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“Cost Effectiveness Analysis: Health Sector”

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**Resumen Ejecutivo**

Improvements in health conditions of the population are shown in a better quality of life, in individual welfare, and also in the development of the society. The economic growth in the past decades (5% average in the last 15 years; BCRP) allowed important advances in the Peruvian health sector. As consequence, key indicators of the sector's development such as child and maternal mortality, and chronic malnutrition, shows a decreasing trend. In spite of the advances, Peru still presents high indicators of health deficiency in comparison with other countries, in part due to the low budget assignation that the health sector manages. Even though the sector budget has increased in the past years, it's still limited. For the year 2009 the public health budget was 5,735 millions of Nuevos Soles, which represent 7.2% of the Total Budget (SIAF, 2009); or around 1.5% of the GDP. This low assignation restricts the necessary advances in effective coverage and even more, limits the advance in reducing the gap between rural and urban areas. Clearly, this is added to the inefficiencies that take place in the system that doesn't allow for an optimized use of the resources. The budget assigned is particularly low considering that Peruvian government is implementing a policy of universal insurance. No country has been able to apply a universal insurance policy with a public health budget less than at least 6% of their GDP. This document is focused on improving government expenditure in the health sector, particularly on the maternal and neonatal health expenditure. For this purpose the central section of this work is a Cost Effectiveness Analysis (CEA) of government expenditure and policies to increase institutional deliveries -deliveries in health establishments. This analysis is particularly important as the budget for maternal and neonatal health has entered a reform process in the framework of the Result Based Budget. This reform intent to change the way budget is assigned and thus the distribution of money for different health policies. Policy recommendations for this particular subsector are fundamental at the time.

Palabras clave: Health, Budget, Cost Effectiveness Analysis, Peru.

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## INTRODUCTION

Improvements in health conditions of the population are shown in a better quality of life, in individual welfare, and also in the development of the society. The economic growth in the past decades (5% average in the last 15 years; BCRP) allowed important advances in the Peruvian health sector. As consequence, key indicators of the sector's development such as child and maternal mortality, and chronic malnutrition, shows a decreasing trend. Furthermore, in the last decades, progress related to the health services access has been made, as well as increasing the health insurances rates. These programs increase the welfare of the population.

In spite of the advances, Peru still presents high indicators of health deficiency in comparison with other countries, in part due to the low budget assignation that the health sector manages. Even though the sector budget has increased in the past years, it's still limited. For the year 2009 the public health budget was 5,735 millions of Nuevos Soles, which represent 7.2% of the Total Budget (SIAF, 2009); or around 1.5% of the GDP. This low assignation restricts the necessary advances in effective coverage and even more, limits the advance in reducing the gap between rural and urban areas. Clearly, this is added to the inefficiencies that take place in the system that doesn't allow for an optimized use of the resources. The budget assigned is particularly low considering that Peruvian government is implementing a policy of universal insurance. No country has been able to apply a universal insurance policy with a public health budget less than at least 6% of their GDP.

Moreover, even though policies in the last years intent to focus in the poorest, the inequality is still an important problem the sector must resolve. For example, there have been great advances related to institutional deliveries which allowed that 80% of pregnant women access them in 2009. Nevertheless, this result is a national average that hides strong inequalities between rural and urban areas. The Health Demographic Survey (ENDES, 2009) shows that while in the urban area 93% of pregnant women received professional medical attention, in the rural area, just 57% access them.

Health care requires government intervention in order to guarantee the population well being at minimum cost. However, in Peru, household financing of the medical services occupied the first financing source (37% in 2005, OPS/OMS Peru, 2005). Government is just the third source of financing the medical expenses (24% in 2005). Households' contribution is made, mainly, through pocket expenditure in a country where more than one third of the population is poor. This fact limits access to health services only to those who can afford it, while low income households have a higher risk of being excluded from access to these services. In developed countries, financing depend mostly from public treasury or social security for health funds; thus, payment is made before the occurrence of the attention though insurance mechanisms and the configurations of funds that allow risk-diversification (OPS/OMS Peru, 2005).

This document is focused on improving government expenditure in the health sector, particularly on the maternal and neonatal health expenditure. For this purpose the central section of this work is a Cost Effectiveness Analysis (CEA) of government expenditure and policies to increase institutional deliveries -deliveries in health establishments. This analysis is particularly important as the budget for maternal and neonatal health has entered a reform process in the framework of the Result Based Budget. This reform intent to change the way budget is assigned and thus the distribution of money for different health policies. Policy recommendations for this particular subsector are fundamental at the time.

Before presenting the Cost Effectiveness Analysis, we make a description of the PSMN because it is the framework in which policy recommendations will have to be implemented. The second section is a summary of the government objectives regarding maternal health and institutional deliveries. The third section describes the current situation of institutional deliveries in Peru, making emphasis in potential differences among marginalized groups. The information in this section will serve as a baseline to evaluate the gap between the current situation and the government goals and will also help understand the impact evaluation. Sections 3 and 4 are the core of this work as they contain the impact and cost estimations respectively. Finally section 5 contains the cost-effectiveness estimations and the policy recommendations. Section 6 concludes.

## I. INSTITUTIONAL DELIVERIES AND THE STRATEGIC PROGRAM OF MATERNAL AND NEONATAL HEALTH

Although Peru has been experiencing important economic growth for the last fifteen years<sup>1</sup>, development indicators, especially the ones related to poverty and health, have not experienced enough improvements. This is particularly true for the maternal and child health indicators.

Maternal mortality rate (MMR) and proportions of professionally attended deliveries are widely accepted indicators for maternal health. In Peru, the maternal mortality rate in year 2005 was 164 per 100,000 live births and the proportion of deliveries that received assistance from specialized sanitary staff was 72%. Both indicators are well above those from developed countries and even the Latin America & Caribbean average. Moreover, there are dramatic differences between Peruvian regions.

In developed countries, in year 2006, the MMR was around 9 per 100,000 live births and the proportion of deliveries attended by skilled health care personnel was 99% (United Nations, 2008). According to the same source, MMR for Latin America & Caribbean, on average, is 130 per 100,000 live births, and 86% of deliveries are attended by skilled health care personnel.

Moreover, as it is common in Latin American countries (OPS-OMS, 2007), national averages hide important differences among regions and socioeconomic sectors. One of the most important differences is among rural and urban population. For instance, institutional delivery rates are quite different: in 2009, while 93% of deliveries are institutional in urban areas, only 57% are institutional in rural areas. Women in urban areas also attend more prenatal checkups, are more likely to receive assistance by health staff during deliveries, and make more use of birth control methods.

Birth attention is highly important to reduce MMR; proper care during delivery has a relevant impact in overall maternal and infant health. Complications during delivery are an important cause of maternal mortality. According to MINSa (MEF, 2008), in 2003, hemorrhage was the first cause of maternal death (43%) followed by hypertensive diseases of pregnancy (14%), sepsis (8%) and unsafe abortion (8%); and these reasons have not change in the last years. All these complications have a higher probability of being solved if the delivery takes place in an adequate facility with skilled health staff.

Regarding neonatal and child health, and according to studies in Peru, the principal causes of neonatal deaths are the respiratory disorders proper of the neonatal period (in the rural areas the 60% of the neonatal deaths are attributed to asphyxia), the low birth weight, neonatal sepsis, and

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<sup>1</sup> The country's GDP has grown 4.15% in average since 1990 and 6.2% in the 2002-2007 period.

congenital malformations. The respiratory disorders are related to two factors: the labor and obstetric complications, and the low weight birth and prematurity.

To improve government expenditure for combating these issues the Strategic Program of Maternal and Neonatal Health was created in 2008. It was part of a group of five budgetary programs created in the Performance Based Budget framework, all of which continues for 2009 and 2010. This strategic program received 361'623,892 Nuevos Soles in 2008, which represents 0.5% of Peruvian Government Budget and 4% of the budget for the Ministry of Health for that year. This budget was distributed among the Ministry of Health (34%), the Integral Health Insurance (23%) and the regional authorities (43%) to perform specific activities to accomplish the goals stated below. The activities of the program include broadening the attention of deliveries in institutional establishments, improvements in hemotherapy, increase childbearing women affiliated to SIS and the elaboration of technical guidelines for maternal and neonatal attention.

Formally, the Strategic Program of Maternal and Neonatal Health (PSMN) seeks to improve women and children's health. The principal interventions of this program focus in three different moments of life cycle<sup>2</sup>:

Before pregnancy: The program looks to increase the population with knowledge in sexual and reproductive health, and that have access to birth control methods through:

- Setting up healthy town councils, communities, schools and families that stimulate sexual and reproductive health.
- Increasing the availability and access to sexual and reproductive health counseling, and to birth control methods.

During pregnancy and labor: The program seeks to reduce maternal mortality and morbidity through:

- Increase the access to quality prenatal services for pregnant women. These include diagnose and appropriate treatment for the complications that appear during pregnancy, like anemia, sexually transmitted diseases, and urinal infections.
- Increase the proportion of deliveries in qualified health establishments.
- Increase the access to establishments with the right capacity to solve basic, essential and intensives obstetric emergencies.
- Raise the access to the net of hemotherapy centers.

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<sup>2</sup> MEF. Maternal and Neonatal Health Strategic Program

- Strengthen the reference system concerned with its organization, operations and financing.

During neonatal period (the first 28 days of the newborn): The program looks to reduce neonatal mortality and morbidity through:

- Increase the proportion of deliveries in qualified health establishments.
- Increase the access to establishments with the adequate capacity to solve basic, essential and intensive neonatal emergencies.

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#### A. GENERAL GOALS

The four principal goals of this program are (see Table 1):

##### **Conduction of the management of the strategy**

This objective can be considered as the link between the government and society. For this program, the information has been gathered in three different ways: reports of the responsible institutions for the execution of activities and services related to the advances and problems that are facing up for the program implementation, reports of the MEF related to the budget implementation and the accomplishment of the specific goals established in the strategic program, and reports of the effectiveness performance of the local services in the chosen territories.

##### **Population with knowledge on sexual and reproductive health, and with access to birth control methods**

The ENDES 2000 reported that in Peru:

- Almost all the women know or have heard about at least one birth control method, being the most known the pill (95%) and the injection (96%).
- The lowest percentages of birth control methods users are located in rural areas, in the departments of Huancavelica and Ayacucho; there, just one out of two women uses a birth control method.
- One of every ten women needs knowledge about birth control methods, mainly to limit the family size.



### **Reduction of maternal mortality and morbidity**

Peruvian Government has prioritize institutional birth when considered reducing maternal mortality as the first National Sanitary Objective in its National Coordinated Health Plan (2007-2020), with the specific goals of reducing teenage pregnancy; complications during pregnancy, delivery and post delivery; and broadening access to different birth control methods.

