraceptive need or percentage of deliveries overseen by trained health personnel. Unemployment and the pupil–teacher ratio were statistically significantly associated with infant mortality and percentage deliveries overseen by trained personnel, while pupil–teacher ratio and female education level were statistically significantly associated with under-five mortality. Clinically relevant changes (52–68% increase in the percentage of deliveries overseen by trained personnel, 25–33% decrease in infant mortality rate, and 8–14% decrease in under-five mortality rate) were found in both the intervention (SMP) and control groups.

Introduction

Indonesia, the world's largest archipelagic state with the world's largest Muslim population, is also home to many of the world's poorest individuals, with 18% of its population living below the Indonesian poverty line, set at approximately $0.55 per person per day (Badan Pusat Statistik, 2007). Moreover, Indonesia has and continues to suffer from high rates of child and maternal mortality, the reduction of which is the focus of two of the United Nation's eight Millennium Development Goals (MDGs) (United Nations, 2006). Approximately 80% of all maternal deaths and complications are avoidable (Mathai, 2006), as are over half of all infant and child deaths (Child and Adolescent Health and Development; WHO, 2004). These preventable deaths make maternal and child mortality among the top causes of the global burden of disease (Lopez, Mathers, Ezzati, Jamison, & Murray, 2006; Murray & Lopez, 1999). Poverty is inextricably linked to maternal and child health (MCH), especially birth outcomes for mother and child and physical well-being for children under five (Brooks-Gunn & Duncan, 1997; Case & Paxson, 2006; Hughes & Simpson, 1995; Ruger & Kim, 2006; Turner, 1992). Poverty also negatively impacts educational attainment, and female education level is a critical factor affecting both maternal and child health (Bender & McCann, 2000; Deaton, 2003; Levin, 1995; Shiffman, 2000). Even low levels of maternal education can have positive effects on child mortality (Basu & Stephenson, 2005).

The Indonesian government has focused on development policy for its poor since the 1970's (Pusat Data Kesehatan, 1997), with a poverty reduction strategy that has included high quality data collection to allow for rigorous, quantitative assessment of policy effectiveness (Surbakti, 1995). During this period, the government first started working on projects aimed at improving the country's infrastructure, urban poverty situation and agriculture (World Bank Operations Evaluation Department, 1996).

More recently, the Indonesian government has focused World Bank lending in the so-called "soft" development sectors of human development, especially health, nutrition, and population. Since 1988, Indonesia has mobilized its political system to prioritize and invest significant resources in safe motherhood programs (Shiffman, 2003). Unlike many developing countries, Indonesia has also committed to systematically collect data for the eventual evaluation of such programs.

☆ We acknowledge financial support from the Whitney and Betty MacMillan Center for International and Area Studies at Yale Universityand the Henry Luce Foundation. Dr. Ruger is supported in part by an Investigator Award from the Patrick and Catherine Weldon Donaghue Medical Research Foundation (grant DF06-112). We thank Nora Ng for research assistance. John Baird is currently at the University of Pittsburgh Graduate School of Public Health.

* Corresponding author. 60 College Street, P. O. Box 208034, Room 316, New Haven 06520, United States. Tel.: +1 203 785 3710.
E-mail address: jennifer.ruger@yale.edu (J.P. Ruger).

0277-9536/$ – see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.socscimed.2010.04.038

Indonesia's Safe Motherhood Project (SMP) is part of a broader plan to address maternal and reproductive health issues in Indonesia (Saadah, 1997). Through this project and others, the Indonesian government has confirmed its commitment to changing the institutional structure and capacity for health improvement for women and children (Barnum, 1998). In particular, the project aimed to address issues related to the professionalization, quality, technical and counseling capacity, and sustainability of midwives and other health providers, especially in poor villages, with an underlying emphasis on governance and stewardship. On the demand side, a major emphasis is on the improvement of family planning, awareness, and reproductive health with a target population of women of child-bearing age, families and newborn children, and adolescents. As part of its overall strategy to improve maternal and child health, the Indonesian government also sought assistance—financial and technical—from other international agencies, including the United Nations Children's Fund (UNICEF) with its focus on health and protection for children and mothers, particularly decreases in maternal mortality, infant mortality and under-five child mortality. Moreover, the Safe Motherhood Project differed from the World Bank's broader Health Project 5 (HP5), a considerably more general effort to improve utilization, distribution and efficiency of health personnel, especially in rural areas and among low-income residents in urban areas in the project districts. HP5 focused mainly on institutional change in the health sector, toward more decentralization, greater coordination, and better training, regulation, and oversight of health providers. Together these efforts have placed an emphasis on strengthening financial and human capital for health improvement in Indonesia.

We sought to examine the impact of the World Bank's Safe Motherhood Project intervention (which targeted access and demand for maternal and child health care among the needy) on the health outcomes of Indonesia's poor. Though the project was rated "satisfactory" (Ho, 2005) by the World Bank in overall health service impact and given a likely chance of sustainable development, we sought to objectively and independently analyze infant, child, and maternal health outcomes before and after the introduction of SMP. Few, if any, studies have evaluated the effects of the World Bank's development programs on outcomes, and to our knowledge none has focused on the maternal and child health of the poor (Wagstaff & Yu, 2007). There is significant need for independent evidence-based evaluations of health, nutrition and population interventions (Flanagin & Winker, 2006). Our study took into account other related projects to estimate the net effect of SMP.

