Promoting Sustainability for Micro Health Insurance:

A Risk-adjusted Subsidy Approach for Maternal Healthcare Service*

Working Paper

July 2017

Yi Yao [a], Joan Schmit [b], Julie Shi [a]

[a] *School of Economics, Peking University, China*

[b] *School of Business, University of Wisconsin at Madison*

*Yi Yao and Ju Shi are both assistant professor at School of Economics, Peking University. Joan Schmit is American Family Insurance Chair Professor in Risk Management and Insurance at School of Business, University of Wisconsin at Madison. We are grateful to Nannan Zhang and participants in the APRIA 2017 Conference for helpful comments. This research was supported by the National Natural Science Foundation of China (NSFC) (71503014) and the research seed fund of the School of Economics in Peking University. We are grateful to research assistant Yunlong Wang for his work. All errors are our own.

Promoting Sustainability for Micro Health Insurer:

A Risk-adjusted Subsidy Approach for Maternal Healthcare Service

Abstract

Micro health insurance is an important way to finance health expenditure for low income people, and maternity care is a key component of relevant coverage. Adverse selection, however, makes commercial provision of maternity care difficult. Various authors (see Yao et al. 2015) have suggested that a government subsidy for maternity care is one method to achieve the social goal of extending commercial health insurance to the low-income population. Yet even that approach requires nuances to limit over-utilization of health care; hence, we propose a risk adjusted premium provided by the government to microinsurers as a method to enhance micro health insurance for maternity benefits. Using a large dataset from a micro health insurance program in Pakistan, we identify appropriate methods to create such risk-adjusted payments. We use various econometric models to predict maternity-related expenses and to calculate an appropriate risk-adjusted subsidy from government to microinsurer. Comparing the model fit under various assumptions, we identify the best model from which we estimate the government subsidy magnitude and simulate the microinsurers' financial results. If successful, such a payment model could improve efficiency and extend affordable maternity care to low income women in developing regions.

Keywords:

Micro health insurance, risk adjustment, maternity healthcare

Introduction

Improving maternal health and reducing child mortality are two important targets in the United Nations Millennium Development Goals (MDGs). From 2000 to 2015, progress has been made to improve access and quality of maternal care, yet the maternal mortality rate (MMR) remains high in developing countries. In 2015 alone, roughly 303,000 women are estimated to have died during and soon following pregnancy and childbirth. Almost all of these deaths occurred in low-resource settings, and most could have been prevented.[1] The MMR in developing countries in 2015 was 239 per 100,000 live births versus 12 in developed countries, a difference of almost 20 times.[2] A woman's lifetime risk of maternal death, defined as the probability that a 15 year old woman will eventually die from a maternal cause, is 1 in 4,900 in developed countries, versus 1 in 180 in developing countries.[3]

Among the various underlying conditions contributing to high MMR, lack of adequate maternal healthcare is a leading factor (Liu and Wang, 2010; Dumont et al., 2013). According to a statement by WHO, poverty and lack of access to qualified maternal health care are still the main obstacles to achieve the Sustainable Development Goals on child and maternal mortality before 2030.[4]

In developed countries, maternity care is commonly included in government or employer provided health insurance plans, with comprehensive prenatal and postpartum care. In comparison, for low income residents living in many developing countries, social insurance or employment-based health insurance is often nonexistent, leaving micro health insurance as their only choice of accessing formal insurance.[5]

---

[1] Source: http://who.int/mediacentre/factsheets/fs348/en/

[2] UNICEF and World Bank (2014). Trends in maternal mortality: 1990 to 2013. World Bank Publications.

[3] Source: http://who.int/mediacentre/factsheets/fs348/en/

[4] Source: http://www.afro.who.int/en/maternal-health/

[5] A number of developing countries including Uganda, Liberia, Senegal, Burundi, Kenya and Niger have begun to provide free delivery services. With the exemption in national health insurance premiums for pregnant woman, Ghana has seen an increased enrollment rate among the target population (Frimpong et al., 2014).

Microinsurance does not have a universally-accepted definition, yet typically is considered a commercially-available insurance product designed for low-income people against specific perils, including life, crop, and health coverages, among others. The provision of maternal healthcare through micro health insurance has been shown to be associated with increased utilization of formal services, decreased out-of-pocket payments (OOPs), and improved quality of care in developing countries (Okusanya, 2015; Smith and Sulzbach, 2008; Mcquestion and Velasquez, 2006); however, the sustainability of micro health insurer is particularly challenging due to the prevalence of adverse selection and moral hazard (Clement, 2009; Frimpong, 2014; Okusanya, 2015; Yao et al., 2015). The common practice in micro health insurance is to charge a flat rate for all enrollees in order to save administrative costs and to make the policy simple and clear. The flat rate (also called community rating) and use of limited underwriting activities, however, expose microinsurers to severe adverse selection. Specifically, flat rates and limited underwriting encourage women to enroll into the program only after they are pregnant.

Yao et al. (2015) studies the Aga Khan Agency of Microfinance (AKAM) micro health insurance program in Pakistan. It establishes a classic adverse selection death spiral. The premium increased from 300 Pakistan Rupees (PKR) in 2007 to 450 PKR in 2010 due to severe adverse selection, mostly associated with maternity care, which caused the program to halt operation temporarily in 2012. A potential solution offered by Yao et al. is for the government to provide maternal care insurance, leaving microinsurer to cover other types of health insurance. This dual process, however, will incur significant administrative expenses that could make it infeasible. Providing maternal care in a comprehensive health plan, with government subsidies for the maternity care, could be an alternative solution.

The United Nation focused on increased funding for maternal health services as a key to achieving its MDGs. Yet developing nations hold limited financial resources. We are argue for the prioritization of subsidizing micro health insurer for maternity service instead of other services for two reasons. First, maternity and early child care is an important human rights issue which would impact the population growth and quality fundamentally. Second, the nature of pregnancy is different from other diseases. It is quite vulnerable to adverse selection, but not as much as regard to moral hazard in general.[6] In this paper, we provide an ex ante estimation of the impact of a government subsidy for maternity benefits on microinsurer's sustainability. While we focus on maternity care, we believe that this method could be generalized to provide subsidies for other healthcare services if necessary.

The form of government subsidy could be provided in a variety of ways including fee-for-service, lump sum budget, flat rate capitation, and risk adjusted capitation. We begin with a discussion of each of these subsidy options.

The most aggressive form of subsidy would be a full subsidy on a fee-for-service basis. As shown in traditional insurance markets, payment on a fee-for-service basis generates incentives for (micro)insurers and healthcare providers to over-utilize health care, which would inflate cost. A lump sum budget has the contrary effect of motivating insurers and providers to enroll/treat fewer participants because they receive no benefit in extending their services more broadly. A flat rate capitation addresses the interest in treating more people, yet is likely to result in cream skimming for healthier enrollees (those who will yield higher profits per capita), leaving the women with pre-existing conditions and complicated pregnancy histories less likely to be covered (Alexander, 2016).

Radermacher et al. (2016) addressed these issues by proposing a risk-adjusted subsidy framework to provide ex ante compensation according to the participants' expected additional cost. We apply a risk-adjusted capitation framework to maternal care to

[6] Woman may choose to enroll in insurance when she plans for pregnancy, but usually the decision of whether to have a child is not dependent on the status of insurance.

balance the efficiency and equality, and we evaluate its effectiveness using claim data from a micro health program in Pakistan.