### **Reduction of neonatal mortality and morbidity<sup>3</sup>**

According to data from MEF, the neonatal mortality rate (produced in the first month of life) is 10.6 per a thousand live births for the urban areas and 18.7 for the rural areas. The MEF and MINSA have proposed to take as indicators the neonatal mortality rate per thousand of live births and the institutional birth coverage in pregnancy women from rural areas.

However, according to a 2009 evaluation on the progress of the PSMN, budget was not assigned to the new components of the strategic program: health infrastructure, improvement of resolute capacity of health facilities and blood banks. This evaluation also highlights an uneven distributed budget in terms of the size of the problem along different regions. Finally, this evaluation also suggests needed improvements in hemotherapy through investment in “access of pregnant women to safe blood” and “blood Banks”.

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<sup>3</sup> Cooperative Roundtable on the Fight against Poverty (“Mesa de Concentración para la Lucha contra la Pobreza”). Following Monitoring Maternal and Neonatal Health Strategic Program. June Report 2008.

**Table 1: Main goals of the Maternal and Neonatal Health Program**

Goal	Component Objectives	Inputs	Indicators
Improve women and children's health	Conduction of the management of the strategy	Management of the strategy	Proportion of supervised establishments with maternal and neonatal health services
		Regulation of the provision and funding of maternal and neonatal attention	Number of regulations about maternal and neonatal health
	Population with knowledge on sexual and reproductive health and that have access to birth control methods	Population informed about sexual and reproductive health	Proportion of women in childbearing age with knowledge of any birth control method
		Access to birth control methods and counsel on sexual and reproductive health	Proportion of women with unsatisfied birth control methods demand
	Reduction of Maternal mortality and morbidity	Pregnant women have access to prenatal attention services of quality and complications are attended according to resolutive capacity	Proportion of pregnant women with 6 prenatal checkups
			Proportion of pregnant women with at least one prenatal checkup in the first trimester
		Pregnant women have access to qualified delivery attention and normal and complicated puerperium services according to resolutive capacity	Proportion of attended deliveries in health establishments that fulfill obstetric and neonatal functions
			Proportion of complicated deliveries attended in health establishments that fulfill Obstetric and Neonatal Functions (FON)
		Pregnant women have access to safe blood and components	Number of viable investment profiles
			Proportion of pregnant women with hemorrhage diagnosis that receive safe blood transfusion
		Pregnant women have access to maternal and neonatal reference and counter-reference according to resolutive capacity	Proportion of pregnant women with referred complications that were attended in health establishments with basic, essential or intensive obstetric and neonatal functions (FONB, FONE or FONI)
			Proportion of referred complicated neonates that were attended in FONB, FONE or FONI
	Reduction of neonatal mortality and morbidity	Neonates have access to normal neonatal attention services	Percentage of institutional attention of the newborn
		Neonates have access to services with resolutive capacity to attend neonatal complications	Proportion of complicated neonates attended with FONB, FONE, FONI
		Neonates have access to intensive care neonatal services	Proportion of complicated neonates attended in ICU

Source: MEF

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## B. QUANTITATIVE GOALS

There are three main sources to determine and follow government's goals regarding institutional deliveries. The main one comes from the result based budget, which has objectives towards 2011, and is the more reliable in terms of data gathering. The indicators for this goal are<sup>4</sup>:

- To reduce MMR from 185 to 120 per 100,000 live births by 2011.
- To reduce MMR to 66 per 100,000 live births by 2020.
- To increase the rate of institutional delivery coverage in rural areas from 42.9% to 70% by 2011, with quality and within the cultural context of the population.

Information available for these goals is presented in Table 2.

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<sup>4</sup> Peruvian Ministry of Health. (2007). *National Coordinated Health Plan*. MINSA, Lima. Page 21.

**Table 2: Advancement in the indicators for the maternal and neonatal health program**

Goals	Indicators	Estimates		Progress
		2007	2009	
<b>Final Goals</b>				
Improve Maternal and Neonatal Health	Neonatal Mortality Rate – Number of children born alive that die before being one month old by thousand live births	15	13	No Progress
	Rate of maternal Mortality – Maternal deaths by 100 000 live births	Data not available		
<b>Intermediate Goals</b>				
Population with knowledge of sexual and reproductive health and accesses methods of family planning	Global Fertility Rate – average expected births by women for all her reproductive age	2.4	2.6	No Progress
	Number of couples protected – percentage of married women in fertile age using family planning methods	73.1	73.2	No Progress
Reduction of maternal morbidity and mortality	Coverage of institutional delivery for women in rural areas	49.4	55	No Progress
	Coverage of cesarean section for women in rural areas – percentage of rural women who gave birth by cesarean section	7	7.5	No Progress
Reduction of neonatal morbidity and mortality	Proportion of newborns attended in health establishments	76.6	79.8	Progress
	Proportion of live births under 37 weeks of pregnancy	14.7	15.0	No Progress
	Proportion of newborns with complications attended at health establishments	Data not available		

Government statistics show a decrease in neonatal mortality rate from 15 by thousand live births to 13 by thousand live births. In addition to the final goals, the maternal and neonatal health program includes intermediate and immediate goals. One intermediate goal is reducing maternal morbidity and mortality and one of the indicators is coverage of institutional deliveries for rural areas.

The government, through the Congress, set to increase the coverage of institutional deliveries in rural areas up to 70% for the year 2011. In 2007, the rate was 49.4%; it rose to 55% in the year 2009. There is a 15 percentage points gap to fulfill. We use this goal as the basis for our cost estimations. If the proportion of rural deliveries over national deliveries stays at 36%, then the increase to 70% of rural institutional deliveries would imply a global increase on institutional deliveries to 85%.

The other two sources of information on government goals for institutional deliveries are:

a) The United Nation's Millennium Development Goals with the Peruvian government commitment towards fulfilling them on 2015 and with monitoring on the advances by the Presidency of the Chamber of Ministers (PCM). However, many of the global objectives do not have quantitative objectives for Peru. There is not enough information from the millennium development to quantify government goals regarding institutional delivery.<sup>5</sup>

b) The National Coordinated Health Plan with goals for 2011 and 2020.<sup>6</sup>

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<sup>5</sup> PCM (2009) "Resumen ejecutivo informe del cumplimiento de desarrollo del milenio Perú- 2008" Available in: <http://www.onu.org.pe/upload/documentos/IODM-Peru2008.pdf>

<sup>6</sup> MINSA(2007) "Plan Nacional Concertado de Salud" Available in: [www.lachealthsys.org](http://www.lachealthsys.org)

## II. SITUATION OF INSTITUTIONAL DELIVERIES

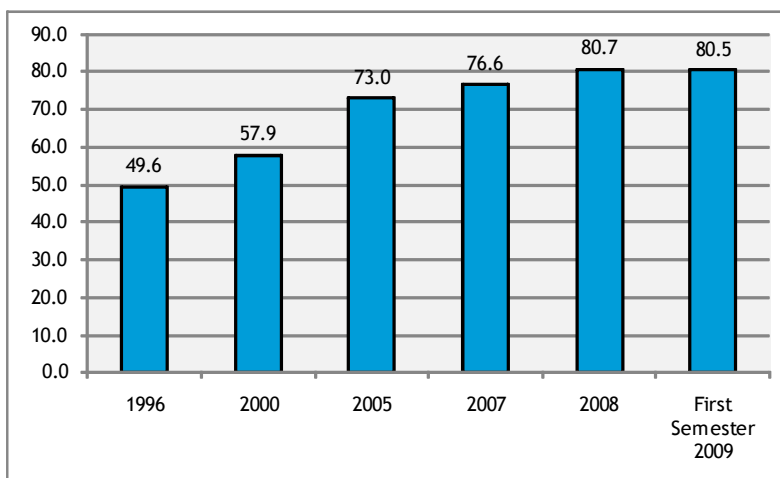
Diagnosing and reviewing the current state of birth attention is important in order to execute interventions directed to broaden birth institutional attention, and specially, focusing on the poorest population. The following section presents charts and graphs with descriptive statistic that depicts the situation on institutional deliveries and other key variables. The statistics estimated for this section are primarily based on the ENDES 2009, a national health and demographic household survey.

The ENDES survey takes into account demographic and social characteristics of women in childbearing age and of children younger than 5 years old. It is the most trustworthy data set with more detailed information regarding pregnancy, delivery and post delivery characteristics and it is representative on a national, regional and by area of residence (urban/rural) level.

### 1. INSTITUTIONAL DELIVERY

The official figures for institutional deliveries from Peruvian National Statistics Institute (INEI) show an increasing trend of institutional deliveries for the last years (see Graphic 1).

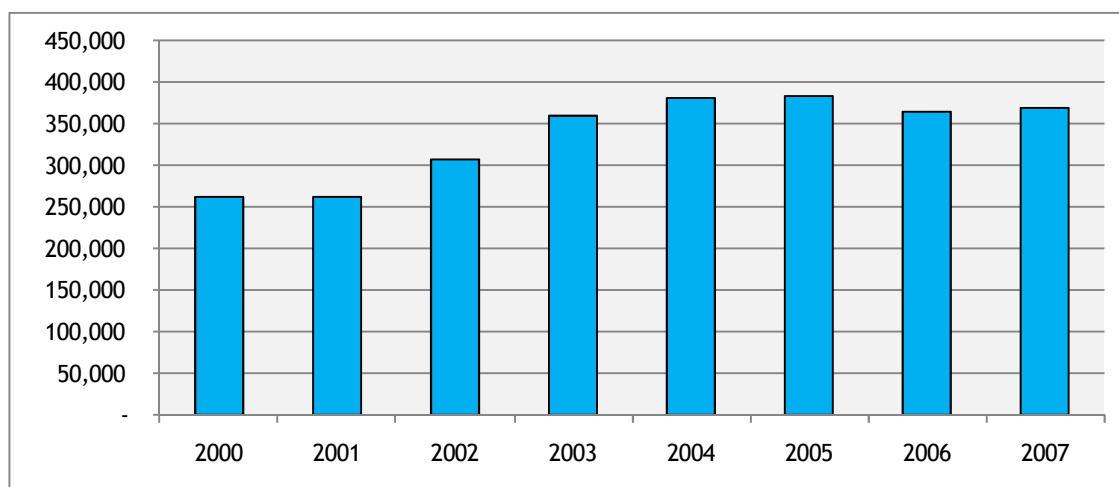
**Graphic 1: Proportion of deliveries in health establishments**



Source: INEI-ENDES

Our estimations for the year 2009 show 80% coverage of institutional deliveries. Regarding deliveries performed in MINSA's establishments, Graphic 2 shows the evolution from year 2000 until 2007.