Methods

Setting

Indonesia is the 4th largest country in the world, with nearly 4% of the world's population and the world's 3rd largest female population of ages 15–19 (NationMaster.com, 2009; Population Division of United Nations Department of Economic and Social Affairs, 2009). Indonesia has a human development index ranking of 108 of 177 countries worldwide, placing it in the lower half of nations in terms of standard of living, education, and life expectancy (United Nations Development Programme, 2006). Indonesia's maternal mortality rate is 230 per 100,000 women, compared to the industrialized world rate of 13 per 100,000; the Indonesian lifetime risk of maternal death is 1 in 150, compared to 1 in 4000 in the industrialized world. Indonesia's under-5 mortality rate is 38 per 1000, giving it a ranking of 83 worldwide and 16 out of 29 in the East Asia and Pacific Region (United Nations Children's Fund, 2006). Indonesia's large and growing female population is at the height of reproductive capacity. This, coupled with worrisome maternal and child mortality rates, make Indonesia an important geographic focus for studying the impact of development projects on these critically important Millennium Development Goals.

Intervention group

The Safe Motherhood Project was an intervention designed specifically for Indonesia's Central and East Java provinces, and was implemented from 1998 to 2003 (Saadah, 1997). The SMP sought to: (1) increase the demand for and utilization of quality maternal and child health care through education and awareness, (2) increase the supply of health services at the village level, (3) improve the quality of MCH care via training, and (4) improve health services aimed at adolescent reproductive health (Saadah, 1997). On the supply side, the SMP provided training and funding for specific programs, such as health counselors. On the demand side, the SMP targeted province residents with educational campaigns to increase awareness of what services were available to them.

Indonesia's Ministry of Health had previously attempted several programs to improve MCH, such as increasing the number of midwives and other trained personnel, but had failed to create demand for such services. The SMP was intended as the first phase of a large-scale program aimed at addressing this problem (Saadah, 1997).

A total of $42.5 million was allocated for SMP. The SMP was implemented in two provinces, East and Central Java, and affected nearly 75 million Indonesia residents. East and Central Java were selected due to their population size, number of rural villages, and administrative infrastructure. These provinces were also chosen for their more advanced administrative capacities and their abilities to "serve as best practice example[s]" (Ho, 2005, p. 2). The project was originally designed to end in 2002, but continued into 2003 due to delays in funding.

Control group

East and Central Java are both provinces of Java Island. Thus, in this study, we chose control provinces from the rest of Java Island and the surrounding area to control for geographic and cultural factors (Fig. 1). The control Java Island provinces were: West Java, Daerah Khusus Ibukota (DKI) Yogyakarta, DKI Jakarta, and Banten (which split from West Java in October 2000). In early surveys from 1991 to 1994, Bali was grouped with Java Island, then in later surveys with the Lesser Sunda Islands, West and East Nusa Tenggara. These three provinces were also included as control provinces. Our control group thus consisted of seven provinces.

Data for the control provinces was gathered over the same time period as East and Central Java, i.e., from 1990 to 2005. The total population of the control provinces was approximately 70 million, similar to that of the two SMP provinces. Other factors such as sex ratio (the ratio of boys to girls) and population density (people per square kilometer) were comparable between the intervention and control groups.

Primary and secondary outcome measures

The outcome variables chosen for analysis were those the SMP proposed to impact, with the exception of two variables (the complications percentage and the number of reproductive health centers) that we were unable to study due to insufficient data. Primary outcomes to measure SMP impact included: (1) percentage of unmet contraceptive need, and (2) percentage of deliveries overseen by trained personnel (OBGYN, general practitioner, nurse, or midwife) (Ho, 2005). Secondary outcome measures included: (1)

Fig. 1. Map of Indonesia. Source: Wikipedia (Provinces of Indonesia).

infant mortality (per 1000 births); (2) under-five mortality (per 1000 births); (3) total fertility rate (number of children per adult woman); and (4) percentage of teenage pregnancy.

Covariate variables

In the modeling of our primary and secondary outcomes, the following independent variables were of main interest: (1) indicator of project participation (to control for participation in two other MCH projects), and (2) funding received. In the multivariate analysis, we also included a number of covariates that might be associated with these outcomes. These covariates included demographic data for each province: population density and sex ratio. We were especially concerned about the need to include reliable and valid education variables for a number of theoretical and empirical reasons. First, educational quality is known to have an effect on public health outcomes (Martin, Trussell, Salvail, & Shah, 1983; Morrisson, 2002). Second, education levels of both females and males directly bear on women's autonomy and bargaining power within the relationship, which in turn affect women's reproductive health decisions (Beegle, Frankenberg, & Thomas, 2001). Third, more specific to female education, more highly educated females have greater control over their own health and that of their children (Schultz, 1993). Finally, an increase in female education level has been shown to be directly associated with an increased demand for contraceptives and reproductive health options (Gertler & Molyneaux, 1994). For these reasons, we included three different education variables: (1) education level of males, (2) education level of females, and (3) pupil–teacher ratios (a measure of educational quality, with low ratios leading to increase in test scores, retention, and grade attainment) (Glewwe, 2002; Lee & Barro, 2001). Education levels were recorded in terms of average grade level completed.

We were also aware of the strong link between economic opportunity and health (Gertler & Molyneaux, 1994). Poor and unemployed females tend not to practice contraception or make use of maternal health services as often as the middle or upper classes (Rani & Lule, 2004). For these reasons, we included the general unemployment rate as a covariate, which is appropriate given the varying rates of unemployment in Indonesia. Other covariates included male and female life expectancies.

Data collection

We employed objective (not World Bank-derived) sources of data to evaluate the World Bank's program. The primary data source was the Indonesian Demographic and Health Surveys (IDHS) collected by the Badan Pusat Statistik (Biro Pusat Statistik, 1991, 1994, 1997, 2003). The reliability and validity of the surveys have been well established and reported elsewhere (Molyneaux & Gertler, 2000). In order to include data for intermediate years, we utilized additional data compiled by the United Nations Children's Fund (UNICEF) for the Maternal and Child Survival Development and Protection project on behalf of the Indonesian government. The BPS was involved in the creation of these additional datasets, rendering them equivalent in reliability and validity as data from the IDHS (Badan Pusat Statistik, 2000, 2007; Government of Indonesia, 1995).