Our paper contributes to the existing literature in two aspects. First, it adds to the literature on improving sustainability of micro health insurance. Sustainability is an important issue hindering the development of microinsurance, and our paper is the first that we know to test empirically the feasibility of a public private partnership model to boost the financial strength of the program. We anticipate that the use of risk adjustment to determine transfer payments from governments to microinsurers for all childbearing age women may bring mutual benefits for all three stakeholders involved. The government benefits from increased efficiency of fund using as well as improved quantity and quality of population. The microinsurer benefits from obtaining additional subsidies while minimizing administrative costs of running two programs separately, and the insureds benefits from increased utilization and improved quality of formal maternity service leading to lower MMR (Dror et al., 2005; Mcquestion and Velasquez, 2006; Islam et al. 2012).

Second, it contributes to risk adjustment literature by applying this method to the microinsurance context. Risk adjustment is widely applied in the developed countries including the U.S., Belgium and the Netherlands (Newhouse et al., 2012; Van Kleef et al., 2013; Buchner et al., 2013), and it has proved to be effective in controlling cost while maintaining fair access for all patients. We apply this method to a developing country scenario to promote the efficient usage of the government subsidy, given the resources are in general limited.

The paper is organized as follows. Section 2 provides literature review. Section 3 describes the data and model. Section 4 illustrates regression and simulation results. Section 5 summarizes the conclusions and discusses the findings.

Literature Review

Sustainability and adverse selection in maternity microinsurance

Sustainability issue of micro health insurance is persistent, especially for those programs providing maternity coverage. Scholars apply different methods to measure the financial performance of microinsurance, including financial indicators calculation, and efficiency frontier comparison using DEA method (Wipf and Garand, 2008; Biener and Eling, 2011). Most of the existing research targets information asymmetry, especially adverse selection, as the main cause of unsustainability (Yao et al., 2015).

Clement (2009) investigates information asymmetry in the national health insurance scheme (NHIS) of Ghana, finding not only that women in their reproductive age with dependents are more likely to enroll, but also that they tend to register for insurance only after they get pregnant. To solve the problem of adverse selection and to expand maternity service to rural poor, NHIS began granting a premium exemption for pregnant women as of July 2008, i.e. it waives premium for pregnant women participants for all maternity related services. Frimpong et al. (2014) discovered a sharp increase in the enrollment ratio among pregnant women after the premium exemption. Ankrah et al. (2013) further analyzes the financial impact of premium exemption on sustainability of the program, and the results suggest that donor’s one time startup funding is not sufficient to cover the recurrent expenditure for maternal care.

Jütting (2004) examines the utilization of healthcare service in a community based health insurance (CBHI) scheme in rural Senegal, finding that women participants tend to use more hospital service than men, and most of the inpatient service is related to maternity needs. Overall, complications during pregnancy and birth have a significant impact on the total cost, leading to a 120% increase in expenditure.

Using survey data of insured and uninsured women in low-income households in India, Desai et al. (2011) also finds preliminary evidence for adverse selection in maternity service, observing that women insured by a CBHI tend to have more hysterectomy surgeries than the uninsured. The rates of having hysterectomy surgery are 9.8% and 5.3% for urban and rural insureds respectively, while the corresponding figures are 7.2% and 4% respectively for uninsured women in urban and rural areas. The choice of hysterectomy is usually not due to moral hazard in the form of overutilization, thus, it is more likely to suggest the existence of adverse selection.

In addition, Smith and Sulzbach (2008) examine the relationship between CBHI membership and maternal health care utilization in Senegal, Mali, and Ghana, and they conclude that CBHI membership is positively associated with maternal health service usage, particularly for more expensive delivery related care.

Some researchers, however, fail to find adverse selection in maternity-related services in microinsurance. Dror et al. (2005) collects cross-sectional data for both insureds and non-insureds from six micro health insurance units (MIUs) in the Philippines. They use the total number of deliveries in the 5 years preceding the survey as a proxy indicator for future maternity needs, and find the rate of deliveries among the insured cohort is slightly lower than the rate recorded among the uninsured, the opposite of what we would expect in a situation involving adverse selection. The proxy for maternity need, however, might be flawed in that the greater number of children already in the household could yield fewer future children desired by the parents. Further, while they find the rate of deliveries attended by a doctor is significantly higher among the insured cohort than the uninsured, the authors do not regard the result as an implication for adverse selection nor moral hazard without further evidence provided by a longitudinal study.

Similarly, Aggarwal (2010) evaluates the impact of India’s CBHI program named “Yeshasvini” on health-care utilization, financial protection, treatment outcomes and economic well-being using propensity score matching of insured and non-insured groups, and finds no significant impact of enrollment on maternal health care, in particular for the lower socio-economic groups. Further, the insured status did not result in greater likelihood of using more private institutional health facilities instead of public facilities. It should be note, however, that the program did not cover normal deliveries until recently and normal delivery service is also free in government hospitals.

Risk adjustment and its application

Subsidies to insurers can take a number of forms, including fee-for-service (FFS), lump sum budget, flat rate capitation, and risk adjusted capitation. We begin with a discussion of each of these subsidy options.

FFS is widely used for its convenience, but it encourages over utilization of medical services, leading inevitably to inflated expenditure and reduced efficiency of government fund. Gruber and Owings (1996) shows evidence of induced demand demonstrating the increase of cesarean delivery in the United States is driven by physicians' motivation for more reimbursement compared with normal delivery, given fertility rate is falling.

Paying insurers with a lump sum budget will control costs; however, providers are induced to reduce quantity (possibly as well as quality) of service provided, resulting in dissatisfaction among insureds. Alternatively, a flat rate capitation is another way to control cost, but it generates a cream skimming problem in that providers would favor treating healthier patients while refer the sicker patients to other facilities (also called risk selection by providers) (Alexander, 2016; Duggan, 2004; Leibowitz et al., 1992). As a solution to risk selection while controlling the healthcare cost, a risk adjusted capitation is applied in national health insurance programs in several developed countries (Eggleston and Bir, 2009; Yao et al., 2017).

Given that FFS and flat rate capitation provide incentives for insurance providers to engage in risk selection, Eggleston and Bir (2009) provide empirical evidence showing that risk adjustment could reduce risk selection. They use the net marginal benefit, defined as the financial profit minus the cost for risk selection, to quantify provider's incentive. The empirical analysis finds risk adjustment significantly reduces selection incentives for any given level of supply-side cost sharing. They further suggest that risk adjustment and mixed payment methods such as partial-capitation and pay-for-performance could reduce risk selection incentives and align incentives with quality improvement in certain medical items.

Glazer and McGuire (2000) also claims risk adjustment should be viewed as a way to set prices for different individuals in order to address adverse selection. Shen and Ellis (2002) describe an optimal risk adjustment strategy, concluding that if the current risk adjustment regime has used enough information, there should be little incentive for insurers to engage in risk selection. They further find that a capitation payment system would draw near the optimum-social cost minimum.

Beck et al. (2010) use age, gender, health care expenditure, and pharmaceutical cost groups of different illnesses as risk adjustors, and they show risk adjustment is effective in aligning insurers' incentives with that of society in the long run. Risk adjustment method could be further applied to predict costs for specific types of healthcare needs, including diabetes, mental illness and drug abuse, as well as acute asthma, with a tailored set of predictors (Maciejewski et al., 2009; Ettner et al.,1998; Tsai et al., 2009). Age, gender, and measures of previous medical history are commonly included as risk adjustment factors. In the Medicare program operated in the U.S., it also uses welfare status and county-of-residence, besides age and gender, as risk adjusters to set prices to plans (Glazer and McGuire, 2000).