**Graphic 2: Institutional deliveries attended in MINSA's Establishments (2000-2007)**



Source: MINSA-OGEI

Even though the overall trend is positive, the real increment took place until 2004, maintained in 2005, and dropped in 2006. Some possible explanations for the decrease of total MINSA attended deliveries are:

- Health management is going through, along other public programs, a decentralization process. MINSA has transferred resources, which implies more autonomy for each region, but it has the counterpart of MINSA losing leadership<sup>7</sup>. Different country regions have different health priorities besides delivery, possibly affecting institutional deliveries.
- By September of 2005, a regulation for the appointment of MINSA personnel was approved<sup>8</sup>. It stated that, starting in 2006, health professionals such as nurses, obstetricians and others would be appointed in their positions inside MINSA. This implied a migration of professionals to principal cities for administrative positions, therefore, reducing attention in many establishments, especially in the countryside.
- Policy measures of increasing the number of obstetrician implied hiring more male obstetrician for the most faraway places, however, due to cultural costumes, women did not like a male doctor attending them.

Moreover, there are wide disparities among different places of residence. Table 3 shows the differences among rural and urban households. According to ENDES 2009, while more than 9 of every ten women have an institutionally attended delivery in urban areas, just half of the women in rural areas have one.

<sup>7</sup> Information obtained through interviews with MINSA personnel.

<sup>8</sup> Peruvian Health Ministry (MINSA) Press Release, September 2005.

Available in: [http://www.minsa.gob.pe/ocom/prensa/notadeprensa.asp?np\\_codigo=2874&mes=9&anio=2005](http://www.minsa.gob.pe/ocom/prensa/notadeprensa.asp?np_codigo=2874&mes=9&anio=2005)

Even though ENDES show an improved situation in the rural area compared to year 2000, where, according to ENDES, only 24% of rural deliveries were made at institutional establishments, there is still, four of every ten women in this zone who don't have and institutional delivery, and the urban/rural gap is yet far from being closed.

Similarly, women who had institutional deliveries in urban areas, have better access to obstetricians and doctors -the type of personnel MINSA considers capable of conducting a proper delivery- and access to health establishments with higher level of capacity of resolution than women in rural ones.

**Table 3: Type of Delivery by geographic location**

	Non-ID	ID by Doctor or Obstetrician	ID by other personnel	TOTAL
Urban	7%	92%	1%	100%
Rural	43%	51%	6%	100%
<b>TOTAL</b>	<b>20%</b>	<b>77%</b>	<b>3%</b>	<b>100%</b>

Source: ENDES 2009

Table 4 shows institutional deliveries by natural region. In this case, as well, there are significant difference between the coast and the rest of the country. While in Lima-Metropolitan area, only 2% of the deliveries are non-institutional, in the highland and in the jungle, more than 30% are non-institutional deliveries. Moreover, there is a significant gap between women in Lima and other coastal regions, and women from the rest of the country in the access to doctors and obstetricians.

**Table 4: Type of institutional delivery by natural region**

	Non-ID	ID by Doctor or Obstetrician	ID by other personnel	TOTAL
Lima-metropolitan area	2%	97%	1%	100%
Other coastal	8%	91%	1%	100%
Highland (sierra)	32%	63%	5%	100%
Jungle (selva)	36%	60%	4%	100%
<b>TOTAL</b>	<b>20%</b>	<b>77%</b>	<b>3%</b>	<b>100%</b>

Source: ENDES 2009

Table 5 shows that according to ENDES 2009, 39 women of every 100 women who had an institutional delivery deliver their children in Ministry of Health (MINSA) hospitals. Thus, MINSA's hospitals are the most important place of delivery. However, women's or midwife's homes are the second most important place of delivery where 19 of every 100 women give birth. This fact implies a high risk for women and their babies because of complications not attended by professional staff in an adequate environment.



Notice also that 8 of every 100 institutional deliveries is performed in a MINSA's health post establishment which, catalogued by the Ministry of Health, as incapable to attend this type of interventions because of their low level of complexity and low capacity of resolution<sup>9</sup>.

**Table 5: Place of delivery by geographic location**

	Total	Urban	Rural
Hospital MINSA	39%	48%	23%
Hospital Essalud	10%	15%	2%
Hospital FFAA/PNP	0%	1%	0%
Health Center MINSA	15%	14%	16%
Health Post MINSA	6%	2%	13%
Center/Post Essalud	1%	2%	0%
Private Practice	8%	11%	1%
Women's or Midwife's house	19%	6%	42%
Other	1%	1%	2%
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Source: ENDES 2009

Differentiating according to places of delivery by area of residence, Table 5 also shows that nearly half of the women living in urban zones give birth in MINSA's hospitals and 6% do it in their own or at her midwife's homes. The situation is different for rural areas, where only 23% of all women give birth in MINSA's hospitals and 42% of them do so in their own or at her midwife's homes. Another relevant difference is the attention in health posts. Even though posts are not places recommended by MINSA to give birth, yet 13% of women in rural areas that have an institutional delivery attended a health posts, almost 7 times more than women in urban areas. This shows even more inequalities in access to health services between populations living in different areas.

The delivery establishment is useful as a proxy to quality of attention received in institutional deliveries. Assuming that the best place to give birth at is a hospital, and the worst, your own house or other place, then urban household not only have more access to delivery health services, but also they have better access in terms of quality than rural households.

Another proxy to quality is the caregiver capability to lead the delivery. Doctors and obstetricians are the first in the ranking, followed by nurses, health specialists (sanitarios), traditional birth

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<sup>9</sup> Health posts shouldn't attend deliveries unless is an imminent one, while health centers are capable of attending deliveries with skilled health professionals and proper equipment. The situation is different for Health Centers and Posts from Essalud, because Essalud Health Posts do count with at least one obstetrician, and have the capability to perform them.

attendants and the rest of possible caregivers, including health auxiliary personnel, technicians, friends or family, among others.<sup>10</sup>

Table 6 presents crossed information between place of delivery and type of health professional assisting delivery. This table shows an expected higher participation of doctors and obstetricians for institutional deliveries. The importance of the category “others” is quite relevant among non institutional deliveries; even though there is nothing certain about the level of skills and type of care caregivers in the “others” category<sup>11</sup>.

In terms of differences in the quality of delivery attention among urban and rural women by type of caregiver, Table 6 shows that even when the delivery is institutional, rural women are more likely to be attended by a nurse or an obstetrician, rather than a doctor. If the delivery is non institutional, the proportions are similar but urban women are more likely to be attended by a doctor or obstetrician, while the “others” category is greater for rural women.

**Table 6: Caregiver assisting delivery by geographic location and type of delivery**

		Doctor	Obstetrician	Nurse	Health Specialist	Traditional Birth attendant	Other	No one	Total
Non Institutional Delivery	Total	4.0%	7.9%	4.7%	0.4%	37.8%	43.9%	1.3%	100%
	Urban	12.6%	10.8%	2.5%	1.3%	37.7%	34.1%	1.2%	100%
	Rural	1.4%	7.1%	5.4%	0.1%	37.8%	46.9%	1.3%	100%
Institutional Delivery	Total	60.9%	35.6%	2.6%	0.1%	0.0%	0.8%	0.0%	100%
	Urban	67.3%	31.5%	1.0%	0.0%	0.0%	0.3%	0.0%	100%
	Rural	42.1%	47.9%	7.2%	0.2%	0.1%	2.4%	0.0%	100%

Source: ENDES 2009

<sup>10</sup> If the woman reported more than one caregiver for her delivery (in ENDES), it is considered that the delivery was in charge of the most qualified type of caregiver listed.

<sup>11</sup> The “Others” category is constructed in this case considering deliveries attended by a “health worker” (not a specialist), a friend or relative or the “others” category of ENDES which is any uncoded person. The proportions of these differ by area of residence. In the aggregate, the proportion of relatives or friends is higher than the rest of the categories, while in the urban zone the “others” are more important. For the rural area, the relatives or friends are the main component of the proportion shown in Table 6.

## INSTITUTIONAL DELIVERY AND WOMEN AND HOUSEHOLDS' CHARACTERISTICS

Tables 7 to 11 sums up the situation of delivery among three features: the women's highest completed level of education, mother tongue, and household's wealth quintile using ENDES 2009.

**Table 7: Distribution of deliveries by education level and area of residence**

	Non Institutional Delivery			Institutional Delivery		
	Total	Urban	Rural	Total	Urban	Rural
No education, Preschool	9%	4%	11%	2%	1%	7%
Primary	63%	52%	66%	23%	14%	50%
Secondary	24%	31%	22%	47%	51%	37%
Higher	4%	13%	1%	27%	34%	6%
<b>TOTAL</b>	100%	100%	100%	100%	100%	100%

Source: ENDES 2009

Most of women giving birth in an institutional facility have completed secondary or superior education (74% of institutional deliveries), while 72% of women giving birth in non institutional places have not completed secondary education at all, according to ENDES. This shows a clear correlation between educative level and type of delivery, where, the more educated the woman, the more likely she is to have an institutional delivery.

Table 8 shows that completing primary education increases the probability of having an institutional delivery by 9 percentage points while finishing secondary education increases the likelihood in 20 additional percentage points.

**Table 8: Rate of institutional delivery by education level**

	Rate of Institutional Delivery
No Primary	51%
Primary	60%
Secondary	89%
Higher Education	96%
<b>TOTAL</b>	80%

Source: ENDES 2009

Another important characteristic is mother's tongue due the large number of different cultures living in the country. Table 9 shows the proportion of institutional and non institutional deliveries for several language categories.

**Table 9: Proportion of deliveries by mother's language and area of residence**

	Total		Urban		Rural	
	NID	ID	NID	ID	NID	ID
Spanish	17.2	82.8	6.9	93.1	42.9	57.1
Quechua	37.6	62.4	27.1	72.9	38.6	61.4
Aymara	48.6	51.4	47.7	52.4	48.7	51.3
Other indigenous languages	84.5	15.5	73.1	26.9	85.2	14.8

\*NID= Non Institutional Delivery; \*ID= Institutional Delivery

Source: ENDES 2009

Spanish speakers have the highest rate of institutional delivery (83%) followed by Quechua speakers (62%), Aymara speakers (51%), and other indigenous language speakers (16%). For the latter, a possible explanation is that selvatic regions have the lowest ratio of doctors and obstetricians per 10000 habitants; there aren't enough health professionals to tackle demand. Moreover, establishments in Aymara and Sylvan languages areas count, mostly, with health technicians and auxiliaries in health posts. Even though they do speak native languages, they are neither qualified nor authorized to conduct deliveries. Even though there is a clear supply side problem to handle institutional deliveries for these population, customarily, Aymara and selvatic women also prefer to give birth on their own and aren't used to go to health establishments.

To capture exclusion and inequalities in access to institutional delivery, we consider the wealth quintile distribution among institutional and non institutional delivery. When considering wealth, differences between the richest and the poorest quintiles are broad. In the poorest quintile, 50% of women have an institutional delivery, while in the richest one, 98% of women have it.