Statistical analyses

In our study, we analyzed provincial-level data from 1990 to 2005. Transformations of measurements were performed as necessary to ensure marginal normal distributions. We computed correlation coefficients between explanatory variables to simplify the variable set prior to multivariate analysis. Specifically, we found that male and female education levels were highly correlated ($rho = 0.925$, $p < 0.0001$), and dropped male education level from consideration. In addition, unemployment and female education level were also highly correlated ($rho = 0.705$, $p < 0.0001$), so only one of them was used in model construction to avoid colinearity.

To check the comparability of the intervention and control groups, we first compared their baseline characteristics using Chi-squared tests for categorical variables and *t*-tests for continuous variables.

In this study, we were interested in the net effects of the intervention, which were defined as the changes experienced by the intervention group minus those experienced by the control group. Thus, the difference-in-differences approach was warranted. In univariate analysis, this approach involves simply making proper subtractions. Statistical inference is conducted using *t*-tests. In multivariate analysis, this approach is equivalent to properly defined linear regression models. Our analytical framework is consistent with that in Molyneaux and Gertler (2000) and others in evaluating the nonrandom allocation of resources.

In multivariate analysis, we used Y as the generic notation for outcome. Define I(after) as the binary period indicator, which equaled to 0 for the "before" time period (1990–1997) and 1 for the "after" time period (1998–2005). Define I(SMP) as the SMP membership indicator, which equaled to 1 for provinces under the SMP and 0 otherwise. Define Z as the vector of confounders. Our statistical model assumed that

$$Y = \beta_0 + \beta_1 I(\text{after}) + \beta_2 I(\text{SMP}) + \beta_3 I(\text{after}) \times I(\text{SMP}) + \gamma Z + \varepsilon,$$

where β_1, β_2, β_3, γ are the unknown regression coefficients and ε is the random error with zero mean and finite variance. Under the above model, β_2 measured the initial difference among the SMP and non-SMP provinces; β_1 measured the "before–after" difference experienced by the non-SMP provinces; $\beta_1 + \beta_3$ measured the "before–after" difference experienced by the SMP provinces. Thus, β_3 could measure the net difference caused by the SMP, which was the targeted difference-in-differences.

Estimation and inference with the above model were carried out in the same manner as with standard linear regression models. We used the above regression model to analyze outcomes including unmet contraceptive need, the percentage of deliveries overseen by trained health personnel, infant mortality, under-five mortality, total fertility rate, and teenage pregnancy.

We took into account other related projects to estimate the net effect of SMP. More specifically, in our statistical analyses we controlled for the impact of two additional health projects: (1) The World Bank's Indonesia Health Project 5, which ran from 1998 to 2004, aimed at improving the quality of health services and included a maternal health component (Barnum, 1998); and (2) a UNICEF-sponsored Maternal and Child Survival Development and Protection project (MCS), which ran from 1995 to 2000 (Government of Indonesia, 1995). Health Project 5 overlapped with the SMP in Central Java. MCS crossed over with the SMP in both East and Central Java, and also affected West Java, West Nusa Tenggara, and East Nusa Tenggara. Dichotomous variables were used to denote SMP, Health Project 5, and MCS memberships; money disbursed by each project into the provinces was accounted for. We also included economic and educational variables (Gertler & Molyneaux, 1994; Molyneaux & Gertler, 2000) in our models that we hypothesized would be related to our primary and secondary outcomes.

In our multivariate analysis, we used the forward stepwise approach for model reduction, searching for more parsimonious models with more lucid interpretations. All main effects were considered along with second-order interactions and quadratic terms. All models were checked for validity, including residual behaviors, outliers, and goodness-of-fit. We did not perform any evaluation of program components due to lack of sufficient data. No cost benefit analysis was conducted, as the main goal of this research was to establish whether any benefit existed. A comparison of the rates of change in indicators was conducted, but did not lead to any significant findings.

In intervention evaluation studies, it is common to combine the difference-in-differences (DID) approach with propensity score matching (PSM) (Wagstaff & Yu, 2007). In a typical application of the PSM approach, usually five or more matching "untreated" subjects are needed for each "treated" subject (Morgan & Harding, 2006; Morgan & Winship, 2007). For our analysis, employing the PSM would be equivalent to using all available "untreated" provinces. We therefore used all nine provinces in the analysis without further matching using PSM. PSM is best employed when there is reason to suspect a link between the covariates and the likelihood of receiving treatment (Drake, 1993). In this case, there is no reason to suspect that East and Central Java were chosen for the SMP because of their maternal and child health record; as stated before, they were chosen for other reasons. By including indicators for SMP and before–after dichotomous variables in our models, the regression models we used are equivalent to the DID with PSM approach. All analyses were performed using SAS (2007), version 9.1.3.

Table 1
Baseline characteristics in intervention (SMP) and control (non-SMP) Indonesian provinces, 1990–2005.

	N	SMP[a]	Non-SMP[a]	*p*-value[b]
Outcomes				
Deliveries overseen by trained personnel (%)	52	69.31 (20.97)	45.63 (27.95)	0.10
Infant mortality (per 1000)	80	53.82 (20.32)	60.02 (31.23)	0.31
Under-five mortality (per 1000)	63	54.24 (28.99)	85.18 (49.54)	0.28
Total fertility rate (births per woman)	79	2.42 (0.59)	2.68 (0.91)	0.19
Teenage pregnancy (%)	31	9.19 (3.51)	8.93 (5.12)	0.07
Indicators				
Population density[c] (people/km^2)	51	824.00 (107.41)	765.00 (462.63)	0.21
Sex ratio	33	97.06 (1.08)	98.85 (2.74)	0.08
Pupil–teacher ratio	100	18.88 (0.99)	18.13 (3.51)	0.35
Male education level (average grade completed)	42	5.82 (0.52)	6.64 (1.71)	0.09
Female education level (average grade completed)	42	4.10 (0.54)	5.06 (1.49)	0.14
Male life expectancy (years)	25	64.62 (1.55)	64.07 (5.09)	0.68
Employed females (%)	25	58.22 (6.18)	61.21 (16.83)	0.52

[a] Given as Mean (Std).
[b] *P*-value based on Pooled or Satterthwaite *t*-test; alpha = 0.05.
[c] Given as Median (Std).

