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Who benefits from free health insurance: evidence from Mexico

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Who Benefits From Free Health Insurance: Evidence from Mexico

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Abstract

We present the first comprehensive evidence on the health impacts of the introduction and expansion of a large non-contributory health insurance program in Mexico, the Seguro Popular (SP). SP provided access to health services without co-pays to individuals with no Social Security protection. To identify the impacts of the program we use its staggered rollout across municipalities between 2002 and 2010. Our intent-to-treat estimates show that SP reduced infant mortality by 10% in poor municipalities. We are unable to detect program impacts on mortality for children ages 1-4, adults or elderly. The decline in infant mortality is driven by reductions in deaths due to perinatal conditions, congenital malformations, diarrhea and respiratory infections. Also in poor municipalities, the introduction of SP is associated with an immediate 7% increase in obstetric-related hospital admissions and with a 6% increase in hospital admissions due to diarrhea and respiratory infections among infants. The decline in infant mortality attributed to SP closes 84% of the gap in infant mortality rates between poor and rich Mexican municipalities.

JEL Codes: 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 with various degrees of success (Boerma et al., 2014; Reich and Evans, 2016; WHO, 2015). In particular, many developing nations in Latin America and elsewhere (Atun et al., 2015) have increased the funding for public 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 prioritize 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.[1] 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 eligibility requirement for SP is the lack of access to employment-based health insurance, half of the country's population was to be enrolled. The Ministry of Health (or *Secretaria de la Salud*, SSA) 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, which are run by the Ministry of Health. In exchange, affiliated individuals are required to pay a subsidized premium; in practice, nearly all affiliates are exempted from it.

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

[1] 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.

palities in Mexico, between 2002 and 2010. Our paper is the first to study the health impact health of SP using the large set of administrative data available in the country, namely the administrative data on deaths, the universe of admissions to public hospitals and the registries of human and physical resources of all public medical units in Mexico. Combining mortality and hospitalization data sets allows to pin down the mechanisms behind the health impacts found. We also use for the first time the microdata on all households affiliated to SP, which allows us to characterize individuals enrolled at different points in time of the expansion of the program, and to relate the characteristics of early entrants to the impacts found. Additionally, all the data sets we use cover several years, since before the introduction of SP (in 2002), up to until the program had reached full coverage (2012).

We study the program impacts on mortality across all age groups, but we only find a reduction on mortality among infants residing in poor municipalities in Mexico.[2] Reduction of child mortality (using the infant mortality as an indicator) and improvement of maternal health are two of the eight Millennium Development Goals, and, since its introduction, SP offered generous coverage for conditions prevalent among poor children below the age of five and prenatal care and deliveries in hospital. 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 mortality rates. Our main finding is that the introduction of SP reduced infant mortality by 10% in poor municipalities, which corresponds to 1.55 deaths per 1000 livebirths. The impact is detected three years

[2]A municipality is defined poor by the Mexican authorities if the 2000 marginalization index is high or very high, as opposed to very low, low or medium. About half of the municipalities in Mexico are poor and these municipalities are defined as priority in the launch of social programs (for example, the Progresa-Oportunidades; see CONAPO (2001)). The marginalization index is used in the planning process and in the allocation of budgetary resources of federal and state governments to public policies aimed at improving the living conditions of the most disadvantaged population. The index is the first principal component extracted using principal component analysis on the information collected in the 2000 CENSUS in four areas: lack of access to education, inadequate housing, insufficient income and residence in small localities. Within the four broader areas, nine indicators are used to construct the index for a given geographic area: (1) percentage of population living in homes without piped water, (2) percentage of population in dwellings without sewage or sanitation for exclusive use of the house, (3) percentage of population living in housing with earthen floor, (4) percentage of population living in homes without electricity, (5) percentage of population in housing with some level of overcrowding, (6) percentage of employed population with income of up to two minimum wages, (7) percentage of the population aged 15 or over who are illiterate; (8) percentage of population aged 15 years or more without full primary education, (9) percentage of population living in localities with less than 5,000 inhabitants (ie, rural localities).

after the implementation of SP in a municipality and this decrease in infant mortality closes 84% of the baseline gap in infant mortality rates between poor and rich municipalities. The reduction in infant deaths can be attributed to three types of medical conditions. First, it is associated with a reduction in deaths due to preventable and communicable conditions, mainly intestinal and respiratory infections; 59% of the deaths due to these conditions were immediately covered by SP when introduced in 2002. Second, the reduction in IMR is due to a reduction in deaths associated with perinatal conditions, namely respiratory disorders or infections specific to the perinatal period, and congenital malformations (in particular, congenital cardiac malformations). These medical conditions can be associated either with unassisted deliveries or with congenital defects which, without immediate care by skilled medical personnel, would have led to the death of the newborn.

We then examine potential mechanisms through which SP reduced infant mortality, by investigating the role played by demand and supply of health services. We show that upon the introduction of SP there is an immediate 10% increase in deliveries in SSA hospitals and the effect becomes stronger with exposure to the program, reaching 14% three or more years after its implementation in a municipality. We show that these are births which would have otherwise occurred outside the health system, and not additional births due to an increase in fertility. We also find an immediate increase in other obstetric-related admissions, and a 7% increase in hospital admissions for infants, mainly due to diarrhea and respiratory infections. Finally, we are unable to detect any impact of SP on mortality at ages 1-4, 20-59 and among elderly (ie, 60 or over).

We provide different pieces of evidence that the main identification assumption is likely to hold. First, we show through graphical analysis that municipalities that launched SP in different years were not in differential mortality trends prior the introduction of SP. Second, we use a flexible time-to-event specification which has the double benefit of allowing to explicitly understand the dynamics of program impacts and to test whether there was a significant differential change in mortality prior to the launch of SP. Finally, our estimates are robust to a battery of alternative specifications, namely to including state-year trends, state-year fixed effects, municipality trends in pre-program characteristics and pre-SP municipality linear trends.

Our paper provides several contributions. First, we contribute to the literature on the effects of health insurance expansions for low SES individuals (as are the uninsured in developing countries), so our findings are also relevant for the undergoing (or attempted) reforms in developed countries like US.[3] In the case of Mexico, 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 in both its temporal and geographic scope. Thus, the jury is still out about the SP impacts on health, and there is still no understanding about 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 reviews the pertinent literature, and Section 3 presents the institutional background and the main features of the program. Section 4 describes the data used and Section 5 details the empirical strategy. The results are presented in Section 6. Section 7 concludes.

2 Related Literature

While economic theory provides unambiguous predictions about the effects free or subsidized 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

[3] 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*.

scarcer. We start by summarizing the evidence from health insurance expansions in developed countries, and then we provide more detailed evidence from low and middle income countries, with a setting similar to the Mexican one.

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, 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 (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. For example, increased eligibility for free health insurance through Medicaid led to improvements in infant mortality (Currie and Gruber, 1996*b*,*a*).

Health insurance in less developed countries As mentioned in the introduction, many less developed countries have increased the funding for public health insurance programs over the last decade. Here we review the evidence on these recent expansions, and how SP relates to them.

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 it suffers from long waiting times, poor quality and shortage of specialists (Savedoff and Smith, 2011). Despite these issues, Bitrán, Escobar and Gassibe (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 and Macinko, 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 (*Programa Saúde de Família*), which was adopted in 1994 with the goal to promote and provide primary care services through the use of professional health care teams which intervene directly at the family level. As in the Mexican Seguro Popular, enrolment in the program is voluntary. Each team is based in a local health facility and consists of one GP, one nurse, two nursing assistants, and up to 12 community agents (an agent per max 750 individuals). This team-based outreach is unlike the Seguro Popular. The main goal was to re-structure the system and to expand outpatient care, replacing hospital care for simpler conditions and increasing referral for the complex ones. Evaluations of the program have used a differences-in-differences approach relying on the rollout of the Family Health Program across Brazilian municipalities. The Family Health Program has been consistently associated with a reduction in infant mortality (Macinko, Guanais and de Fátima Marinho de Souza, 2005; Aquino, de Oliveira and Barreto, 2009; Bhalotra, Rocha and Soares, 2016), and in maternal mortality and with an increase in prenatal care (Bhalotra, Rocha and Soares, 2016).

Colombia introduced the *Regimen Subsidiado* (Subsidized Regime) in 1993 which fully subsidized the poor to purchase insurance from private, government-approved insurers. As the Seguro Popular in Mexico, the *Regimen Subsidiado* provided a package of health services for pregnant women, which included prenatal care, delivery care, cesarean delivery, special care for women with high-risk pregnancies, a package of medicines, vitamins, and nutritional supplements. Since eligibility to the program is based on an index of wealth, Miller, Pinto and Vera-Hernndez (2013) compare those just eligible and those just ineligible to the *Regimen Subsidiado* in a regression discontinuity design setup. They find that the program was successful in protecting from financial risk, increasing the use of preventive services, and improving health. Adopting a similar strategy and using administrative data for a single urban municipality, Camacho and Conover (2013) find that it also reduced the incidence of low birth weight.

Lastly, Peru underwent a public health insurance expansion in 2001, with the introduction of the *Seguro Integral de Salud* (Comprehensive Health Insurance). The program is similar to the Seguro Popular in the type of coverage offered without co-payments, or similar fees. Unlike in Mexico, but like in Colombia, eligibility is based on the index of wealth, which Bernal, Carpio and Klein (2017) explore using survey data in a regression discontinuity design as in Camacho and Conover (2013) and Miller, Pinto and Vera-Hernndez (2013). They find that the *Seguro Integral de Salud* is associated to a decrease in out-of-pocket health expenditures, increase in visits to doctors, prescription of medicines and diagnostic testing, but no impacts on the use of preventive care, with the exception of women in fertile age.