**Table 10: Proportion of deliveries by wealth quintile and area of residence**

	Total		Urban		Rural	
	NID	ID	NID	ID	NID	ID
Poorest Quintile	50.4	49.6	31.3	68.7	52.6	47.4
Second Quintile	23.5	76.5	16.2	83.8	32.2	67.8
Third Quintile	6.7	93.3	5.3	94.7	17.1	82.9
Fourth Quintile	3.0	97.0	3.1	96.9	0.2	99.8
Richest Quintile	2.4	97.6	2.4	97.6	0.0	100

\*NID= Non Institutional Delivery; \*ID= Institutional Delivery

Source: ENDES 2009

## INFORMATION ACCESS

Tables 11 through 14 present evidence on how access to information affects institutional deliveries. The variables considered are frequency of reading newspaper and frequency of listening radio. As can be seen, reading a newspaper or magazine, even if it is less than once a week, is a strong indicator of a better chance of having an institutional delivery. Table 11 presents the difference; from women who had non institutional deliveries, 42% don't read newspapers or magazines. Even women who read less than once a week show an important increase in the likelihood of having an institutional delivery. Table 12 shows this relationship clearly: the institutional delivery rate for women who don't read paper is 56%, while women who read more than once a week have a rate of 91%.

**Table 11: Distribution of deliveries by frequency of reading and type of delivery**

	For women who had ID	For women who had Non ID	For all deliveries
Doesn't read paper	14%	42%	19%
Less than once a week	56%	49%	55%
More than once a week	10%	4%	9%
Every day	20%	4%	17%
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

**Table 12: Type of institutional delivery by frequency of reading**

	Rate of Institutional Delivery
Doesn't read paper	56%
Less than once a week	82%
More than once a week	91%
Every day	95%
<b>TOTAL</b>	<b>80%</b>

In terms of frequency of listening radio, the impact of accessing this media on institutional delivery is less evident, nevertheless still important. The rate of institutional deliveries is 58% for women who don't listen to the radio and up to 79% for women who do listen to it. Let it be noted that around 98% of women said they listened to radio while only 80% said they read a newspaper or magazine.

**Table 13: Distribution of deliveries by frequency of listening to radio and type of delivery**

	For women who had ID	For women who had Non ID	For all deliveries
Doesn't listen to the radio	4%	7%	5%
Less than once a week	37%	37%	37%
More than once a week	3%	3%	3%
Every day	56%	53%	55%
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

**Table 14: Type of institutional delivery by frequency of listening to radio**

	Rate of Institutional Delivery
Doesn't listen to the radio	70%
Less than once a week	80%
More than once a week	81%
Every day	81%
<b>TOTAL</b>	<b>80%</b>

## INSURANCE

SIS (standing for Integral Insurance of Health in Spanish) is a government's health insurance program directed to poor people with less access to medical services. It counts, by the end of 2009, with 11'815,242 insured (SIS, 2008). Data from SIS states that they attended over 317,000 deliveries during 2009. To see SIS effectiveness in broadening institutional delivery coverage, Table 15 shows the type of delivery for women affiliated to SIS by area of residence.

**Table 15: Type of institutional delivery by affiliation to SIS and area of residence**

	SIS Insured
<b>Total</b>	
Non Institutional Delivery	30.4
Institutional Delivery	69.6
<b>Urban</b>	
Non Institutional Delivery	10.9
Institutional Delivery	89.1
<b>Rural</b>	
Non Institutional Delivery	43.7
Institutional Delivery	56.3

Source: ENDES 2009

In aggregate, despite the majority of women affiliated to SIS (69%) have an institutional delivery, one out of three affiliated prefer to give birth at home by themselves or with a traditional birth attendant. The situation is particularly critical in rural areas, where almost half the women

affiliated to SIS have a non institutional delivery. Table 16 shows institutional delivery coverage for poorest women in rural areas.

**Table 16: Type of delivery for rural women from the poorest quintile by SIS affiliation**

	NID	ID
<b>Total</b>	50.4	49.6
Not affiliated to SIS	54.3	45.7
Affiliated to SIS	48.8	51.2

\*NID= Non Institutional Delivery; \*ID= Institutional Delivery

Source: ENDES 2009

Table 16 shows how, for the poorest women in rural areas, affiliation to SIS does make a significant difference: the proportion of women giving birth at institutional establishments differs by 5.5 percentage points if they are affiliated to SIS or not. However, there is still an enormous amount of poor women affiliated to SIS giving birth in a non institutional setting. This fact raises questions about the effectiveness and the quality of information that SIS affiliates receive regarding the best ways to give birth. It also raises questions about the availability of health services even for affiliated to SIS; woman could be affiliated, but still the health establishment is too far away, or doesn't have a qualified staff or medical equipment necessary, so she still prefers to give birth somewhere else; usually, at home.

Tables 17 and 18 present institutional and non institutional deliveries for poor women (first and second income quintiles, respectively). The second row is the proportion of women affiliated to SIS at national level. Only 66% of expecting women from the poorest income quintile were affiliated to SIS; 51% had an institutional delivery. For women in the second lowest income quintile, 46% were affiliated to SIS and 76% of them had an institutional delivery. The coverage of SIS for pregnant women is still too low in these lowest income quintiles.

**Table 17: Type of delivery by affiliation to SIS of women in the poorest income quintile**

	Total	Affiliated to SIS	Not affiliated to SIS
<b>Total</b>	100.0	65.7	34.3
Non Institutional Delivery	50.4	48.8	54.3
Institutional Delivery	49.6	51.2	45.7

Source ENDES 2009



**Table 18: Type of delivery by affiliation to SIS of women in the second poorest income quintile**

	Total	Affiliated to SIS	Not affiliated to SIS
<i>Total</i>	100.0	45.8	54.2
Non Institutional Delivery	23.5	23.8	23.3
Institutional Delivery	76.5	76.2	76.7

Source: ENDES 2009

In terms of poverty itself, when poor women do not access to ID, not only the probability of death (for them and their children) is higher, but also the consequences are more dangerous, because the lower access to health care; post-delivery complications as well as problems for the newborn wouldn't be, most likely, adequately treated, generating a more health deficient population and reinforcing a vicious circle of diseases and poverty. According to the National Statistics and Information Institute (INEI), 35% of Peruvian population was poor in 2009.

Work should still be done by the Peruvian government to increase the number of women affiliated to SIS as well as to improve the ratio of institutional delivery among women affiliated to SIS.

## 2. Supply Resources

### Specialized services and infrastructure

SIS was created in 2002 absorbing the Child and Maternal Health Insurance. Since then, it has then broadened its coverage. Attentions related to maternal health services from year 2005 to 2007 are shown in Table 19.

**Table 19: SIS attentions 2005-2007**

SIS attentions	Year		
	2005	2006	2007
Deliveries	290,476	281,123	275,782
Cesarean sections	51,762	56,671	58,752
Prenatal attentions	1,587,762	1,710,545	1,779,591
Intensive Care Attentions	722	696	663
Transfers	22,742	24,313	25,787
Iron for pregnant women	905,939	1,171,043	1,277,151
Folic Acid for pregnant women	324,334	561,321	742,808
Complicated pregnancy or post-delivery	160,993	179,747	188,428
Deliveries with complications that required surgical intervention	25,602	33,754	38,332
Post-delivery attentions	294,221	304,296	310,590

Source: SIS

The delivery attentions have drop since 2005, information consisted with MINSa data. The number of cesarean sections has increased importantly, however, as well as the number of prenatal attentions and the provision of iron and folic acid for pregnant women. This is probably showing that the maternal care has become more complete in a sense that it attends women not only during delivery but during the entire process of pregnancy, delivery and post-delivery. Prenatal checkups could be more important now because Juntos program, government's conditional cash transfer program, has the attendance to these checkups as mandatory to receive the benefits of the program. Juntos started in 2006.

As part of the Performance Based Budget, Peruvian Ministry of Health established physical goals for several indicators, including delivery attentions. Table 20 shows the goals per region and type of delivery attention expected compared with the number of women in fertile age by region and live births per year. The goals show incongruence; there are regions where the goal is seven times the live births per year.

**Table 20: Physical goals for the Performance Based Budget Program: Maternal and Neonatal Health, 2008**

Region	Normal Delivery Attention	Non Surgical Complicated Delivery attention	Surgical Complicated Delivery attention (cesareans)	Total Delivery Attentions (a)	Women in fertile age	Live Births per year (b)	Goal's Coverage of Total Births (a)/(b)	Rural Institutional Deliveries coverage per region
<i>Amazonas</i>	3533	442	692	4667	88563	8380	55.7%	52.2%
<i>Ancash</i>	17516	859	2744	21119	310235	19366	109.1%	60.3%
<i>Apurimac</i>	61122	596	1046	62764	93601	7938	790.7%	90.8%
<i>Arequipa</i>	15389	550	3470	19409	326500	18297	106.1%	86.1%
<i>Ayacucho</i>	20183	3136	3067	26386	146176	11669	226.1%	69.2%
<i>Cajamarca</i>	19101	3198	2364	24663	347158	27326	90.3%	39.6%
<i>Callao</i>	12120	545	3934	16599	249680	861463	1.9%	97.9%
<i>Cusco</i>	27733	3660	3429	34822	295444	20463	170.2%	69.0%
<i>Huancavelica</i>	13103	2302	1996	17401	104646	8654	201.1%	54.0%
<i>Huánuco</i>	13665	4484	2147	20296	185156	14663	138.4%	67.6%
<i>Ica</i>	23397	257	407	24061	194547	13320	180.6%	93.5%
<i>Junín</i>	20822	3580	3149	27551	319572	21851	126.1%	68.6%
<i>La Libertad</i>	26615	3885	6664	37164	428104	31971	116.2%	62.1%
<i>Lambayeque</i>	45930	927	1096	47953	305157	20705	231.6%	83.9%
<i>Lima</i>	97332	17997	33753	149082	2446521	132652	112.4%	96.1%
<i>Loreto</i>	44698	3714	4649	53061	217614	25483	208.2%	44.9%
<i>Madre de Dios</i>	4979	275	413	5667	29144	2489	227.7%	86.8%
<i>Moquegua</i>	1742	162	585	2489	44477	2468	100.9%	91.0%
<i>Pasco</i>	1813	222	351	2386	73306	5150	46.3%	68.7%
<i>Piura</i>	48871	5747	7362	61980	435466	36092	171.7%	74.6%
<i>Puno</i>	29279	4610	4385	38274	325592	20781	184.2%	42.4%

<b>San Martín</b>	16038	1094	1449	18581	180464	15634	118.8%	71.0%
<b>Tacna</b>	1532	90	1342	2964	85166	4567	64.9%	83.5%
<b>Tumbes</b>	2067	70	110	2247	53849	4136	54.3%	95.4%
<b>Ucayali</b>	12173	655	1817	14645	110911	11203	130.7%	71.1%
<b>TOTAL</b>	<b>580753</b>	<b>63057</b>	<b>92421</b>	<b>736231</b>	<b>7397049</b>	<b>1346721</b>	<b>54.67%</b>	<b>57%</b>