Results

Baseline characteristics

Table 1 shows the baseline characteristics of the intervention (SMP) and control (non-SMP) study groups. There were no significant differences in any outcomes or socio-economic indicators, although differences in teenage pregnancy rates, sex ratio and male education level were approaching significance at the $p = 0.05$ level. Tests for heterogeneity were conducted; they showed that provinces in the intervention and control groups had no significant differences, which allowed for pooling across provinces within treatment conditions.

Use of reproductive health services and health outcomes

Table 2 reports study differences in the use of reproductive health services (deliveries overseen by trained personnel) and the four major health outcomes (rates for infant mortality, under-five mortality, total fertility, and teenage pregnancy). Before the introduction of SMP, the intervention group had a slightly lower percentage of unmet contraceptive need compared to the control group (14% vs 18%; $p = 0.18$) (results for unmet contraceptive need not shown in Table 2). There were statistically non-significant declines of 1.9% in the intervention group and 3.8% in the control group after the implementation of SMP. The difference between the two groups was a statistically non-significant 1.8% relative decline in unmet contraceptive need among the control group ($p = 0.72$).

The percentage of deliveries overseen by trained personnel increased significantly over time in both SMP and non-SMP groups ($p = 0.004$ and $p = 0.009$, respectively). Comparing the change between the two, there was a statistically non-significant 0.13% relative increase over time in the percentage of deliveries overseen by trained personnel in the SMP group compared with the non-SMP group ($p = 0.89$).

Infant mortality rates had a statistically significant decrease over time for both SMP and non-SMP groups ($p = 0.005$ and $p = 0.004$,

Table 2
Use of reproductive health services and health outcomes in intervention (SMP) and control (Non-SMP) Indonesian Provinces, 1990–2005.

	SMP				Non-SMP				Difference-in-differences	
	Before (Std)	After (Std)	Change (%)	*p*-value[a]	Before (Std)	After (Std)	Change (%)	*p*-value[a]	Net change[b]	*p*-value for NBC
Health services										
Deliveries overseen by trained personnel (%)	34.88 (7.75)	58.68 (16.78)	23.81 (68.26)	0.004	45.63 (27.95)	69.31 (20.97)	23.68 (51.90)	0.009	0.13	0.89
Health outcomes										
Infant mortality (per 1000)	53.82 (20.32)	40.63 (7.80)	−13.19 (−24.51)	0.005	60.02 (31.23)	40.19 (9.86)	−19.83 (−33.04)	0.004	−6.64	0.45
Under-five mortality (per 1000)	54.24 (28.99)	49.91 (7.24)	−4.33 (−7.98)	0.002	85.18 (49.54)	73.48 (14.14)	−11.70 (−13.74)	0.01	−7.37	0.59
Total fertility rate (births per woman)	2.42 (0.59)	2.11 (0.23)	−0.31 (−12.86)	0.05	2.68 (0.91)	2.43 (0.39)	−0.25 (−9.33)	0.18	0.06	0.90
Teenage pregnancy (%)	9.19 (3.51)	10.00 (1.27)	0.81 (8.81)	0.24	8.93 (5.12)	13.20 (3.27)	4.27 (47.82)	0.91	3.46[c]	

[a] *p*-value based on Pooled or Satterthwaite *t*-test; alpha = 0.05.
[b] Magnitude is the difference of the change in SMP and the change in non-SMP. Performance is relative to the outcome, rather than absolute in magnitude. None of these values were statistically different from 0. Change values may not add perfectly due to rounding.
[c] Unable to calculate *p* value.

respectively), as had the under-five mortality rates ($p = 0.002$ and $p = 0.01$, respectively). For both infant and under-five mortality rates the non-SMP group had greater declines, but these declines were not statistically different from those of the SMP group ($p = 0.45$ and $p = 0.59$, respectively). On total fertility rates, the SMP group had a statistically significant 0.3% decline over time ($p = 0.05$), but again this decline was not statistically different from that of the non-SMP group ($p = 0.90$). There was no significant change over time in the percentage of teenage pregnancy within or between groups. In summary, the intervention and the control groups exhibited no statistically significant difference in the changes of any health outcomes after SMP implementation.

Socio-economic indicators

We also examined socio-economic indicators separately and as covariates to assess their independent effect on primary and secondary outcomes. Table 3 shows how these indicators changed over time. The pupil–teacher ratio significantly decreased over time for the SMP ($p < 0.001$) and non-SMP groups ($p = 0.01$). Both male and female education levels increased over time in the intervention (males $p = 0.002$, females $p < 0.001$) and control (males $p = 0.05$, females $p = 0.007$) groups. Unemployment significantly increased over time for both SMP ($p < 0.001$) and non-SMP ($p = 0.002$) groups. Between the intervention and control groups there were no statistically significant changes in socio-economic indicators over time. No other covariates, including population density, percentage of female employment, or male and female life expectancies showed any statistically significant changes over time for both study groups.

Outcomes by Indonesian province

Table 4 shows the "before" and "after" mean outcomes for each province; we note that no statistical comparisons were made on the province level because of the small sample sizes at this level of stratification. Regardless of SMP status, every province experienced decreases in infant and under-five mortality. All provinces also experienced increases in the percentage of deliveries overseen by trained personnel.

Parameter estimates of final multivariate models

Table 5 shows the final results of our model construction; all three models were significant ($p < 0.0001$ for all). The infant mortality rate was explained by pupil–teacher ratios, the unemployment rate and its second-order term, and membership in the MCS. After adjusting for covariates, the ratio of infant mortality rate

Table 3
Socio-economic indicators in intervention (SMP) and control (Non-SMP) Indonesian provinces, 1990–2005.

