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## **Health Insurance and Child Health: Evidence from Mexico**

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August 2016

# Health Insurance and Child Health: Evidence from Mexico

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## ABSTRACT

### Health Insurance and Child Health: Evidence from Mexico\*

We present evidence on the health impacts and mechanisms of a large expansion in non-contributory health insurance in Mexico. The Seguro Popular (SP) was rolled out in 2002-2010 across municipalities, providing exogenous variation in access to health services without co-pays. Our intent-to-treat estimates show that SP reduced child mortality by 7% in poor municipalities, saving 861 children/year. The decline is driven mainly by deaths due to preventable causes, such as diarrhea and respiratory infections. We also document an increase in hospital care for children with the same conditions. Our findings have important implications for the ongoing health insurance expansions.

JEL Classification: H10, I12, I13, J13, O18

Keywords: health insurance, child mortality, health care utilization, Mexico

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# 1 Introduction

In recent years, many countries have moved towards universal health coverage (UHC) with various degree of success (Boerma et al., 2014; Reich et al., 2015; WHO, 2015). In particular, many developing nations in Latin America and elsewhere (Atun et al., 2014) have increased the funding for voluntary health insurance programs like the Mexican *Seguro Popular* (hereafter, SP), which we study in this paper. Economists from 44 countries have recently signed a call on global policy makers to prioritise a pro-poor pathway to universal health coverage as an essential pillar of development (Summers, 2015). The relevance of this type of policies is unprecedented especially for those countries, like Mexico, which are undergoing a rapid epidemiological transition, with the burden of disease shifting from infectious towards metabolic conditions, such as obesity and diabetes. SP, with its comprehensive package of both preventive and curative interventions providing a “continuum of care”, constitutes an important attempt to meet the complex health needs emerging in such epidemiological landscapes.<sup>1</sup> Are these policies an effective mean to improve the health of the population? If so, why and for whom? In this paper we address these questions in the context of the recent Mexican experience.

The *Seguro Popular* is an ambitious non-contributory health insurance program for unprotected individuals in Mexico. Given that the main eligibility requirement for SP is to have no access to employment-based health insurance, half of the country’s population was to be enrolled. The Ministry of Health introduced the program as a pilot in 2002 with the aim of transforming the existing health services into a national health insurance system. Individuals affiliated to SP are guaranteed access to a comprehensive package of health services without co-payments, within a dedicated network of hospitals and health centers (i.e., the medical units of the Ministry of Health). In exchange, affiliated individuals are required to pay a subsidized premium; in practice, the majority of affiliates was exempted from it.

Our identification strategy exploits the staggered rollout of *Seguro Popular* across

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<sup>1</sup>This is in contrast with other health insurance schemes recently introduced in countries at a similar stage of the epidemiological transition, such as the Indian RSBY (Rashtriya Swasthya Bima Yojna), which is restricted to hospital services (secondary and/or tertiary care), i.e. it excludes primary care.

all municipalities in Mexico. Our analysis of the health impacts of SP uses a rich combination of administrative and survey data. The administrative data come from detailed death records, the universe of all hospital admissions and the registry of the human and physical resources of all medical units administered by the Health Ministry. We also provide complementary evidence on mechanisms from the Mexican health survey. All the data sets we use have the advantage of covering several years, since before the introduction of SP (2002), up to until the program had reached full coverage (2012).

We focus on child mortality, since that is a key target of the Millennium Development Goals, and SP offered generous coverage of the conditions for children below the age of five since its pilot years. We perform our analysis by the poverty status before the introduction of the program, since we expect larger gains from the reform for poorer municipalities with higher child mortality rates. Our main finding is that the introduction of SP reduced child mortality by 7% in poor municipalities, which corresponds to 0.34 deaths per 1000 livebirths, or 861 children saved per year. These impacts are detected after three years since the implementation of SP in a municipality and are robust to a variety of alternative specifications. The reduction in deaths is concentrated among preventable and communicable conditions - mainly intestinal and respiratory infections - which have been covered by the program since its inception.

We then examine potential mechanisms through which SP reduced child mortality, by investigating the role played by demand and supply factors. We show that the introduction of SP led to an increase in hospital admissions for children with the same conditions for which we find a decline in deaths, and to a reduction in the severity of diarrhea and in the incidence of respiratory infections.

Our paper provides several contributions. First, we contribute to the literature on the effects of health insurance expansions for low SES individuals, as are uninsured in developing countries; as such, our findings are also relevant for the reforms undergoing in developed countries like US.<sup>2</sup> In particular, in the Mexican context,

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<sup>2</sup>Contrary to the Mexican experience, in the United States universal health coverage has not been reached yet, despite the remarkable progress obtained with the Affordable Care Act (ACA): affordable care insurance is still out of reach for many, in particular poor individuals, minorities and unemployed (Gostin et al., 2015) – all categories which have been covered by *Seguro Popular*.

no previous paper has comprehensively examined the impact of SP on health outcomes, utilization of medical services and supply of health care, using the rich array of data we exploit here. The evidence to date is mixed and limited to mean impacts, without trying to understand the timing and the mechanisms underlying the observed effects. Furthermore, ours is the only paper to date which exploits the quasi-exogenous variation arising from the staggered rollout of the program across *all* municipalities in the country, constructed *directly* from registry data on millions of beneficiaries with exact affiliation date. Given the substantial degree of heterogeneity which exists among municipalities in Mexico, results based on a subsample of them might provide a misleading picture of the impacts of the program at the national level. Second, we add to the growing interdisciplinary literature on intervening in early childhood to promote health across the lifecourse (see e.g. Conti and Heckman, 2013, and Currie and Rossin-Slater, 2015).

The paper proceeds as follows. Section 2 presents the institutional background and the main features of the program, and Section 3 reviews the pertinent literature. Section 4 describes the data used and Section 5 details the empirical strategy. The results are presented in Section 6. Section 7 concludes.

## 2 Background

**The Health Care System before *Seguro Popular*** Before SP, health care in Mexico was characterized by a two-tiered system. About half of the population was covered through a contributory system (still in place today) guaranteed by the Social Security Institutions: the Mexican Social Security Institute (*Instituto Mexicano del Seguro Social*, IMSS), covering the private sector workers; the Institute for Social Security and Services for State Workers (*Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado*, ISSSTE), covering the civil servants; and Mexican Petroleums (*Petroleos Mexicanos*, PEMEX), covering the employees in the oil industries. Health coverage was provided by these institutions in public hospitals; however, individuals could also pay for care in private hospitals, or buy private health insurance. In 2000, IMSS covered 40%, and ISSSTE 7% of the population,

respectively (Frenk et al., 2006).<sup>3</sup>

Health care was also available to the poor through two programs. The first one was the Coverage Expansion Program (*Programa de Ampliacion de Copertura*, PAC), which started in 1996 and consisted of health brigades visiting the more rural and marginalized areas of the country. The other program was the Program for Education, Health and Nutrition (*Programa de Educacion, Salud y Alimentación*, Progresá), that was launched in 1997 in rural areas as the main anti-poverty program in Mexico, and renamed *Oportunidades* and expanded to urban areas in 2002.<sup>4</sup>

The uninsured population not covered by PAC or *Progresá* could seek health care either in public health units run by the Ministry of Health (*Secretaria de Salud*, SSA) or in private ones. In both cases, payment was at the point of use and patients had to buy their own medications. Hence, in 2000, approximately 50% of health expenditures was classified as “out-of-pocket expenses” (Frenk et al., 2009), and 50% of the Mexican population - about 50 million individuals - had no guaranteed health insurance coverage.

**The Implementation of *Seguro Popular*** SP was launched as a pilot program in 2002 in 26 municipalities (in 5 states: Campeche, Tabasco, Jalisco, Aguascalientes, Colima) under the name Health for All (*Salud para Todos*). During 2002, 15 additional states<sup>5</sup> implemented the program, by agreeing with the federal government to provide the health services covered by SP. By the end of the pilot phase, on 31st December 2003, six additional states<sup>6</sup> had joined. The System of Social Protection in Health (*Sistema de Protección Social en Salud*, SPSS) was officially introduced on January 1st 2004 to extend health coverage and financial protection to the eligible

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<sup>3</sup>A more detailed description of the Mexican health system is provided in Appendix C.

<sup>4</sup>*Progresá* has a health component: the beneficiaries receive free of charge the Guaranteed Basic Health Package (*Paquete Básico Garantizado de Salud*), which covers a set of age-specific interventions, including the monitoring of the nutrition of children and pregnant women through monthly consultations. Information on preventive health behaviors is provided through community workshops, and emergency services are secured by the Ministry of Health, IMSS-Oportunidades (the dedicated network of medical units for families enrolled in the program) and other state institutions. See <http://www.normateca.sedesol.gob.mx/es/NORMATECA/Historicas> (accessed May 10th 2015).

<sup>5</sup>Baja California, Chiapas, Coahuila, Guanajuato, Guerrero, Hidalgo, Mexico, Morelos, Oaxaca, Quintana Roo, San Luis Potosi, Sinaloa, Sonora, Tamaulipas and Zacatecas.

<sup>6</sup>Baja California Sur, Michoacán, Puebla, Tlaxcala, Veracruz and Yucatán.

population. The expansion prioritized states with: (1) low social security coverage; (2) large number of uninsured in the first six deciles of income; (3) ability to provide the services covered by the program; (4) potential demand for enrollment; (5) explicit request of the state; (6) existence of sufficient budget for the program. In 2004, three more states introduced the program (Nayarit, Nuevo Leon and Querétaro). The last three states (Chihuahua, Distrito Federal and Durango) joined SP in 2005.

**Eligibility and Enrolment** Individuals who are not beneficiaries of social security institutions are eligible to enroll in SP. Enrollment in the program is voluntary, and is granted upon compliance with simple requirements.<sup>7</sup> The basic unit of protection is the household. Within ten years since the piloting of SP, by April 2012, 98% of the Mexican population was covered by some health insurance (Knaul et al., 2012). The main reasons for affiliation in SP were access to free medicines and to primary care at reduced costs (Nigenda, 2009).

**Funding** Before 2004, the public health expenditure on the insured was twice that on the uninsured, but the gap was substantially closed after 2004 (see figure A.1 in Appendix). Hence, the program seems to have been successful in accomplishing one of its goals, that of redistributing resources from the insured to the uninsured. SP is a non-contributory health insurance system, funded by revenues from general taxes, on the basis of a tripartite structure similar to that adopted by the two major social insurance agencies in Mexico, IMSS and ISSSTE. More precisely, it is funded by contributions from the federal government, the states, and the families.<sup>8</sup>

**Coverage of Health Services** Once a family is enrolled in SP, she is assigned a health center (which, in turn, is associated to a general hospital) and a family doctor

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<sup>7</sup>The requirements are: proof of residence in the Mexican territory; lack of health insurance, ascertained with self-declaration; and possession of the individual ID (*Clave Unica de Registro de Población*, CURP).

<sup>8</sup>The family contribution was based on the position of the average household income in the national income distribution. In 2010, 96.1% of the enrolled families were exempted from paying the family contribution, on the basis of their low socioeconomic status; in practice, very few households ever contributed at all (Bonilla-Chacin and Aguilera, 2013).

for primary care, and has access to a package of health services. The number of interventions covered increased yearly, from 78 in 2002 to 284 in 2012, and was listed in a ‘Catalogue of Health Services’ (since 2006 called *Catalogo Universal de Servicios de Salud*, CAUSES) revised annually (see Knaul et al., 2012).

A wide range of services were included, from prevention, family planning, pre-natal, obstetric and perinatal care, to ambulatory, emergency and hospital care, including surgery. The bulk of the services covered since 2002 were preventive age-specific interventions. In particular, for children under five years of age, SP covered vaccinations, comprehensive physical check-ups (including measurement of height and weight, and nutritional advice for parents), and diagnosis and treatment (e.g. up to seven days of medicines) of acute intestinal and respiratory infections. The package of services for children under five underwent a further expansion in 2006 with the introduction of Health Insurance for a New Generation (*Seguro Medico para una Nueva Generación*, SMNG).<sup>9</sup> The services are delivered in the hospitals and clinics run by the Ministry of Health, which has a completely separate network from that of the contributory system.

**Supply of Health Care** One of the main objectives of the health reform was to increase investment in health care infrastructure and to achieve a more equitable distribution of health care resources. In addition, medical facilities could only enter in the SP network upon receiving accreditation, which was granted only in case they had in place the required resources to provide the covered interventions (Frenk et al., 2009). Coherently with this objective, the proportion of the Ministry of Health budget devoted to investment in health infrastructure increased from 3.8% in 2000 to 9.1% in 2006, with the construction of 2,284 outpatient clinics and 262 (community, general and specialized) hospitals between 2001 and 2006 (see Table B.1 in the Appendix);<sup>10</sup> as a consequence, the number of municipalities covered by each

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<sup>9</sup>For adults 20-59 years of age, the coverage included vaccinations, check-ups for pregnant women, and regular check-ups every three years after the age of 40. Among those over 60, it included medical checks-up with blood tests for cholesterol and lipids detection every three years, annual checks for hypertension, and regular cervical cystology and mammography every other year up to age 69.

<sup>10</sup>In the public sector as a whole, 1,054 outpatient clinics and 124 general hospitals were built in the same period (Frenk et al., 2009).

hospital declined from a 2000 average of 7 to a 2010 average of 5.<sup>11</sup> As a result, the gap between individuals covered and not by Social Security was reduced in terms of the availability of general and specialist doctors, nurses and beds (Knaul et al., 2012 and Table B.2 in the Appendix, which shows a bigger increase in medical personnel in SSA than non-SSA units). Further redistribution was achieved by prioritizing the resources in poor municipalities: Table B.3 in the Appendix shows a bigger growth in the number of hospitals and beds in poor than in rich municipalities. We return to the role of the supply in section 6.2.<sup>12</sup>

### 3 Related Literature

While economic theory provides unambiguous predictions about the effects of health insurance on the demand for medical care, whether it has any effects on health is still a fundamental and debated question, especially in less developed countries, where the evidence is scantier and the mechanisms at play might be different.

**Health insurance in developed countries** Most of the evidence on developed countries comes from the United States, where two major health insurance experiments have taken place. The first evidence, from the RAND Health Insurance Experiment, showed that free care (vs. 95% co-pay) increases the likelihood of any annual usage of health care by almost 20p.p. (86.7% vs. 68%) (Manning et al., 1987); however, it has limited impacts on health, with the exception of few conditions, such as hypertension (Newhouse et al., 1993). More recent evidence from the 2008 Medicaid expansion in Oregon has shown that access to subsidized care for the poor is associated with higher health care utilization, lower out-of-pocket expenditures and debt, increased E.R. use (Taubman et al., 2014), higher probability of diagnosis and treatment of diabetes, better self-reported physical and mental health

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<sup>11</sup>Source: own calculations based on the Health Ministry discharges data.