Risk adjustment is most common in developed countries, with Radermacher et al. (2016) being the first we know to construct a framework for microinsurance subsidies in developing countries. They argue that by providing ex-ante risk adjusted subsidies to insurers (which equals to the expected additional cost of a person joining the scheme), the current community rating practice in microinsurance can be retained while avoiding cream skimming yet also achieving cost effectiveness in administrative costs. They fail to provide detailed empirical evidence, though, for the viability of this framework.

Our paper offers this empirical evidence, applying a risk adjustment method for maternity related services in developing countries. We use a set of common risk adjustment factors (individual characteristics including age, number of children, diagnosis information etc.) to evaluate maternity related cost and to calculate risk adjusted subsidies for microinsurance. We expand the analysis based on the framework provided by Radermacher et al. (2016), to provide evidence for the impact of risk adjusted subsidies on the sustainability of micro health insurance.

Data and Model

AKAM Program and Data

Our empirical application uses a dataset acquired from the Microinsurance Initiative of the Aga Khan Agency of Microfinance (AKAM). AKAM started its pilot program for an annual micro health insurance policy in the Northern Area (NA) of Pakistan starting from November 2007. The overall loss ratio from 2007 to 2010 was as high as 1.93, leading AKAM to halt its operations temporarily in November 2011 because of sustainability issues.

The AKAM health insurance program offers a simple contract design. The individual annual premium of 350 Pakistan Rupees (PKR) (approximately $5.6) is paid up front.[7]

[7] The flat premium of 350 PKR per person was set in November 2007. It increased to 400 PKR for participants enrolled in November 2008, July 2009 and November 2009. It increased again to 450 PKR for new participants in two LSOs (ZADO and DANYORE) in July 2010, but stayed at 400 PKR for all the other insureds.

The core coverage of the policy is annual hospitalization coverage up to 25,000 PKR per person (approximately $400).[8] It covers both maternity related inpatient expense as well as other inpatient services due to acute or chronic diseases. The policy has no deductible and no coinsurance. The maternity service is subject to adverse selection and the payout counts for about one third of total claim, resulting in high overall loss ratio for the program. AKAK requires each household to enroll as a unit, in order to alleviate adverse selection.

In Pakistan, the maternal mortality rate was 170 per 100,000 live births in 2013.[9] It ranks the sixth highest among 22 Eastern Mediterranean countries in 2013, with a regional average level at 129 per 100,000 live births. Providing adequate and high quality maternity care could potentially benefit the society greatly.

We have complete claim data and enrollment information from three enrollment periods, namely November 2008, July 2009 and November 2009. Each policy runs for one year. The dataset is composed of individual as well as household level information, including basic demographics on the age and gender for all households' members. The dataset also has some policy-level information such as renewal status, and enrollment date. Moreover, it contains detailed information on claims made during the policy periods. This information includes diagnosis, pre-existing conditions, the name of the hospital visited, date of admission, length of stay, and total claim amount. The Local Supporting Organization (LSO) to which a household belongs is also recorded. It is a group organization representing all insureds in the geographical areas to sign the contract with insurer. There are in total 14 LSOs involved in the area where the AKAM program is running.

[8] The coverage increases to 30,000 PKR for renewed customers as an encouragement to stay in program.
[9] Database: http://www.emro.who.int/entity/statistics/statistics.html

Summary Statistics

Using the same definition as WHO, we define women of childbearing age (reproductive age) as 15 to 49,[10] and restrict our sample accordingly. The sample size becomes 14,820, with 7,919 already a mother of at least one child. Table 1 presents summary statistics of key variables.

Table 1 Summary Statistics of Key Variables

Variable	Number	Percentage (%)
Age (N=14,820)		
15-19	2,034	13.72
20-24	2,416	16.30
25-29	3,044	20.54
30-34	2,350	15.86
35-39	2,485	16.77
40-44	1,646	11.11
45-49	845	5.70
Number of children (conditional on having at least a child, N=7,919)		
1	2896	36.57
2	2193	27.69
3	1403	17.72
4	884	11.16
5	369	4.66
6	119	1.50
7	47	0.59
8	7	0.09
9	1	0.01
Mean	2.27	
Age of the youngest child (conditional on having at least a child, N=7,919)		
Mean	7.19	
Minimum	1	
25th percentile	3	
Median	5	
75th percentile	11	
Maximum	37	
Diagnosis type (conditional on filing at least one claim, N=3,886)		
Abortion	160	4.12
Fetal distress	260	6.69
Infection, antepartum	44	1.13

[10] Source: http://apps.who.int/gho/indicatorregistry/App_Main/view_indicator.aspx?iid=4668

Normal delivery	1,865	47.99
Pregnancy, other complications	179	4.61
Premature labor	32	0.82
Miscellaneous maternity claims	43	1.11
Other acute or chronic claims	1,303	33.53

Note: There are 14,820 women aged between 15 and 49 enrolled in AKAM from November 2008 to July 2010, in which 11,487 of them made no claim, while 3,333 participants made at least one claim. There are in total 3,886 claims. The distributions of age, number of children, and age of the youngest child are based on observation of 14,820 participants and the distribution of claim type is based on 3,886 claims.

We observe from Table 1 that program enrolled is around 37% of women in their twenties, decreasing to 32% for participants in their thirties. It further dropped sharply to 17% for women in their forties. From the age distribution, it may suggest the existence of selection based on maternity need. As to number of children, 53% of participants have at least one child (7,919 out of 14,820). Among those who have at least one child, the proportion of having one, two, and three children are 37%, 28% and 18% respectively. Only 18% of them have more than three children when enrolled in the program. Conditional on having at least one child, the childbearing age female participants have on average 2.27 children. The unconditional mean of number of children for childbearing age women enrolled in AKAM is 1.21, which is significantly fewer compared with a national average of 2.96 children per household. Overall the size of AKAM enrolled family is 3.9 per household, which is also significantly smaller compared with a national average level of 6.58.[11]

Age of the youngest child is a rough proximate of the duration from her last delivery. Among those who have at least one child, the mean and median age of the youngest child is 7 and 5 respectively. The diagnosis type is summarized based on the existing claim information from AKAM program. There are 3,333 participants filing 3,886 inpatient claims. Normal delivery counts for almost half of all claims, while the claim count due to other acute or chronic diseases stands for 34%. Abortion, fetal distress, antepartum infection, other complicated pregnancy and premature labor are another

[11] Data source: http://www.pbs.gov.pk/sites/default/files/social_statistics/publications/hies07_08/table1.pdf

five relatively frequent maternity related diagnoses besides normal delivery. For all the rest of maternity related diagnoses, we categorize them into miscellaneous maternity claims. Refer to Table A1 in the appendix for detailed claim count and average claim amount of all maternity related diagnosis.

Table 2 Summary Statistics of Claim Frequency and Claim Amount

Claim Frequency			
0	11,487		77.51%
1	2,874		19.39%
2	382		2.58%
3	62		0.42%
4	13		0.09%
5	2		0.01%
Claim Amount			
Overall Maternity Expense		Other Acute or Chronic Diseases	
Number	2,583.00	Number	1,303.00
Mean	4,721.21	Mean	5,396.36
S.D.	5,625.73	S.D.	6,402.75
Minimum	277.00	Minimum	178.00
25th percentile	1,574.00	25th percentile	1,393.00
Median	2,543.00	Median	2,495.00
75th percentile	4,071.00	75th percentile	6,126.00
Maximum	30,000.00	Maximum	30,000.00

Note: Claim frequency is based on 14,820 participants while statistics for claim amount are based on 15,373 records.