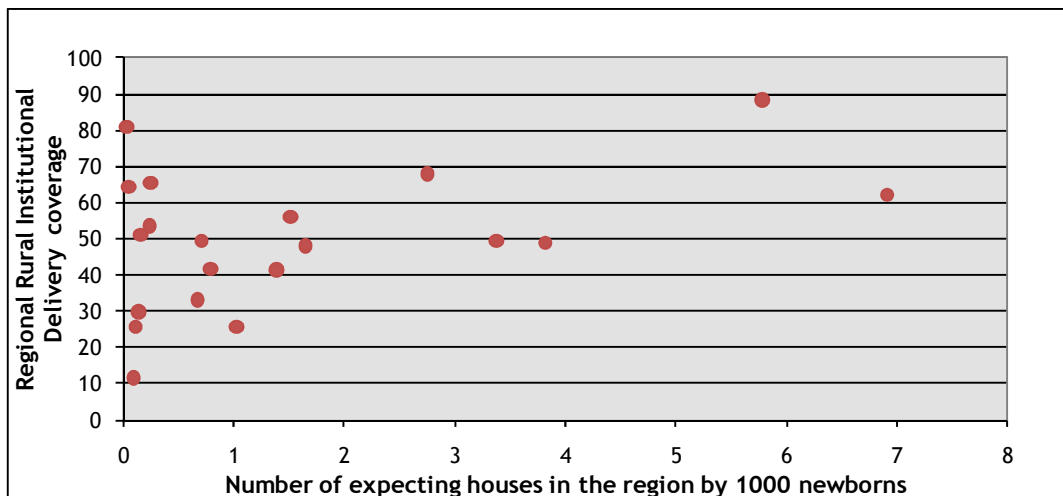
Source: MEF, 2007 Census

Regarding the goals for cesareans, they are mostly around the 15% WHO standard, the national average is 13% of cesareans; there are, however, some differences among regions: Tacna, Moquegua and Callao have more than 23% of cesareans, while Ica, Lambayeque and Tumbes have less than 5% of programmed cesareans.

One important and relatively recent government's strategy in the maternal care field is the habilitation of "Expecting Houses", developed since 1997 as an attempt to overcome the distance barrier that kept women from giving birth in health establishments. These expecting houses are places where pregnant women and some relatives can live until they give birth, and are equipped to solve unexpected emergencies.

By June 2010, 405 of these expecting houses were distributed throughout the country. Graphic 3 show their allocation in the region controlled by regional 1000 newborns.

**Graphic 3: Number of Expecting Houses by regional rate of rural institutional delivery**



\*This graph considers Peruvian regions with at least one expecting house (Tacna, Tumbes, Madre de Dios and Ica are excluded)

Cusco has the largest amount of Expecting Houses (140) and a proportion of rural institutional deliveries of 62% (the ninth highest among the 24 regions)<sup>12</sup>.

To analyze more specifically the availability of MINSA's infrastructure specialized in maternal care, Table 21 presents the latest FON evaluation. FON states for Obstetrical and Neonatal Functions (Funciones Obstétricas y Neonatales, in Spanish). MINSA performs evaluations of the capacity of resolution for establishments with FON since 2007 (authorized to perform obstetric and neonatal interventions).

There are four types of FON according to their level of complexity, from the simpler to the most complex one: Primary Obstetrical and Neonatal Functions (FONP), Basic Obstetrical and Neonatal Functions (FONB), Essential Obstetrical and Neonatal Functions (FONE) and Intensive Obstetrical and Neonatal Functions (FONI)<sup>13</sup>.

Thus, Table 21 presents the results from the FON evaluation for Capacity of Resolution (CR) at a national level for all available MINSA's Health Directions.

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<sup>12</sup> Information has been requested through several means regarding specific locations of the expecting houses, however it hasn't been provided and, therefore, no distinction can be made between rural and urban located ones.

<sup>13</sup> See Appendix 1 for a more complete description of the FON levels.

**Table 21: Results from FON evaluation all available Health Directions <sup>1/</sup>**

**(2007-2008)**

		2007	2008
<b>Total MINSA's establishments</b>		<b>6486</b>	
<i>Number of evaluated establishments with FON</i>	<i>FONP</i>	3611	3773
	<i>FONB</i>	455	472
	<i>FONE</i>	72	85
	<i>FONI</i>	1	1
	<i>TOTAL</i>	4139	4331
<i>Capacity of Resolution (CR)</i>	<i>CR larger than 80% for FONP</i>	852	955
	<i>CR larger than 80% for FONB</i>	164	187
	<i>CR larger than 80% for FONE</i>	38	49
	<i>CR larger than 80% for FONI</i>	1	1
	<i>CR larger than 80% for FON</i>	1055	1192
<i>% of FON Health Establishments with adequate CR</i>	<i>FONP</i>		25.31
	<i>FONB</i>		39.62
	<i>FONE</i>		57.65
<i>% of Health Establishments that applied FON evaluation</i>		63.80	66.77
<b><i>% of Health Establishments with more than 80% of CR</i></b>		<b>25.50</b>	<b>27.50</b>
<i>Percentage of Advance in FON Application</i>		2.98	
<i>Increment percentage of Health Establishment with adequate CR</i>		2.00	

1/ Tumbes, Lima Norte and Ayacucho Health Directions didn't present the information

At a national level, the percentage of health establishments with a CR for FON higher than 80% is 27.5%, which implies that almost three of every four health establishments that can, legally, attend deliveries, doesn't have enough CR to do so<sup>14</sup>. This situation is predominant among the Primary FON establishments, which are the most numerous and, generally, the closest to poor people or those with limited access to more complex or alternative health institutional services.

These results show the deficient services and infrastructure supply Peruvian government has to offer in maternal care. Some improvements have been made in the last years, even from 2007 to 2008, when the proportions of establishments with an adequate CR increased 2 percentage points. However, more improvements should be performed if the National Sanitary Objectives and the Millennium Development Goals are to be fulfilled on time, so maternal and infant deaths can be significantly reduced.<sup>15</sup>.

In terms of human resources, two problems are important. The first one is the deficiencies in the number of professionals needed to fulfill the demand requirements. As an example, WHO reported, for 2005, the number of physicians by ten thousand inhabitants in Peru as 11.7 while the average for Latin America was 18,4. The second one is an allocation problem: there is a bad distribution of professionals and this is a management and a legal problem. At this point, the public sector laws regarding human resources, is inadequate. For instance, it is not possible to move professionals from one place (district or region) to another without professionals' contentment.

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<sup>14</sup> As can be seen in Table 21, the cut point to determine "adequate" CR is 80%, meaning that if an establishment has a Capacity of Resolution (CR) of more than 80%, then it's considered able to perform adequately institutional deliveries. The cut point is the standard that MINSa works with.

<sup>15</sup> If all establishments performed the FON Evaluation, it would be possible to match the places where women were attended with the CR of those establishments. This would be a powerful tool to concentrate efforts to improve delivery attentions where is more needed. Unfortunately, this is not the case.

### III. EFFECTIVENESS EVALUATION

As a way to ascertain the relation between the availability of health services and the probability of having an institutional delivery in a public health establishment, to measure the effectiveness of policies designed to increase the rate of institutional deliveries<sup>16</sup>, we calculated an econometric model, using an ordered logistic regression, because the dependent variable is of binary outcome –whether the woman had an institutional delivery.

Even though we would like to use information on maternal mortality, this information is scarce; yet it is possible to rely on the well studied premise that institutional delivery (ID) is an important factor in preventing maternal mortality, and that a strong negative correlation has been found between MMR and ID for the 2000-2002 period in Peru. Internationally, ID has been found as good predictor of MMR as showed by Fortney et al., 1985; Walker et al., 1985; McCarthy et al., 1992 and Graham et al., 2001, among others.

This model uses various types of input variables. First, a number of variables describing women characteristics: frequency of reading newspaper, woman's native language, where the household is located, among other variables affecting woman's demand for health services. Second, variables describing woman's usage of health and prenatal services - affiliation to insurance, number of antenatal controls, usage of government's assistance programs. Finally, the supply-side variables measuring the amount of health resources available at the woman's district: number of doctors, obstetricians and nurses per thousand inhabitants in the district and number of health centers and posts per thousand inhabitants in the district.

We constructed a database combining information from the ENDES health survey, the Health Information System (HIS) from the Ministry of Health (MINSa) and the schooling census. The ENDES contains information on deliveries and demand control variables. The ENDES survey also contains information on insurance coverage including coverage by SIS - one of the policy variables. The HIS contains information on health establishments and human resources at district level. The schooling census has information on child undernourishment and participation in government programs -Crecer and Juntos<sup>17</sup>. Given the differences in year data collection from the various sources, our database contains information from 2005 to 2008, for all women in fertile years.

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<sup>16</sup> Raising the number of institutional deliveries is not an outcome -it is in fact an output variable. Thus, we are estimating the marginal cost of an institutional delivery. However, we are using institutional deliveries in the regression instead of an outcome variable –such as the likelihood of an infant death or a birth complication- because of data limitations.

<sup>17</sup> The Crecer Program is an articulated development program which seeks to reduce poverty by utilizing very focalized government intervention. It is articulated because it includes intervention by regional, distrital and central government institutions. The Juntos program is a conditional.



## 1. MODEL

The model was defined as a binomial discrete selection model because the dependable variable – institutional deliveries- only take the values of 1 or 0. Specifically, the model –specified to quantify the effects of different policy variables on the incidence of institutional deliveries- is a logit discrete selection one, represented as:

$$p = \frac{e^{x'\beta}}{1 + e^{x'\beta}}$$

The estimated model is:

$$x'\beta = \beta_0 + \beta_1 \text{Woman} + \beta_2 \text{Household} + \beta_3 \text{District} + \beta_4 \text{Insurance} + \beta_5 \text{Prenatal} + \beta_6 \text{Prof} + \beta_7 \text{Estab} + \xi$$

Where:

- **Woman** includes the following variables:
  - Women's level of education measured in single years.
  - Women's frequency of reading newspaper or magazines. Takes the value of 0 if she doesn't read any and 1 if she reads less than once a week.
  - A dummy variable that takes the value of 1 if the woman's mother language is Quechua and 0 otherwise.
  - A dummy variable that takes the value of 1 if the woman's mother language is Aymara and 0 otherwise.
  - A dummy variable that takes the value of 1 if the woman's mother language is indigenous and different from Quechua or Aymara and 0 otherwise
  - The number of children including the current child
  - Women's age at the moment of birth
- **Household** includes:
  - Dummy variables for the household's wealth quintiles
  - The household's cluster altitude
  - A dummy variable which takes the value of 1 if the household is located in a rural area
- **District** includes the following variables:
  - The logarithm of the districts child malnutrition rate
- **Insurance** includes the following variable:

- A dummy variable for affiliation to SIS health insurance, takes the value of 1 if affiliated and 0 otherwise.
- A dummy variable for affiliation to a health insurance different from the SIS.
- **Prenatal** includes the following variable:
  - A variable that takes account of the number of prenatal checkups only if at least one was performed by either a doctor or an obstetrician.
  - A multiplicative variable that takes into account the interaction between SIS insurance and prenatal checkups.
- **Prof** includes the following variables:
  - The number of MINSA's nurses per 1000 habitants of the district.
  - The number of MINSA's obstetricians per 1000 habitants of the district.
- **Estab** includes the following variables:
  - The number of MINSA health centers per 1000 habitants in the district.
  - The number of MINSA health posts per 1000 habitants in the district.
- $\xi$  is the error term

The model is estimated for the complete sample and for a sample including only rural households, because of the government goals for institutional deliveries specially set for the rural area. Policy recommendations and their implementation must vary according to location.