Outside Latin America, the most relevant evidence to our study comes from the health reforms in Thailand and in Turkey. In 2001, Thailand introduced the "30 Baht", which increased funding available to hospitals to care for the poor and reduced the co-pays to 30 Baht. Gruber, Hendren and Townsend (2014) and Limwattananon et al. (2015), use a differences-in-differences approach comparing the change in outcomes for provinces with differential pre-reform health insurance coverage. They find an increase in health care use and a reduction in postneonatal mortality (Gruber, Hendren and Townsend, 2014) and out-of-pocket medical expenditure (Limwattananon et al., 2015). Finally, Turkey launched in 2005 the Family Medicine Program, which up to 2010 gradually expanded to all 81 provinces in the country. The program assigns a GP to each citizen, and primary care services are offered free of charge in health centers. The doctors recruited under the scheme have to comply with performance requirements in maternal and child health. Cesur et al. (2017) use the rollout of the program across provinces in a differences-in-differences framework and find that it reduced mortality among infants, children 1-4 years old and elderly.

While the recent evidence reviewed about has significantly expanded our knowledge on health insurance in less developed countries, we are able to further contribute to it. Relative to all the papers above, we are able to explore richer data on mortality (which includes information on causes of death) and also on hospitalizations, in addition to study the determinants of local implementation of the program.

We now turn to the evidence on Mexico. To date, a large part of the SP literature has focused on the labor market impacts, to examine evidence of a potential distortion of workers' incentives to switch from formal work arrangements, which provided health insurance coverage before SP, to informal jobs. The evidence on this issue is mixed: some studies do not find any impact (Gallardo-García, 2006; Barros, 2008), while others find relatively small increases in the share of informal workers among the less educated and those with children (Aterido and Pages, n.d.; Azuara and Marinescu, 2013; Bosch and Campos-Vazquez, 2014; del Valle, 2014). 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. Typically, these studies use small subsamples of the more than 2400 municipalities in the country (for example, Azuara and Marinescu (2013) and Conti, Ginja and Narita (2017) rely on the Mexican labor force survey and use, respectively, 350 and 600 municipalities, whereas Bosch and Campos-Vazquez (2014) use data for 1395 municipalities).

The literature on the health impacts of SP is more recent, but vast, and we summarize it in table B.1 in Appendix. For each paper listed in the table we include the data set used, the period of analysis covered, the identification strategy adopted, and the findings. Here we summarize the main findings of the various studies. King et al. (2009), Barros (2008) and Grogger et al. (2015) focus 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-Rubí, Galrraga and Harris (2009) find an increased use of prenatal care among those affiliated to SP, while King et al. (2009) and Barros (2008) find no effect on the population at large. Bernal and Grogger (2013*a*) and Bernal and Grogger (2013*b*) merge the experimental data from King et al. (2009) with the administrative data on the discharges from hospitals run by the SSA, and find an increase in obstetric-related hospital visits – mostly births that would have taken place outside the health system in the absence of SP. Knox (2015) uses a panel of urban municipalities (created to evaluate the expansion of *Oportunidades* to urban areas) and finds an increase in the use of health services provided by SP among the poorest urban population. Finally, Barros (2008), Knox (2015) and King et al. (2009) are unable to detect any health impact of SP, using experimental or survey data. Pfutze (2014) uses the 2010 Census and finds that SP led to a reduction in infant mortality by 5 deaths per 1,000 livebirths. Although the data used covers the whole country, the paper restricts the analysis to births which could have occurred between 2004 and 2009, using recall information collected in the decennial Census about all births to women 12 years or older. Using a similar strategy in the 2009 Demographic Survey, Pfutze (2015) finds that SP decreased the likelihood of miscarriages among women pregnant between 2004 and 2008.

In summary, the evidence available to date has provided a fragmented and partial picture of the health impacts of SP. Of the 17 papers listed in table B.1 no study has used data from before the introduction of the program in 2002 and up to after its full rollout (ie, after 2010), which would allow understanding the dynamics of treatment effects; no paper has used variation from all municipalities in country, which is needed to study the characteristics of the municipalities launching the program in different years; finally – and somewhat surprisingly – no paper so far has used the administrative records on mortality. Instead, the current literature provides a partial picture of the possible health impacts of SP due to a number of issues. First, part of the evidence draws on the experimental data of King et al. (2009), which is based on 100 health clusters in 7 (of the 32) states (Spenkuch, 2012; Bernal and Grogger, 2013*a*,*b*; Grogger et al., 2015). Besides the limited geographic analysis, the experiment includes a baseline survey collected in 2005 and a 10-months follow-up, which is too short to learn about the program maturity. Second, except from Pfutze (2014) and Pfutze (2015), none of the other papers is able to study medium- or long-run effects of the SP. Third, most papers rely on survey data, which cover just a few hundreds of the municipalities in the country (Gakidou et al., 2006; Scott, 2006; Gallardo-García, 2006; Sosa-Rubí, Galrraga and Harris, 2009; Harris and Sosa-Rubí, 2009; Hernández-Torres et al., 2008; Barros, 2008; Knox, 2015; Pfutze, 2015; Turrini et al., 2015). Our work overcomes all of the limitations of previous studies.

3 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).

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*, Progresa), 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.[4]

The uninsured population not covered by PAC or *Progresa* 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.

[4] *Progresa* 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).

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[5] 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[6] 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 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; and (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. The requirements are: proof of residence in the Mexican territory; lack of health insurance, ascertained with self-declaration; and possession of the individual ID. 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., 2006). 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. As a non-contributory health insurance system SP is

[5] Baja California, Chiapas, Coahuila, Guanajuato, Guerrero, Hidalgo, Mexico, Morelos, Oaxaca, Quintana Roo, San Luis Potosi, Sinaloa, Sonora, Tamaulipas and Zacatecas.

[6] Baja California Sur, Michoacán, Puebla, Tlaxcala, Veracruz and Yucatán.

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.[7]

Coverage of Health Services Once a family is enrolled in SP, it is assigned a health center (which, in turn, is associated to a general hospital) and a family doctor for primary care, and it has access to a package of health services. The number of interventions covered increased yearly, from 78 in 2002 to 284 in 2012, as listed in a 'Catalogue of Health Services' (since 2006 called *Catalogo Universal de Servicios de Salud*, CAUSES) which is revised annually (Knaul et al., 2006).

A wide range of services are included, from prevention, family planning, prenatal, obstetric and perinatal care, to ambulatory, emergency and hospital care, including surgery. The bulk of the services covered since 2002 are preventive age-specific interventions. For children under five years of age, SP covers 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 this age group underwent a further expansion in 2006 with the introduction of Health Insurance for a New Generation (*Seguro Medico para una Nueva Generación*, SMNG).

Prenatal care is also covered and it is delivered in health centers including five medical check-ups during a normal pregnancy (during the first 12 weeks and at the following four periods: weeks 22-24, 27-29, 33-37, 38-40). In addition to the provision of acid folic, a set of laboratory tests should be performed during the medical check-ups: blood and urine tests, VDRL test (screening test for syphilis), blood type and HIV test for women at potential risk. Diagnoses associated with high risk pregnancies, such as obesity, eclampsia, diabetes, placenta previa, and growth retardation are referred to specialist care (CNPSS, 2002, 2004). Covered services include also normal delivery, puerperium and perinatal care of the newborn, metabolic screening of the newborn to detect

[7]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).

phenylketonuria and congenital hypothyroidism, and treatment of congenital hypothyroidism.

For adults 20-59 years of age, the coverage included vaccinations, 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.[8]

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 systems.

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 if the required resources to provide the covered interventions were in place (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.2 in the Appendix);[9] as a consequence, the number of municipalities covered by each hospital declined from an average of 7 in 2000 to an average of 5 in 2010.[10] 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 (see Knaul et al. (2012) and Table B.3 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.4 in the Appendix shows a bigger growth in the number of

[8]The prevalence of medical conditions covered by SP was used as a guide to choose the four age groups studied in this paper (infants, children 1-4, adults 20-59 and elderly 60+). We do not focus on mortality among adolescents due to the low prevalence of covered conditions.

[9]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).

[10]Source: own calculations based on the Health Ministry discharges data. Table B.2 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*).

hospitals and beds in poor than in rich municipalities.

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 seven 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^{st} 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. 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 then have 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.

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 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 by age group (infants less than 1, children 1-4, adults 20-59 and 60+).[11]

[11] We downloaded the data from the *Direccion General de Informacion en Salud*, National Information Sys-

Third, we use administrative data on births between 1998 and 2012. This data includes information on the exact date of birth, gender, status of the baby at birth (ie, born alive or not), municipality of birth and municipality of residence of the mother, whether the birth took place in hospital or not (but no information about the type of insurance coverage or the entity managing the hospital), and age of the mother.[12] This data is used to construct annual counts of live births per municipality-year, which are used to study the impact of SP on fertility and to compute the infant mortality rate (ie, the number of deaths before age 1 per 1,000 live births). For individuals older than 1, we construct the age adjusted mortality rate by age group (that is, 1-4, 20-59 and 60+) dividing the deaths counts by the population in each age group in that municipality in a given year.[13]

Fourth, we use two data sources on hospital discharges. The first is the administrative data with the information from discharges from any public hospital in Mexico, which is available for the years 2004-2012.[14] 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., SSA – Health Ministry hospitals, IMSS, ISSSTE, IMSS-Oportunidades or PEMEX). The second is the administrative data containing all discharges from the Health Ministry hospitals, which is available for the years 2000-2012.[15] 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 carried out during the hospitalization. We use this data to examine the impact of SP on hospital admissions (total and by cause), mode

tem for the Health website: 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).

[12]The data was downloaded from the INEGI's website (INEGI stands for *Instituto Nacional de Estadistica y Geografia*– National Institute of Statistic and Geography; see http://www.beta.inegi.org.mx/proyectos/registros/vitales/natalidad/).

[13]The population data is obtained from the CONAPO website. CONAPO stands for *Consejo Nacional de Poblacion* (National Population Council). See http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos.

[14]We downloaded the data from http://www.dgis.salud.gob.mx/contenidos/basesdedatos/std_egresoshospitalarios.html.

[15]We downloaded the data from http://www.dgis.salud.gob.mx/contenidos/basesdedatos/std_egresoshospitalarios.html.

of entry (that is, through E.R. or not) and length of stay. We focus on admissions to general or integrated hospitals, speciality hospitals and clinics, excluding psychiatric hospitals and federal health institutes.[16] In Mexico, SSA hospitals are present in 544 of the 2,454 municipalities.