Table 2 reports the distribution of claim frequency for all inpatient services, as well as claim amount for maternity related claims and other inpatient claims due to acute or chronic diseases respectively. Among all childbearing age women participants, 22% of them report at least one inpatient claim. Most of them had just one inpatient stay (19.39%) and 2.58% of them have two inpatient stays.

Among those who had at least one claim, two thirds are maternity related claims with an average claim amount of 4,721, while the other one third is due to other non-maternity reasons with an average claim amount of 5,396. Furthermore, Table A2 in appendix reports the claim count and amount distribution by detailed maternity related diagnosis type.

Model

Risk adjustment is broadly defined to mean “the use of information to calculate the expected health expenditures of individual consumers over a fixed interval of time” (Van de Ven and Ellis, 2000). It is commonly applied in payment systems in developed countries, including Medicare and the Health Insurance Marketplaces created by the Affordable Care Act in the U.S., and the national systems in Belgium and the Netherlands (Van de Ven and Ellis, 2000; Ellis, 2008; Pope et al., 2004; Kautter et al., 2014; Geruso and McGuire, 2016; Schokkaert and Van de Voorde, 2003).

We use a concurrent model to predict the maternity expense for each participant, i.e., predicting the expense in the current period with information collected in the same period. The risk adjustment model takes the following form:

$ME_{i,t} = f(WA_{i,t}, NOC_{i,t}, YCA_{i,t}, DT_{i,t}, G_{i,t}, u)$

Specifically, $ME_{i,t}$ denotes the maternity related expense in the current year t for woman i, $WA_{i,t}$ denotes woman’s age at the beginning of the enrollment period. We use an age band of 5 years to classify participants age, given the impact of age on maternity need might be nonlinear. $NOC_{i,t}$ represents the number of children in the household, $YCA_{i,t}$ represents the youngest child’s age. We also include a squared term of $YCA_{i,t}$ in the regression because the maternity need of insured might be nonlinear. $DT_{i,t}$ represents the maternity related diagnosis type for the woman if she filed any maternal care claim with AKAM program in the current period. $G_{i,t}$ are the LSO dummies that identify the Local Supporting Organization to which the woman belongs to account for the geographical differences that may cause variation in the cost of seeking health care. Based on model parameters, we would be able to predict a level of maternity related medical spending based on personal and family characteristics for each individual.

In seeking the best predictive method, we test the following four model forms: First, we estimate with OLS as the baseline comparison; second, we use an OLS model with log transformation, which addresses the thick right tail for medical spending data; third, we apply a Two Part Model, which deals with a large number of zeros in medical spending data; and fourth, we consider a Tobit model left censored at zero, which deals with non-negative observations in medical spending data.

Our intent is to identify the best model form among these four to predict the maternity related expense and to calculate the risk adjusted subsidy from government to microinsurer accordingly. In order to compare different model forms, we use the predicted values from each model to regress on the actual maternity expense in the current year, then compare R squares for the best model fit. We further compare the deciles for predicted total maternity related claim amount for each method with the actual claim amount. Lastly, we calculate the predictive ratios for each type of maternity related diagnosis under each model form to compare the accuracy of prediction.

With this process, we are able to use the best model to estimate the magnitude of government subsidy and to simulate the financial results for microinsurer with an updated loss ratio, in order to evaluate the impact of risk adjusted subsidies on insurer's sustainability and its effectiveness in the context of providing maternity related care to low income women in the developing regions through microinsurance.

Results

Regression results

We report main regression results in Table 3 on page 19. The regression is based on 14,820 observations from November 2008 till October 2010. The dependent variable is individual's maternity related claim in the current enrollment period. Given that renewed insured could appear twice in our sample, robust standard errors clustered on individual level are reported in parentheses. Marginal effect is reported for the 1st part logit regression of Two Part Model. We include LSO fixed effect in all models to control for the geographic differences within the area.

The regression results are largely consistent across different model forms. It is shown that the seven maternity related diagnosis categories are key predictors for maternity related cost in the current period as expected, no matter which model form it takes. Using OLS results for example to illustration, we find female insured who had normal delivery claim in the current period spent 2,354 PKRs more compared with childbearing age female insured without any claim, all else being equal. Using Ln OLS model, we find female insured who experience complicated pregnancy spent 626.3% more in maternity relate expense than those without any inpatient claim.

Without controlling for maternity diagnosis information, we find age group of the insured, as well as the number of children in the household, age of the youngest child are all significant predictors of having maternity related spending, using 1st part logit regress in the Two Part Model. Each additional child in the household decreases the likelihood of incurring any maternity inpatient cost by 1.42%. Age of the youngest child is a measure of the duration since last labor. It appears the probability of incurring maternity cost first increases then decreases with the duration, which is consistent with our expectation. The female insured's age groups also matter. Compared with the base group of those from 45 to 49, insureds in their twenties and thirties are significantly more likely to incur maternity cost. For example, the probability or having maternity expense for female in the 25-29 age group is 38.8% higher than those in 45-49 age group.

Table 3 Regression results of four models

Variable	**OLS**	**Ln OLS**	**Two Part Model**		**Tobit**
			1st part (logit)	2nd part (Ln OLS)	
Number of children	-8.393	-0.00674	-0.0142***	-0.008	-66.96
	[8.208]	[0.00430]	[0.0028]	[0.0122]	[56.99]
Age of the youngest child	-4.266	0.00314	0.0181***	-0.0317***	18.19
	[5.185]	[0.00255]	[0.0029]	[0.00943]	[37.23]
Age of the youngest child squared	0.0693	-0.000149	-0.00138***	0.00148*	-2.456
	[0.188]	[0.00009]	[0.0002]	[0.00065]	[2.118]
Insured age 15-19	-35.29	0.00965	0.0681*	0.132	634.7
	[29.23]	[0.0159]	[0.0363]	[0.212]	[536.0]
Insured age 20-24	1.307	0.0332	0.368***	0.158	1230.7*
	[37.49]	[0.0194]	[0.0534]	[0.209]	[531.2]
Insured age 25-29	49.84	0.0753***	0.388***	0.172	1463.7**
	[35.65]	[0.0184]	[0.0509]	[0.209]	[527.4]
Insured age 30-34	42.62	0.0598***	0.347***	0.157	1461.4**
	[33.39]	[0.0176]	[0.0528]	[0.209]	[526.0]
Insured age 35-39	30.14	0.0318*	0.203***	0.17	1319.3*
	[27.98]	[0.0143]	[0.0460]	[0.209]	[524.2]
Insured age 40-44	42.14	0.0179	0.0527	0.201	1172.0*
	[25.24]	[0.0121]	[0.0366]	[0.220]	[554.1]
Abortion	4027.8***	7.408***		0.405***	10606.4***
	[219.4]	[0.176]		[0.0940]	[365.5]
Fetal distress	17401.2***	9.092***		1.806***	24061.4***
	[220.2]	[0.108]		[0.0886]	[323.9]
Infection, antepartum	1985.4***	3.565***		0.15	5411.9***
	[373.5]	[0.539]		[0.117]	[724.8]
Normal delivery	2353.6***	7.376***		-0.122	9449.8***
	[51.56]	[0.0289]		[0.0856]	[239.6]
Pregnancy, other complications	10089.3***	6.263***		1.144***	14860.4***
	[553.6]	[0.295]		[0.0768]	[751.7]
Premature labor	2157.7***	3.094***		0.203	4939.0***
	[628.6]	[0.601]		[0.112]	[931.2]
Miscellaneous maternity claims	6565.1***	5.186***		0.664***	10840.4***
	[1303.4]	[0.589]		[0.146]	[1633.8]
Other acute or chronic claims	25.5	0.0209		0.0501	167.6
	[45.76]	[0.0215]		[0.0586]	[276.1]
LSO	X	X	X	X	X
Constant	134.3***	0.0494*		7.982***	-8072.1***
	[36.62]	[0.0192]		[0.231]	[581.9]
N	14,820	148,20	14820	2411	14820
R^2 (pseudo R^2)	0.842	0.959		0.626	0.216