<sup>12</sup>Table B.1 in the Appendix shows that there was an increase in the total number of medical units under the SSA umbrella by about 21%, from 11,824 in 2001 to 14,374 in 2010. The increase in the number of units varied by type, with an increase by about 20% in the number of outpatient units, and by about 60% in the number of inpatient units. This latter increase was mainly driven by the community hospitals (*hospitales integrales/comunitarios*).

(Finkelstein et al., 2012), and lower probability of diagnosis of depression (Baicker et al. 2013). In their comprehensive review, Levy and Meltzer (2008) conclude that health insurance is effective mostly for the poorest and most vulnerable individuals, partially because of the crowd-out of private care by publicly provided care among the less vulnerable and poor (Card and Shore-Sheppard, 2004). A classical example is provided by Currie and Gruber (1996a, 1996b), who find that increased eligibility for free health insurance through Medicaid led to improvements in infant mortality.

**Health insurance in less developed countries** As mentioned in the introduction, many less developed countries have increased the funding for voluntary health insurance programs over the last decade. Here we review the evidence mostly in relation to the Latin American experience. Chile and Brazil both undertook health reforms in the 1980s. Chile introduced a dual system in 1981, which requires workers and retirees to affiliate with either the National Health Fund (FONASA), or with private health insurance institutions (ISAPRES). The public system, FONASA, is a universal health plan that resembles SP and suffers from long waiting times, poor quality and shortage of specialists (Savedoff, 2011). Despite these issues, Bitran et al. (2010) find that the program increased access and coverage, and reduced hospital case-fatality rate for some diseases, such as hypertension, diabetes and depression. Brazil created the Unified Health System (*Sistema Único de Saúde*) in 1988. This is a publicly funded health care system serving more than 80% of the population (Paim et al., 2011), which has also been associated with long waiting times and physicians shortages (Harmeling, 1999). The anchor of the system is the Family Health Program, which was adopted in 1994 to provide primary care services, and it has been consistently associated with a reduction in infant mortality (Macinko et al., 2006; Aquino et al., 2009). Colombia introduced the *Regimen Subsidiado*, a publicly-funded insurance program targeted to the poor, in 1993. Miller et al. (2013) find that the program was successful in protecting from financial risk, increasing the use of preventive services, and improving health. Lastly, Peru underwent a public health insurance expansion in 2006. Bernal et al. (2014) present evidence of impacts on out-of-pocket health expenditures, visits to doctors, prescription of medicines and diagnostic testing, but not on preventive care, with the exception of women in fer-



tile age. Outside Latin America, the evidence more relevant to our study comes from the universal health care reform of 2001 in Thailand, which increased health care use and reduced postneonatal mortality and out-of-pocket medical expenditure (Gruber et al., 2014; Limwattananon et al., 2015).

We now turn to the evidence on Mexico. To date, a large part of the SP literature has focused on the labor market impacts, in relation to a potential distortion of workers' incentives to operate in the informal sector. The evidence on this issue is mixed: some studies do not find any impact (Gallardo-García, 2006; Barros, 2011), while others find relatively small increases in the share of informal workers among the less educated and those with children (Aterido et al. 2011; Azuara and Marinescu, 2013; Bosch et al., 2014; del Valle, 2015).<sup>13</sup>

The literature on the health impacts of SP is more recent. King et al. (2009), Barros (2011) and Grogger et al. (2014) have focused on out-of-pocket expenditures, and unanimously show that SP has been effective in substantially reducing them. The existing studies of the impacts of SP on health care use and health present, instead, mixed results. Sosa-Rubi et al. (2009) find an increased use of prenatal care among those affiliated to SP, while King et al. (2009) and Barros (2011) find no effect on the population at large. Bernal and Grogger (2013a,b) merge the experimental data from King et al. (2009) with administrative data from the SSA hospital discharges, and find an increase in obstetric services and hospital visits – mostly births that would have taken place outside the health system in the absence of SP. Knox (2015) uses the panel of urban *Oportunidades* and finds an increase in the use of health services provided by SP among the poorest urban population. Barros (2011), Knox (2015) and King et al. (2009) are unable to detect any health impact of SP, using experimental or survey data. Pfutze (2014), instead, finds that SP led to a reduction in infant mortality by 5 deaths per 1,000 livebirths, using data from the 2010 Census.

In summary, the evidence available to date has provided a fragmented and partial picture of the health impacts of SP. Importantly, the vast majority of the papers

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<sup>13</sup>The differences in the impacts do not seem driven by the identification strategy employed, but rather by the period studied - with smaller effects found in studies that have examined the earlier period.

have based their analyses on subsets of municipalities implementing the program in different years (as in, for example, Aterido et al., 2011, Azuara and Marinesco, 2013, and Knox, 2015), and have not relied on administrative registry data to study the health impacts of SP. Our work overcomes most of the limitations of previous studies and provides the most comprehensive evidence to date on the health impacts of SP.

## 4 Data

We combine rich administrative and survey data to provide complementary evidence on the health impacts of SP and the mechanisms through which they occurred.

**Administrative Data** We use four administrative data sources. First, for this project, we were granted access to the registry of *all* families with a valid enrolment in Seguro Popular by December 31<sup>st</sup> of each year, since 2002 until 2010, which is called the *Padrón*. This is the key source used by the Federal Government and the States to decide the amount of funds to allocate to the program. In addition to the exact affiliation date, the *Padrón* contains information on the demographic and socioeconomic characteristics of the enrolled families, on their address of residence, and on the identifiers of the health center and of the general hospital assigned at the time of enrolment. The exact date of affiliation of each family is used to construct the treatment indicator: the date of implementation of the program at the level of the municipality.<sup>14</sup>

Second, to analyze the impact on mortality we use the death certificates for the whole country between 1998 and 2012. The data contains information on the date, place and cause of death (ICD10 classification), its registration date, and on

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<sup>14</sup>For the years 2002 and 2003 (in which the program ran as a pilot), only information on the date of enrolment and on the state of residence was recorded. Since each family has a unique identifier, we have been able to identify the exact date of implementation of SP in a given municipality by backtracking the relevant information from the subsequent years. We have then confirmed the accuracy of the implementation date obtained with this procedure by cross-checking it against the official list of municipalities which adopted SP in the pilot period.

the date of birth, gender, type of health insurance and residence of the deceased. We use this data to construct municipality-year counts of deaths before age 5.<sup>15</sup> We then construct the child mortality rate by dividing the deaths counts by the population less than 5 years of age in that municipality, which we obtained from the CONAPO.<sup>16</sup>

Third, we use two data sources on hospital discharges. The first is the universe of discharges from any public hospital in Mexico, which is available for the years 2004-2012. This data includes limited information: gender and age of the patient (banded in categories), main medical condition at admission, state in which the medical unit is located and the entity managing it (i.e., IMSS, ISSSTE, IMSS-Oportunidades or Health Ministry). The second is the universe of discharges from the Health Ministry hospitals, which is available for the years 2000-2012.<sup>17</sup> This data includes more detailed information: the identifier of the medical unit, demographic characteristics of the patient (age, gender, state and municipality of residence), the dates of admission and discharge, the main conditions diagnosed, and the medical procedures applied during the hospitalization. We use this data to examine the impact of SP on hospital admissions (total and by cause), mode of entry and length of stay. We focus on admissions to general or integrated hospitals, speciality hospitals and clinics, excluding psychiatric hospitals and federal health institutes.<sup>18</sup> In Mexico, SSA hospitals are present in 544 of the 2454 municipalities.

Fourth, we use two data sources on the supply of health care. The first is the universe of the human resources for all inpatient and outpatient units providing health services for the years 1996-2011. This data is obtained from the State and Municipal System Databases (*Sistema Estatal y Municipal de Bases de Datos*, SIM-

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<sup>15</sup>We downloaded the data from the DGIS (*Direccion General de Informacion en Salud*, National Information System for the Health) website: [http://www.dgis.salud.gob.mx/contenidos/basesdedatos/bdc\\_defunciones.html](http://www.dgis.salud.gob.mx/contenidos/basesdedatos/bdc_defunciones.html). This is assembled by the civil registry and the public prosecutor (in case of accidental or violent death).

<sup>16</sup>CONAPO stands for *Consejo Nacional de Poblacion* (National Population Council); see [http://www.conapo.gob.mx/es/CONAPO/Proyecciones\\_Datos](http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos).

<sup>17</sup>We downloaded the data from <http://www.sinais.salud.gob.mx/egresoshospitalarios/basesdedatoseh.html>.

<sup>18</sup>These are medical units specialized for the treatment of cancer or cardiovascular diseases, pediatric care or geriatric care. They are mostly located in the Distrito Federal, but serve the whole country.

BAD),<sup>19</sup> and contains information at the level of the municipality on the medical personnel (doctors and nurses) and the number of outpatient visits for each public providers of health services (i.e., IMSS, ISSSTE, PEMEX, IMSS-Oportunidades, SSA and others such as military or local providers), including both health centers and hospitals. The second is the registry of the physical and human resources for each outpatient and inpatient unit administered by the Health Ministry for the period 2001-2010.<sup>20</sup>

**Health Survey** Lastly, we use data from the Mexican Health Survey, for which three waves of data collection have been carried out as repeated cross-sections. The National Health and Nutrition Survey (*Encuesta Nacional de Salud y Nutrición*, ENSA/ENSANUT) was fielded in 2000, late 2005/early 2006, and late 2011/early 2012, i.e. before, in the middle and at the end of the SP rollout.<sup>21</sup> The data includes both self-reported and objective health measures, and age-specific modules. Unfortunately, several variables are not consistently collected across the three waves, which limits the use of this data to study the impact of SP on child health.

## 5 Empirical Strategy

Our identification strategy exploits the quasi-exogenous variation in the timing of implementation of SP at the level of the municipality. Given its scale and the constraints imposed by financial resources and availability of infrastructure, the SP was gradually introduced across the Mexican states, and across municipalities within each state. As mentioned in section 2, while the state-level rollout was regulated by law, the municipality-level expansion was unregulated. As specified in section 4, we use information from the *Padrón* on the date in which each household in Mexico enrolled in SP to construct the treatment variable. In the absence of a formal

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<sup>19</sup>It was downloaded from <http://sc.inegi.org.mx/sistemas/cobdem/>.

<sup>20</sup>It was downloaded from: <http://www.sinais.salud.gob.mx/basesdedatos/recursos.html>.

<sup>21</sup>This survey includes 45,711, 47,152 and 50,528 households living in 321, 582 and 712 municipalities for the years of 2000, 2006 and 2012, respectively. In our analysis, we restrict the sample to municipalities observed at least twice in data (that is, 432 municipalities out of the 990 ever surveyed).

definition, we consider that SP is introduced in a municipality when the number of families affiliated to the program is at least 10.<sup>22</sup> Figure A.2 in Appendix displays the year of implementation of SP in each municipality in Mexico, between 2002 and 2010. This graph (together with its zoomed state-level version reported in Figures A.3-A.5) shows that there is considerable variation, both across municipalities and over time, in the timing of implementation of SP. We exploit the staggered timing of implementation of SP by comparing changes in outcomes for municipalities that introduced it in different years between 2002 and 2010, i.e. earlier vs. later entrants, within an event-study framework. In particular, we estimate the following equation:

$$y_{mst} = \sum_{k=-K}^{-2} \beta_k^B SP_{mst} \mathbf{1}[t - T_m = k] + \sum_{k=0}^L \beta_k^A SP_{mst} \mathbf{1}[t - T_m = k] + \mu_{ms} + \pi_t + \varepsilon_{mst} \quad (1)$$

where  $SP_{mst}$  is an indicator variable equal to 1 if the municipality of residence  $m$  in state  $s$  offers SP in year  $t$ . For most of the analysis we use registry data on deaths and hospital discharges aggregated at the level of the municipality of residence  $m$  in year  $t$ , which refers to the time of the death and of the admission to the medical unit, respectively. In all our models we include municipality fixed effects  $\mu_{ms}$ , to account for time-invariant municipality-level unobserved heterogeneity; and year fixed effects  $\pi_t$  to account for common shocks;  $\varepsilon_{mst}$  are idiosyncratic shocks. The standard errors are clustered at the municipality level to account for autocorrelation in the outcomes (Bertrand et al., 2004), and all estimates are weighed by the population under age 5 in the municipality in 2000 (as e.g. in Almond et al., 2011, and Bailey and Goodman-Bacon, 2015).

The impact of being exposed to SP is captured by the coefficients  $\beta_k$ , where  $k$  is the difference between the year of observation  $t$  and the year of implementa-

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<sup>22</sup>We adopt this number for a variety of reasons. First, we prefer an absolute to a percentage measure since we want to capture the fact that the residents of a municipality can use the services provided by SP (and not the fact that a certain proportion of the population has been covered). Second, we do not use smaller figures such as 2 or 5 households since these could be more prone to measurement error. Third, we use a definition which has become relatively common in the SP-related literature, see e.g. Bosch and Campos-Vazquez (2014) and Del Valle (2015).

tion  $T_m$ .<sup>23</sup> Thus, the estimated  $\beta_k^B$  and  $\beta_k^A$  coefficients describe the evolution of the outcome in (eventually) treated municipalities before SP, and the divergence in outcomes  $t$  years after its introduction, respectively, relative to the year prior to the implementation (since  $t = -1$  is omitted). This event-study framework allows to test for the presence of pre-treatment trends (rather than assuming that  $\beta_k^B = 0$  for  $k < 0$ ). It further allows for dynamics in the treatment effects, which might arise for several reasons: individuals may not be immediately aware of the availability of SP in their municipality of residence,<sup>24</sup> and/or medical units may take time to adjust their technology of provision of care to the potential new demand.

While when we present the results in figures we display all the estimated coefficients of equation (1), for the sake of precision, for most of our analysis we group them into three, according to the following specification:

$$y_{mst} = \beta_1 SP_{mst} \mathbf{1}[t - T_m \leq -2] + \beta_2 SP_{mst} \mathbf{1}[0 \leq t - T_m \leq 2] + \beta_3 SP_{mst} \mathbf{1}[t - T_m \geq 3] + \mu_{ms} + \pi_t + \varepsilon_{mst} \quad (2)$$

Here  $\beta_1$  subsumes the impact up to 2 years before the introduction of SP,  $\beta_2$  captures the short run impact (up to 2 years after the introduction of SP), and  $\beta_3$  captures the impact of exposure for 3 years or more. We interpret the coefficients as intention-to-treat effects (ITT), since our regression model estimates the reduced form impacts on implementing SP in the post-reform period. This parameter averages the SP effects over all individuals in the municipality, although not all are affected by the health reform.