Fifth, we use two data sources on the supply of health care. The first is the administrative data containing information on the human resources for all public 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*, SIMBAD),[17] and it has information at municipality level on the medical personnel (doctors and nurses) and the number of outpatient visits for each public provider 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 data source is the administrative data which includes for each outpatient and inpatient unit administered by the Health Ministry information on the physical (e.g., number of beds, MRI equipment) and human resources (number of doctors by speciality, nurses and other health technicians) for for the period 2001-2010.[18]

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.[19] 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. Nevertheless, it is from this data that we measure simultaneously the place of birth (ie, at hospital or not) and also the entity managing the

[16]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.

[17]It was downloaded from http://sc.inegi.org.mx/cobdem/.

[18]This data was downloaded from: http://www.sinais.salud.gob.mx/basesdedatos/recursos.html.

[19]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).

hospital of delivery.

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 3, 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 enrolled in SP to construct the treatment variable. In the absence of a formal definition, we consider that SP is introduced in a municipality when the number of families affiliated to the program is at least 10. 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 effectively use the services provided by SP, as a result of the authority's decision, and not the fact that a certain proportion of the population has been covered (which is determined by individual choice). In Appendix, we show that our results are robust to the choice of threshold, and we show that the results are unchanged if we use a definition based on 5, 15 or 20 families. Second, we do not use smaller figures such as 1 or 2 households since these could be more prone to measurement error.[20] 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 (2014).

Figure A.2 in Appendix displays the year of implementation of SP in each municipality in Mexico, between 2002 and 2010 (see also Panel A of table B.6 for the number of municipalities implementing SP per year). This graph (together with its zoomed state-level version reported in Figures A.3-A.5) shows that there is considerable variation across municipalities in the timing of implementation of SP; in Figure A.6 we include the total number of municipalities offering SP

[20] For example, a municipality in the state of Aguascalientes (Asientos) has one family enrolled in September 2002, and after this four families were recorded in January 2004.

in each month. 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:

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

where SP_{mst} is an indicator variable equal to 1 if the municipality of residence m in state s offers SP in year t. T_{sm} is the year of implementation of the program. The exact values of k depend on the number of years available in the data, before (K) and after (L) the implementation of SP. For sake of precision, in our most flexible specification we assume constant effects for five or more years before introduction of SP (so $K = 5$) and seven or more years of exposure ($L = 7$). 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 state s) in year t, which refers to the time of the death and of the admission to the medical unit, respectively.[21] In all our models we include fixed effects for the municipality of residence μ_{ms}, to account for time-invariant municipality-level unobserved heterogeneity. Year fixed effects π_t account for yearly shocks which are common to all municipalities which may affect the outcome y_{mst}. Finally, ε_{mst} are idiosyncratic shocks.

The standard errors are clustered at the municipality level to account for autocorrelation in the outcomes (Bertrand, Duflo and Mullainathan, 2004). In our estimation we measure outcomes (mostly, mortality and hospitalizations) for four age groups: infants (ie, before 1 year of age), children (ages 1-4), adults (ages 20-59) and elderly (age 60+). We use these age groups as they reflect the age-specific medical interventions covered by the SP. All our estimates are weighed by the population in each age group in the municipality in 2000 (as e.g. in Almond, Hoynes and Schanzenbach (2011) and Bailey and Goodman-Bacon (2015)).

The impact of being exposed to SP is captured by the coefficients β_k, where k is the difference

[21] The date of death refers to the date of occurrence.

between the year of observation t and the year of implementation T_{sm}. Thus, the estimated β_k^B and β_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). We use $t = -1$ as the control year as Hoynes and Schanzenbach (2009) and Bailey and Goodman-Bacon (2015) who use strategies similar to ours and in a similar context (introduction of Food Stamps and Community Health Centers across counties in the US, respectively). Additionally, throughout the year of implementation of SP ($t = 0$), some municipalities may reach the 10-families threshold in either January or in December, meaning that for those municipalities who launched the program early in the year $t = 0$ may effectively include some of the program immediate impacts.[22]

This event-study framework has two main advantages. First, it allows for an immediate test of the existence of differential pre-program trends in the outcome. That is, rather than assuming that $\beta_k^B = 0$ for $k < 0$, this more flexible model allows to visualize whether the key identifying assumption that there are no group-specific trends that are correlated with the treatment is met or not. We return to this issue in detail below. Second, it further allows for dynamics in the treatment effects, which might arise for several reasons. For example, individuals may not be immediately aware of the availability of SP in their municipality of residence, which 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; and/or medical units may take time to adjust their technology of provision of care to the potential new demand.

When we present the results in figures we display all the estimated coefficients of equation (1), but for the sake of precision, for most of our analysis we group them into three categories,

[22] Panel B of table B.6 in Appendix presents the number of municipalities introducing the program in the first, second, third or fourth quarter of the year. Interestingly, the third quarter is when most municipalities launch SP; as a note, the federal budget is approved in November.

according to the following specification:

$$y_{mst} = \beta_1 SP_{mst}\mathbf{1}\left[t - T_{sm} \leq -2\right] + \beta_2 SP_{mst}\mathbf{1}\left[0 \leq t - T_{sm} \leq 2\right] +$$

$$+\beta_3 SP_{mst}\mathbf{1}\left[t - T_{sm} \geq 3\right] + \mu_{ms} + \pi_t + \varepsilon_{mst}. \tag{2}$$

Here β_1 subsumes the impact up to 2 years before the introduction of SP, β_2 captures the short run impact (up to 2 years after the introduction of SP), and β_3 captures the impact of exposure after 3 years or more. We interpret the coefficients as intention-to-treat effects (ITT), since our regression model estimates the reduced form impacts of implementing SP, and our estimated coefficients average the SP effects over all individuals in the municipality, although not all are affected by the health reform. Hence, our estimates are a lower bound of the program impacts. In 2000, the mean share of eligible per municipality was .73 (Table 1; the standard deviation – not included in table – is .21). Figure 1 shows the enrolment rate in SP among eligible across municipalities from the year of the implementation of the program ($t = 0$) onward. The black dots are the mean enrolment rate among eligible, whereas the red dots are the 25th and 75th percentiles. In the year of introduction of SP, on average nearly 40% of the eligible enrol in the program, with considerable variation across municipalities (the 25th and 50th percentiles are 10% and just over 50%, respectively). This figure is similar across poor and rich municipalities (see Figure A.7 in Appendix).

The timing of implementation of SP The key identifying assumption underlying our empirical strategy is that the outcomes in the treated and the control group would have had the same trend in the absence of SP. Of course, it is possible that municipalities that adopted the program earlier did so because they were better equipped to provide the services required by SP. To understand if this is the case, we study the determinants of the timing of implementation by estimating the following equation:

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

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 and health care resources and π_s are state fixed effects. 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.[23] 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.

The results of estimating model 3 are reported in Table 1. Column (1) presents the mean for each variable; in column (2) we include 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 richer municipalities, with a smaller share of eligible individuals, of children 0-4, with more hospitals, health centers and doctors per eligible, and where there is 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 (3),[24] we find that the program was implemented earlier in municipalities with a larger share of children 0-4; all the other estimated coefficients keep the same sign as in column (2), their magnitude is reduced, but they are still significant. These pre-existing differences in levels should be accounted for by the municipality fixed effects.

Nevertheless, it is possible that earlier adopters were municipalities already on a declining trend of mortality due to the pre-existing health infra-structure. This would induce a spurious correlation between the treatment and mortality. In Figure 2 we investigate this possibility and we plot estimates of γ_k from the following model:

[23]The list of the variables and their sources is provided in Table B.5 in the Appendix. We present in Table 1 health supply indicators measured by eligible since the information used on the number of hospitals, health centers and doctors is for medical units administrated by the SSA-Health Ministry, which is the dedicated network for the uninsured and where SP health services are offered.

[24]Unobserved time-invariant state-level characteristics explain about 50% of the variation in the timing of entry of a municipality.

$$y^*_{mst} = \zeta + \sum_{k=2002}^{2007} \gamma_k \mathbf{1}[T_m = k] + \upsilon_{mst}, t < k \tag{4}$$

where $y^*_{mst} = y_{mst} - \widehat{\tau_{st}}$ is the re-scaled outcome y_{mst} after removing state-year fixed effects (τ_{st}), and y_{mst} is measured in the years before the introduction of the SP in a given municipality to which data is available, T_m is the year of introduction of SP in a given municipality m and $k = 2002, ..., 2007$. Since only 3% of the municipalities implemented SP between 2008 and 2010, for sake of precision we assign to them 2007 as the year of introduction. If state-year effects are able to capture all the unobserved shocks that may be correlated with SP and mortality rates, than we expect no correlation between the year of implementation of SP and mortality rates before the program launch. This is what panels A, B, C and D of Figure 2 show (with the exception of child and adult mortality rates for municipalities entering in 2002). We include also two additional outcomes: admissions to hospital via ER for infants (panel E) and political alignment between the mayor of the municipality and governor of the state (panel F). Again, the correlation is zero. Since after removing common shocks there is no correlation between changes in outcomes measured before SP and the year of implementation of the program, this re-assures us that with our empirical strategy we are able to identify the causal impact of SP and not local shocks or pre-existing trends. In Figure A.8 in Appendix we show that this also hold for poor municipalities.

In addition to providing the evidence above, we also run a battery of robustness checks in section 6. We summarize here the eight alternative specifications we use and defer to section 6 the discussion of the results. First, we exclude from our baseline specification those municipalities that launched the program during the pilot period, that is, 2002 and 2003.[25] Second, rather than clustering the standard errors by municipality, we do it by state-year to account for within state-year correlation in the allotment of funds across municipalities. Third, we control for municipality linear trends in baseline characteristics of municipalities (see Acemoglu, Autor and Lyle (2004)), in particular, we include trends for the following characteristics: socioeconomic indicators measured

[25] As seen in Panels B and C of Figure 2, these municipalities might have been already on declining trends for child and adult mortality.