Note: The regression is based on 14,820 observations from November 2008 till October 2010. The dependent variable is individual's maternity related claim in the current enrollment period for the OLS model. For Ln OLS model, the dependent variable is the log form of individual's total maternity claim in the current enrollment period plus one. For the Two Part Model, marginal effect is reported for the 1st part logit model, and the dependent variable of the 2nd part is defined in the same way as in Ln OLS model. We ran a Tobit model left censored at zero. Robust standard errors clustered on individual level are reported in parentheses.
*Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Model comparison

The R^2 reported in Table 3 cannot be compared directly across different models to measure goodness of fit. The Ln OLS model used the log form of expenditure. The Two Part Model only reports R^2 for the second part regression and the Tobit model only reports pseudo R^2. In order to compare the models directly, we calculate the predicted value of maternity claim payout, and regress it on the actual maternity claim amount to get R^2 for consistent comparison. Note that the policy limit for any inpatient service is 25,000 and 30,000 for newly enrolled and renewed individual respectively, we truncate the predicted value at the policy limit accordingly.

Table 4 reports the regression results. The observed maternity claim amount is the dependent variable and the predicted (after truncation) maternity claim amount is the independent variable. The result shows OLS and Tobit model are the two with relatively high R^2. They perform relatively well in terms of model fit.

Table 4 R^2 comparison of regressions of predicted spending on observed spending

Models	OLS	Ln OLS	Two Part Model	Tobit
R^2	0.844	0.375	0.486	0.785
N	14,820	14,820	14,820	14,820

In order to observe the overall prediction pattern for all four models, we further compare the difference between the observed maternity spending and the predicted spending by decile of predicted spending in Figure 1. The solid black line is the 45 degree line which marks the accurate prediction. It is obvious that TPM (the green dashed line) is outperformed by the other three models, in that it under predicts the spending at the 10th decile. The OLS model (the blue dashed line) also mildly underestimates the 10th decile, while Ln OLS and Tobit model perform quite well.

But given the observations are clustered within the first nine deciles, we further present Figure 2 to graph the first nine deciles comparison. The results are consistent with the finding in Figure 1 using all ten deciles. The TPM over estimates spending in the lower end and under estimates spending in the upper end, so it is outperformed by the other three. Tobit predicts the closest to the 45 degree line, with OLS slightly over estimates all nine deciles. The Ln OLS also performs relatively well.

In summary, Tobit, Ln OLS and OLS perform well in terms of model prediction, while the pattern of TPM is less satisfactory.

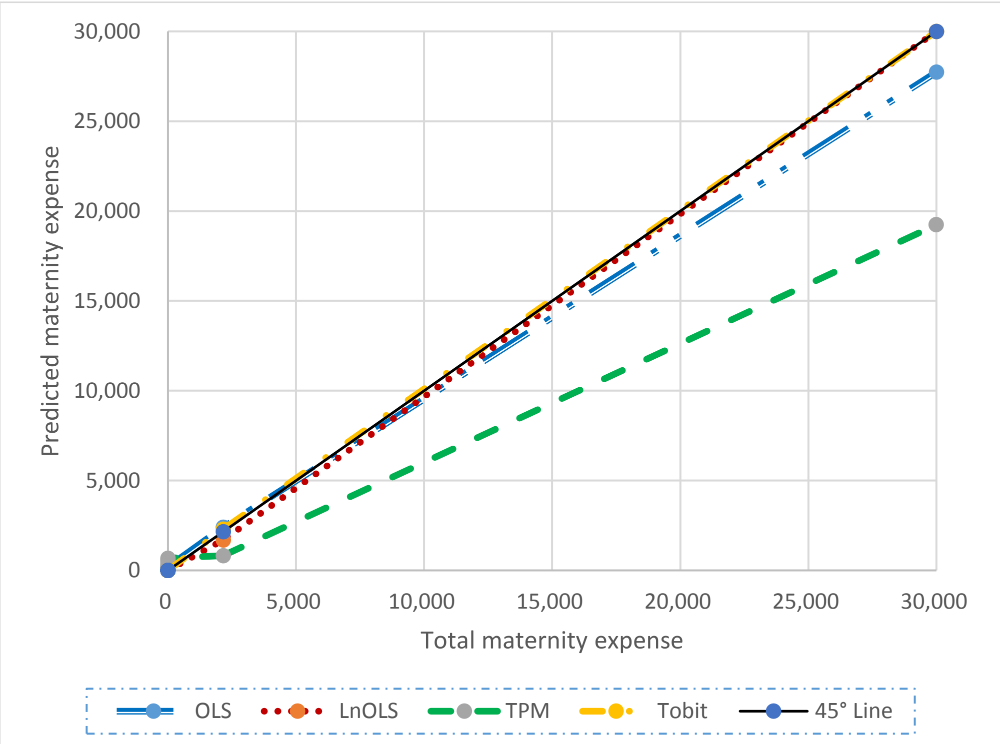

Figure 1. Prediction patterns for the ten deciles using four models

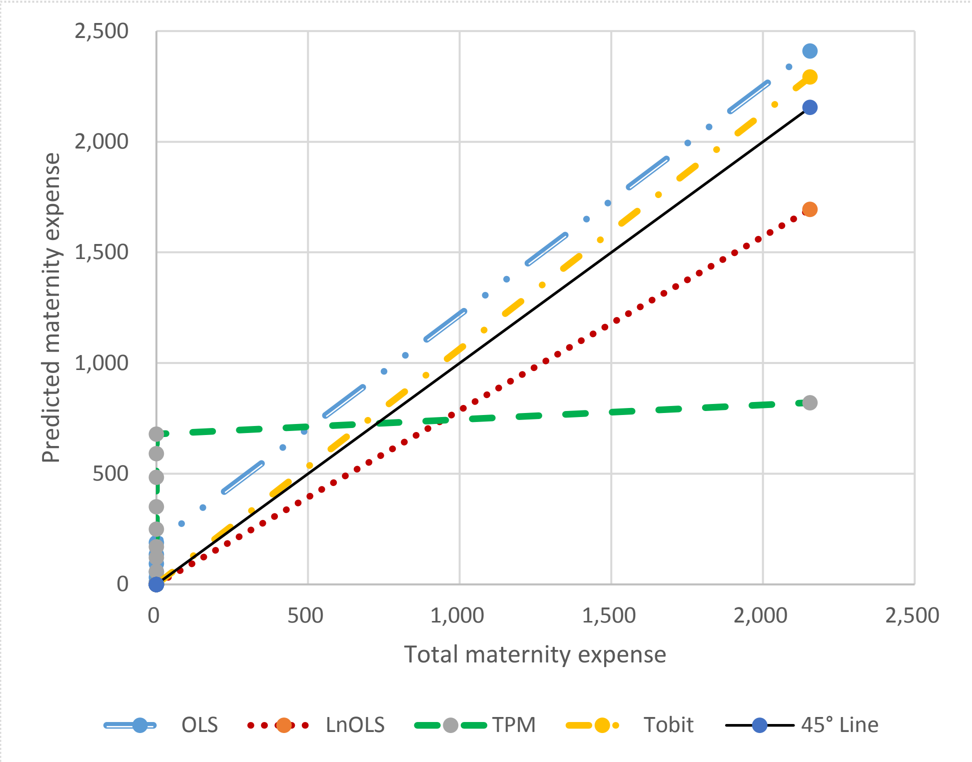

Figure 2. Prediction patterns for the first nine deciles using four models

Predictive ratio analysis

Besides the accuracy of prediction for overall maternity spending, it is also important to compare the level of accuracy within each diagnostic category. Figure 3 graphs the predictive ratio defined as the overall predicted cost for a given category divided by the actual cost for each of the six major maternity related categories. A predictive ratio close to 1 indicates good performance.