**The timing of implementation of SP** The key identifying assumption underlying our empirical strategy is that the timing of implementation of SP at the municipality level is uncorrelated with unobserved time-varying determinants of the outcomes. To provide suggestive evidence on the validity of this assumption, we examine whether the year of implementation of SP can be predicted by baseline

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<sup>23</sup>The exact values of  $k$  depend on the number of years available in the data, before ( $K$ ) and after ( $L$ ) the implementation of SP.

<sup>24</sup>This might occur either because they are not exposed to the relevant sources of information, or because people tend to become affiliated at the time they use medical services.

municipality characteristics.<sup>25</sup> By December 2010, 2,443 municipalities in Mexico had implemented the program. Throughout the paper, we use a sample of 2,424 municipalities which existed in 2000 and implemented SP by 2010 and for which there is non-missing data on baseline characteristics.

We study the determinants of the timing of implementation by estimating the following equation:

$$Year_{ms} = \eta \mathbf{X}_{ms,t0} + \pi_s + \chi_{ms} \quad (3)$$

where  $Year_{ms}$  is the year of implementation of SP in municipality  $m$  of state  $s$ ,  $\mathbf{X}_{ms,t0}$  is a vector of pre-SP municipality-level socio-demographic and political characteristics, health care resources and health indicators, and  $\pi_s$  are state fixed effects.

The results are reported in Table 1. Column (1) presents estimates for a version of equation 3 without state fixed effects. It shows that, across states, earlier implementation of SP took place in more populous and less poor municipalities, with a smaller share of eligible individuals and of population working in the primary sector, more hospitals,<sup>26</sup> health centers and doctors per eligible, a lower child mortality rate, and alignment between the party of the mayor and that of the governor of the state. When we study the determinants of the time of entry within states in column (2),<sup>27</sup> we find that child mortality is no longer a significant predictor of the rollout, and that the program was implemented earlier in municipalities with a greater share of children; all the other estimated coefficients are reduced in magnitude but still significant. Column (3) shows that, after conditioning on the socio-demographic

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<sup>25</sup>We use 2000 as our baseline year for the socio-demographic and health characteristics, with the exception of the resources allocated to the public health care sector, for which information is only available since 2001. A detailed list of the variables used as determinants of the rollout is provided in Table B.4 in the Appendix.

<sup>26</sup>Figure A.6 in Appendix shows that the program was rolled out first in those municipalities with the presence of a hospital. We also studied the strategy that the states followed to rollout SP. We found a negative relationship between the share of eligible families when the program was launched in a municipality (defined as the number of families served by SP during the first three months of operation divided by the total number of families served in 2010) and the proportion of municipalities in the state that launched SP. This suggests that the states launched the program with a relatively high intensity of coverage in a restricted number of municipalities.

<sup>27</sup>Unobserved time-invariant state-level characteristics explain about 50% of the variation in the timing of entry of a municipality.

determinants, the availability of health centers (but not of hospitals or doctors) and the political alignment between the mayor of the municipality and the governor of the state are the two key factors determining the timing of the rollout. A comparison of the magnitude of the coefficients reported in column 3 of Table (1) reveals that the alignment between the party of the mayor and that of the state governor predicts an earlier implementation of SP by almost 1 year; and an increase by one standard deviation in the number of health centers predicts an earlier implementation by about 3 months.<sup>28</sup> When we split the sample by poverty status (cols. 4 and 5), we do not find significant differences in the determinants of the timing of the rollout between rich and poor municipalities. Finally, we also show in Table 2 that both short (1-year) and longer (3-years) differences in child mortality rate (our primary outcome variable) do not predict the year of implementation of SP in a municipality.

In addition to providing the evidence above in support of the validity of the assumptions underlying our identification strategy, we also run a battery of robustness checks for all the models we estimate. First, we control for linear trends (as in Acemoglu et al., 2004) in the year of death/admission to the hospital and the following characteristics of the municipality of current residence: socioeconomic indicators measured in 2000 (quadratic of the index of marginalization, log of total population, and share of population of ages 0-4); labor market indicators measured in 2000 (share of uninsured individuals, share of individuals employed in the primary, secondary and tertiary sectors); health care indicators measured in 2001 (number of hospitals, health centers, and doctors in hospitals, all per uninsured). Second, we control for the number of years since the implementation of *Oportunidades* in the municipality, since the program underwent the urban expansion in the same years in which SP was rolled out. Third, we control for the political alignment between the governor of the state and the mayor of the municipality, which we have shown in Table 1 to be a significant determinant of the timing of the rollout. Lastly, we include municipality-level pre-reform linear and quadratic trends, to account for omitted trends in outcomes that might be correlated with the introduction of SP.<sup>29</sup>

<sup>28</sup>In results not reported here, we also show that child mortality does not predict the timing of implementation of SP, even after conditioning on the pre-existing supply of health care services.

<sup>29</sup>We estimate municipality-specific trends using data before 2004, and we obtain a slope es-



We show that our results are robust to this full battery of checks in the next section.<sup>30</sup>

## 6 Results

### 6.1 Impacts on Child Mortality

We now present our main results on the impacts of SP on child mortality in Table 3, where we report estimates of equation (2) by the level of poverty of the municipality.<sup>31</sup> Column (1) shows a reduction of 0.34 deaths per 1,000 livebirths in poor municipalities 3 or more years after the implementation of SP, which, given a baseline mortality rate of 4.72 deaths per 1,000 livebirths, corresponds to a 7% decline. Column (2) shows that in rich municipalities, instead, there was a pre-SP declining trend in mortality. The full event study estimates from equation (1) are plotted in Figure 1, panels (a) and (b) for the poor and rich municipalities, respectively. Figure (1a) shows that, for poor municipalities, there is no significant evidence of a differential trend in mortality in treated locations before the introduction of SP. Instead,

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timate  $\lambda_{ms}$  for each municipality. We then extrapolate the pre-expansion time trends to the post-reform period as follows:

$$y_{mst} = \sum_{k=-K}^{-2} \beta_k^B SP_{mst} \mathbf{1}[t - T_m = k] + \sum_{k=0}^L \beta_k^A SP_{mt} \mathbf{1}[t - T_m = k] + \delta_1 \widehat{\lambda}_{ms} t + \delta_2 \widehat{\lambda}_{ms} t^2 + \mu_{ms} + \pi_t + \varepsilon_{mst}.$$

<sup>30</sup>Another concern would be selective migration of uninsured individuals to neighbouring municipalities just before the rollout of SP. We have used data from the extended questionnaire of the 2010 CENSUS, which surveys 2.9 millions households, to shed light on this issue. We have focused on a sample of male heads of household of working age (25 to 60 years old), and regressed an indicator for whether the individual resides in 2010 in the same municipality as in June 2005 on an indicator for whether the current municipality of residence introduced SP between 2006 and 2008, controlling for an extended set of characteristics (a quadratic for the age of the individual, an indicator for whether the head is married or living in partnership, her level of education, the log of the population in the municipality of current residence in 2000 and its share of individuals without Social Security coverage). Our results show that we cannot reject the null of no correlation between the implementation of SP in a municipality and individual-level mobility (results available upon request).

<sup>31</sup>A municipality is defined poor by the Mexican authorities if the marginalization index is high or very high, as opposed to very low, low or medium. About half of the municipalities in Mexico are poor.

after the introduction of SP, the child mortality rate fell sharply in poor municipalities, with statistically significant impact detectable already after two years. On the other hand, we detect no significant impact of SP on child mortality in rich municipalities (Figure 1b). Hence, in the remainder of the paper we restrict our analysis to the subsample of poor municipalities.

Given that eligibility itself can be affected by the introduction of the program,<sup>32</sup> we do not restrict our estimation sample to eligible individuals. Instead, we examine whether the reduction in child mortality in poor municipalities is driven by the sample of children eligible to SP, i.e. those born in families without access to Social Security. The results, presented in Table 4, show that the decrease in child mortality is indeed concentrated among the eligibles, and that SP has no impact among the non eligibles.<sup>33</sup> Importantly, they show that the reduction in child mortality among the eligibles amounts to 0.467 and 0.533 child deaths per 1,000 livebirths soon after the introduction of the program and after three years since its implementation, respectively. This corresponds to a reduction by 11-12 percent, given the baseline of 4.3 deaths per 1,000 livebirths among eligibles. While throughout the paper we mostly refer to the ITT estimates, i.e. to the average effect of SP among *all* children in the municipality, since the program achieved universal coverage in 2012, the effect on the eligibles is indeed the implied average treatment effect on the treated (ATT) on child mortality.

**Sensitivity Analysis** We now investigate the robustness of our findings to different specifications of equation (2). The results are displayed in Table 5. Column (1) reports our baseline estimates of column (1) in Table 3. Columns (2) to (7) of Table 5 show that the results are robust to a full battery of specification checks, more specifically to controlling for: linear trends in baseline characteristics of the municipalities (cols. 2 to 7); an indicator of alignment between the party ruling

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<sup>32</sup>In Section 3 we have reviewed that the literature on the effects of SP on informality finds small impacts, especially for less educated individuals with children.

<sup>33</sup>An alternative interpretation of this finding is the absence of spillover effects on the non-eligibles. This is not unexpected, given that the two systems (SP and IMSS/ISSSTE) delivered care in two completely separate networks of hospitals and health centers, so there was no scope for contamination. Additionally, we study a sample of children who do not attend school yet, so that also this channel of potential contagion can be ruled out.

in the municipality and in state (cols. 3, 5, 6 and 7); linear (cols. 4 to 7) and quadratic (cols. 4 and 7) pre-intervention municipality trends; indicators for the number of years since the introduction of *Oportunidades* in the municipality (cols. 6 and 7). The fact that our estimates are virtually unchanged across the various columns of Table 5, and that the coefficients for the post-reform period across the various specifications are jointly significant, provides robust evidence that the decline in mortality in poor municipalities was driven by SP and not by local shocks or underlying trends.

Lastly, it is possible that child deaths are measured with error in the administrative records, in particular that they are under-reported. We consider two cases. First, if under-reporting is systematically correlated with permanent local conditions which also affect mortality, then this is accounted for by the municipality fixed effects. Second, a more serious concern would arise if the introduction of SP affected the quality of reporting; more precisely, if it led to an improvement in the recording of deaths. We assess this by testing whether the proportion of missing information about the place of reported child death is influenced by the introduction of the program, and we find no evidence of a significant impact of SP.

## **6.2 Mechanisms: Understanding the Reduction in Child Deaths**

After having established that the introduction and expansion of SP led to a significant decline in child mortality, we investigate possible mechanisms through which this reduction might have occurred.

### **6.2.1 Access to Health Care**

First, we re-estimate specification (2) separately by type of condition, to understand what is driving the reduction in child mortality in poor municipalities. Table 6 shows that SP led to a significant reduction in intestinal and malnutrition-related conditions (ICD10 codes A and E, respectively) and respiratory infections (ICD10 codes J, predominantly influenza and pneumonia), which represent 29% of

all deaths in 2000 (col. 2).<sup>34</sup> Importantly, both sets of conditions have been covered by SP since its introduction: the *Catalogos de Beneficios Medicos (CABEME)* (2002-2003) includes, among others, “diagnosis and treatment of acute respiratory infections”, “diagnosis and treatment of acute diarrhea”, and “monitoring of nutrition, growth and well-baby visits”. Indeed, Knaul et al. (2012) report that, between 2000 and 2006, coverage and effective coverage of SP have increased for a variety of conditions, including *treatment of diarrhoea and acute respiratory infections in children*, concentrated in the poorest states and income deciles. Reassuringly, column (3) shows no impact of SP on deaths due to external causes (e.g., accidents).

Second, we turn to investigate possible mechanisms through which SP might have led to a reduction in child mortality, starting from its effects on access to medical care. Dafny and Gruber (2005) notice that greater access to care may increase hospitalizations, however improved efficiency of care for newly eligible children might also reduce them. Using data from the universe of SSA hospital discharges, Table 7 shows that the introduction of SP led to an immediate 9% increase in hospital admissions for children 0-4 years old in poor municipalities, from a pre-program mean of 22 admissions/municipality in 2000 (column 1). Table B.5 in the Appendix shows that this effect of SP is robust to a variety of alternative specifications. Thus, as in Dafny and Gruber (2005), the access outweighs the efficiency effect as consequence of the introduction of SP. Complementary evidence from the universe of discharges from any public hospital in Mexico shows that the increase in hospital admissions for children 0-4 years old is only detectable in the Ministry of Health units (Figure A.7).<sup>35</sup> Column (2) of Table 7 also shows that SP had a larger impact on admissions due to intestinal and malnutrition-related conditions and respiratory infections, and no impact on admissions due to external causes - consistently with the evidence we find for child mortality. The last two columns show that the introduction of SP led to no detectable change in the length of stay, and to a significant

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<sup>34</sup>In Table 6, we pool together ICD10 codes A and E since they are strictly related, however, given that only the main cause of death/admission is reported in the Mexican data, malnutrition is less likely to be cited (see e.g. Rice et al., 2010).

<sup>35</sup>This alternative data source only contains information on the post-reform period (from 2004 onward), hence it does not allow us to control for pre-SP trends. Additionally, it only contains information at state level, so we cannot report two separate figures for rich and poor municipalities.

increase in admissions through E.R.

To gain some insights on why we detect immediate impacts of the program, we resort to the *Padrón* and examine the association between several household characteristics and the year of entry of SP. The results, reported in Table B.6 in the Appendix, show that the households who enroll earlier in the program within a municipality are more likely to be among the poorest (i.e., in the 1st decile of the national income distribution), headed by a female with less than primary education, with a disabled member, a larger family and a greater number of children 0-4 years old, and to be enrolled in *Oportunidades*.<sup>36</sup> In other words, earlier entrants are in a condition of disadvantage with greater potential benefits from access to health care.