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). Fourth, we control by an indicator of alignment between the party ruling in the municipality and in the state in a given year. Fifth, we use the fact that we are able to measure mortality and hospitalizations before the introduction of SP to include municipality-level pre-reform linear trends in these variables and should account for omitted trends in outcomes that might be correlated with the introduction of SP.[26] Sixth, we control for state cubic trends. Seventh, we include state-year fixed effects. Finally, 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.

Lastly, we deal with an additional concern, that of selective migration of uninsured individuals residing in municipalities not yet providing SP to municipalities already offering it. We investigate this possibility using data from the extended questionnaire of the 2010 CENSUS, which surveys 2.9 millions households. We use the sample of households with working age heads (ie, 25 to 60 years old), and we regress an indicator for whether they moved between 2005 and 2010 to a municipality that started offering the program between 2002 and 2004. We control for characteristics of the household (quadratic for the age of the head, gender of the head, presence of children less than 5, an indicator for whether the head is married or living in partnership and his level of education) and fixed effects for the municipality of residence in 2005. We do not find evidence of cross-municipality migration induced by SP (results available upon request).

[26] We estimate municipality-specific trends using data before the implementation of SP, and we obtain a slope estimate λ_{ms} for each municipality. We then extrapolate the pre-expansion time trends to the post-reform period as follows (see also Bhuller et al. (2013)):

$$y_{mst} = \beta_1 SP_{mst}\mathbf{1}\left[t - T_{sm} \leq -2\right] + \beta_2 SP_{mst}\mathbf{1}\left[0 \leq t - T_{sm} \leq 2\right] + \beta_3 SP_{mst}\mathbf{1}\left[t - T_{sm} \geq 3\right] + \delta\widehat{\lambda_{ms}}t + \mu_{ms} + \pi_t + \varepsilon_{mst}.$$

6 Results

6.1 Impacts on Mortality

Infant Deaths We start by presenting estimates of the impacts of SP on infant mortality in Table 2, where we report estimates of equation (2) by the level of poverty of the municipality. Column (1) shows a reduction of 1.553 deaths per 1,000 live births in poor municipalities 3 or more years after the implementation of SP, which, given a baseline mortality rate of 15.55 deaths per 1,000 live births, corresponds to a 10% decline. Column (2) shows that in rich municipalities, instead, there were no impacts of SP on IMR. The full event study estimates from equation (1) are plotted in Figure 3, panels (a) and (b) for the poor and rich municipalities, respectively. Figure 3a shows that, for poor municipalities, there is no significant evidence of a differential trend in mortality in treated locations before the introduction of SP, with the coefficients for the pre-program years being all statistically insignificant. Instead, after the introduction of SP, the infant mortality rate fell sharply in poor municipalities, with statistically significant impacts detectable after four years. On the other hand, we detect no significant impact of SP on infant mortality in rich municipalities (Figure 3b). Hence, for the remainder of the paper we restrict our analysis of IMR to the subsample of poor municipalities.

Given that eligibility itself can be affected by the introduction of the program,[27] we do not restrict our estimation sample to eligible individuals. Nevertheless, we examine whether the reduction in IMR in poor municipalities is driven by the sample of infants eligible to SP, i.e. those in families without access to Social Security. The results are presented in Table 3, where we include estimates of model 2 separately by eligibility status. The results in column 1 show that the decrease in infant mortality is indeed concentrated among the eligibles, and that SP has no impact among the non eligibles (column 2).[28] Additionally, the reduction in infant mortality among the eligibles

[27] As reviewed in Section 2, in the literature the program has been associated with a small increase in informality rates, that is, an increase the share of families eligible to SP.

[28] 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, there was virtually no scope for contamination. Additionally, we study a sample of children who do not attend school yet, so also this channel of potential contagion can be ruled out.

is detected immediately and amounts to 1.189 and 1.542 fewer infant deaths per 1,000 live births soon after the introduction of the program and three years after its implementation, respectively. This corresponds to a reduction by 6-10%, given the baseline of 15.2 deaths per 1,000 infants among eligibles. Throughout the paper we mostly refer to the ITT estimates, i.e. to the average effect of SP among *all* children in the municipality, however, since the program achieved universal coverage in 2012, the effect on the eligibles is indeed the implied average treatment effect on the treated (ATT) for infant mortality.

Deaths at other ages In Figure A.9 in Appendix we turn to the impact of SP on mortality at other ages. The graphs in the figure include estimates for the full event study equation (1). They display the estimated SP impacts on mortality at ages 1-4 (Panel A), 20-59 (Panel B) and among the elderly (60+; Panel C); the left hand side of the figure includes the graphs for the poor municipalities, the hand right side for the richer. The six graphs show no significant impact of SP on mortality for either of the three age groups.[29]

Tables B.7-B.9 in Appendix present the estimates for β_1, β_2 and β_3 of model (2) for children ages 1-4, adults (20-59) and elderly (60 or older). Column (1) of each of the three tables shows the impacts on overall mortality per age group and the remaining columns show the impacts by causes of death. We are unable to detect any significant impact for these three age groups.[30][31]

Sensitivity Analysis We now investigate the robustness of our findings to different specifications of equation (2). The results are displayed in Table 4. Column (1) reports our baseline estimates.

[29]Elderly mortality was already declining before the introduction of SP. One possible explanation for this trend could be the concurrent expansion of other non-contributory programs for poor elderly over 60. In 2001 the government of the Federal District implemented the Nutritional Support, Medical Attention, and Free Medicines Program for the Elderly (*Programa de Apoyo Alimentario, Atencion Medica y Medicamentos Gratuitos para Adultos Mayores*), covering residents older than 70 in the poorest areas of the Distrito Federal (Villagómez and Ramírez, 2015). In 2003 the government introduced the program Attention to the Elderly in Rural Areas for individuals non-participating in any other social protection program, which targeted adults older than 60 living in nutritional poverty and resident in poor rural communities with less than 2,500 inhabitants.

[30]The significant impact in column 1 of Table B.8 is not detected in Panel B.1 of Figure A.9, and it is also not robust the exclusion of municipalities that implemented SP in 2002 and 2003 (results available upon request).

[31]We have also re-done the analysis in Table 3 for children age 1-4, adults and elderly. We unable to detect any program impacts also by eligibility status for these ages groups. The results are available from the authors.

Columns (2) to (9) show that the results are robust to a battery of specification checks. In column (2) we present our baseline specification but exclude the municipalities that launched the program during the pilot period, that is, 2002 and 2003, since (as shown in Table 1) early adopters were better equipped to provide the services. The estimates in column (2) are similar to the baseline estimates, so we rule out the possibility that differential changes in IMR mortality rates in pilot municipalities could be driving the result. In column (3) we maintain the baseline specification and sample, but cluster the standard errors by state-year to account for within state-year correlation in the allotment of funds across municipalities.

We then add successively the following controls: linear trends in baseline characteristics of the municipalities (cols. 4, 5, 7, 8 and 9); an indicator of alignment between the party ruling in the municipality and in the state in year t (col. 5); and linear pre-intervention municipality trends (cols. 6 and 7), which are estimated as detailed in the note to the table. In column 7 we also include a state cubic trend; in column 8 we instead use state-year fixed effects; and, finally, in column 9, we control for indicators for the number of years since the introduction of *Oportunidades* in the municipality. The fact that our estimates are virtually unchanged across the various columns of Table 4 provides robust evidence that the decline in mortality in poor municipalities was driven by SP and not by local shocks or underlying trends.[32]

Since the definition of introduction of SP relies on having at least 10 families enrolled in the program, in Table B.10 in Appendix we show that the impact estimated on IMR is not driven by this choice. The table shows that the impacts are similar if three alternative thresholds to assign SP to a municipality are used: 5, 15 and 20 families enrolled in the program.

Lastly, it is possible that infant deaths are measured with error in the administrative records, in particular that they are under-reported. Two situations are possible. 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

[32]To avoid issues related to changes in the composition of the sample, we work with a balanced panel of municipalities by replacing with zeros the observations for the years in which no deaths are recorded. However, the results are similar if we restrict the sample to municipalities that always have non-zero deaths in the 15 years under analysis, in particular, β_3 is -1.468 (standard error 0.540).

introduction of SP affected the quality of reporting; more precisely, if it led to an improvement in the recording of deaths since health services become more accessible. We provide suggestive evidence to rule out this possibility by testing whether the proportion of missing information about the place of reported death is influenced by the introduction of the program, and finding no evidence of a significant impact of SP. In particular, we re-estimate equation (2) using as dependent variable the share of missing information about the place of reported death of the infant and we find the following estimates for β_1, β_2 and β_3, respectively (standard errors in parenthesis): -0.004 (0.005), 0.011 (0.006), 0.007 (0.010). The p-value for the null hypothesis $H_0 : \beta_2 = \beta_3 = 0$ is 0.131. In any case, if the reporting of infant deaths improves with SP, then our findings underestimate the impacts of the program.

6.2 Mechanisms: Understanding the Reduction in Infant Deaths

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

Mortality due to Specific Conditions We start in table 5 by re-estimating specification (2) separately by cause of death to pin down which are driving the reduction in infant mortality in poor municipalities. In columns 2-5 of the table we present four types of conditions, which account for 90% of all infant deaths; the remaining 10% of infant deaths are scattered across different categories which we aggregate in column 6, due to lack of power to study them separately. Column (2) of table 5 shows that SP led to a significant reduction of 0.382 deaths due to intestinal and malnutrition-related conditions (ICD10 codes A and E, respectively) and respiratory infections (ICD10 codes J, predominantly influenza and pneumonia), which represented 26% of all infant deaths in 2000. This corresponds to a reduction of nearly 10% in IMR due to these conditions.[33]

[33] In Table 5, 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 and Black (2000)). We also bundle together ICD10 codes A, E and J, due to the link between gastrointestinal and respiratory diseases (see Budden et al. (2016)).

Importantly, most of the conditions causing these deaths 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. This is precisely what is shown in the bottom three rows of the table, where we include the share of deaths in 2002, 2006 and 2010 which are attributable to conditions covered by SP, within group of medical conditions.