It is apparent that OLS performs the best for all six categories. Antepartum infection and premature labor are two categories with relatively small observations (44 and 32 cases respectively), therefore the predictive ratio for these two categories are particularly low, especially for Ln OLS and Tobit models. In general, Tobit, Ln OLS and TPM all underestimate for all categories systematically. The TPM significantly underestimates for all categories, and the average predictive ratio ranges around 20%. Ln OLS and Tobit both perform poorly for categories with fewer observations.

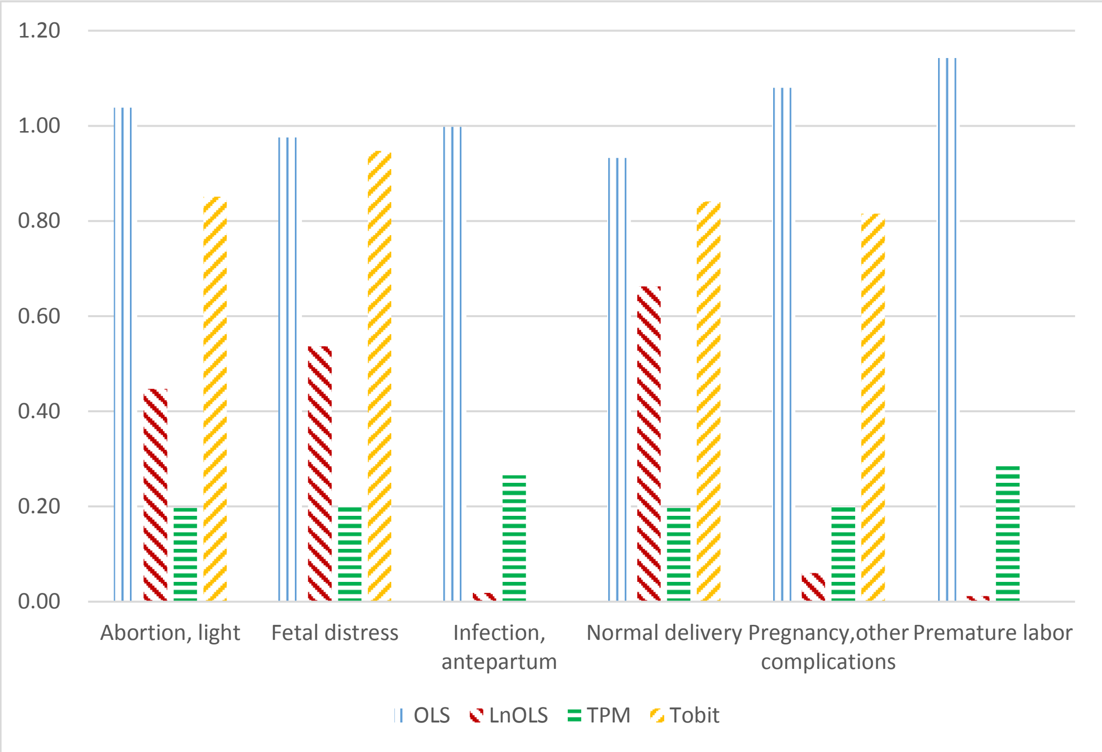

Figure 3. Predictive ratio of six major maternity related diagnosis using four models

Subsidy and loss ratio simulation

By model comparison, we find the OLS and Tobit are the two models that perform well consistently, so we use only those two for the purpose of subsidy calculation and loss ratio simulation for the microinsurance program.

Table 5 on page 25 reports the preliminary simulation results. Since we have complete claim data for November 2008, July 2009 and November 2009 enrollment periods, we report the results by each period, as well as the overall performance.

Column (1) reports the total premium income of AKAM program for any enrolled period for all insureds. We use the flat rate of 400 PKRs per person to apply to all insureds enrolled (not limited to childbearing age women). Column (2) shows the total claim cost of the program (not limit to maternity related expense). Column (3) calculates the actual loss ratio of the program without subsidy, using claim cost over premium income. We could see the actual loss ratios range from 1.81 to 2.31, and the overall loss ratio is 1.91, which is apparently unsustainable.

Then we simulate the magnitude of the subsidy using OLS and Tobit model by calculating the sum of predicted maternity spending for all enrolled childbearing age women, and we use them as simple measures of risk adjusted subsidies (column 6 and 8). We also calculate the subsidy under FFS for comparison, which should equal to the actual total maternity related spending in the given period (column 4), because government would simply reimburse all maternity related expense to insurer. The loss ratio is calculated by dividing the total claim amount with the sum of premium and subsidy calculated corresponding to each method. We did not report the results of Ln OLS and TPM since they are outperformed by the other two models in terms of prediction accuracy, but the same procedure could be applied as well if necessary.

Consistent with our expectation, the loss ratios drop significantly with government subsidy. The FFS method is the simplest one without individual risk adjustment. The updated loss ratio drops from 1.91 to 1.22. As to risk adjustment method, the OLS yields the largest magnitude of government subsidy, thus resulting in the lowest loss ratio among all method, reaching 1.22, 1.31 and 1.16 respectively for the three enrollment periods. The overall updated loss ratio decreases to 1.21. The Tobit method would also results in significant improvement in loss ratio at a level of 1.26.

Overall, due to the simplicity in implementation, as well as the accuracy in prediction, OLS model is preferred among the four model forms. Subsidizing microinsurer with risk adjusted method instead of under FFS will improve the efficiency in government fund, while assisting the sustainable operation of microinsurance program to a large extent.

Table 5 Simulation results for loss ratio by different methods

				FFS		**OLS**		**Tobit**	
Period	Premium	Cost	Loss Ratio	Subsidy	Loss Ratio	Subsidy	Loss Ratio	Subsidy	Loss Ratio
	(1)	(2)	(3)	(4)	(5)=(2)/[(1)+(4)]	(6)	(7)=(2)/[(1)+(6)]	(8)	(9)=(2)/[(1)+(8)]
Nov-08	8,145,600	14,996,230	1.84	4,183,702	1.22	4,138,955	1.22	3,626,230	1.27
Jul-09	3,857,200	8,905,712	2.31	2,868,953	1.32	2,952,127	1.31	2,722,727	1.35
Nov-09	9,757,200	17,629,086	1.81	5,142,218	1.18	5,399,342	1.16	4,877,648	1.20
Overall	21,760,000	41,531,028	1.91	12,194,873	1.22	12,490,425	1.21	11,226,606	1.26

Note: We use the flat rate of 400 PKRs per person to calculate the total premium income of AKAM program for all enrolled households. The cost equals the overall claim payout of the program (not limited to just maternity claims). Subsidies for each model (OLS and Tobit) is calculated using the sum of predicted maternity cost for each enrolled childbearing age women, and the subsidy under FFS equals to the actual total maternity related claims. The loss ratio is calculated by dividing the total claim amount with the sum of premium and subsidy. We did not report the results of Ln OLS and TPM since they are outperformed by the other models in terms of prediction accuracy. The complete results are available upon request.