Indicator	SMP				Non-SMP				Difference-in-differences
	Before (Std)	After (Std)	Change (%)	*p*-value[a]	Before (Std)	After (Std)	Change (%)	*p*-value[a]	Net change[b]
Pupil–teacher ratio	18.88 (0.99)	16.06 (2.24)	−2.81 (−14.88)	<0.001	18.13 (3.51)	15.98 (3.26)	−2.14 (−11.80)	0.01	−0.67
Male education level (average grade completed)	5.82 (0.52)	7.05 (0.13)	1.23 (21.13)	0.002	6.64 (1.71)	7.83 (1.57)	1.19 (17.92)	0.05	0.04
Female education level (average grade completed)	4.10 (0.54)	5.88 (0.10)	1.78 (43.41)	<0.001	5.06 (1.49)	6.62 (1.54)	1.56 (30.83)	0.007	0.22
Unemployment (%)	3.61 (0.25)	8.21 (0.91)	4.60 (127.42)	<0.001	4.65 (3.11)	9.73 (4.64)	5.09 (109.46)	0.002	−0.49

[a] *P*-value based on Pooled or Satterthwaite *T*-test; alpha = 0.05.
[b] Magnitude is the difference of the change in SMP and the change in non-SMP. Performance is relative to the outcome, rather than absolute in magnitude. None of these values were statistically different from 0. Change values may not add perfectly due to rounding.

Table 4
Outcomes before (1990–1997) and after (1998–2005) SMP by Indonesian province.

Province[a]	Infant mortality[b] (per 1000)			Under-five mortality[b] (per 1000)			Deliveries overseen by trained personnel[b] (%)		
	Before (Std)	After (Std)	Diff	Before (Std)	After (Std)	Diff	Before (Std)	After (Std)	Diff
SMP									
Central Java	51.52 (7.72)	39.00 (6.00)	−12.52	75.90 (10.54)	44.31 (8.61)	−31.59	30.55 (6.97)	52.82 (15.47)	22.27
East Java	56.12 (11.90)	42.25 (9.95)	−13.87	71.47 (17.33)	55.50 (6.07)	−15.97	39.20 (6.46)	64.54 (19.01)	25.34
Non-SMP									
West Java	80.88 (22.38)	46.25 (10.78)	−34.63	118.16 (32.38)	61.72 (27.21)	−56.44	26.20 (4.83)	54.61 (8.35)	28.41
Banten[c]	–	38.50 (0.71)	–	–	56.00 (0.00)	–	–	61.29 (2.28)	–
DKI Jakarta	32.97 (7.92)	24.75 (8.62)	−8.22	50.78 (7.03)	36.85 (7.18)	−13.93	86.95 (4.67)	95.95 (2.33)	9
DKI Yogyakarta	32.55 (7.47)	21.50 (5.80)	−11.05	43.86 (10.44)	25.43 (4.20)	−18.43	50.80 (6.81)	87.40 (3.10)	36.6
Bali	45.76 (8.31)	24.50 (9.04)	−21.26	58.32 (8.79)	25.35 (11.00)	−32.97	72.90 (5.25)	90.26 (3.47)	17.36
West Nusa Tenggara	112.86 (20.16)	72.75 (15.20)	−40.11	171.75 (29.99)	106.54 (6.14)	−65.21	15.30 (4.65)	54.42 (6.10)	39.12
East Nusa Tenggara	64.66 (8.70)	52.25 (11.59)	−12.41	86.05 (5.73)	73.63 (1.09)	−12.42	21.60 (6.65)	41.26 (6.87)	19.66

Diff (difference) is defined as "After−Before".
[a] No statistical tests for changes were conducted due to small sample size.
[b] Given as Mean (Std).
[c] Banten was founded in 2000, so data do not exist for this province before that year and thus it only has one under-five mortality observation.

for SMP vs non-SMP groups is 0.78, which was not significant at the $p = 0.05$ level. As the pupil–teacher ratio increased by 1, the infant mortality rate increased by 5%. Provinces that were part of the MCS tended to have a higher infant mortality rate than provinces that were not part of the MCS.

The under-five mortality rate was explained by the pupil–teacher ratio, female education level, and membership in SMP and in MCS. After adjusting for covariates, the ratio of under-five mortality rate for the SMP vs non-SMP groups is 0.70, which was statistically significant ($p = 0.03$). As the pupil–teacher ratio increases by 1, the under-five mortality increases by 6%. As female education level increases by 1 grade, under-five mortality decreases by 13%. Membership in MCS was associated with a higher under-five mortality rate, while membership in SMP was associated with a lower under-five mortality rate.

Table 5
Results of multivariate analyses for reproductive health services and health outcomes in Indonesian provinces, 1990–2005.

	Coefficient	Standard Error	p-value[a]	Adjusted R^2 [b]
Ln(Infant mortality)[c]				
Before–after	0.094	0.1654	0.57	
SMP membership	−0.246	0.1377	0.09	
MCS membership	0.650	0.1333	<0.001	0.67
Pupil–teacher ratio	0.047	0.0189	0.02	
Unemployment	−0.043	0.0141	0.005	
Unemployment^2	0.006	0.0030	0.05	
Ln(Under-five mortality)[c]				
Before–after	0.081	0.1458	0.59	
SMP membership	−0.355	0.1507	0.03	
MCS membership	0.445	0.1937	0.04	0.74
Pupil–teacher ratio	0.056	0.0200	0.01	
Female education level	−0.132	0.0580	0.04	
% Deliveries overseen by trained personnel				
Before–after	−2.327	5.2241	0.66	
SMP membership	9.189	4.8398	0.07	
MCS membership	−26.591	4.6735	<0.001	0.86
Pupil–teacher ratio	−3.551	0.7549	<0.001	
Unemployment	2.533	0.6859	0.001	

F-tests for all models had $p < 0.0001$, so the F-test results were not included here.
[a] p-value based on comparison to t-value; alpha = 0.05.
[b] Adjusted coefficient of determination for full model.
[c] Female education level and unemployment are not included in the same models due to colinearity.