Column (3) of table 5 shows that SP is associate with a 12.5% reduction in infant deaths due to perinatal conditions (ie, less 0.852 deaths/1000 live births), which represented 44% of the infant deaths in 2000. These conditions correspond to ICD10 codes P, and the most prevalent ones in poor municipalities in 2000 are the following five, which account for two thirds of the related deaths: birth asphyxia (ICD10 P21), which is most commonly due to a drop in maternal blood pressure or some other substantial interference with blood flow to the infant's brain during delivery; respiratory distress of newborn (ICD10 P22), that is, any signs of breathing difficulties in the neonate; congenital pneumonia (ICD10 P23); neonatal aspiration syndromes (ICD10 P24), which occur when fluids, typically meconium, is present in the lungs of the baby during or before delivery; and, finally, bacterial sepsis of newborn (ICD10 P36), which refers to the presence of a bacterial blood stream infection in the newborn (such as meningitis, pneumonia, pyelonephritis, or gastroenteritis). The symptoms of congenital pneumonia are similar to those of sepsis, and these include signs of respiratory distress accompanied by temperature instability. Early identification and treatment of neonates at risk of infection or with symptoms of infection reduces both morbidity and mortality (Gallacher, Hart and Kotecha, 2016). Additionally, neonatal aspiration syndromes are difficult to prevent before birth, thus identification of risk factors and assisted delivery are associated with decreases mortality due to these conditions (Usta and Sibai, 1995)

Finally, the decrease in IMR can also be attributed to the reduction in deaths due to congenital malformations, that is, medical conditions associated with ICD10 codes Q. SP is associated with a reduction of 0.391 deaths/1000 live births, which represents a 17% reduction in deaths due to these conditions (see column (4) of table 5). Among these, malformations of the circulatory system (ie, ICD10 Q20-Q28) are the most prevalent, accounting for nearly 40% of deaths due to congenital malformations.

While conditions associated with respiratory and intestinal infections (in column 3) have been covered since the introduction of the program (see the bottom three rows of the table), perinatal and congenital malformations were not covered initially. Nevertheless, hospital deliveries were covered, and they could potentially reduce mortality due to these conditions, as we show below.

Reassuringly, column (5) shows no impact of SP on deaths due to external causes (e.g., accidents), which at this age group occur due to conditions not covered by SP (see the panel in the bottom of the table).

Use of Hospitals by Infants and Pregnant Women The introduction of SP was associated with a decrease in infant mortality due to three types of conditions: intestinal and respiratory infections, perinatal conditions and congenital malformations. We now turn to the impacts on access to medical care associated with SP. 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 6 shows that the introduction of SP led to an immediate 7% increase in hospital admissions for infants in poor municipalities, from a pre-program mean of 15 admissions/municipality in 2000 (column 1). 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 presented in panel A of Figure 4 shows that the increase in hospital admissions for infants is only detectable in the Ministry of Health units, whereas there is a slight decrease in admissions in hospitals run by all other public providers (non-SSA).[34] Table B.11 in the Appendix

[34]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

shows that this effect of SP is robust to the same eight alternative specifications to which we subjected the estimates for IMR.

Columns 2-5 of Table 6 show that most of the increase in hospital admissions before age 1 is driven by admissions due to intestinal and malnutrition-related conditions and respiratory infections (column 2). There are no impacts on admissions due to external causes (column 5) - consistently with the evidence we find for infant mortality, but also no impacts on admissions due to perinatal conditions and congenital malformations (columns 3 and 4, respectively). We turn to these two types of conditions in the following paragraph in more detail. Columns 6 and 7 of Table 6 show that the introduction of SP led to no detectable change in the length of stay, but it significantly increased the share of admissions through E.R.

As mentioned above, part of the decrease in IMR is due to perinatal conditions and congenital malformations, although there is not a corresponding increase in hospital admissions due to such conditions. These conditions can be either triggered or detected during delivery, and morbidity and mortality can be reduced with immediate treatment. Since SP covers hospital births, in columns 8-12 of Table 6 we examine its impacts on all obstetric-related admissions (coded ICD10 O) to SSA hospitals among women 15-44 years old. We consider four types of obstetric admissions: births (IDC10 O80-84) are included in column (9), conditions related to the fetus and amniotic cavity and possible delivery problems (ICD10 O30-48) are in column (10), complications of labor and delivery (ICD10 O60-75) are in column (11), whereas all other obstetric-related admissions are included in column (12). The impact on overall obstetric admissions is immediate and it strengthens with exposure to the program. In particular, obstetric-related admissions increase by 6.8% in the first two years of operation and by 11.5% after two years (column 8). Among these, the impact is stronger for deliveries and it varies from 10 to 14.2% (column 9), whereas it is slightly weaker in magnitude, but still significant, for all other types of obstetric admissions (columns 10-12). Using data from deliveries that occurred in all public hospitals in Mexico, in panel B of Figure 4 we show that while deliveries in SSA units increased between 2004 and 2012, they remained nearly stable

report two separate figures for rich and poor municipalities. Figure A.10 in Appendix presents the corresponding admissions to all public hospitals for children ages 1-4, adults 15-64 and among elderly (65+).

in non-SSA units.

Furthermore, using the Mexican health survey ENSANUT (2000, 2006 and 2012), in Table B.12 we provide suggestive evidence that in poor municipalities the increase in deliveries in SSA hospitals is due to births which would have occurred at home in the absence of the SP. This table has three columns for three mutually exclusive places of delivery: birth at SSA hospital (col. 1), birth at an hospital managed by other public or private provider (col. 2) or at other place (col. 3; typically home). Information in the data is only available for infants and, due to sample size, we cannot separately estimate the model for poor and rich municipalities, instead we interact the treatment variable with the indicator for the type of municipality.[35] Finally, we do not detect any impact of the program on the number of births (see table B.13), corroborating the fact that the increase in hospital deliveries is due to a shift and not to an overall increase in fertility.

In sum, access to skilled delivery and emergency obstetric and neonatal care provided under SP are likely to be the reason behind the decrease in deaths due to congenital malformations and perinatal conditions. According to the 2005 Lancet Neonatal Series, access to obstetric care is the most effective way to reduced neonatal deaths (Knippenberg et al., 2005).

Use of Outpatient Services Finally, we examine whether the introduction of SP led to an increased burden in outpatient care. To do so, we use municipality-level data which includes the information on the number of outpatient visits and medical personnel in all medical units (hospitals and health centers) run by each public providers in Mexico. Unfortunately, there is no information on outpatient visits disaggregated by age of attendees. Table B.14 in the Appendix includes the estimates for these two variables. In columns 1-3 we show the impact on outpatient visits per 1,000 individuals and find that the reform was associated with a 11% increase in outpatient visits in SSA units, accompanied by a decrease in outpatient visits to non-SSA units. In columns 4-6 we

[35]Controls excluded from the table are: an indicator for gender of the infant, 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 state of residence, and baseline characteristics of municipalities (quadratic of the index of marginalization, log of total population, and share of population of ages 0-4; share of uninsured individuals, and share of individuals employed in the primary, secondary and tertiary sectors, all of these measured in 2000 and health care indicators measured in 2001, as number of hospitals, health centers, and doctors in hospitals, all per uninsured).

include estimates for the impact on medical personnel per 1,000 individuals; we do not find that SP is associated with a change in the medical personnel in the SSA units (column 6). In sum, the combined evidence from columns 3 and 6 of table B.14 suggests a small increase in the burden of doctors delivering outpatient services in SSA.

Characteristics of Early Enrollers To understand why we detect immediate impacts of the program on the use of hospital services, we resort to the *Padrón* and examine the association between several household characteristics and the year of enrolment in SP. The results, reported in Table B.15 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 a head having less than primary education, with a disabled member, a larger family, with children 0-4 years old, and enrolled in *Oportunidades*.[36] In other words, earlier entrants are in a condition of disadvantage with greater potential benefits from access to health care.

7 Conclusion

In this paper, we have contributed to the ongoing debate on universal health coverage by estimating impacts and mechanisms of the Mexican health insurance program *Seguro Popular* on 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. While we have investigated impacts on infant, child (1-4), adult (20-59) and elderly (60+), we have only detected significant effects of SP on the first group.

Our intent-to-treat estimates show that the introduction of SP led to a significant reduction in infant mortality by 10% in poor municipalities. This amounts to avoiding the deaths of approximately 804 babies before age 1 per year. The impact of SP is detected 3 years after the introduction

[36]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 families that entered SP through the Oportunidades program (about 22% of the total).

of the program in a municipality and is robust to a variety of alternative specifications. Part of the reduction in infant mortality is 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. Another part of the reduction in infant mortality can also be attributed to perinatal conditions and congenital malformations, which decrease the probability of survival in case of unassisted births or deliveries by unskilled personnel and, thus, can be diagnosed and treated in case of a hospital delivery.

We have also examined potential mechanisms which might have driven these impacts, investigating the role played by demand and supply of health services. We have showed that the introduction of SP led to an increase in hospital admissions for respiratory and intestinal infections, for which we find a reduction in deaths. We have also shown that SP led to an increase in hospital births, which would have occurred outside the medical system in the absence of SP and in other obstetric-related admissions. Additionally, we provide evidence that the program was rolled out gradually starting in municipalities which had adequate pre-existing supply, however the burden of SSA doctors delivering outpatient services increased. 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, by providing access to hospital deliveries and treatment of risky pregnancies, and also to preventive care with cheap timely treatment, can significantly contribute to reduce the gap in mortality for poor infants in less developed countries. For the Mexican case, SP closed 84% of the gap in infant mortality between poor and rich municipalities.