Conclusion

Micro health insurance is an important way to finance health expenditure for low income people. Maternity care is necessary but difficult to provide by commercial microinsurer alone because of severe adverse selection problems. A risk adjusted subsidy provided by the government to microinsurers offers one possible model of a successful public-private partnership (PPP). Due to a number of barriers including adverse selection and moral hazard, transaction cost, behavioral biases, and technical ability, Cole (2015) also suggests PPP as an effective model to promote the development of microinsurance market.

Radermacher et al. (2016) first offered this concept. Our contribution is to identify appropriate methods to create such risk-adjusted payments. If successful, such a model could improve efficiency and make provision of affordable maternity care to low income women in the developing regions possible.

We use different model forms to predict maternity related spending and to simulate the corresponding magnitude of risk adjusted subsidy in order to evaluate the impact on microinsurer's loss ratio. We find the risk adjusted subsidy could significantly improve the loss ratio by almost 40 percent. The updated loss ratio after subsidization is around 120%, which is much closer to a sustainable level. We do recognize that minimizing administrative cost and increasing investment performance are also necessary to eventually achieve sustainability of the microinsurance. In addition, the overall subsidy for all three enrollment periods totals over 12 million PKRs, which is more than half of aggregate premium income. The magnitude of the subsidy accounts for roughly 1.2% of annual public health expenditure of NA area.[12] The current fully subsidized program design requires continuous and intense government support. Another option is to

[12] The total budget for NA area is 12 billion rupees, and the budget for public health service is 942 million in 2016-2017 fiscal year. Source: http://www.gilgitbaltistan.gov.pk/DownloadFiles/ADPS/ADP2016-17.pdf

provide partial subsidization, combined with increased premium rates to improve the sustainability of program. Providing partial subsidy instead of full subsidy may also help set up incentive for microinsurer to control cost.

The risk adjustment payment practice in developed countries show that upcoding patients to diagnosis codes with higher price is a possible response of hospital/physician to price/subsidy change (Dafny, 2005). Upcoding is also a possible problem given it is difficult and expensive for the government to verify all maternity diagnosis information of program participants in the context of microinsurance. So microinsurer (and the healthcare providers) may have the motivation to upcode for higher subsidies. Therefore, the government should consider this reaction, and apply an effective method to monitor the claim process is necessary.

Our paper intends to provide an ex ante simulation of the impact of risk adjustment subsidy on the sustainable operation of microinsurance. The data analysis is based on the AKAM program. The concept and method are universal and they could be applied further to other programs and could be expanded to all kinds of healthcare services (instead of just maternity related service) if government fund is sufficient. But the actual magnitude of decrease in loss ratio cannot be directly assumed for other micro health insurance programs, given the enrollment and claim patterns are not the same. Further research on risk adjustment in other micro health insurance programs are needed to reach a generalized conclusion on policy impact.

Reference

Aggarwal and Aradhna. (2010) ‘Impact evaluation of India’s ‘Yeshasvini’ community-based health insurance program’, *Health Economics* 19 (Supplement): 5-35.

Alexander, D. (2016), ‘How do doctors respond to incentives? Unintended consequences of paying doctors to reduce costs’, working paper, http://scholar.princeton.edu/sites/default/files/dalexand/files/alexander_jmp.pdf

Ankrah, O.E., P. Akweongo, B. Yankah, F. Asenso-Boadi, I. Agyepong, (2013) ‘Sustainability of recurrent expenditure on public social welfare programmes: expenditure analysis of the free maternal care programme of the Ghana National Health Insurance Scheme”, *Health Policy and Planning* 29: 271-279.

Beck, K., Trottmann, M., and Zweifel, P. (2010) ‘Risk adjustment in health insurance and its long-term effectiveness’, *Journal of Health Economics* 29(4): 489-498.

Biener, C. and Eling, M. (2011) ‘The performance of microinsurance programs: a data envelopment analysis’, *Journal of Risk and Insurance* 78(1): 83–115.

Buchner, F., D. Goepffarth, and J. Wasem, (2013) ‘The new risk adjustment formula in Germany: Implementation and first experiences’, *Health Policy* 109: 253-262.

Clement, O. N. (2009) ‘Asymmetry information problem of moral hazard and adverse selection in a national health insurance: the case of Ghana national health insurance’, *Management Science and Engineering* 3(3): 101-106.

Cole, S. (2015) ‘Overcoming barriers to microinsurance adoption: Evidence from the field’, *The Geneva Papers on Risk and Insurance - Issues and Practice* 40(2): 720-740.

Dafny, L.S. (2005) ‘How do hospitals respond to price changes?’ *American Economic Review* 95: 1525-1547.

Desai, S., Sinha, T., and Mahal, A. (2011) ‘Prevalence of hysterectomy among rural and urban women with and without health insurance in Gujarat, India’, *Reproductive Health Matters* 19(37): 42-51.

Dror, D., Soriano, E., Lorenzo, M., et al. (2005) ‘Field based evidence of enhanced healthcare utilization among persons insured by micro health insurance units in Philippines', *Health Policy* 73(3): 263-271.

Mark Duggan, M. (2004) 'Does contracting out increase the efficiency of government programs? Evidence from Medicaid HMOs', *Journal of Public Economics* 88(12):2549–2572.

Dumont, A., Fournier, P., Abrahamowicz, M., Traoré, M., Haddad, S., and Fraser, W. D. (2013) 'Quality of care, risk management, and technology in obstetrics to reduce hospital-based maternal mortality in Senegal and Mali (QUARITE): a cluster-randomized trial'. *Lancet* 382(9887): 146-157.

Eggleston, K., and Bir, A. (2009) 'Measuring selection incentives in managed care: Evidence from the Massachusetts state employee insurance program', *Journal of Risk and Insurance* 76(1): 159–175.

Ellis, R. P. (2008) 'Chapter 8. Risk adjustment in health care markets: concepts and applications', *Financing Health Care New Ideas for A Changing Society*.

Ettner, S. L., McGuire, T. G., Newhouse, J. P., et al. (1998) 'Risk adjustment of mental health and substance abuse payments', *Inquiry A Journal of Medical Care Organization Provision and Financing* 35(2): 223-39.

Frimpong, J. A., Helleringer, S., Awoonorwilliams, J. K., et al. (2014) 'The complex association of health insurance and maternal health services in the context of a premium exemption for pregnant women: A case study in northern Ghana', *Health Policy and Planning* 29(8): 1043-1053.

Geruso, M., and McGuire, T. G. (2016) 'Tradeoffs in the design of health plan payment systems: Fit, power and balance', *Journal of Health Economics* 47(1): 1-19.

Glazer J. and McGuire, T. G. (2000) 'Optimal risk adjustment in markets with adverse selection: An application to managed care', *American Economic Review* 90(4): 1055-1071.

Gruber, J. and M. Owings. (1996) 'Physician financial incentives and cesarean section delivery', *RAND Journal of Economics* 27(1): 99-123.

Islam, M. T., Igarashi, I., and Kawabuchi, K. (2012) 'The impact of Gonoshasthaya Kendra's micro health insurance plan on antenatal care among poor women in rural

Bangladesh' *Bioscience Trends* 6(4): 165-175.