The percentage of deliveries overseen by trained personnel was associated with the pupil–teacher ratio, unemployment rate, and MCS membership; it also approached statistically significant association with SMP membership. An increase in the pupil–teacher ratio by 1 decreased the use of trained personnel by 3.5 percentage points. A one-point increase in the unemployment rate corresponds to a 2.5% increase in the percentage of deliveries overseen by trained personnel. Being a member of MCS was associated with a much lower percentage of such deliveries (about 27% lower).

Discussion

To our knowledge, this is the first study to examine the impact of a World Bank intervention in the field of maternal and child health. Overall, with the exception of the under-five mortality rate, we found that changes in outcomes in the SMP provinces were not statistically significantly different from those in non-SMP provinces. However, in both SMP and non-SMP provinces, clinically relevant changes occurred. For example, the percentage of deliveries overseen by trained personnel increased by 52–68%, infant mortality decreased by 25–33%, and under-five mortality decreased by 8–14% in both study groups.

In our evaluation, we sought to study the impact of the SMP on multiple primary and secondary outcomes. Among the primary outcomes, the SMP sought to increase the percentage of deliveries overseen by trained personnel and to increase the use of maternal and child health care services. A secondary outcome associated with this increased utilization was a reduction in the infant mortality rate. The SMP's longer-term goals included an increase in women's demand for health services over the long run for all aspects of motherhood. The secondary effects of this outcome entailed efforts to achieve sustained decreases in under-five mortality rates. Findings from our study indicate that SMP participation had no statistically significant beneficial impact on either the percentage of deliveries overseen by trained personnel or infant mortality rates, although it did have a positive, statistically significant effect on under-five mortality rates. Clinically relevant changes, however, as noted above, did occur in the right direction for both of those primary outcomes.

In our multivariate analyses, we found that the changes in these outcomes were associated primarily with education, employment status, and membership in MCS. In all provinces, our main

education variable, the pupil–teacher ratio, decreased over time, indicating an improvement in education quality. This decrease in the pupil–teacher ratio was associated with increased utilization of reproductive health services and decreases in the infant and under-five mortality rates. Female education levels, which increased in all provinces, contributed to decreases in under-five mortality. These associations are consistent with other findings (Beegle et al., 2001; Gertler & Molyneaux, 1994; Glewwe, 2002; Martin et al., 1983; Morrisson, 2002; Schultz, 1993). The results of this study, therefore, underscore the importance of education, especially its quality and the focus on girls and women, for health outcomes for women and children. While these results are consistent with other findings it is important to reiterate the primacy of female education, perhaps as a necessary condition or foundation upon which to cultivate or build development programs focused specifically on maternal and child health.

Unemployment rates increased for all provinces, nearly doubling over the study period. The increase in unemployment was associated with an increase in the utilization of reproductive health services. This is an unusual result. Previous studies, for example, have attributed rising unemployment to a decrease in health service utilization. This is because many households will cope with financial hardship by forgoing or delaying health care services and expenditures (Chernichovsky & Meesook, 1986; Frankenberg, Smith, & Thomas, 2003). Other studies have found a link between increased income and an increase in demand for contraception, and between low income and low use of maternal and sexual health services (Gertler & Molyneaux, 1994; Rani & Lule, 2004). One possible explanation for our unusual result can be found in Indonesian households' reactions to the 1997–1998 economic crisis and the subsequent instability (Frankenberg et al., 2003). During the economic crisis, many households increased the number of total hours worked (Frankenberg et al., 2003) through males working longer hours and some male members' migration to urban areas for work (Frankenberg et al., 2003; Strauss et al., 2004). Adults not working, unable to work, or who had lost their jobs moved instead to rural areas, where costs of living are lower (Frankenberg et al., 2003). One key feature of this arrangement was that pregnant women and women with offspring remained unemployed (Frankenberg et al., 2003) and moved to rural areas with lower living costs; this allowed them more time for child rearing. In some previous studies, it has been found that mothers who work tend to use maternal and child health care services less than housewives who care for their children full time (Alexander & Markowitz, 1986). Therefore, it may be possible that, in the Indonesian case, this tendency toward male migration to urban areas allowed for greater utilization of available health services by women and children remaining in the rural areas. Further research is needed to delve more rigorously into the underlying factors driving this relationship between increasing unemployment and rising use of health services.

Our study had several limitations. First, at the time of this study, data for 2006 had not yet been released, limiting the post-project analysis to two years: 2004 and 2005. A longer follow-up period may reveal different patterns in outcomes. In several years, after the next Indonesian Demographic and Health Survey, this study should be replicated with more recent data and focus on identifying longer-term institutional SMP effects. Second, we were unable to account for behavioral factors due to data restrictions on indicators such as addictive behaviors and nutritional status. Third, our data set did not contain views on various cultural issues. For example, women's attitudes on refusing to have sex with their husbands were only first measured in the 2002/2003 survey (Biro Pusat Statistik, 2003). This would have been a useful covariate in these models had it been measured starting in 1991. Indonesia's large Muslim population makes accounting for these cultural issues especially important. There is no widespread opposition to contraceptives under past and present Islamic law, but the Muslim perspective on other maternal and reproductive health services, such as access to abortions, is less homogenous and prone to be guided by local interpretations of the religious texts (Sachedina, 1990). More research is required on how Indonesia's Muslim population perceives various health topics. Fourth, our study methodology did not involve randomization as is done in randomized controlled trials or randomized field experiments. As such, it is impossible, in this study context, to fully isolate any given variable for analysis. Moreover, a fifth limitation involves the fact that our conclusions should be interpreted as assessments of association as opposed to causality. Given the study design and available data, it is prudent to resist inferences of causality from these analyses. Finally, it could be argued that it is difficult to isolate the independent impact of any given project, such as SMP, given the overall climate of development assistance. While this is a valid objection to our methodology, we contend that impact evaluation requires a more rigorous threshold, and our approach is a step toward a new evaluative framework.