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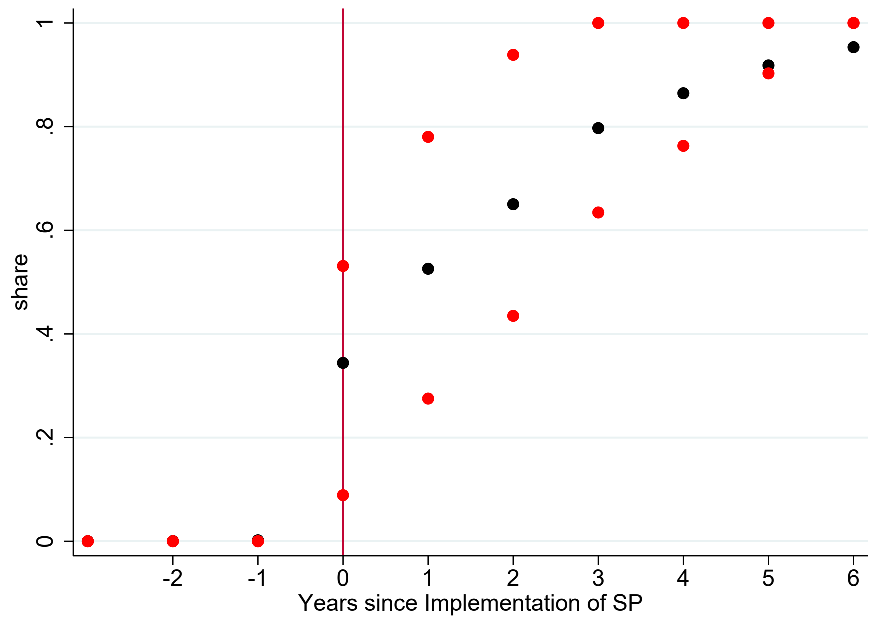
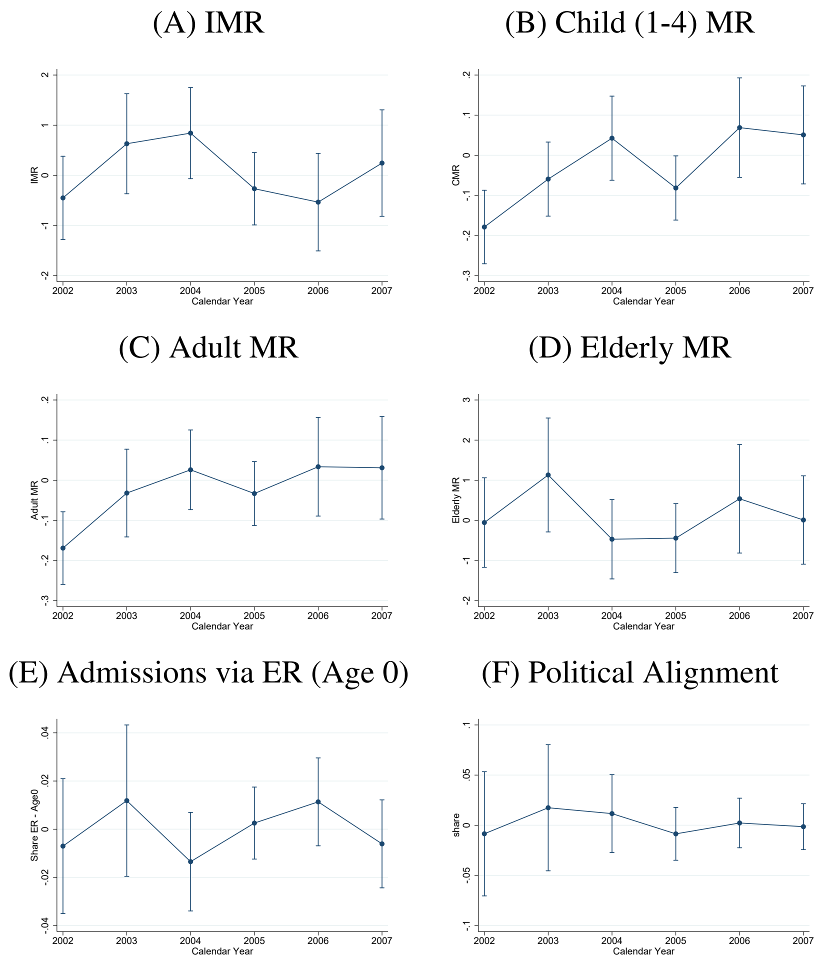
8 Figures and Tables

Figure 1: Average Share of Families Eligible Enrolled in SP.



Note: The figure includes the mean of the share of families eligible to SP enrolled in the program (black dots) in each year around the introduction of SP in a municipality (year 0). The red dots are the percentiles 25 and 75 of this share. Source: Own calculations from the *Padron* (the administrative data of all households affiliated to SP).

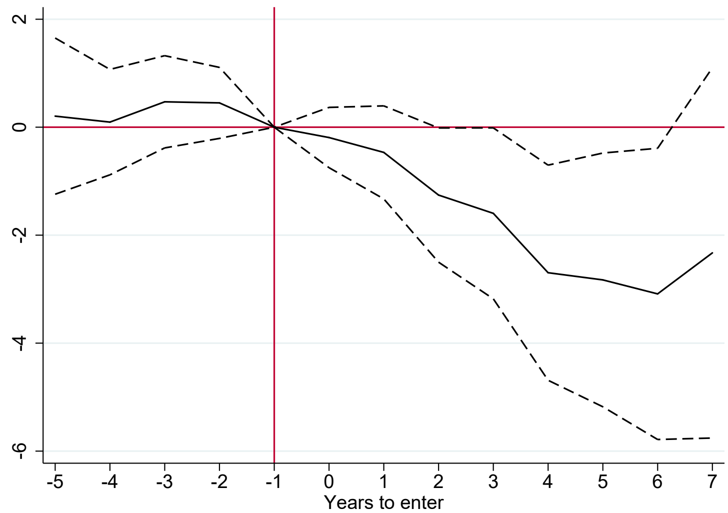
Figure 2: Year of Implementation of SP and Pre-Existing Characteristics.



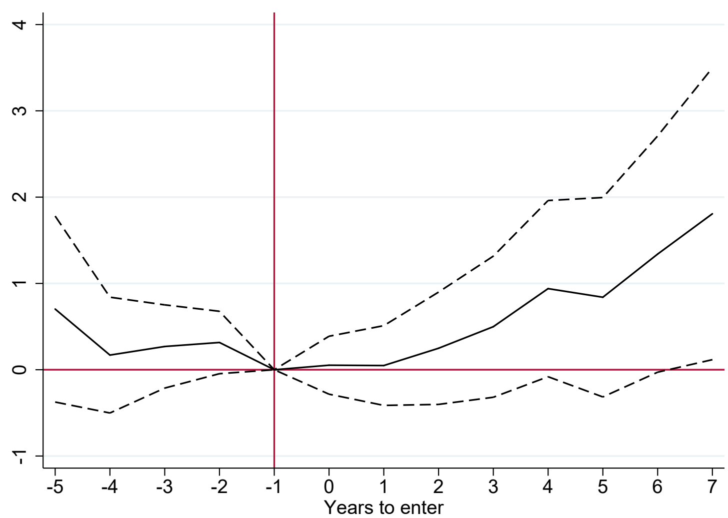
Note: The figures plot the coefficient on the indicator variables for year of implementation of SP, where the dependent variable is the variable on the title of the graph residualized from state-year fixed effects. y_{mst} is measured in the years before the introduction of the SP in a given municipality to which data is available. Since only 3% of the municipalities implemented SP between 2008 and 2010, for sake of precision, we assign to them 2007 as the year of introduction. The bands are 99% confidence intervals.

Figure 3: Impact of SP on Infant Mortality, by Poverty of the Municipality.

Panel A: Poor Municipalities



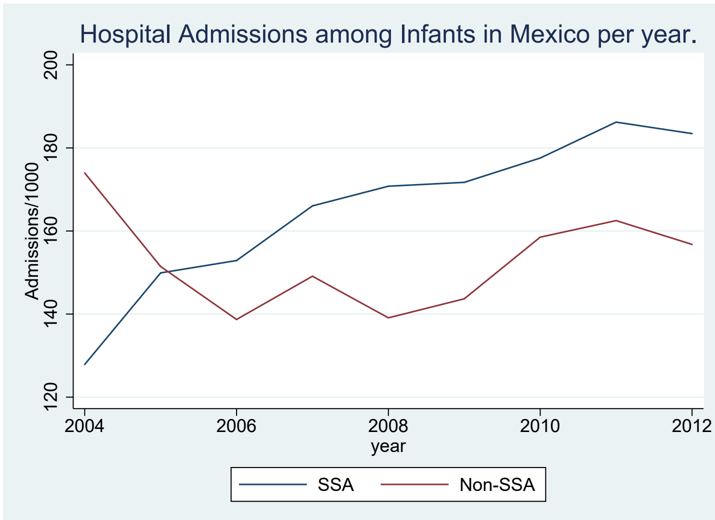
Panel B: Rich Municipalities



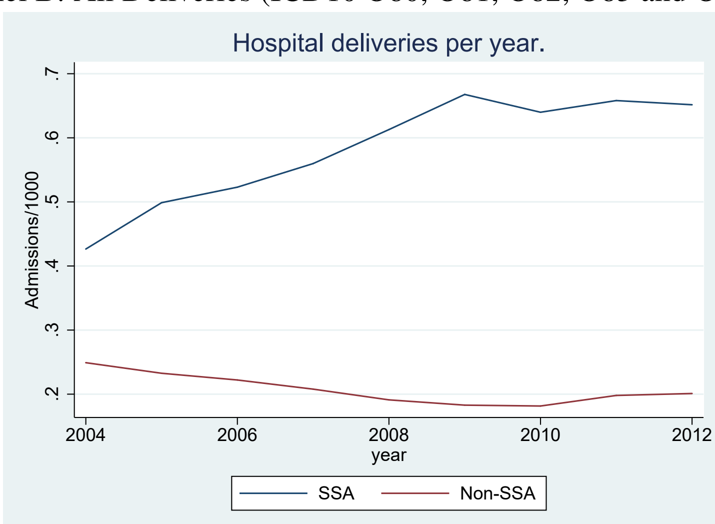
Note: The figures plot weighted least square estimates of β from specification (1). The dependent variable is the infant mortality rate. The dashed lines are 90% confidence intervals. Data source: Mortality Registry 1998-2012.