Lastly, we complement the analysis based on the administrative data with evidence from the health surveys. The results, reported in Table 8, show that SP is also associated with a decrease in the prevalence of respiratory infections in the two weeks prior to the survey among children living in poor municipalities (column 2), and with a decrease in the likelihood of a doctor visit in case of diarrhea (column 3), which suggests a reduced severity of such condition, likely due to the increased awareness, screening, and availability of basic medicines.<sup>37</sup> Notice that an analogous mechanism is reported in Bailey and Goodman-Bacon (2015) in explaining the impact of Community Health Centers (CHCs) on the mortality of older Americans. Hence, the evidence from the health survey complements and supports the evidence on the reduction in child deaths from the mortality registries.

## 6.2.2 Supply of Human Resources

Finally, we study the potential role of the supply. We have already shown that the rollout of SP was accompanied by an expansion in physical and human resources in the health care sector (see Tables B.2 and B.3 in the Appendix). We now in-

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<sup>36</sup>Of the total of 17.6 million families observed in the data, about 816,000 are assigned to IMSS-Oportunidades centers when they enroll in SP (less than 5% of the families), among the 3.7 million of those families that entered SP through the Oportunidades program (about 22% of the total).

<sup>37</sup>The quality of primary health care management of children with diarrhoea and acute respiratory infections was very low before SP, especially in case of private doctors: 66% and 58% of them have been reported to make a wrong decision in the prescription of antimicrobial and symptomatic drugs, see Bojalil et al. (1998).

investigate whether the supply also responded to the demand, which increased substantially with the expansion of the program. Table B.7 in the Appendix reports the number of families enrolled per medical unit in each year, obtained from our restricted version of the *Padrón*, merged with the health care data. It shows that there is a large variability in the number of families assigned to a health center and a hospital (with standard deviations of 1,496 and 22,206 per health center and hospital, respectively). It also shows that there has been a large increase in the number of families served by hospitals with the expansion of the program, with a relatively larger increase in the right tail of the distribution, suggesting a potential risk of overcrowding of larger hospital units;<sup>38</sup> instead, the increase in the number of potential users of health centers is uniform across the distribution.

We first assess whether the introduction of SP in a municipality led to an increase in the supply of the healthcare workforce. We have already seen in Table 1 that the program is rolled out earlier in municipalities with a greater supply of health care resources. An event-study analysis of the medical personnel employed by all providers of health care (from the SIMBAD data) reported in Figure A.8 in the Appendix confirms this: we cannot distinguish the change in medical personnel occurred in municipalities after the introduction of SP from a long-run trend.

Second, we examine whether the introduction of SP led to an increased burden in outpatient care. Using again data from the SIMBAD, Table B.8 in the Appendix shows that, in poor municipalities, the health reform was not associated with an increase in the number of outpatient visits per medical personnel in the SSA sector. In sum, our evidence suggests that municipalities choose to enrol families in SP in adequacy to the available supply of health care services.

## 7 Conclusions

In this paper, we have contributed to the ongoing debate on universal health coverage (UHC) by estimating impacts and mechanisms of the Mexican health insurance

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<sup>38</sup>Concerns about insufficient infrastructures and lack of medicines or equipment were raised since the early stages, see e.g. <http://www.jornada.unam.mx/2005/10/27/index.php?section=sociedad&article=016n1soc>.

program *Seguro Popular* on child health. Differently from the previous literature, we have used a unique combination of administrative and survey data and exploited the temporal and spatial variation arising from the introduction of SP in *all* the municipalities in Mexico.

Our intent-to-treat estimates show that the introduction of SP led to a significant reduction in child mortality by 7% in poor municipalities. This amounts to avoiding the deaths of approximately 861 children before age 5 per year. The impact of SP is detected 3 years after the introduction of the program in a municipality and is robust to a variety of alternative specifications. The reduction in child mortality is mostly driven by preventable conditions, namely respiratory and intestinal infections, which can be cured with timely access to medicines, and which have been covered by the program since 2002.

We have also examined potential mechanisms which might have driven these impacts, investigating the role played by demand and supply factors. We have showed that the introduction of SP led to an increase in hospital admissions for respiratory and intestinal infections, the same conditions for which we find a reduction in deaths. Complementary evidence from the health surveys also reveals that SP led to a reduction in the severity of diarrhea infections and in the prevalence of respiratory conditions in poor municipalities. Additionally, we provide evidence that the program was rolled out gradually in municipalities which had adequate pre-existing supply. Our findings remark the importance of the provision of primary care for promoting population health, and emphasize the need of improving basic infrastructures in the countries undergoing health insurance expansions.

Of course, health insurance is not the only input in the production of health, and successful health policies need to consider the wider social determinants. Additionally, while reaching full coverage in only nine years of operation has been a major achievement, the implementation of SP at state level still faces significant challenges (Nigenda et al., 2015). Nonetheless, our results suggest that universal health coverage (UHC), by providing access to preventive care and to cheap timely treatment, can significantly contribute to reduce the gap in mortality for poor children in less developed countries.

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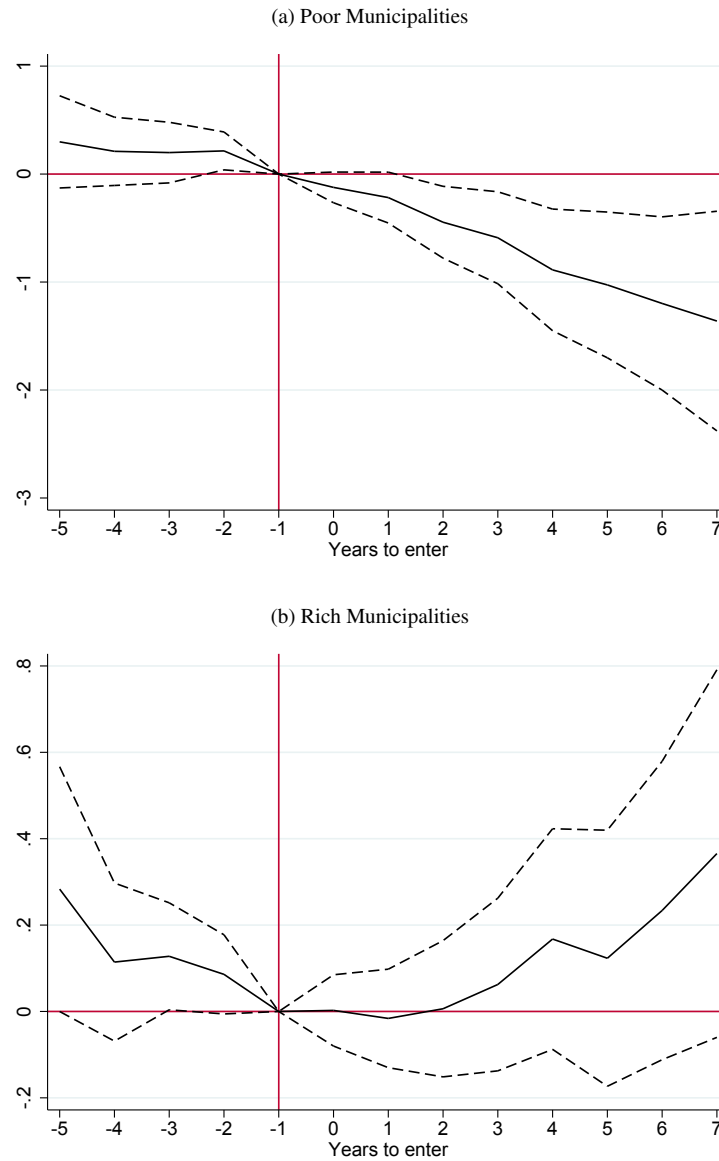
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## 8 Figures and Tables

Figure 1: Impact of SP on Child Mortality, by Poverty of the Municipality



Note: The figures plot weighted least square estimates of  $\beta$  from specification (1). The dependent variable is the child mortality rate. The dashed lines are 90% confidence intervals. Data source: Mortality Registry 1998-2012.

Table 1: The Determinants of the Timing of the Municipality Rollout of SP (Levels)

Sample of municipalities	(1)	(2)	(3)	(4)	(5)
All	All	All	All	Rich	Poor
<i>Socio-demographic and Political Indicators (2000)</i>					
Log population	-0.390*** (0.022)	-0.329*** (0.024)			
Marginalization Index	0.464*** (0.030)	0.203*** (0.037)			
% of population 0-4 years of age	0.030*** (0.015)	-0.033*** (0.014)			
% eligible population	0.018*** (0.002)	0.006*** (0.002)			
% of employed population working in: the primary sector	0.018*** (0.001)	0.010*** (0.002)			
the secondary sector	-0.014*** (0.003)	-0.005* (0.003)			
the tertiary sector	-0.031*** (0.002)	-0.020*** (0.002)			
Alignment b/w party in power in municipality and state	-1.409*** (0.072)	-0.786*** (0.088)	-0.722*** (0.083)	-0.647*** (0.094)	-0.812*** (0.144)
<i>Supply of Health Care (2001) and Health (2000)</i>					
No. Hospitals (per 100,000 eligible)	-0.065*** (0.018)	-0.036** (0.017)	-0.010 (0.016)	-0.003 (0.020)	0.024 (0.030)
No. Health Centers (per 100,000 eligible)	-0.003*** (0.001)	-0.001** (0.001)	-0.006*** (0.001)	-0.004*** (0.001)	-0.009*** (0.001)
No. Doctors in Hospitals (per 100,000 eligible)	-0.003*** (0.001)	-0.002*** (0.000)	-0.000 (0.000)	-0.001* (0.001)	-0.002 (0.002)
Child Mortality Rate	0.035*** (0.008)	0.008 (0.009)	0.003 (0.008)	-0.023 (0.017)	0.009 (0.009)
No. of observations	2,424	2,424	2,424	1,144	1,280
State fixed effects	No	Yes	Yes	Yes	Yes
Controls for socio-demographic	No	No	Yes	Yes	Yes

Note: Each cell in column 1 presents the estimated coefficient from a linear regression of the year of entry of SP in a municipality on a pre-program characteristic. Column 3 controls for a quadratic in the index of marginalization, the log of population, the share of population 0-4 years old, the share of eligible population, and the share of population employed in the primary, secondary and tertiary sectors. Robust standard errors in parentheses. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%.



Table 2: The Determinants of the Timing of the Municipality Rollout of SP (Trends)

	(1)	(2)	(3)	(4)	(5)	(6)
Sample of municipalities	All	Rich	Poor	All	Rich	Poor
Child Mortality Rate	-0.0001 (0.0063)	$t-1$ 0.0102 (0.0117)	$t-1$ -0.0036 (0.0070)	$t-3$ -0.0002 (0.0036)	$t-3$ 0.0034 (0.0045)	$t-3$ -0.0013 (0.0075)
No. of observations	2,424	1,144	1,280	2,424	1,144	1,280

Note: Each cell presents the estimated  $\varphi$  coefficient from the following linear regression:

$$Year_{ms} = \varphi \Delta x_{ms,t-k} + \gamma \mathbf{Z}_{mst} + \pi_s + \chi_{ms} \quad (4)$$

where  $Year_{ms}$  is the year of implementation of SP in municipality  $m$  of state  $s$ ;  $\Delta x_{ms,t-k}$  is the change in pre-SP municipality-level child mortality rate between year  $t$  (the year prior to the introduction of SP in a municipality) and  $t-k$  ( $k=1, 3$ );  $\mathbf{Z}_{mst}$  is a vector which includes the log of population and a quadratic in the index of marginalization of the municipality in 2000; and  $\pi_s$  are state fixed effects. Robust standard errors in parentheses. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%.

Table 3: Impact of SP on Child Mortality (ages 0-4)

Sample of Municipalities	(1) Poor	(2) Rich
before SP ( $\beta_1$ )	0.057 (0.083)	0.145*** (0.055)
0 to 2 years after SP ( $\beta_2$ )	-0.082 (0.070)	-0.008 (0.041)
3 or more years after SP ( $\beta_3$ )	-0.340*** (0.114)	0.099 (0.067)
$p$ -value $H_0 : \beta_2 = \beta_3 = 0$	0.004	0.039
Mean in 2000	4.721	3.747
SD in 2000	4.981	2.939
No. of Observations	19,200	17,160
No. of Municipalities	1,280	1,144

Note: This table displays weighted least squares estimates of our baseline specification (2) on the deaths data, aggregated at municipality-year level. The dependent variable is the child mortality rate. Each column presents results for separate weighted regressions, where the weights are given by the population 0-4 years old in municipality  $m$  in state  $s$  in 2000. Controls include fixed effects for year and municipality of residence. Standard errors (in parentheses) are clustered at the level of the municipality. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%. Data source: Mortality Registry 1998-2012.

Table 4: Impact of SP on Child Mortality, by Eligibility (Sample of Poor Municipalities)

Sample	(1) Eligible	(2) Non-Eligible
before SP ( $\beta_1$ )	-0.246 (0.229)	-0.816 (0.955)
0 to 2 years after SP ( $\beta_2$ )	-0.467** (0.226)	-0.163 (1.030)
3 or more years after SP ( $\beta_3$ )	-0.533** (0.261)	-0.396 (0.840)
$p$ -value $H_0 : \beta_2 = \beta_3 = 0$	0.115	0.717
Mean in 2000	4.318	6.053
No. of observations	19,147	14,864

Note: This table displays weighted least squares estimates of our baseline specification (2) on the deaths data, aggregated at municipality-year level. The dependent variable is the child mortality rate. Each column presents results for separate weighted regressions, where the weights are given by the population 0-4 years old in municipality  $m$  in state  $s$  in 2000. Controls include fixed effects for year and municipality of residence. Standard errors (in parentheses) are clustered at the level of the municipality. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%. Data source: Mortality Registry 1998-2012.