For the final estimation, two variables have been instrumentalized due to potential endogeneity problems: prenatal controls and affiliation to the SIS.

In the case of the "Prenatal variable", it is possible that willingness to attend prenatal checkups is correlated to the willingness to attend an institutional delivery. Both of them indicate an unobservable advantage a woman might have, like proximity to a health facility, or personal recognition of the importance of maternal health. Since willingness is not captured in the model, it may generate a correlation between the prenatal variable and the dependable variable.

In the case of the "affiliation to SIS" it is possible that women are more likely to get SIS affiliation if they are expecting to get pregnant and are willing to have an institutional delivery.

In both cases, an instrumental variable method was used to correct the problem. For the first stages, a least squares method for the prenatal regression and a logit specification for the SIS variable were used, against a set of exogenous variables included in the original model. The prediction was used as an instrument in the logit regression.

We are less concern about an endogenous program placement –government constructing more hospitals, health centers and posts as well as assigning more obstetricians and nurses in low institutional delivery regions – because the correlation coefficients between the number of health establishments and the poverty level -and thus, institutional delivery-, by region show a weak relationship between these variables.

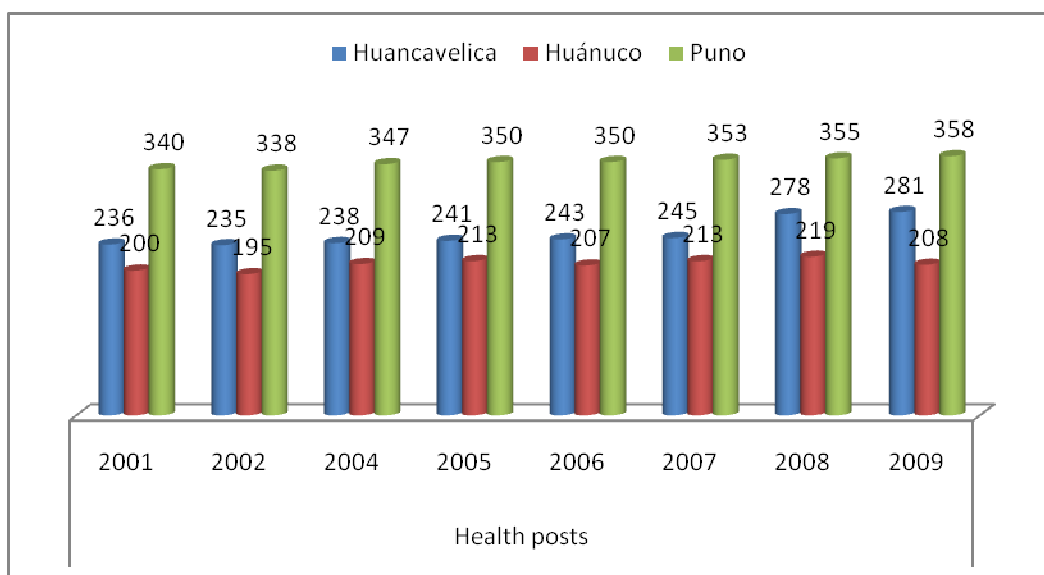
**Table 22: Correlation between health establishments and poverty level by regions**

Type of health facility	2001	2005	2009
Hospital	0.09	-0.22	-0.01
Health Center	0.12	-0.12	0.05
Posts	0.33	0.51	0.25

Source: INEI

Even though, the correlation between health posts and poverty level is higher, a more detail analysis of the data proves no significant variation over time. Graphic 4 present data on the number of health posts by region over time for three poorest regions in Peru - Huancavelica, Huánuco and Puno. According to the INEI, these regions were in 2000 among the five regions with the lowest institutional delivery. Despite, the number of health posts has not change significantly.

**Graphic 4: Number of health posts in Huancavelica, Huánuco and Puno, by years**



Source: INEI

## 2. RESULTS

Resulting coefficients for the complete model and for the rural sector are presented in Table 23.

**Table 22: Results from effectiveness evaluation model**

	Complete Model	Rural Model
<b>WOMAN Variables</b>		
Education	0.0616622	0.050198
Paper	0.0322503	0.121383
Quechua	0.5951073	0.873293
Aymara	-0.6691742	-0.51752
Other indigenous language	-1.342463	-1.19904
Children	-0.1652892	-0.15895
Age	0.0405503	0.03876
<b>HOUSEHOLD Variables</b>		
Wealth 1	-1.190265	-1.13902
Wealth 2	-1.084501	-1.01779
Wealth 3	-0.4745966	-0.34813
Altitude	-0.00012	-0.00011
Rural	-0.617209	

<b>INSURANCE Variables</b>		
Other_Insurance	0.5515561	0.776565
SIS*	0.6119348	0.840952
<b>Prenatal Variables</b>		
Antenatal*	0.1765799	0.190959
SIS x Antenatal	0.0667883	0.062747
<b>DISTRICT Variables</b>		
Obs_per1000	0.1649748	0.124468
Nur_per1000	0.2310663	0.187501
Cen_per1000	0.0684363	0.161009
Pos_per1000	0.0594537	0.039847
Log_undernourishment	-0.3742722	-0.2308826
<b>CONSTANT</b>	<b>-63.94642</b>	<b>-85.30028</b>

\* Denotes where an instrumental variable has been used

All coefficients in the table are significant at 5%

The results for both models are consistent with the theoretical framework as well as the descriptive statistics section. For the WOMAN variables, the coefficient associated with the years of education and the frequency of reading newspaper are positive. The educative level and the frequency of reading newspapers are variables reflecting the quantity and, most likely, the quality of information a woman has; thus, they affect positively the probability of having an institutional delivery. As for the mother language variables, the Aymara and other indigenous language variables have a negative coefficient, reflecting the negative impact on institutional delivery rates. The number of children presents a negative effect on the rate of institutional delivery. The model estimation also shows that older women are more likely to attend an institutional delivery.

The wealth index, the household location (rural/urban) and the cluster altitude (households located in higher altitudes have a lower probability of having an institutional delivery) are measures of access to health services.

For the Insurance and Prenatal variables, we expected positive coefficients and they are, in fact, positively correlated to the dependable variable. Having insurance implies lower costs for the delivery attention; it should increase the probability of insured women attending an institutional delivery. Prenatal checkups give relevant information to pregnant women and a better informed woman is more likely to give birth at a better establishment (if possible). Prenatal checkups also provide opportunities to detect potential risks in women. Thus, prenatal checkups are shown as very important determinants for institutional deliveries.

The positive coefficient of the multiplicative variable between prenatal controls and affiliation to SIS (SIS\*antenatal) reflects complementarities among these variables; for instance, women affiliated to the SIS may access more prenatal controls.

In terms of the supply side variables -physical and human resources- we expected a positive effect on institutional deliveries. Having more obstetricians and nurses, as well as having more centers and posts in the region are useful to increase institutional delivery. The magnitudes of these coefficients are important for policy recommendations. Thus, in Table 24 marginal effects for key variables, for both the complete sample and the rural model, are presented. This effects show the impact on institutional deliveries of increasing one unit of the variables analyzed.

**Table 234: Marginal effects from the effectiveness evaluation model**

	Complete Model	Rural Model
Other_insurance	0.0467269	0.182654
SIS	0.07764	0.268046
Antenatal	0.016822	0.051291
Obstetrician_per1000	0.016005	0.031046
Nurse_per1000	0.0224169	0.046768
Center_per1000	0.0066393	0.04016
Post_per1000	0.0057679	0.009939

Table 24 suggests that having health insurance increases de likelihood of having an institutional delivery, although SIS insurance is more effective than other insurances, for both the rural model and the complete model. Having SIS insurance increases the probability of having an institutional delivery, on average, 7.7 percentage points for the complete model and 26.8 percentage points for the rural model. We suspect that SIS increases the health professionals and health establishments’ productivity as well.

Using the previously presented information of the coefficients regression, we simulate the rate of institutional delivery for women, under different demand side circumstances. For the complete data sample, the average woman has a 78% probability of having an institutional delivery while the average woman in the rural sample has only a 51% chance.

Using the complete sample coefficients, we simulate the likelihood of women with lowest demand side variables for health but with average supply side variables: they have 14% chance of having an institutional delivery; thus, 1 out of seven women with this characteristics - Aymara woman, with no education, who doesn’t read paper, in the lowest wealth quintile, living in a rural area, with no insurance and not prenatal checkups- access an institutional delivery. On the other hand, a woman belonging to the higher wealth quintiles, with education and reading paper, insured and with prenatal checkups, but still living in a rural area and with the same average supply side variables, has a 98% chance of having an institutional delivery.

As for woman living in urban areas, the average woman has a probability of having an institutional delivery of 93%. If we keep women with the demand characteristics as if they are poor rural

women –lowest demand side variables- but with the supply side and district variables as if they are mean urban districts, her probability of having an institutional delivery would be 28%: 14 percentage points higher than women living in average districts in terms of supply side variables but with lowest demand side characteristics.

It is also possible to estimate the impact of the supply-side variables. For the complete sample, an average woman would have 98% chance of having an institutional delivery if she had the highest per capita rate of nurses and obstetricians’ in the country (5 MINSA nurses and 3.5 MINSA obstetricians per 1000 inhabitants), keeping the physical resources supply at their average. If instead, this woman has the highest rate of physical resources (center and posts) but average nurses and obstetricians, her probability of having an institutional delivery would be 93%.

Table 25 presents the final outputs for both models - complete and rural sample. The table presents the relative coefficients of comparable supply side variables. These ratios give an idea of the relative impact of these variables on institutional delivery: the relative magnitude of one unit increase in obstetricians over nurses as well as the relative importance of one unit increase in centers over posts. This information will be fundamental for the cost effectiveness analysis that will follow in later sections.