Figure 4: Hospital Admissions due to Births and among Infants in SSA and non-SSA Hospitals.

Panel A: Infants (children < 1 year old).



Panel B: All Deliveries (ICD10 O80, O81, O82, O83 and O84).



Note: Panel A includes all admissions among infants. Panel B shows the number of hospital admissions in all public hospitals in Mexico between 2004 and 2012 for deliveries. "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.

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

	(1)	(2)	(3)
Socio-demographic (2000) and Political Indicators			
Log population	-2.151	-0.3901***	-0.3294***
		[0.0224]	[0.0243]
Marginalization Index	0.001	0.4638***	0.2031***
		[0.0297]	[0.0373]
% eligible population	72.79	0.0179***	0.0065***
		[0.0015]	[0.0017]
% of population 0-4 years of age	11.28	0.0305**	-0.0332**
		[0.0155]	[0.0143]
Alignment b/w party in power in municipality and state in $t = 0$	0.243	-1.4094***	-0.7862***
		[0.0723]	[0.0875]
Supply of Health Care (2001)			
No. Hospitals (per 100,000 eligible)	0.555	-0.0649***	-0.0356**
		[0.0184]	[0.0169]
No. Health Centers (per 100,000 eligible)	39.21	-0.0033***	-0.0013**
		[0.0006]	[0.0006]
No. Doctors in Hospitals (per 100,000 eligible)	16.40	-0.0032***	-0.0020***
		[0.0006]	[0.0004]
Observations		2,424	2,424
State Fixed Effects		No	Yes

Note: Column (1) presents the mean for each variable. Each cell in column (2) 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 state fixed effects. Robust standard errors in parentheses. *** Significant at 1%, ** Significant at 5%, * Significant at 10%.

Table 2: Impact of SP on Infant Mortality (before age 1).

Sample of Municipalities	(1) Poor	(2) Rich
Up to 2 years (inclusive) before SP (β_1)	0.233	0.483**
	(0.287)	(0.194)
0 to 2 years after SP (β_2)	-0.385	-0.017
	(0.286)	(0.173)
3 or more years after SP (β_3)	-1.553***	0.431
	(0.498)	(0.292)
p-value $H_0 : \beta_2 = \beta_3 = 0$	0.001	0.049
Mean in 2000	15.55	13.70
S.D.	21.47	13.67
Observations	19,197	17,159
Nb. 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 model estimated is the following (see equation 2):

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

where the dependent variable y_{mst} is the infant mortality rate in municipality m of state s in year t. Each column presents results for separate weighted regressions, where the weights are given by the births in municipality m in state s in 2000. Controls include fixed effects for year (π_t) and municipality of residence (μ_{ms}). 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 3: Impact of SP on Infant Mortality, by Eligibility (Sample of Poor Municipalities).

Sample	(1) Eligible	(2) Non-Eligible
Up to 2 years (inclusive) before SP (β_1)	-0.351	-2.585
	(0.458)	(1.707)
0 to 2 years after SP (β_2)	-1.189***	1.844
	(0.422)	(1.959)
3 or more years after SP (β_3)	-1.542***	-2.925
	(0.587)	(2.808)
p-value $H_0 : \beta_2 = \beta_3 = 0$	0.016	0.055
Mean in 2000	15.19	10.07
S.D.	17.39	25.31
Observations	19,098	13,458

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 infant mortality rate. Each column presents results for separate weighted regressions. In column (1) the weights are given by the population less than 1 years of age in municipality m in state s in 2000 eligible to SP; whereas in column (2) the weights are the population less than 1 year of age in municipality m in state s in 2000 not eligible to SP. We do not use the births in 2000 as weights since there is no information on births by eligibility level. The dependent variable IMR in this table is also computed as counts of deaths by eligibility group per 1,000 infants in each of the two eligibility groups (rather than by 1,000 births). 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 Infant Mortality, Robustness (Sample of Poor Municipalities).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Up to 2 years (incl.) before SP (β_1)	0.233	0.363	0.233	0.322	0.332	0.169	0.322	0.284	0.321
	(0.287)	(0.307)	(0.378)	(0.290)	(0.289)	(0.305)	(0.301)	(0.313)	(0.312)
0 to 2 years after SP (β_2)	-0.385	-0.389	-0.385	-0.413	-0.458*	-0.339	-0.277	-0.291	-0.265
	(0.286)	(0.339)	(0.374)	(0.289)	(0.278)	(0.286)	(0.275)	(0.317)	(0.318)
3 or more years after SP (β_3)	-1.553***	-1.810***	-1.553***	-1.548***	-1.672***	-1.452***	-1.136**	-1.019*	-0.997*
	(0.498)	(0.619)	(0.595)	(0.514)	(0.470)	(0.482)	(0.461)	(0.541)	(0.541)
p-value $H_0 : \beta_2 = \beta_3 = 0$	0.001	0.003	0.012	0.002	0.000	0.001	0.015	0.120	0.122
Observations	19,197	16,573	19,197	19,197	17,920	19,197	19,197	19,197	19,197
Year FE	x	x	x	x	x	x	x	x	x
Municipality FE	x	x	x	x	x	x	x	x	x
Trends in 2000 Municipality Xs				x	x		x	x	x
Political Alignment					x				
Pre-SP Linear Municipality Trend						x	x		
State Cubic Trend							x		
State -Year FE								x	x
Dummy for years since Oportunidades									x
Cohorts	02-10	04-07	02-10	02-10	02-10	02-10	02-10	02-10	02-10
Cluster of SE	Mun.	Mun.	State	Mun.	Mun.	Mun.	Mun.	Mun.	Mun.

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 infant mortality rate. Each column presents results for separate weighted regressions, where the weights are given by the births in municipality m in state s in 2000. The baseline municipality Xs (in cols. 4, 5, 7, 8 and 9) 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). We estimate municipality-specific trends in cols. 6 and 7 using data before the implementation of SP, and we obtain a slope estimate λ_{ms} for each municipality. We then extrapolate the pre-expansion time trends to the post-reform period as follows (see also Bhuller et al., 2013):

$$y_{mst} = \beta_1 SP_{mst}\mathbf{1}\left[t - T_m \leq -2\right] + \beta_2 SP_{mst}\mathbf{1}\left[0 \leq t - T_m \leq 2\right] + \beta_3 SP_{mst}\mathbf{1}\left[t - T_m \geq 3\right] + \delta\widehat{\lambda_{ms}}t + \mu_{ms} + \pi_t + \varepsilon_{mst}.$$

*** Significant at 1%, ** Significant at 5%, * Significant at 10%. Data source: Mortality Registry 1998-2012.

Table 5: Impact of SP on Infant Mortality, By Condition (Sample of Poor Municipalities).

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Bacterial/Intestin. Malnutrition Respiratory (ICD10 A, E J)	Perinatal (ICD10 P)	Congenital (ICD10 Q)	External Causes (ICD10 V, W, X)	All other Conditions not in col. 2-5
Up to 2 years (incl.) before SP (β_1)	0.233	0.210	0.173	-0.025	-0.009	-0.115
	(0.287)	(0.137)	(0.185)	(0.094)	(0.044)	(0.073)
0 to 2 years after SP (β_2)	-0.385	-0.135	-0.238	-0.074	0.071	-0.009
	(0.286)	(0.114)	(0.202)	(0.099)	(0.046)	(0.073)
3 or more years after SP (β_3)	-1.553***	-0.382**	-0.852***	-0.391**	0.049	0.023
	(0.498)	(0.186)	(0.320)	(0.168)	(0.066)	(0.112)
p-value $H_0 : \beta_2 = \beta_3 = 0$	0.001	0.109	0.004	0.032	0.219	0.885
Mean in 2000	15.55	3.969	6.799	2.291	1.011	1.480
S.D.	21.47	7.632	12.90	6.155	10.17	5.152
Observations	19,197	19,197	19,197	19,197	19,197	19,197
Nb. Municipalities	1,280	1,280	1,280	1,280	1,280	1,280
% of all Deaths	100%	26%	44%	15%	7%	10%
Covered by SP in 2002?	17%	59%	1%	0%	0%	3%
Covered by SP in 2006?	50%	75%	46%	50%	0%	44%
Covered by SP in 2010?	71%	73%	80%	76%	0%	61%

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 infant mortality rate. Each column presents results for separate weighted regressions, where the weights are given by the births 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 6: Impact of SP on Hospital Admissions among Infants and Pregnant Women, by Condition (Sample of Poor Municipalities).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
			Before age 1			Before age 1				Obstetric (Women 15-44)		
	All	Bacterial/Intestin. Malnutrition Respiratory ICD10 A, E, J	Perinatal ICD10 P	Congenital ICD10 Q	External Causes ICD10 V, W, X	Days	Share ER	All ICD10 O	Deliveries O80-84	Care related to fetus & of labor O30-48	Compli-cations O60-75	Obstetric conditions not in col. 9-11
Up to 2 years before SP (β_1)	0.003	-0.012	0.002	-0.002	0.024	0.006	-0.001	-0.013	-0.026	-0.010	-0.025	0.022
	(0.024)	(0.034)	(0.025)	(0.029)	(0.034)	(0.151)	(0.009)	(0.028)	(0.033)	(0.028)	(0.030)	(0.025)
0-2 years after SP (β_2)	0.070***	0.061*	0.033	0.041	0.036	0.062	0.023**	0.068***	0.100***	0.028	0.056*	0.046*
	(0.026)	(0.036)	(0.027)	(0.031)	(0.037)	(0.142)	(0.010)	(0.024)	(0.028)	(0.027)	(0.030)	(0.025)
3+ years after SP (β_3)	0.074*	0.102*	0.030	0.072	0.028	0.038	0.045***	0.115***	0.142***	0.117***	0.142***	0.109***
	(0.038)	(0.054)	(0.041)	(0.048)	(0.041)	(0.209)	(0.016)	(0.042)	(0.050)	(0.043)	(0.054)	(0.039)
p-value $H_0 : \beta_2 = \beta_3 = 0$	0.029	0.159	0.454	0.323	0.628	0.875	0.017	0.010	0.001	0.012	0.033	0.018
Mean in 2000	15.07	4.584	8.086	1.002	0.251	6.674	0.726	75.20	45.28	11.79	6.156	11.98
S.D.	36.020	13.000	19.950	2.127	0.761	5.636	0.267	194.900	136.7	27.79	13.31	30.21
Observations	16,640	16,640	16,640	16,640	16,640	14,228	14,239	16,640	16,640	16,640	16,640	16,640
Nb Municip.	1280	1280	1280	1280	1280	1274	1274	1,280	1,280	1,280	1,280	1,280

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)-(5), (8)-(12), the number of days in column (6), and the share of admissions through E.R. in column (7). Each column presents results for separate weighted regressions, where the weights are given by the births 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.