Table 5: Impact of SP on Child Mortality, Robustness (Sample of Poor Municipalities)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
before SP ( $\beta_1$ )	0.057 (0.083)	0.056 (0.084)	0.092 (0.084)	0.045 (0.087)	0.067 (0.091)	0.085 (0.087)	0.109 (0.092)
0 to 2 years after SP ( $\beta_2$ )	-0.082 (0.070)	-0.081 (0.070)	-0.117* (0.071)	-0.066 (0.071)	-0.096 (0.072)	-0.107 (0.071)	-0.138* (0.073)
3 or more years after SP ( $\beta_3$ )	-0.340*** (0.114)	-0.338*** (0.107)	-0.422*** (0.109)	-0.291*** (0.107)	-0.365*** (0.111)	-0.394*** (0.108)	-0.465*** (0.110)
$p$ -value $H_0 : \beta_2 = \beta_3 = 0$	0.004	0.001	0.000	0.005	0.001	0.000	0.000
No. of observations	19,200	19,200	17,920	19,200	19,200	17,920	17,920
Year fixed effects	X	X	X	X	X	X	X
Municipality fixed effects	X	X	X	X	X	X	X
Trends in baseline Municipality Xs		X	X	X	X	X	X
Political Alignment			X		X	X	X
Pre-2004 Linear Trend				X	X	X	X
Pre-2004 Quadratic Trend				X			X
Dummy for years since <i>Oportunidades</i>						X	X

Note: This table displays weighted least squares estimates of our baseline specification (2) on the deaths data, aggregated at municipality-year level. The dependent variable is the child mortality rate. Each column presents results for separate weighted regressions, where the weights are given by the population 0-4 years old in municipality  $m$  in state  $s$  in 2000. The baseline municipality Xs for which we include trends are: socioeconomic indicators measured in 2000 (quadratic of the index of marginalization, log of total population, and share of population of ages 0-4); labor market indicators measured in 2000 (share of uninsured individuals, share of individuals employed in the primary, secondary and tertiary sectors); health care indicators measured in 2001 (number of hospitals, health centers, and doctors in hospitals, all per uninsured). Standard errors (in parentheses) are clustered at the level of the municipality. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%. Data source: Mortality Registry 1998-2012.

Table 6: Impact of SP on Child Mortality, By Condition (Sample of Poor Municipalities)

	(1)	(2)	(3)
	All	Bacterial/Intestin. Malnutrition Respiratory (ICD10 A, E, J)	External Causes (ICD10 V, W, X)
before SP ( $\beta_1$ )	0.057 (0.083)	0.041 (0.041)	0.008 (0.017)
0 to 2 years after SP ( $\beta_2$ )	-0.082 (0.070)	-0.038 (0.034)	0.020 (0.016)
3 or more years after SP ( $\beta_3$ )	-0.340*** (0.114)	-0.102* (0.056)	0.016 (0.023)
$p$ -value $H_0 : \beta_2 = \beta_3 = 0$	0.004	0.193	0.408
Mean in 2000	4.721	1.383	0.335
No. of observations	19,200	19,200	19,200
% of all PNM (2000)	100%	29%	7%
Covered by SP by 2002?	20%	59%	1%
Covered by SP by 2006?	50%	74%	7%
Covered by SP by 2010?	67%	74%	8%

Note: This table displays weighted least squares estimates of our baseline specification (2) on the deaths data, aggregated at municipality-year level. The dependent variable is the child mortality rate. Each column presents results for separate weighted regressions, where the weights are given by the population 0-4 years old in municipality  $m$  in state  $s$  in 2000. Standard errors (in parentheses) are clustered at the level of the municipality. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%. Data source: Mortality Registry 1998-2012.

Table 7: Impact of SP on Child Hospital Admissions, by Condition (Sample of Poor Municipalities)

	(1)	(2)	(3)	(4)	(5)
	All (log)	Bacterial/Intestin. Malnutrition Respiratory (ICD10 A, E, J)	External Causes (ICD10 V, W, X)	# of Days	Share E.R.
before SP ( $\beta_1$ )	-0.001 (0.024)	0.020 (0.037)	0.016 (0.032)	0.007 (0.122)	0.001 (0.008)
0 to 2 years after SP ( $\beta_2$ )	0.087*** (0.026)	0.113*** (0.038)	0.033 (0.032)	0.059 (0.119)	0.016* (0.009)
3 or more years after SP ( $\beta_3$ )	0.092** (0.042)	0.144** (0.060)	0.041 (0.045)	0.036 (0.166)	0.040*** (0.014)
$p$ -value $H_0 : \beta_2 = \beta_3 = 0$	0.004	0.013	0.584	0.842	0.007
Mean in 2000	22.282	8.062	1.534	6.152	0.741
No. of observations	16,640	16,640	16,640	14,903	14,912

Note: This table displays weighted least squares estimates of our baseline specification (2) on the discharges data, aggregated at municipality-year level. The dependent variable is the log number of discharges in columns (1)-(3), the number of days in column (4), and the share of admissions through E.R. in column (5). Each column presents results for separate weighted regressions, where the weights are given by the population 0-4 years old in municipality  $m$  in state  $s$  in 2000. Standard errors (in parentheses) are clustered at the level of the municipality. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%. Data source: Registry of Admissions to SSA Hospitals 2000-2012.

Table 8: Prevalence and Treatment of Infections in Children

	(1)	(2)	(3)	(4)
	Diarrhea in past 2 weeks	Respiratory infection in past 2 weeks	Visited doctor if: had diarrhea	had respiratory infection
$1[SP=1] (\beta_1)$	0.013 (0.013)	-0.015 (0.024)	0.034 (0.072)	0.033 (0.031)
$1[SP=1] \times \text{Poor} (\beta_2)$	0.000 (0.018)	-0.075** (0.030)	-0.168* (0.101)	-0.024 (0.055)
$p\text{-value } H_0 : \beta_1 + \beta_2 = 0$	0.505	0.011	0.217	0.865
No. of observations	22,099	22,110	2,514	9,674
Mean in 2000: Poor	0.160	0.470	0.500	0.533
Mean in 2000: Rich	0.116	0.449	0.492	0.598

Note: The sample is restricted to infants less than 5 years old. Controls excluded from the table but included in all the estimated specifications are: an indicator for gender of child, a quadratic in age, an indicator for whether the head of household has at most completed primary education, fixed effects for the quarter of interview and for the municipality of residence. Standard errors (in parentheses) are clustered at the level of the municipality. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%. Data source: ENSA2000, ENSANUT2006 and ENSANUT2012.

# HEALTH INSURANCE AND CHILD HEALTH: EVIDENCE FROM MEXICO

**Gabriella Conti & Rita Ginja**

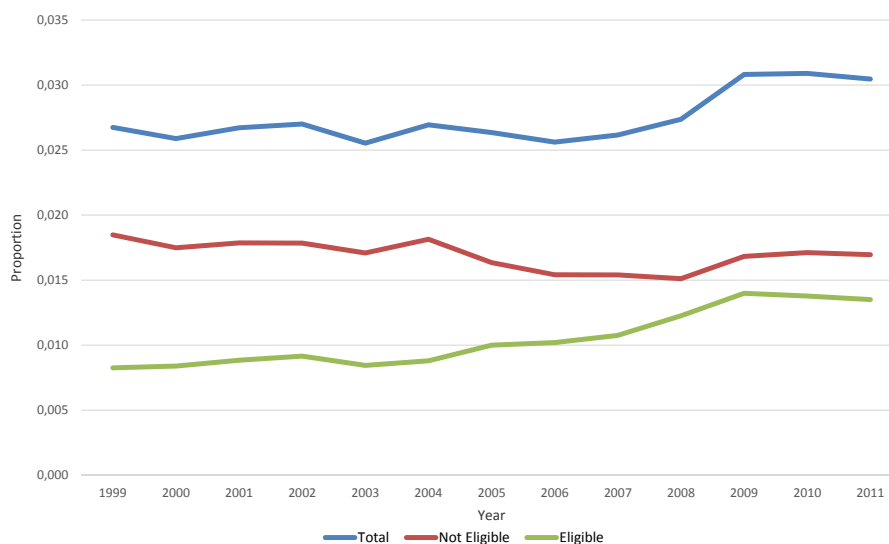
**ONLINE APPENDIX**

**NOT FOR PUBLICATION**



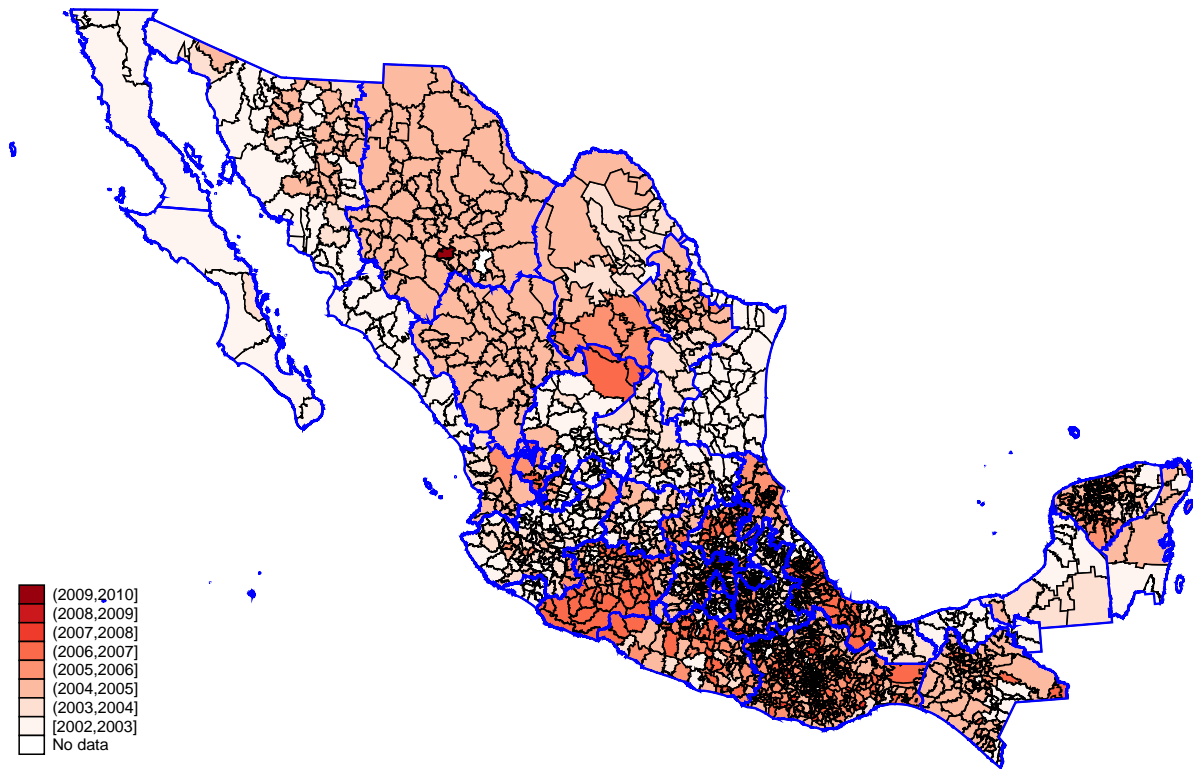
## A Additional Figures

Figure A.1: Public Expenditure on Health, Overall and by SP Eligibility Group



Note: The figure shows the ratio of public expenditure on health to GDP, overall and by SP eligibility group. The total public expenditure on health is the sum of the public expenditure for the insured population (not eligible to SP), i.e. those affiliated with IMSS (*Instituto Mexicano del Seguro Social*), ISSSTE (*Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado*) and PEMEX (*Petróleos Mexicanos*), and for the uninsured population (eligible to SP). This latter includes both federal and state expenditures, while the former combines resources assigned to (1) the Ministry of Health (*Ramo 12*), (2) the FASSA (*Fondo de Aportaciones para los Servicios de Salud, Ramo 33*) - these two constitute the *Aportaciones Federales* - or other health services funds; and (3) the IMSS-Oportunidades (*Ramo 19*). Source: own calculations from the official budget.

Figure A.2: Year of Implementation of SP in a Municipality



Note: A municipality is defined as having implemented SP if there are at least 10 households enrolled. Source: own elaborations using the *Padrón* data.

Figure A.3: Year of Introduction of SP in a Municipality, By State

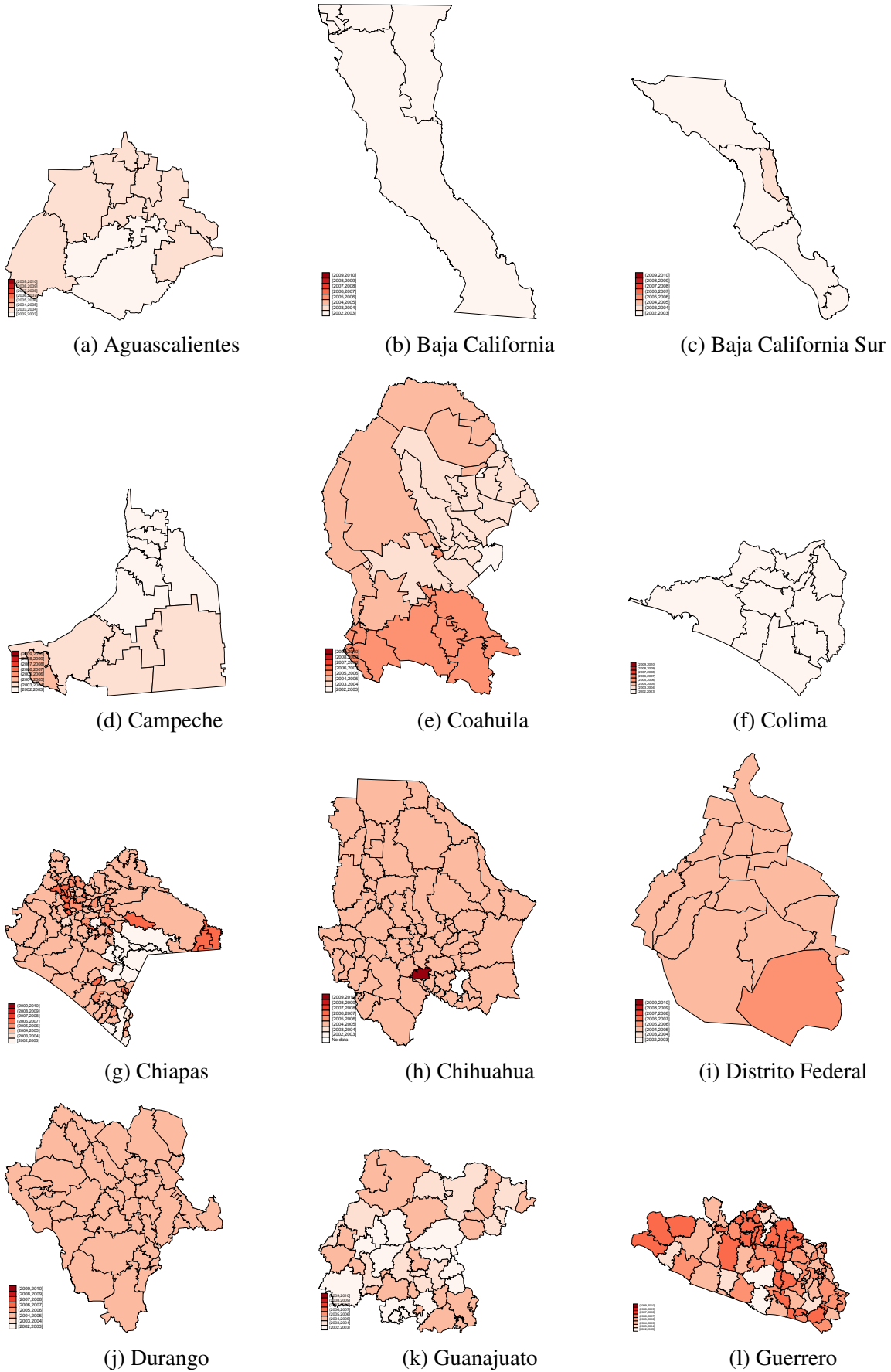
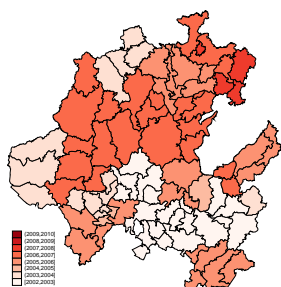
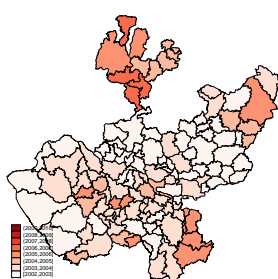


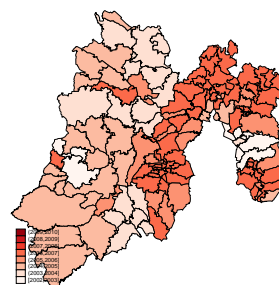
Figure A.4: Year of Introduction of SP in a Municipality, By State (cont.)