**Table 25: Relative impact effects from effectiveness evaluation model**

	Complete Model	Rural Model
Obstetrician / Nurses	0.713972	0.663826
Centers / Posts	1.151086	4.040672

## IV. COST ESTIMATIONS

The cost estimations are the second input needed for the cost effectiveness analysis. There are a number of policy variables that have been identified as significant in the impact estimations. For these variables, cost estimations are required to make the alternative policies comparable. The cost estimation section presents the methodology to calculate the costs as well as the resulting cost estimated.

### 1. METHODOLOGY

The cost estimation for the SIS considers two inputs. Since the SIS is a subsidized insurance program, the main expenses for the program are health providers' compensations for attending SIS insured people. In our case, these transferences are relevant just when finance a delivery. This information was obtained from the independent SIS evaluation, performed in 2009 in the framework of the result based budget. In addition to these transferences, it is important to consider the SIS administrative costs since they are bound to increase in an eventual expansion of SIS coverage. The resulting per capita administrative cost is relatively low.

Given that SIS only transfers variable costs to health providers, we have estimate transfers only over these variable costs. This may underestimate the costs, especially if large increases in coverage are expected. However, no information on fixed cost is available.

Cost estimations for the physical resources supply variables (health posts and health centers) are based on the budget information for the years 2009 and 2010. The cost estimate is the average investment required to build and equip a single facility, data available for some facilities in the budget analysis. Additionally, it is impossible to differentiate the costs of building physical resources by usage. As for the human resources, the cost of providing additional nurses and obstetricians will be the average yearly payment to MINSA's employees. This information is collected directly from MINSA.

### 2. RESULTS

#### SIS COSTS

The cost estimation for SIS is divided in the estimation of variable costs and the individual administrative costs. The variable cost is the tariff SIS pays for delivery attentions. This tariff is 21.5 Nuevos Soles for a normal delivery and 53 Nuevos Soles for a caesarian section. Using Household Survey data it is possible to estimate the proportion of institutional deliveries by caesarean section. This number is 13% for the rural area and 26.5% at national level. Weighting the tariffs by



the proportion of deliveries with and without caesarean section, the average delivery tariff is 29.8 Nuevos Soles nationally and 25.6 Nuevos Soles for the rural area.

As for administrative costs, the executed budget for the year 2009 was 458'519,244 Nuevos Soles. This budget is divided in three programs in the budget report: government planning, management and individual health. Administrative costs are considered in both management and government planning, and they represent 18'919,035 Nuevos Soles from the total budget. To calculate the unitary administrative cost we require an estimation of country wide affiliation to SIS. The SIS website reported 11'815,242 affiliates for the year 2009; this renders a unitary administrative cost of 1.60 Nuevos Soles. When adding this amount to the average tariff for deliveries, we obtain the cost of adding one woman to the SIS and of that woman having an institutional delivery: 31.4 Nuevos Soles at the national level and 27.2 Nuevos Soles for the rural area.

These calculations consider the costs of covering a single woman's delivery needs. If we add the average cost of prenatal attentions, the cost increases. Rural women affiliated to the SIS, averages 5 prenatal attentions while the national average for SIS affiliates is 6. Using crossed frequency between caesarean sections and prenatal attentions performed at formal health establishments, the average cost of insuring a pregnant woman is 66.7 Nuevos Soles for the complete sample and 54 Nuevos Soles for the rural sample. With the administrative costs, costs are 68.3 and 55.6 Nuevos Soles, respectively.

We also need to estimate the cost of other health attentions women affiliated to SIS might have. Budget information for 2009 presents a 100 million Nuevos Soles transfer for the Maternal and Neonatal Health, leaving 335 million of Nuevos Soles transferred for other programs. Dividing these transfers by 11 million affiliates for 2009, we estimate a 28.73 Nuevos Soles additional transfer per affiliate. The estimated cost of affiliating a pregnant woman is 97 Nuevos Soles at national level and 84.3 Nuevos Soles for the rural area. The ENAHO 2009 shows that pregnant woman represent 6.8% of SIS affiliates in the country and 6% in the rural areas: for every pregnant woman in the SIS, there are 14 non-pregnant affiliated in Peru; in rural areas, for each pregnant woman, SIS affiliates 15 additional people. Thus, given the current SIS focalization system, expanding institutional deliveries would imply expanding the whole SIS coverage. Thus, it is necessary to cover a total cost of 513 Nuevos Soles for the complete sample and 560 Nuevos Soles for the rural area.

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## PHYSICAL RESOURCES

Physical resources costs have been estimated using budget data. This data contains cost associated with the construction and equipment of health posts and health centers. Budget costs are assigned according to the National Public Investment System (SNIP). Due to inefficiencies in the project formulation, mostly from municipal governments, the data from the national budget had to be cleansed using the reports from the SNIP. Failure to do so would have resulted in too

much variability for the cost estimations as poorly formulated projects tend to overestimate or underestimate investments.

After the data cleansing process, the cost estimation leads to a cost for health posts of 351,000 Nuevos Soles and of 1'526,000 Nuevos Soles for health centers. This makes the health centers 4.35 times more expensive than the health posts.

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## HUMAN RESOURCES

The human resources costs are the nurses and obstetricians salaries. In Peru, health employees receive, in addition to a fix salary, a number of incentives for their service. These incentives are not the same for all workers and differ greatly between regions and facility levels. Since payment information for nurses and obstetricians is only available for Lima, differentiation between average national payments from average rural area payment is not possible. The best possible estimation is the average fix payment salary for Nurses and Obstetricians in Lima and extending it for the rest of the country. These estimations will be good measures of the relative cost of nurses and obstetricians under two assumptions. The first one is that the difference in variable component of the payments for nurses and obstetricians is proportional to the difference in the fix payments. The second, is that the proportion of the salaries for nurses and obstetricians is, in average, equal in Lima than in other parts of the country.

Thus, the average fix payment in the country for nurses and obstetricians is 986 and 984 Nuevos Soles, respectively. Obstetricians cost, on average, the same as nurses.

## V. COST EFFECTIVENESS ANALYSIS

### SIS CEA

SIS costs to cover pregnant on non pregnant affiliates are estimated in 513 Nuevos Soles at the national level and 560 Nuevos Soles for the rural sample.

A 513 Nuevos Soles yearly investment translates in a 7.7 percentage points increase in the probability of having an institutional delivery for the national sample (see Table 24). An investment of 560 Nuevos Soles translates in a 26.2 percentage points increase in the rural area. Increasing the SIS coverage at the national level is less cost effective than increasing it for the rural areas: the impact in coverage by the yearly investment is greater for the rural sample. While the institutional delivery likelihood increases in 1.5 percentage points by each 100 Nuevos Soles invested at the national level, it increases by 4.7 percentage points for the rural sample; thus, three times more cost effective.

### PHYSICAL RESOURCES CEA

The estimated impact effects for the complete sample are 0.66 percentage points for health centers and 0.57 percentage points for health posts. For the rural sample the impact effects are 4 percentage points for health centers and 1 percentage point of health posts. Given the construction cost - 1.5 million Nuevos Soles for the center and 350 000 Nuevos Soles for the post-health posts are 3.8 times more cost effective than health centers at the national level and 1.08 for the rural area sample.

### HUMAN RESOURCES CEA

An additional Nurse per 1000 inhabitants has an impact effect of 2.24 percentage points for the complete model and 4.67 for the rural sample. For obstetricians per 1000 inhabitants the impact effects are 1.6 and 3.1 percentage points for the national and the rural sample, respectively. The cost of hiring obstetricians –following the assumptions stated in the cost estimation section- is 1 the same as hiring nurses. Thus, nurses are 1.4 and 1.5 times more cost effective than obstetricians for the complete sample and the rural one, respectively.

## VI. CONCLUSIONS

In the last fifteen years, maternal mortality rates have been significantly reduced in Peru. These improvements, however, were neither enough nor solved inequality problems across different groups and areas. Given how scarce information on maternal mortality is, we lay on the premise that institutional delivery is an important factor in preventing maternal mortality, and is a good predictor of this rate (Fortney et al., 1985; Walker et al., 1985; McCarthy et al., 1992; Graham et al., 2001, among others). Institutional delivery has increased significantly in the last decade, but great inequalities still marginalize different groups in the country. Women living in rural areas, the selva region, poor and uneducated women have lower institutional delivery rates than the rest of the population.

Three important barriers to institutional delivery are found: economic, accessibility and cultural barriers. Although important efforts have been made by the government to reduce these barriers, they have primarily been focused on the economic barriers.

One of the most influential government policies to alleviate economic barriers has been the creation of the health insurance program for poor and extremely poor people, SIS. Cost effectiveness analysis provides information on the value of SIS to increase institutional delivery especially in the rural areas.

Accessibility barriers are particularly important, especially in the amazonic region, where geographic dispersion and high transportation costs reduce the possibility to access the health facilities in order to get an adequate attention during delivery. Accordingly, it's important to increase the number of health facilities available as well as improve the existing facilities so a wider range of complications may be addressed. In this sense, it is fundamental to attack the low resolute capacity of the health facilities. The institutions in which mothers give birth must have all the required equipment. More than half the health facilities in the country belong to the lowest resolute capacity, with a very narrow capability to solve problems during the delivery. Even when the cost of transforming these facilities to the second level costs almost two hundred thousand dollars for each facility, MINSA should consider which facilities would be convenient to improve. Cost effectiveness analysis provides evidence of the potential impact of improving health posts. Similarly, it is important to hire the appropriate combination of nurses/obstetricians, following the WHO standards and considering the effectiveness of each type of human resource.

An important experience that has helped increase the institutional delivery and which could be expanded furtherer, are the "waiting houses". Pregnant women can go to these houses some weeks before giving birth and wait for the delivery time closer to a health facility.

Cultural and language barriers are important, as shown by the important disadvantage indigenous minorities present. To combat barriers, the government should expand the cultural adequate deliveries. This adequacy it's based in improving the comfort of the pregnant mother during

delivery. Some of this friendly practices are vertical delivery, the capability of burying the placenta, the presence of relatives during delivery, adjusting temperature of the room to the mothers convenience (rather than the doctor's), among others.

One international experience that should be evaluated to improve the economic barriers is the conditional cash transfer program. The conditional cash transfer program Juntos includes pre and post natal controls for the mother as well as growth controls for the infant as requirements to get the cash transfer. More inclusive mechanisms to account for institutional deliveries as conditions for payments have been used in other countries. India has a well defined program, running since 2005. In four years, it has increased its beneficiaries from 740 000 to 8.43 million (almost a third of the number of women that go into labor each year). For the 2009-2010 fiscal year, it is expected to have 9.5 million women covered with a budget of US\$ 342 million. Positive results were found for this program: the institutional delivery rate was increased (almost in half from a national mean of 54.1%) and prenatal deaths were reduced in 14.2 per every 1000 pregnancies (from a national mean of 37.5).