In conclusion, while the maternal and child health intervention evaluated in this study may not have produced statistically significant results, clinically relevant improvements occurred in both the SMP and non-SMP groups in the context of nationwide changes in education and employment among Indonesia's poor. In particular, our study's standards of evaluating the SMP intervention in the context of other development projects – namely UNICEF's MCS project and the Health Project 5, neither of which had beneficial effects in the provinces we studied– demonstrate the complexity in assessing the independent effect of SMP above and beyond other studies of development projects. This type of methodology offers a framework of analysis of specific health interventions in the context of multiple development projects. More research is necessary, however, to fully appreciate and understand the complementarity or redundancy of multiple and sequential development projects focused simultaneously on decreasing poverty and improving health.

Finally, this study, by illuminating clinically important, although not statistically significant, improvements in maternal and child health outcomes across both intervention and control groups, offers a window on four key themes in the development of policies, programs and projects in safe motherhood in Indonesia over the decade-and-a-half period within which this study lies. First, the long term nature of the World Bank's commitment to safe motherhood in Indonesia cannot be ignored and it may be quite difficult to disentangle the separate and independent effects of any given project. Second, several other donor agencies had safe motherhood projects in Indonesia over a fifteen year span, including projects supported by WHO, USAID, UNICEF, the Australian Agency for International Development and the Asian Development Bank, all coordinated by the Indonesian Ministry of Health (Shiffman, 2003). Moreover, the village midwife program is important. Again, although we did control for a UNICEF project in our analyses, it is possible that the cumulative effect of these coordinated efforts crossed over into both intervention and control group so that we were unable to identify a "pure" effect of SMP. Third, the impact of international and transnational forces, such as a 1987 Nairobi conference on safe motherhood and a 1995 international conference on women in Beijing, may have been significant in prioritizing safe motherhood activities in Indonesia across both intervention and control groups. Finally, the significance of domestic-led policies, programs and projects cannot be overstated. From 1987–1997, for example, villages with access to midwives increased 500%, skilled delivery percentages rose by 28% and the percentage of

women receiving ante-natal care increased 31% (Shiffman, 2003). These marked changes in maternal health policy across the country could have been influential in both intervention and control groups in our study. These factors, along with the social and economic transitions noted above, provide possible insights into the findings from this study.

References

Alexander, C., & Markowitz, R. (1986). Maternal employment and use of pediatric clinic services. *Medical Care, 24*(2), 134–147.

Badan Pusat Statistik. (2000). *Penduduk Indonesia: Hasil sensus penduduk 2000*. Jakarta, Indonesia: The Central Bureau of Statistics.

Badan Pusat Statistik. (2007). *Key indicators of Indonesia*. Jakarta, Indonesia: The Central Bureau of Statistics. September 4, 2009, from. http://www.bps.go.id/eng/download_file/Booklet_indikatorkunci.pdf Retrieved.

Barnum, H. (1998). *Project appraisal document on a proposed loan in the amount of US$44.7 million to the Republic of Indonesia for a fifth health project: Improving the efficiency and quality of provincial health services*. Washington, DC: World Bank.

Basu, A., & Stephenson, R. (2005). Low levels of maternal education and the proximate determinants of childhood mortality: a little learning is not a dangerous thing. *Social Science & Medicine, 60*, 2011–2023.

Beegle, K., Frankenberg, E., & Thomas, D. (2001). Bargaining power within couples and use of prenatal and delivery care in Indonesia. *Studies in Family Planning, 32*(2), 130–146.

Bender, D., & McCann, M. (2000). The influence of maternal intergenerational education in health behaviors of women in peri-urban Bolivia. *Social Science & Medicine, 50*, 1189–1196.

Biro Pusat Statistik. (1991). *Indonesia demographic and health survey 1991*. Jakarta, Indonesia: The Central Bureau of Statistics.

Biro Pusat Statistik. (1994). *Indonesia demographic and health survey 1994*. Jakarta, Indonesia: The Central Bureau of Statistics.

Biro Pusat Statistik. (1997). *Indonesia demographic and health survey 1997*. Jakarta, Indonesia: The Central Bureau of Statistics.

Biro Pusat Statistik. (2003). *Indonesia demographic and health survey 2002/2003*. Jakarta, Indonesia: The Central Bureau of Statistics.

Brooks-Gunn, J., & Duncan, G. (1997). The effects of poverty on children. *The Future of Children, 7*(2), 55–71.

Case, A., & Paxson, C. (2006). Children's health and social mobility. *The Future of Children, 16*(2), 151–173.

Chernichovsky, D., & Meesook, O. (1986). Utilization of health services in Indonesia. *Social Science & Medicine, 23*(6), 611–620.

Child and Adolescent Health and Development. Overview of CAH. Retrieved from. http://www.who.int/child-adolescent-health/over.htm.

Deaton, A. (2003). Health, inequality, and economic development. *Journal of Economic Literature, 41*(1), 113–158.

Drake, C. (1993). Effects of misspecification of the propensity score on estimators of treatment effect. *Biometrics, 49*(4), 1231–1236.

Flanagin, A., & Winker, M. (2006). Theme issue on poverty and human development: call for papers on interventions to improve health among the poor. *Journal of the American Medical Association, 296*(24), 2970–2971.

Frankenberg, E., Smith, J., & Thomas, D. (2003). Economic shocks, wealth, and welfare. *The Journal of Human Resources, 38*(2), 280–321.

Gertler, P., & Molyneaux, J. (1994). How economic development and family planning programs combined to reduce Indonesian fertility. *Demography, 31*(1), 33–63.

Glewwe, P. (2002). Schools and skills in developing countries: education policies and socioeconomic outcomes. *Journal of Economic Literature, 40*(2), 436–482.