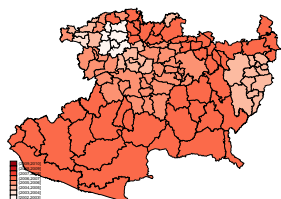
(a) Hidalgo



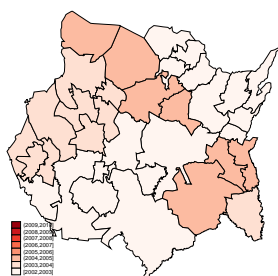
(b) Jalisco



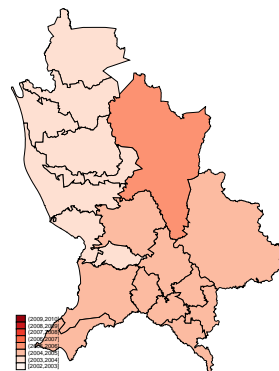
(c) México



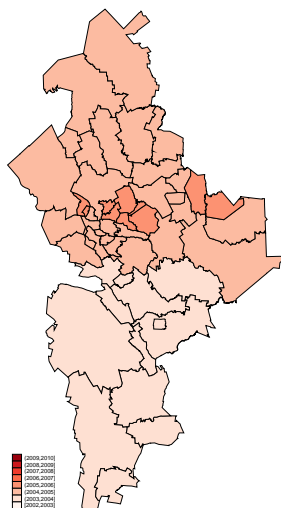
(d) Michoacán



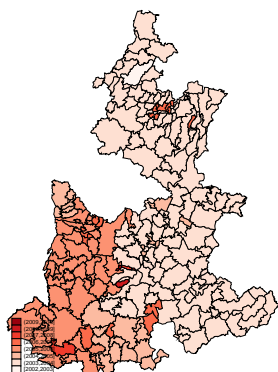
(e) Morelos



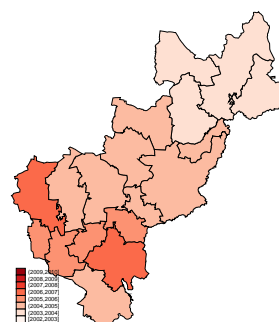
(f) Nayarit



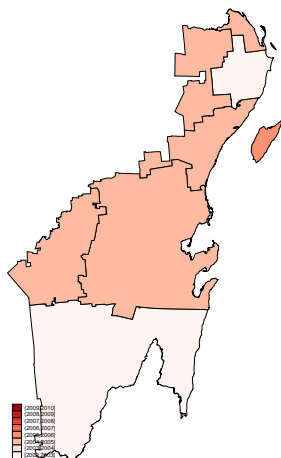
(g) Nuevo León



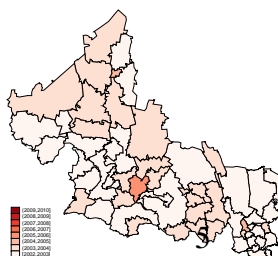
(h) Puebla



(i) Querétaro



(j) Quintana Roo



(k) San Luis Potosí



(1) Sinaloa

Figure A.5: Year of Introduction of SP in a Municipality, By State (cont.)

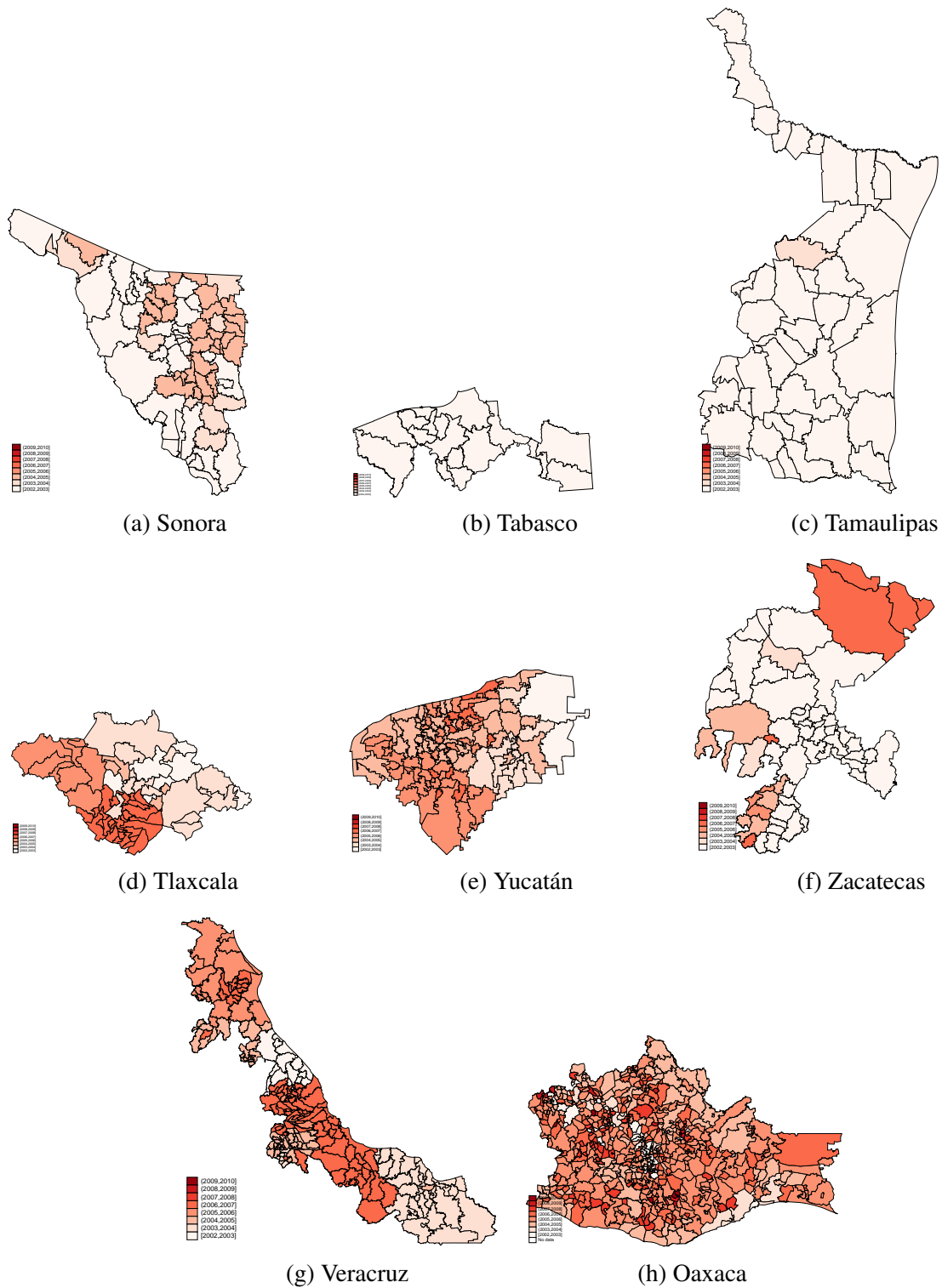
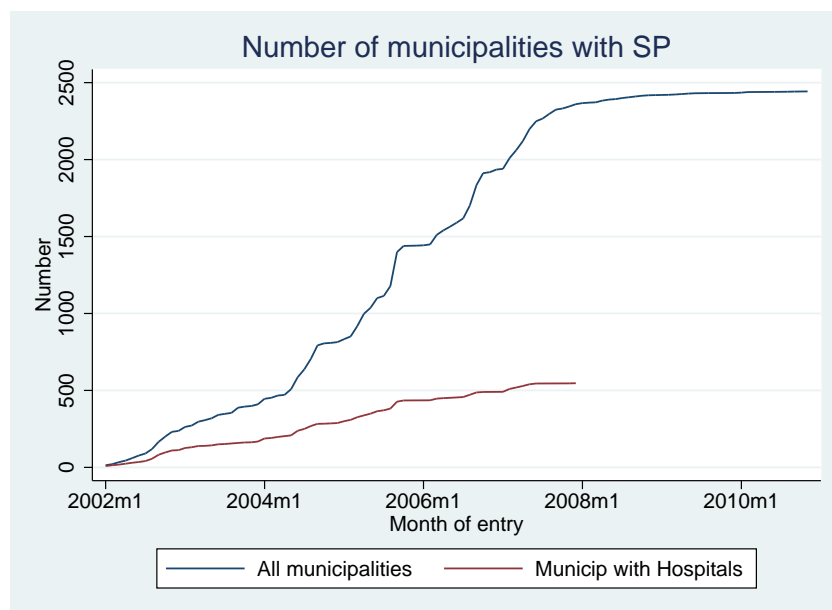
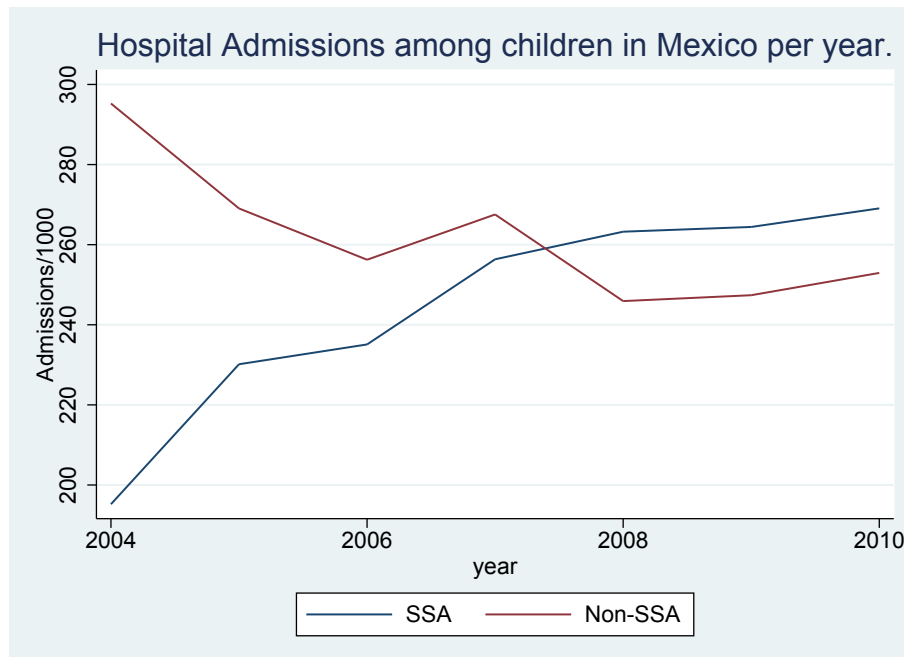


Figure A.6: Number of municipalities with access to SP, by month



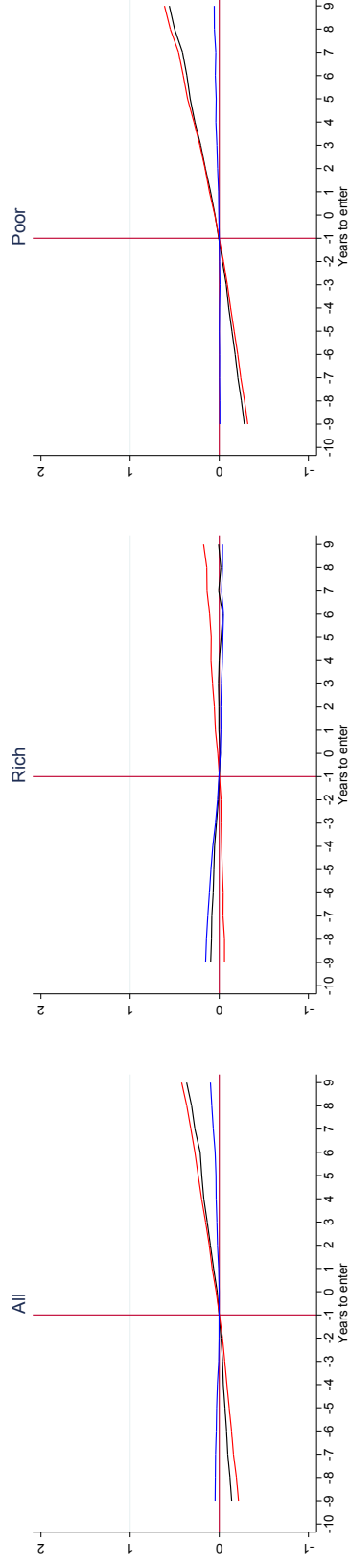
Note: This graph shows the cumulative number of municipalities which have implemented SP in each month between 2002 and 2010. A municipality is defined as having implemented SP if there are at least 10 households enrolled. Source: own elaboration using the *Padrón* data.

Figure A.7: Hospital Admissions in SSA and non-SSA Hospitals for Children <5 years of age



Note: This graph shows the number of hospital admissions in all public hospitals in Mexico between 2004 and 2012 for children less than 5 years old. “SSA” includes all hospital admission in SSA (Ministry of Health) units. “Non-SSA” includes all hospital admissions in hospitals not run by SSA (IMSS, IMSS-Oportunidades, ISSSTE, PEMEX and the military). Note that, even if IMSS-Oportunidades provides medical services to *Oportunidades* people covered by SP, in this figure we bundle them into the “Non-SSA” category since they are not included in the hospital discharges data - so to make the two categories comparable.