Leibowitz, A. Buchanan, J. L. and J. Mann. (1992) 'A randomized trial to evaluate the effectiveness of a Medicaid HMO', *Journal of Health Economics* 11(3):235–257.

Jütting, J. P. (2004) 'Do community-based health insurance schemes improve poor people's access to health care? Evidence from rural Senegal', *World Development* 32(2): 273-288.

Kautter, J., Pope, G.C., Ingber, M., Freeman, S., Patterson, L., Cohen, M., Keenan, P. (2014) 'The HHS-HCC risk adjustment model for individual and small group markets under the Affordable Care Act', *Medicare & Medicaid Research Review* 4(3): 16.

Liu, X., Yan, H., and Wang, D. (2010) 'The evaluation of 'safe motherhood' program on maternal care utilization in rural western China: A difference in difference approach', *BMC Public Health* 10(1): 1-6.

Maciejewski, M. L., Liu, C. F., and Fihn, S. D. (2009) 'Performance of comorbidity, risk adjustment, and functional status measures in expenditure prediction for patients with diabetes' *Diabetes Care* 32(1): 75.

Mcquestion, M. J., and Velasquez, A. (2006). 'Evaluating program effects on institutional delivery in Peru', *Health Policy* 77(2): 221-232.

Newhouse, J. P., M. Price, J. Huang, J. M. McWilliams, and J. Hsu (2012) 'Steps to reduce favorable risk selection in Medicare Advantage largely succeeded, boding well for Health Insurance Exchanges', *Health Affairs* 31(12): 2618-2628.

Okusanya, B. O., Roberts, A. A., Akinsola, O. J., et al. (2015) 'Birth plans and health insurance enrolment of pregnant women: A cross-sectional survey at two secondary health facilities in Lagos, Nigeria', *Journal of Maternal-Fetal and Neonatal Medicine*: 1-5.

Pope, G. C., Kautter, J., Ellis, R. P., et al. (2004) 'Risk adjustment of Medicare capitation payments using the CMS-HCC model' *Health Care Financing Review* 25(4): 119.

Radermacher, R., Srivastava, S., Walsham, M., et al. (2016) 'Enhancing the inclusion of vulnerable and high-risk groups in demand-side health financing schemes in

Cambodia: A concept for a risk-adjusted subsidy approach'. *The Geneva Papers on Risk and Insurance - Issues and Practice* 41(2): 244-258.

Schokkaert, E., and Van, d. V. C. (2003) 'Belgium: Risk adjustment and financial responsibility in a centralized system', *Health Policy* 65(1): 5.

Shen, Y., and Ellis, R. P. (2002) 'Cost-minimizing risk adjustment', *Journal of Health Economics* 21(3): 515-530.

Smith, K. V., and Sulzbach, S. (2008) 'Community-based health insurance and access to maternal health services: Evidence from three West-African countries', *Social Science and Medicine* 66(12): 2460-73.

Tsai, C. L., Clark, S., Sullivan, A. F., and Jr, C. C. (2009). 'Development and validation of a risk-adjustment tool in acute asthma', *Health Services Research* 44(5p1): 1701–1717.

Van de Ven, W., Ellis, R. P., (2000) 'Risk adjustment in competitive health plan markets', In: Culyer, A.J., Newhouse, J.P.(Eds.), Handbook of Health Economics. North-Holland.

Van Kleef, R. C., R. C. V. Vliet, and W. P. M. M. Van de Ven, (2013) 'Risk equalization in the Netherlands: An empirical evaluation', *Expert Review of Pharmacoeconomics & Outcomes Research* 13(6): 829-839.

World Health Organization [WHO], UNICEF, United Nations Population Fund [UNFPA], World Bank; United Nations. Population Division. (2014) *Trends in maternal mortality: 1990 to 2013.*

Wipf, J., and Garand, D. (2008). 'Performance indicators for microinsurance: A handbook for microinsurance practitioners', ADA, BRS and CGAP working group on microinsurance.

Yao, Y., Schmit, J. T., and Sydnor, J. R. (2015). 'The role of pregnancy in micro health insurance: Evidence of adverse selection from Pakistan', *Journal of Risk and Insurance,* forthcoming.

Yao, Y., Chen, Y., and J. Shi, (2017) 'Payment reform in social health insurance: Commentary of international and domestic research progress on China's practice', *China Health Economics* 4: 36-39.

Appendix

Table A1 Summary of average bill (in Pakistan rupees) for maternity related claims

Diagnosis	Claim count	Average bill
Abortion	160	4,829
Fetal distress	260	18,217
Infection, antepartum	44	5,327
Normal delivery	1,865	2,759
Pregnancy, other complications	179	12,460
Premature labor	32	7,893
Ectopic pregnancy	6	23,886
Pregnancy	6	2,723
Abscess of breast, postpartum	4	7,652
Labor, prolonged	4	7,237
Obstruction, delivery	4	18,711
Placenta previa, without bleeding, severe	4	2,933
Vomiting, pregnancy	3	7,290
Placenta previa, without bleeding, light	2	2,042
Sepsis, neonatal	2	12,265
Abortion, severe	1	4,922
Colic, infantile	1	1,903
Endometritis, postpartum	1	15,656
Fetal movement, decreased	1	2,816
Hemorrhage, severe	1	4,078
Post-term infant	1	4,374
Pre-eclampsia	1	5,122
Vomiting, pregnancy, severe	1	868
Total	2,583	5,330

Note: Statistics above are based on 15,373 claim records. The first six types with claim count greater than 10 are used in regression as independent risk adjustors, and the rest of them are groups as miscellaneous maternity claims.

Table A2 Summary Statistics of Maternity Related Claim Amount by Diagnosis Type

Maternity Related Claims by Diagnosis Type			
Abortion		**Fetal distress**	
Number	160.00	Number	260.00
Mean	3,936.11	Mean	17,927.36
S.D.	2,204.76	S.D.	3,269.09
Minimum	540.00	Minimum	857.00
25th percentile	2,523.50	25th percentile	16,513.00
Median	3,659.00	Median	17,561.50
75h percentile	4,938.50	75th percentile	19,358.00
Maximum	13,966.00	Maximum	30,000.00
Infection, antepartum		**Normal delivery**	
Number	44.00	Number	1,865.00
Mean	2,005.30	Mean	2,571.44
S.D.	1,294.70	S.D.	1,801.12
Minimum	496.00	Minimum	277.00
25th percentile	1,222.50	25th percentile	1,426.00
Median	1,529.50	Median	2,201.00
75th percentile	2,496.50	75th percentile	3,072.00
Maximum	5,841.00	Maximum	18,299.00
Pregnancy, other complications		**Premature labor**	
Number	179.00	Number	32.00
Mean	9,403.77	Mean	1,945.47
S.D.	7,605.41	S.D.	1,399.88
Minimum	278.00	Minimum	415.00
25th percentile	1,743.00	25th percentile	899.50
Median	7,004.00	Median	1,525.00
75th percentile	17,015.00	75th percentile	2,111.00
Maximum	25,000.00	Maximum	5,976.00
Miscellaneous maternity claims		**No claim**	
Number	43.00	Number	11,487.00
Mean	6,383.40		
S.D.	8,485.01		
Minimum	505.00		
25th percentile	1,150.00		
Median	2,018.00		
75th percentile	5,041.00		
Maximum	26,597.00		

Note: Statistics above are based on 15,373 claim records.