## PLANS FOR DISSEMINATION

The dissemination of this study will be done considering three spheres: academia, public opinion and public sector.

- ⇒ In the academia level, it is planned to publish the results in the university's journal and magazine. This will be complemented with an exposition of the results in the universities research center (CIUP) with the attendance of researchers and research assistance. The results of these meetings will probably stimulate further research on the effectiveness of public expending in the health sector.
- ⇒ In the public opinion level, meetings with national non-governmental organizations directors will be scheduled when the final version of the CEA has been accepted. This will be done with the intention not only to inform about the results of the research but also to promote their diffusion through their information network and publications.
- ⇒ In the Public sector level, meetings will be scheduled with MINSA's officers to discuss the results of the research.
- ⇒ Additionally, we are creating a micro portal for GDN project -as an extension of the University web page. The portal will include research results, executive summaries of the project, among others.

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- MINSA’s data set on health human resources, 2006 and 2007

## 1. APPENDIX 1 - OBSTETRIC AND NEONATAL FUNCTIONS SPECIFICATIONS

### Obstetric and Neonatal Functions (FON)

FON are activities related with identifying, attending, monitoring and care of gestation, delivery and of the newborn's health, according to the level of complexity of health establishments and to the role these accomplish in local health system. They are typified as following:

### Primary Obstetric and Neonatal Functions (FONP)

They comprehend activities in the maternal, perinatal and birth control that can be done by establishments that count with health technical staff and that may or may not count with health professionals. These health establishments generally give 12 hours attention and eventually 24 hours, they don't have a delivery room, laboratory, newborn immediate attention area or hospitalization area (they are mostly health posts)

Those activities are:

- Basic prenatal and birth control attention.
- Imminent delivery and basic attention of the vigorous newborn.
- Identification and timely transfer of pregnant and puerperian women, and of complicated newborns.
- Obstetric and neonatal emergencies (DST)<sup>18</sup>.
- Post-delivery birth control (orientation/council, provision of barrier, hormonal, oral or injectable methods- transfers should be made for other methods)

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<sup>18</sup> DST: Diagnosing - Stabilization – Transfer.



## Basic Obstetric and Neonatal Functions (FONB)

Comprehend activities in the maternal and perinatal interventions that must be done by all health establishments that count with medical professional staff; obstetrician and nurse. These health establishments generally bring 24 hours attention and have a delivery room, laboratory, newborn immediate attention area and hospitalization area; they don't have surgical centers. (Mostly Health Centers)

Those activities are:

- Prenatal focalized attention and birth control.
- Eutocic delivery and basic normal or with minor problems newborn attention.
- Dystocic delivery or complicated delivery (DST).
- Newborn with complications (DST)
- Not complicated placenta retention.
- Complicated placenta retention (DST).
- Pregnancy induced slight hypertension.
- Pregnancy induced severe hypertension (DST).
- Slight hemorrhage.
- Severe hemorrhage and hypovolemic shock (DST).
- Maternal or neonatal sepsis (DST).
- Incomplete abortion (DST)<sup>19</sup>.
- Vaginal tear level I and II.
- Vaginal tear level II and IV (DST).
- Repair of cervix tear.
- Obstetric surgery (DST).

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<sup>2</sup> It's not DST if the FONB establishment counts with equipment and staff with competences to perform the Manual Vacuum Aspiration (MVA).

- Post-delivery / post abortion birth control (orientation/council, provision of barrier, hormonal, oral or injectable methods and DIU- transfers should be made for other methods)

### **Essential Obstetric and Neonatal Functions (FONE)**

Comprehend activities in the maternal and perinatal interventions that must be done by all health establishments that count with specialized professional staff in gynecologic-obstetrics; pediatrics, surgery, anesthesiology, interns and other specialties such as neonatal nursing. These health establishments generally bring 24 hours specialized attention and have a delivery room, laboratory, newborn immediate attention area, hospitalization area and surgical centers. (Mostly Hospitals)

Those activities are:

- Prenatal focalized attention and birth control.
- Dystocic delivery or complicated delivery (DST).
- Newborn with complications.
- Complicated placenta retention.
- Incomplete abortion.
- Pregnancy induced moderate-severe hypertension and eclampsia.
- Severe hemorrhage and hypovolemic shock.
- Maternal or neonatal sepsis.
- Vaginal tear level II and IV.
- Cesarean
- Laparotomy
- Abdominal Hysterectomy.
- Not complicated surgical neonatal pathology.
- Post-delivery / post abortion birth control (orientation/council, provision of all methods, including voluntary surgical birth control).

### **Intensive Obstetric and Neonatal Functions (FONI)**

Comprehend activities in the maternal and perinatal interventions that must be done by all health establishments that count with specialized professional staff in gynecologic-obstetrics; pediatrics, surgery, anesthesiology, interns, intensivists and other specialties such as neonatal nursing. These health establishments bring 24 hours specialized attention and have a delivery room, laboratory, newborn immediate attention area, hospitalization area, surgical centers and have an *Intensive Care Unit* (ICU) implemented.

Those activities are:

- Prenatal intensive re-focalized attention (APRI).
- Delivery of women with APRI.
- Newborn with complications requiring ICU.
- Complicated incomplete abortion.
- Hypertension induced by delivery, HELLP syndrome attended in ICU.
- Severe hemorrhage and hypovolemic shock requiring ICU.
- Maternal or neonatal sepsis requiring ICU.
- Cesarean of women with APRI.
- Complicated Laparotomy.
- Complicated Abdominal Hysterectomy.
- Complicated surgical neonatal pathology requiring ICU.
- Post-delivery / post abortion birth control (orientation/council, provision of all methods, including voluntary surgical birth control according to patient's condition)

Source: MINSAs-2007

## **2. APPENDIX 2 – SUPPLY GAP IN INFRASTRUCTURE**

Regarding infrastructure and supply of health services, Peruvian government has an initiative of launching universal insurance, for which prepared a technical report of supply deficit in health human resources and infrastructure focusing in the 880 poorest districts of the country. The results indicated that, instead of increasing the number of health establishments, the already existing ones should be improved with better equipment and categorized to attend more complicated needs. There is also an important deficit in the cold chain and in the number of health professional in these districts. The report estimated that an investment of 517.18 millions of Nuevos Soles was needed in a 10 years period to close the estimated gap (ST-CIAS, 2009).

### 3. APPENDIX 3: REGRESION RESULTS

#### Regression Results for the Complete Sample

Dependable Variable: DELIVERY						
Variable	Coefficient	Std. Err.	Z	P>Z	[95% Conf. Interval]	
<b>WOMAN Variables</b>						
Education	0.061662	0.000021	2932.39	0	0.061621	0.061703
Paper	0.03225	7.97E-05	404.41	0	0.032094	0.032407
Quechua	0.595107	7.83E-05	7603.31	0	0.594954	0.595261
Aymara	-0.66917	0.000175	-3826.91	0	-0.66952	-0.66883
Other_Ethnicity	-1.34246	0.00029	-4625.96	0	-1.34303	-1.34189
Children	-0.16529	2.25E-05	-7344.46	0	-0.16533	-0.16525
Age	0.04055	6.75E-06	6006.12	0	0.040537	0.040564
<b>HOUSEHOLD Variables</b>						
Wealth 1	-1.19027	0.000254	-4688.4	0	-1.19076	-1.18977
Wealth 2	-1.0845	0.000201	-5402.43	0	-1.0849	-1.08411
Wealth 3	-0.4746	0.000149	-3193.31	0	-0.47489	-0.47431
Altitude	-0.00012	2.93E-08	-4089.14	0	-0.00012	-0.00012
Rural	-0.61721	0.00013	-4756	0	-0.61746	-0.61695
<b>INSURANCE Variables</b>						
Other_Insurance	0.551556	0.000149	3709.34	0	0.551265	0.551848
SIS	0.611935	0.000222	2754.12	0	0.611499	0.61237
<b>Prenatal Variables</b>						
Antenatal	0.17658	9.83E-05	1796.52	0	0.176387	0.176773
SIS x Antenatal	0.066788	1.22E-05	5475.82	0	0.066764	0.066812
<b>DISTRICT Variables</b>						
Obs_per1000	0.164975	0.000189	871.74	0	0.164604	0.165346
Nur_per1000	0.231066	0.0001	2307.67	0	0.23087	0.231263
Cen_per1000	0.068436	0.00029	235.66	0	0.067867	0.069005
Pos_per1000	0.059454	9.98E-05	595.56	0	0.059258	0.059649

Log_overnourishment	-0.52681	8.78E-05	-5999.05	0	-0.52698	-0.52664
<b>CONSTANT</b>	-0.96317	0.000622	-1548.87	0	-0.96439	-0.96195

### Regression Results for the Rural Sample

Dependable Variable: DELIVERY						
Variable	Coefficient	Std. Err.	Z	P>Z	[95% Conf. Interval]	
<b>WOMAN Variables</b>						
Education	0.050198	2.57E-05	1949.94	0	0.050148	0.050249
Paper	0.121383	9.09E-05	1335.79	0	0.121205	0.121561
Quechua	0.873293	9.23E-05	9458.74	0	0.873112	0.873474
Aymara	-0.51752	0.000217	-2381.98	0	-0.51794	-0.51709
Other_Ethnicity	-1.19904	0.000342	-3511.27	0	-1.19971	-1.19837
Children	-0.15895	0.000026	-6112.95	0	-0.159	-0.1589
Age	0.03876	8.20E-06	4725.82	0	0.038744	0.038776
<b>HOUSEHOLD Variables</b>						
Wealth 1	-1.13902	0.000418	-2724.71	0	-1.13984	-1.1382
Wealth 2	-1.01779	0.000382	-2663.06	0	-1.01854	-1.01704
Wealth 3	-0.34813	0.000368	-946.86	0	-0.34886	-0.34741
Altitude	-0.00011	3.64E-08	-3093.3	0	-0.00011	-0.00011
<b>INSURANCE Variables</b>						
Other_Insurance	0.776565	0.000234	3315.43	0	0.776105	0.777024
SIS	0.840952	2.47E-04	3406.47	0	0.840468	0.841436
<b>Prenatal Variables</b>						
Antenatal	0.190959	0.000116	1644.64	0	0.190732	0.191187
SIS x Antenatal	0.062747	1.38E-05	4558.6	0	0.06272	0.062774
<b>DISTRICT Variables</b>						
Obs_per1000	0.124468	0.000212	586.57	0	0.124052	0.124884
Nur_per1000	0.187501	0.000121	1544.24	0	0.187263	0.187739
Cen_per1000	0.161009	0.000302	532.86	0	0.160417	0.161601
Pos_per1000	0.039847	0.00011	362.48	0	0.039631	0.040062
Log_overnourishment	-0.3545	0.000115	-3081.75	0	-0.35472	-0.35427

<b>CONSTANT</b>	-1.65648	0.000693	-2390.52	0	-1.65784	-1.65513
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