Figure A.8: Health Personnel in the different sectors providing health services



Note: The figures present estimates obtained using the SIMBAD data for the years 1996-2011. The dependent variable is the log of the number of medical personnel (doctors and nurses, measured per 1,000 individuals) in a municipality in a given year. The estimates are presented for all the different providers of health services together (SSA, IMSS, PEMEX, IMSS-Oportunidades and any other public institutions - black line); for SSA only (red line); and for all the public institutions except SSA (blue line). The figures plot the estimated  $\beta$ s coefficients from the following equation:

$$y_{mst} = \sum_{k=-9}^{-2} \beta_k^B SP_{ms} \mathbf{1}[t - T_{ms} = k] + \sum_{k=0}^9 \beta_k^A SP_{ms} \mathbf{1}[t - T_{ms} = k] + \mu_{ms} + \pi_t + \epsilon_{mst} \quad (5)$$

where  $y_{mst}$  is the personnel in municipality  $m$  of state  $s$  in year  $t = 1996 - 2011$ ,  $T_{ms}$  is the year of entry of the municipality in which the medical unit is located in SP,  $\mu_{ms}$  are municipality fixed effects,  $\pi_t$  are year effects.

## **B Additional Tables**



Table B.1: Health Ministry Medical Units, 2001-2010

Type	Year									
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<i>Outpatient Units</i>										
Basic Health Center (Rural)	7,690	7,836	7,933	8,127	8,232	8,307	8,350	8,372	8,334	8,381
Basic Health Center (Urban)	1,458	1,495	1,579	1,602	1,613	1,628	1,636	1,649	1,744	1,783
Health Center with hospitalization	162	149	147	122	121	89	74	65	63	59
Mobile Unit	1,447	1,442	1,420	1,410	1,420	1,406	1,394	1,629	1,849	1,955
<i>Brigada movil</i> (Mobile Brigade)	453	462	453	449	465	478	485	651	625	147
Specialized clinic	72	81	80	86	93	96	93	93	100	98
<i>Consultorio delegacional</i> (Borough Office)	65	65	46	17	17	12	12	15	21	13
<i>Unidad ministerio publico</i> (Public sector unit)	46	48	47	52	52	60	50	51	51	68
<i>Casa de salud</i> (Health Center)	0	0	0	0	17	37	57	134	142	602
<i>Unidad de Especialidades Médicas</i> (UNEMES)	0	0	0	0	0	29	50	108	313	469
<i>Centros Avanzados de Atención Primaria a la Salud</i> (CAAPS)	0	0	0	0	0	29	33	50	63	77
<i>Centros de Salud con Servicios Ampliados</i> (Health Centers with Extended Services)	0	0	0	0	0	0	0	11	18	25
<i>Inpatient Units</i>										
Community Hospital ( <i>Hospital integral/comunitario</i> )	63	78	86	128	133	182	211	228	237	256
General Hospital	268	274	275	278	288	289	290	301	309	307
Specialized Hospital	70	72	71	73	81	83	89	87	94	100
Psychiatric hospital	30	30	30	32	31	33	33	33	33	34
Total	11,824	12,032	12,167	12,376	12,563	12,758	12,857	13,477	13,996	14,374

Note: Number of medical units in Mexico operated by the Health Ministry. Source: authors' calculations based on data for all physical and human resources for all outpatient and inpatient units administered by the Health Ministry for the period 2001-2010.

Table B.2: Outpatient visits and Medical Personnel in all public providers of health care

	(1)	(2)	(3)	(4)	(5)	(6)
	All Municipalities		Poor Muns		Rich Muns	
Year	Number	%	Number	%	Number	%
Panel A: Outpatient visits (per 1,000 inhabitants)						
Panel A1: Non-SSA units						
2001	865		786		954	
2006	961	11%	915	16%	1013	6%
2010	1184	23%	1046	14%	1339	32%
Panel A2: SSA units						
2001	1098		1167		1020	
2006	1510	38%	1559	34%	1455	43%
2010	1746	16%	1814	16%	1669	15%
Panel B: Medical Personnel (per 1,000 inhabitants)						
Panel B1: Non-SSA units						
2001	0.32		0.27		0.38	
2006	0.39	21%	0.31	16%	0.47	25%
2010	0.44	15%	0.33	7%	0.57	20%
Panel B2: SSA units						
2001	0.50		0.46		0.54	
2006	0.64	28%	0.59	28%	0.70	29%
2010	0.89	38%	0.83	40%	0.96	37%
N	2,424		1,280		1,144	

Note: The table presents the number of (and the % change in) outpatient visits (Panel A), medical personnel (Panel B) and their ratio (Panel C) in SSA and non-SSA units, for the years 2001, 2006 and 2010. The non-SSA providers include IMSS, ISSSTE, PEMEX, IMSS-Oportunidades and any other public provider of health services. Source: authors' calculations using the SIMBAD data for the years 2001, 2006 and 2010.

Table B.3: Health Centers, Hospitals, Beds and Doctors in the SSA sector

	(1)	(2)	(3)	(4)	(5)	(6)
	All Municipalities		Poor Muns		Rich Muns	
Year	Number	%	Number	%	Number	%
Panel A: Health Centers (SSA)						
2001	11321		4807		6514	
2006	12100	7%	5080	6%	7020	8%
2010	13599	12%	5665	12%	7934	13%
Panel B: Hospitals (SSA)						
2001	398		77		321	
2006	551	38%	127	65%	424	32%
2010	657	19%	179	41%	478	13%
Panel C: Hospital beds for 1,000 eligibles (SSA)						
2001	0.17		0.05		0.31	
2006	0.20	17%	0.08	53%	0.34	10%
2010	0.25	23%	0.12	45%	0.39	17%
Panel D: Hospital doctors for 1,000 eligibles (SSA)						
2001	0.75		0.54		0.99	
2006	1.12	49%	1.09	100%	1.16	17%
2010	1.34	19%	1.21	12%	1.47	27%
N	2,424		1,280		1,144	

Note: The table presents in Panels A-D the number of (and the % change in) health centers, hospitals, beds and doctors in SSA units. Panel E shows the diffusion of SSA medical units across all municipalities in Mexico. Source: authors' calculations using data for all physical and human resources for all outpatient and inpatient units administered by the Health Ministry for the period 2001-2010.

Table B.4: Sources of variables used for to study the determinants of rollout.

Variable	Source
<i>Socio-demographic and political Indicators (2000)</i>	
Log population	CONAPO ( <a href="http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos">http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos</a> )
Marginalization Index	CONAPO ( <a href="http://www.conapo.gob.mx/es/CONAPO/Datos_Abiertos_del_Indice_de_Marginacion">http://www.conapo.gob.mx/es/CONAPO/Datos_Abiertos_del_Indice_de_Marginacion</a> )
% of individuals 0-4 years	CONAPO ( <a href="http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos">http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos</a> )
% eligible population	CONAPO ( <a href="http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos">http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos</a> )
% of occupied population working in primary, secondary and tertiary sectors	CENSUS 2000 (locality level data) from the INEGI <a href="http://www.inegi.org.mx/est/contenidos/proyectos/ccpv/cpv2000/iter_2000.aspx">http://www.inegi.org.mx/est/contenidos/proyectos/ccpv/cpv2000/iter_2000.aspx</a>
Alignment b/w party in power in municipality and state	CIDAC (Centro de Investigacin para el Desarrollo, A.C.) <a href="http://elecciones.cidac.org">http://elecciones.cidac.org</a>
<i>Supply of Health Care (2001) and Health (2000)</i>	
No. Hospitals, Health Centers, and Doctors in Hospitals (per 100,000 eligible)	Health Ministry data on the physical and human resources per medical unit available at <a href="http://www.sinais.salud.gob.mx/basesdedatos/recursos.html">http://www.sinais.salud.gob.mx/basesdedatos/recursos.html</a>
Child Mortality Rate in 2000	Mortality Records <a href="http://www.dgis.salud.gob.mx/contenidos/basesdedatos/bdc_defunciones.html">http://www.dgis.salud.gob.mx/contenidos/basesdedatos/bdc_defunciones.html</a>

Table B.5: Impact of SP on Child Admissions, Robustness (Sample of Poor Municipalities)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
before SP ( $\beta_1$ )	-0.001 (0.024)	0.018 (0.024)	0.021 (0.023)	0.019 (0.024)	0.018 (0.024)	0.021 (0.023)	0.020 (0.023)
0 to 2 years after SP ( $\beta_2$ )	0.087*** (0.026)	0.082*** (0.026)	0.080*** (0.026)	0.081*** (0.027)	0.081*** (0.027)	0.082*** (0.027)	0.082*** (0.028)
3 or more years after SP ( $\beta_3$ )	0.092** (0.042)	0.099** (0.041)	0.094** (0.040)	0.097** (0.041)	0.096** (0.042)	0.091** (0.042)	0.091** (0.042)
No. of observations	16,640	16,640	15,360	16,640	16,640	15,360	15,360
$p$ -value $H_0 : \beta_2 = \beta_3 = 0$	0.004	0.008	0.010	0.009	0.010	0.010	0.010
Year fixed effects	X	X	X	X	X	X	X
Municipality fixed effects	X	X	X	X	X	X	X
Trends in baseline Municipality Xs		X	X	X	X	X	X
Political Alignment			X		X	X	X
Pre-2004 Linear Trend				X	X	X	X
Pre-2004 Quadratic Trend				X			X
Dummy for years since <i>Oportunidades</i>						X	X

Note: This table displays weighted least squares estimates of our baseline specification 2 on the discharges data, aggregated at municipality-year level. The dependent variable is the log number of discharges. Each column presents results for separate weighted regressions, where the weights are given by the population 0-4 years old in municipality  $m$  in state  $s$  in 2000. The baseline municipality Xs for which we include trends are: socioeconomic indicators measured in 2000 (quadratic of the index of marginalization, log of total population, and share of population of ages 0-4); labor market indicators measured in 2000 (share of uninsured individuals, share of individuals employed in the primary, secondary and tertiary sectors); health care indicators measured in 2001 (number of hospitals, health centers, and doctors in hospitals, all per uninsured). Standard errors (in parentheses) are clustered at the level of the municipality. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%. Data source: Registry of Admissions to SSA Hospitals 2000-2012.

Table B.6: Characteristics of families at entry in SP

Family Charact.	(1) 1 <sup>st</sup> income decile	(2) Male headed	(3) Any member disabled	(4) Head married	(5) In <i>Oportunidades</i>	(6) Family size	(7) Children 0-4 present	(8) Head educ. primary/more	(9) Head age
	-0.133*** (0.038)	0.184*** (0.025)	-0.731*** (0.048)	0.019 (0.025)	-1.535*** (0.037)	-0.250*** (0.006)	-0.131*** (0.017)	0.313*** (0.035)	-0.012*** (0.005)
N	17,275,068	17,271,803	16,852,997	17,275,068	17,275,068	17,275,068	17,248,196	16,460,441	17,243,130
Mean	0.654	0.199	0.023	0.423	0.213	2.685	0.290	0.903	37.330
SD	0.476	0.399	0.151	0.494	0.410	1.662	0.454	0.296	16.070

Note: Each cell presents the estimated coefficient from a linear regression of the year of entry of SP in a municipality on the characteristic of a family. The sample is extracted from the *Padrón* and includes one observation per family, taken the first time she is observed in the registry (thus, the sample includes all families ever enrolled in SP). All estimates control for municipality fixed effects. Standard errors (in parentheses) are clustered at the level of the municipality. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%.

Table B.7: Distribution of SP families per health center and general hospital

	(1)	(2)	(3)	(4)	(5)
	Mean	SD	Percentile 25	Percentile 75	Percentile 95
Year	Panel A: Number of SP families per general hospital				
2005	10,078	11,865	2,056	14,270	29,555
2006	12,607	16,313	2,635	16,380	40,398
2007	15,572	19,233	3,428	19,116	50,487
2008	18,000	21,700	4,557	22,952	56,946
2009	19,682	24,658	4,312	25,449	71,126
2010	25,164	36,425	2,831	29,343	87,307
	Panel B: Number of SP families per health center				
2005	530	1,168	69	523	2,023
2006	551	1,182	54	544	2,188
2007	535	1,199	28	532	2,113
2008	651	1,306	83	669	2,536
2009	728	1,449	112	737	2,826
2010	1,036	2,082	197	991	4,088

Note: Selected moments from the distribution of the number of families allocated to each health center and general hospital by December 31 of each year between 2005 and 2010. Source: own calculations based on the *Padrón*, where we have information about the medical units families are assigned to.

Table B.8: Impact of SP on outpatient visits per medical personnel (poor municipalities).

	(1) All public providers	(2) Non-SSA units	(3) SSA units
before SP ( $\beta_1$ )	-0.005 (0.016)	0.024 (0.024)	0.035 (0.025)
0 to 2 years after SP ( $\beta_2$ )	-0.057*** (0.019)	-0.039* (0.022)	-0.025 (0.023)
3 or more years after SP ( $\beta_3$ )	-0.111*** (0.033)	-0.136*** (0.041)	0.004 (0.041)
Observations	16,411	9,675	11,466
Mean (# in 2000)	5.621	5.901	4.409
SD	11.42	19.32	7.120
$p$ -value $H_0 : \beta_2 = \beta_3 = 0$	0.003	0.002	0.104

Note: This table presents estimates obtained using the SIMBAD data for the years 1996-2011. The dependent variable is the log of the number of outpatient visits per medical personnel (doctors and nurses per 1,000 individuals) in a municipality in a year. The estimates are presented for three different types of providers of health services: column 1 includes personnel employed at the Health Ministry (SSA), IMSS, ISSSTE, PEMEX, IMSS-Oportunidades and any other public institutions; column 2 includes any public institution other than SSA, and column 3 includes only personnel employed at the SSA. Standard errors are clustered at the level of the municipality. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%.



## C Health Services in Mexico

**The Health Care System before *Seguro Popular*** The reform of the health care system in Mexico was a process which had been maturing for years and then culminated in *Seguro Popular*. The first important health sector reform had been launched as part of the National Development Plan 1995-2000 with the mission to improve the quality and the accessibility of health care. The first action taken by the Ministry of Health within this reform was to complete the decentralization process of the health services for the uninsured population, which had been initiated in 1987; an essential part of this process was the creation of health agencies in all the states, which were accountable to the state government, but had otherwise autonomy for financial management and health care delivery.