Government of Indonesia. (1995). *Master plan of operations & plan of operations: Maternal and child survival development and protection, 1995–2000: Country programme of co-operation between Government of Indonesia and UNICEF*. Jakarta: Government of Indonesia.

Ho, T. (2005, June). *Implementation completion report on a loan in the amount of US$42.5 million to the Republic of Indonesia for a safe motherhood project*. Washington, DC: World Bank. (World Bank Report No. 32667).

Hughes, D., & Simpson, L. (1995). The role of social change in preventing low birth weight. *The Future of Children, 5*(1), 87–102.

Lee, J.-W., & Barro, R. (2001). Schooling quality in a cross-section of countries. *Economica, 68*(272), 465–488.

Levin, B. (1995). Educational responses to poverty. *Canadian Journal of Education, 20*(2), 211–224.

Lopez, A., Mathers, C., Ezzati, M., Jamison, D., & Murray, C. (Eds.). (2006). *Global burden of disease and risk factors*. Washington, DC: Oxford University and World Bank.

Martin, L., Trussell, J., Salvail, F., & Shah, N. (1983). Co-variates of child mortality in the Philippines, Indonesia, and Pakistan: an analysis based on hazard models. *Population Studies, 37*(3), 417–432.

Mathai, M. (2006). Reviewing maternal deaths and complications to make pregnancy and childbirth safer. *Regional Health Forum, 9*(1), 27–29.

Molyneaux, J., & Gertler, P. (2000). The impact of targeted family planning programs in Indonesia. *Population and Development Review, 26*(Supplement: Population and Economic Change in East Asia), 61–85.

Morgan, S., & Harding, D. (2006). Matching estimators of causal effects: prospects and pitfalls in theory and practice. *Sociological Methods and Research, 35*, 3–60.

Morgan, S., & Winship, C. (2007). *Counterfactuals and causal inference: Methods and principles for social research*. New York: Cambridge University Press.

Morrisson, C. (2002). *Education and health expenditure, and development: The cases of Indonesia and Peru*. Paris: OECD Development Centre.

Murray, C., & Lopez, A. (1999). On the comparable quantification of health risks: lessons from the global burden of disease study. *Epidemiology, 10*(5), 594–605.

NationMaster.com. (2009). People statistics: female population age 15–19 (most recent) by country. Retrieved October 27, 2009, from. http://www.nationmaster.com/graph/peo_fem_pop_age_151-female-population-age-15-19.

Population Division of United Nations Department of Economic and Social Affairs. (2009). *World population prospects: The 2008 revision*. New York: United Nations. Retrieved October 27, 2009, from. http://www.un.org/esa/population/publications/wpp2008/wpp2008_text_tables.pdf.

Pusat Data Kesehatan (Indonesia). (1997). *Indonesia, evaluating the strategies for health for all by the year 2000: Common framework, third evaluation CFE/3*. Jakarta: Centre for Health Data, Ministry of Health, Republic of Indonesia.

Rani, M., & Lule, E. (2004). Exploring the socioeconomic dimension of adolescent reproductive health: a multicountry analysis. *International Family Planning Perspectives, 30*(3), 110–117.

Ruger, J., & Kim, H.-J. (2006). Global health inequalities: an international comparison. *Journal of Epidemiology and Community Health, 60*, 928–936.

Saadah, F. (1997, June). *Project appraisal document on a proposed loan in the amount of US$42.5 million to the Republic of Indonesia for a safe motherhood project: A partnership and family approach*. World Bank Report No. 16624-IND. Washington, DC: World Bank.

Sachedina, Z. (1990). Islam, procreation and the law. *International Family Planning Perspectives, 16*(3), 107–111.

SAS. (2007). *Version 9.1.3* [computer program]. Cary, North Carolina: SAS Institute.

Schultz, T. (1993). Investments in the schooling and health of women and men: quantities and returns. *The Journal of Human Resources, 28*(4), 694–734.

Shiffman, J. (2000). Can poor countries surmount high maternal mortality? *Studies in Family Planning, 31*(4), 274–289.

Shiffman, J. (2003). Generating political will for safe motherhood in Indonesia. *Social Science & Medicine, 56*(6), 1197–1207.

Strauss, J., Beegle, K., Dwiyanto, A., Herawati, Y., Pattinasarany, D., Satriawan, E., et al. (2004). *Indonesian living standards: Before and after the financial crisis*. Santa Monica: Rand Corp.

Surbakti, P. (1995). *Indonesia's national socio-economic survey: A continual data source for analysis on welfare development*. Jakarta: The Central Bureau of Statistics.

Turner, R. (1992). Birth weight increased, costs cut with Medicaid care-coordination plan. *Family Planning Perspective, 24*(3), 139–140.

United Nations. (2006). *The Millennium development goals report*. New York: United Nations.

United Nations Children's Fund. (2006). Statistical tables. *The State of the World's Children*. (Annual Report, 2006 edition). Retrieved September 18, 2009, from. http://www.unicef.org/sowc06/pdfs/sowc06_tables.pdf.

United Nations Development Programme. (2006) *Human development report*. (Annual Report, 2006 edition): Retrieved October 27, 2009, from. http://hdr.undp.org/en/media/hdr06-complete.pdf.

Wagstaff, A., & Yu, S. (2007). Do health sector reforms have their intended impacts? The World Bank's Health VIII project in Gansu province, China. *Journal of Health Economics, 26*(3), 505–535.

Wikipedia. Provinces of Indonesia. http://en.wikipedia.org/wiki/Provinces_of_Indonesia

World Bank Operations Evaluation Department. (1996). *Enhancing the quality of life in urban Indonesia*. OED Precis. 106, 4.

World Health Organization Department of Reproductive Health and Research. (2004). *Beyond the numbers: Reviewing maternal health and complications to make pregnancy safer*. Geneva: World Health Organization.