Hence, before SP, health care in Mexico was characterized by a two-tiered system.<sup>39</sup> About half of the population was covered through a contributory system (still in place today) guaranteed by the Social Security Institutions: the *Instituto Mexicano del Seguro Social* (IMSS), covering the private sector workers; the *Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado* (ISSSTE), covering the civil servants; and *Petroleos Mexicanos* (PEMEX), covering the employees in the oil industries. Health coverage was provided by these institutions in public hospitals; however, individuals could also pay for care in private hospitals, or buy private health insurance. In 2000, IMSS covered 40%, and ISSSTE 7% of the population, respectively (Frenk et al., 2006).

In addition to the formal sector workers, before the introduction of SP, health care was also available to the poor through two different programs. A first program, the *Programa de Ampliacion de Cobertura* (PAC) (Coverage Expansion Program), started in 1996 within the health reform to serve that part of the population with limited or no access to basic health services.<sup>40</sup> This program consisted of brigades visiting the more rural and marginalized areas of the country, with a variable periodicity between every two weeks or once per month, to deliver a basic package of 13 primary care interventions (Secretaría de Salud, 2002). In 2003 PAC was incorporated in the *Programa de Calidad, Equidad y Desarrollo en Salud* (PROCEDES) (Program for Quality, Equity and Development in Health), and successively in SP under the label *Caravanas de la Salud*. In addition to PAC, part of the uninsured population had access to basic health services through the *Programa de Educacion, Salud y Alimentación* (Progresá). This was launched in 1997 in rural areas as the main anti-poverty program in Mexico; it was renamed *Oportunidades* in 2002 and expanded to urban areas. The program has some overlap with SP, since it has a health component implemented through different channels.<sup>41</sup>

The part of the uninsured population not covered by PAC or *Progresá* could seek health care either in public health units run by the *Secretaría de Salud* (SSA) or in private ones. In both cases, payment was

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<sup>39</sup>This was established with the General Health Law of 1984, which essentially set a national health system made of three types of institutions: public institutions oriented to take care of the needs of the uninsured; social security institutions and social services; and private services, a new system of managed care organizations called *instituciones de seguros especializados en salud*, ISES.

<sup>40</sup>Before the PAC, the *Programa de Apoyo a los Servicios de Salud para la Población Abierta* (PASSPA) (Program in Support of Health Services for the General Population), was already operating in the years 1991-1995 in five states (Chiapas, Guerrero, Hidalgo, Oaxaca and Mexico City). This program provided a first assessment of the health of the population, and of the availability, accessibility, utilization and quality of care of the existing health services.

<sup>41</sup>First, *Progresá* beneficiaries receive free of charge the Guaranteed Basic Health Package (*Paquete Básico Garantizado de Salud*), which includes a set of age-specific interventions; second, the nutrition of both children and pregnant women is monitored through monthly consultations (and nutritional supplements are distributed in case of malnutrition); third, information on preventive health behaviors is provided through community workshops; fourth, emergency services are secured by the Ministry of Health, IMSS-Oportunidades and other state institutions (only in relation to pregnancy and childbirth); lastly, beneficiary families protected by Social Security have also access to second- and third- level care in the units administered by IMSS, while those unprotected have only limited access to second-level care. The legislation of *Oportunidades* was obtained from <http://www.normateca.sedesol.gob.mx/es/NORMATECA/Historicas>. Accessed May 10th 2015.

at the point of use and patients had to buy their own medications. Hence, in 2000, approximately 50% of health expenditures was classified as “out-of-pocket expenses” (Frenk et al., 2009) and 50% of the Mexican population - about 50 millions of individuals - had no guaranteed health insurance coverage. The public per capita health expenditure on the insured was twice as much as that for the uninsured (see Frenk et al., 2006 and figure A.1).

**The Implementation of Seguro Popular** SP was launched as a pilot program in 2002 in 26 municipalities (in 5 states: Campeche, Tabasco, Jalisco, Aguascalientes, Colima) under the name *Salud para Todos*, with the aim to extend it gradually to the rest of the country. Contrary to the plans, already during 2002, 15 additional states<sup>42</sup> implemented the program, by agreeing with the federal government to provide the health services covered by SP. By the end of the pilot phase, on 31 December 2003, six additional states<sup>43</sup> had joined, for a total of 613,938 families enrolled in the program.

The System of Social Protection in Health (SPSS, *Sistema de Protección Social en Salud*) was officially introduced on January 1st 2004 by the General Health Law (*Ley General de Salud, LGS*), with the aim to extend health coverage and financial protection to the eligible population. The Federal Government also created the National Commission for the Social Protection in Health (CNPSS, *Comisión Nacional de Protección Social en Salud*). The rules of operation of the program stated that the expansion should prioritize states with: (1) low social security coverage; (2) large number of uninsured in the first six deciles of income; (3) ability to ensure the provision of services covered by the program; (4) potential demand for enrollment; (5) explicit request of the state authorities; (6) existence of sufficient budget for the program.<sup>44</sup> In 2004, three more states introduced the program (Nayarit, Nuevo Leon and Querétaro). The last three states (Chihuahua, Distrito Federal and Durango) joined SP in 2005.

**Eligibility and Enrolment** The eligibility criteria are defined in art.77 bis 3 of the LGS “Families and individuals who are not beneficiaries of social security institutions, or who have not otherwise access to health services, are entitled to enroll in SP, on the basis of their place of residence. The basic unit of protection is the household.”<sup>45</sup> Enrollment in SP is voluntary, and is granted upon compliance with simple requirements.<sup>46</sup> The effective right to use the system for beneficiaries begins on the first day of

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<sup>42</sup>Baja California, Chiapas, Coahuila, Guanajuato, Guerrero, Hidalgo, Mexico, Morelos, Oaxaca, Quintana Roo, San Luis Potosi, Sinaloa, Sonora, Tamaulipas and Zacatecas.

<sup>43</sup>Baja California Sur, Michoacán, Puebla, Tlaxcala, Veracruz and Yucatán.

<sup>44</sup>Diario Oficial, 4 de julio de 2003, *Reglas de operación e indicadores de gestión y evaluación del Programa Salud para Todos (Seguro Popular de Salud)*.

<sup>45</sup>The art. 77 bis 4 further specifies that the household can be made of the following typologies: (i) spouses; (ii) cohabitants; (iii) single parents; (iv) others as determined by the General Health Council, on the basis of their degree of dependency or cohabitation who justify their transitory or permanent assimilation to a household. The law then considers the following as household members: (i) natural and adopted children less than 18 years of age; (ii) children and adolescents aged 18 years or less who are part of the household and have blood relations with the above-mentioned beneficiaries; (iii) direct ancestors older than 64 years, who live in the same home and are financially dependent, as well as sons or daughters until 25 years of age, single, who prove to be students or disabled dependents. Slightly less generous, instead, is the extent of coverage in the case of IMSS: in addition to the main beneficiary, his/her spouse (or partner if cohabiting for at least 5 years) is also covered, and so are his/her children under 16 (or under 25 if studying) and his/her parents if living in the same household.

<sup>46</sup>The requirements are: proof of residence in the Mexican territory; lack of health insurance, ascertained with self-declaration; and possession of the individual ID (*CURP - Clave Unica de Registro de Población*). This information is necessary for the application of the socio-economic assessment tool used to calculate the premium. The unavailability of the required documentation does not prevent enrollment, and families/individuals can be provisionally registered for up to ninety days. However, if the documentation is not provided after this period, they are dropped from the rolls. This means that families cannot fake their residence status to get enrolled in SP. On the other hand, they can still use the health services until the card is revoked after formal ascertainment; since this is in practice unlikely to happen, it implies that the *Padrón* might be

the calendar month following the enrollment date, and it is valid for twelve calendar months; afterwards, the application has to be renewed within 60 days. Information about all individuals affiliated in the system is listed in an administrative registry, called the *Padrón*. At the end of 2010, the *Padrón* included 15,760,805 families, for a total of 43,518,719 individuals. By April 2012, 98% of the Mexican population was covered by some health insurance (Knaul et al., 2012) - a remarkable achievement against the 50% covered only 10 years earlier. According to the official evaluation report (Nigenda, 2009), the main reasons for affiliation in SP were access to free medicines and to primary care at reduced costs.

**Funding** Between 1999 and 2007, the ratio of the total public expenditures on health to GDP was relatively stable at 2.6% (see Figure A.1). This was one of the lowest figures among OECD countries: the corresponding figures for Denmark (the country with the highest share), US and Brazil in 2004 were 8.2%, 6.9% and 3.4%, respectively. Between 1999 and 2004, the ratio of the total public expenditure on health to GDP for insured (not eligible) and uninsured (eligible) was also stable at 1.8% and 0.9%, respectively. However, after 2004, the ratio for the uninsured (eligible) experienced a steady increase, from 1% to nearly 1.5% in 2009, while that for the insured (not eligible) remained constant after a temporary drop between 2004 and 2008.<sup>47</sup> Hence, the program seems to have been successful in accomplishing one of its goals: redistributing resources between the two groups.

SP is a non-contributory health insurance system, funded by revenues from general taxes, on the basis of a tripartite structure similar to that adopted by the two major social insurance agencies in Mexico, IMSS and ISSSTE: (1) a social contribution (*Cuota Social*) from the federal government; (2) solidarity contributions from both the federal government and the states (*Aportaciones Solidarias*); (3) and a family contribution (*Cuota Familiar*). The *cuota social* is an annual contribution of the federal government for each affiliated family, equal to 15% of the daily minimum wage in Mexico City (about USD200 a year per family) - a figure very similar to the contribution for each employee affiliated with the IMSS. The federal and state solidarity contributions amount to, on average, 1.5 and 0.5 times the *cuota social* per household, respectively.<sup>48</sup> The *cuota familiar* is an annual fee introduced to replace the out-of-pocket payments previously made at the point of use - i.e. a premium; in 2010, 96.1% of the enrolled families were exempted from paying it, on the basis of their low socioeconomic status.<sup>49</sup>

**Coverage of Health Services** Once a family is enrolled in SP, she is assigned to a health center (which, in turn, is associated to a general hospital) and to a family doctor for primary care, and has access to a package of health services, as detailed in the Charter of Right and Duties received upon affiliation. The number of interventions covered increased yearly, from 78 in 2002 to 284 in 2012, and it was listed in a 'Catalogue of Health Services' (since 2006 called CAUSES, *Catalogo Universal de Servicios de Salud*) revised annually (see Knaul et al., 2012). They include a wide range of services, from prevention, family planning, prenatal, obstetric and perinatal care, to ambulatory, emergency and hospital care, including surgery. The basic coverage was complemented in November 2004 with the introduction of the *Fondo*

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an undercount of the number of people actually using the services.

<sup>47</sup>This was due to a failed attempt to increase public revenues to fund SP (Nigenda, 2005).

<sup>48</sup>The federal solidarity contribution is computed based on the following elements: (i) number of beneficiary families; (ii) health needs, proxied by state's indicators of infant and adult mortality; (iii) additional contributions called the "state effort" (*esfuerzo estatal*); and (iv) the performance of health services.

<sup>49</sup>The fee to be paid by each family is progressive and based on the average household income relative to the national income distribution (the verification of the income decile for each affiliated family is held every three years). Families exempted from payment are those (i) with a disposable income in the bottom 20% of the national income distribution; (ii) enrolled in federal programs to combat extreme poverty; (iii) resident in rural areas of very high marginalization with less than 250 inhabitants, and (iv) with other specific requirements set by the CNPSS.

*de Protección contra Gastos Catastróficos (FPGC)*. The FPGC is a reserve fund of unlimited budget with the objective to support the financing of care for high-cost diseases – such as breast and womb cancer, and child leukemia. The conditions covered under this fund were chosen on the basis of the cost-effectiveness of available interventions and the costs associated with premature death and disability. While the interventions included in the CAUSES are paid for by capitation, those covered under the FPGC are paid on a per-case basis. A further expansion took place in 2006 with the introduction of *Seguro Medico para una Nueva Generación (SMNG)*, which offers a specific package of services for children under five.

**Delivery of Health Services** As mentioned above, the non-contributory and the contributory systems have completely separate networks of hospitals and health centers, each to serve its own affiliates. The LGS established that the Federal Government and the states had to share the responsibility for social protection in health, with the former (through the SSA) responsible for regulating, developing, coordinating and monitoring health actions, and the latter for managing the resources allocated by the Federation for the purchase of medicines, staffing and service delivery in general. The official implementation of SP in 2004 established that, in each state, the funding body (the REPSS - *Regímenes Estatales de Protección Social en Salud* - State Regimes of Social Protection in Health) should purchase the health services from public and private providers through management agreements. These bilateral agreements had to specify the number of families to be served in each year,<sup>50</sup> the quality conditions, and the allocation of resources and funds to provide care to the SP beneficiaries, subject to the spending limits mentioned in the funding section. In practice, they led to a large degree of heterogeneity in the provision of services and in the hiring of new physicians contracted to serve under SP.<sup>51</sup>

## References

- [1] Muñoz, Onofre. 2012. “Propuesta de un Sistema Nacional de Servicios de Salud. Componente de Salud de una propuesta de Seguridad Social Universal”, CONEVAL.
- [2] Nigenda, Gustavo. 2005. “El Seguro Popular de Salud en Mexico: Desarrollo e retos para el futuro”, Nota Técnica de Salud no 2/2005, Banco Interamericano de Desarrollo, Departamento de Desarrollo Sostenible, División de Programas de Desarrollo Social.
- [3] Nigenda, Gustavo. 2013. “Servicio social en medicina en México. Una reforma urgente y posible”, Instituto Nacional de Salud Pública.

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<sup>50</sup>This number was set so that between 2004 and 2010 14.3% of the uninsured population (as estimated in 2004) was to be enrolled in the program.

<sup>51</sup>Doctors working in SSA units were on average less qualified than those serving in social security institutions. For instance, in 2010 all physicians providing primary care in the IMSS had a university degree and 40% of them had a specialty in family medicine; instead, 41% of the doctors providing primary care in SSA units were medical interns, with a figure as high as 81% for those assigned to work in rural areas (Muñoz, 2012). Another problem was the widespread use of temporary new appointments between 2002 and 2006. Before 2007, the majority of the new hires was on fixed term contracts (on average, for a period of 5,5 months) and with salaries about 50% lower than those for doctors with a regular contract (Nigenda, 2013). There is substantial cross-state variability among the salaries of doctors on temporary contracts: for example, the gross salary for a general practitioner varied in 2008 between 8,950 pesos per month in Zacatecas and 21,673 in Querétaro.