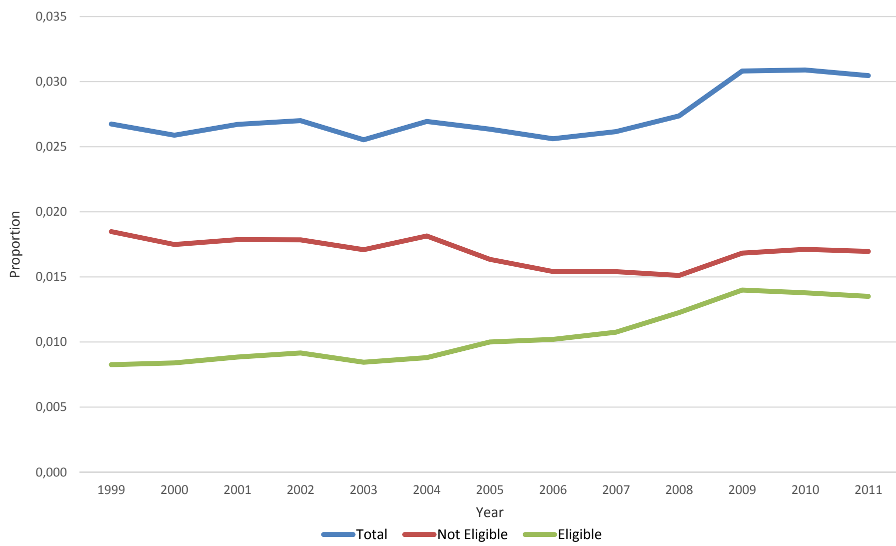
WHO BENEFITS FROM FREE HEALTH INSURANCE: EVIDENCE FROM MEXICO

Gabriella Conti & Rita Ginja

APPENDIX

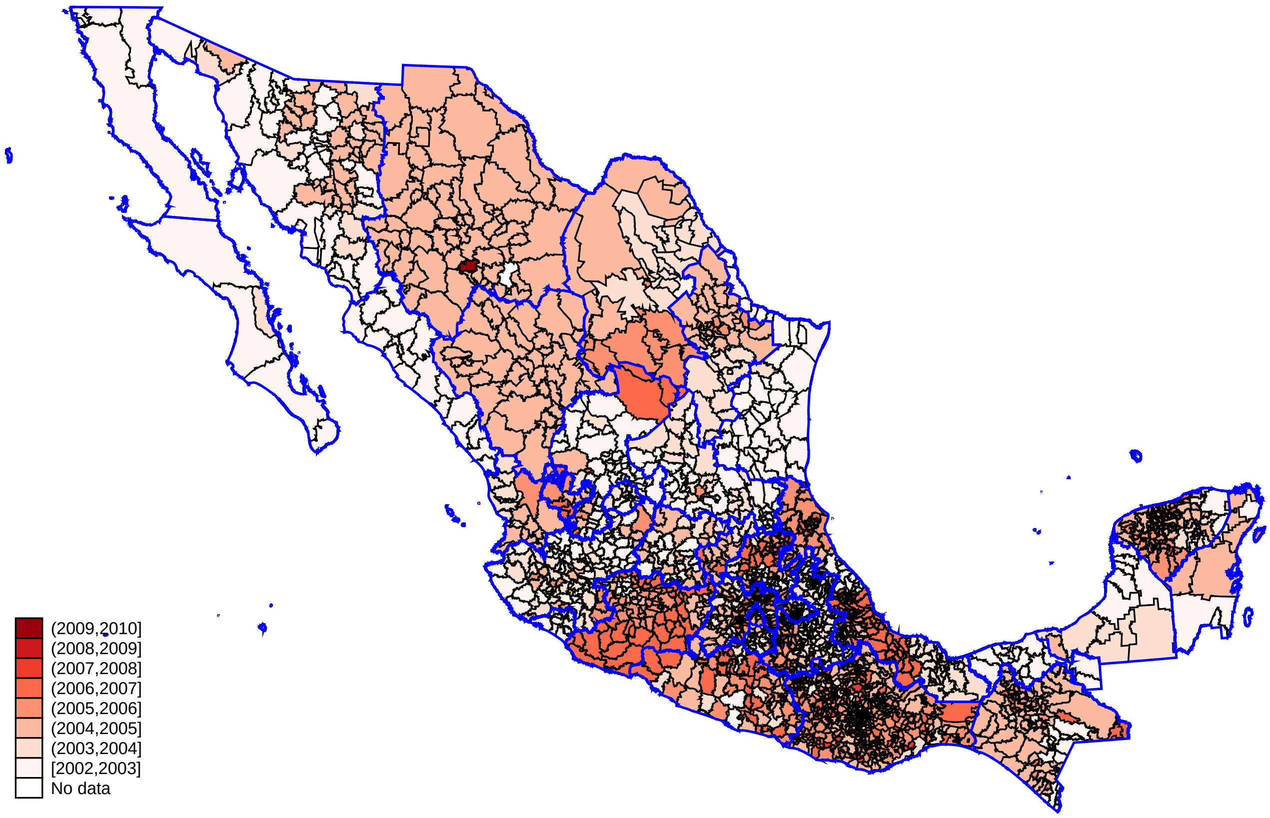
A Additional Figures

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



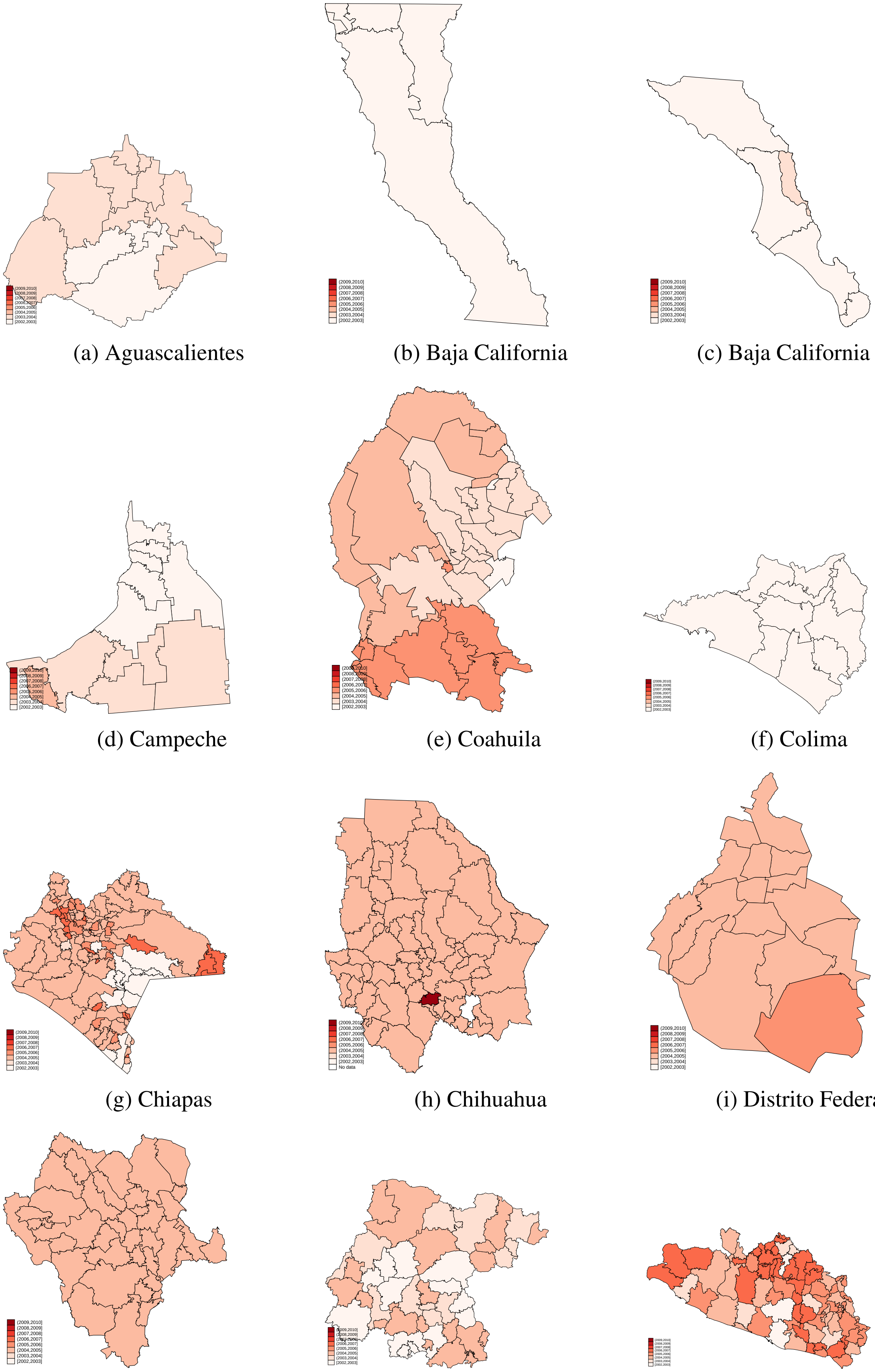
Note: The figure shows the ratio of public expenditure on health to GDP, overall and by SP eligibility group. The total public expenditure on health is the sum of the public expenditure for the insured population (not eligible to SP), i.e. those affiliated with IMSS (*Instituto Mexicano del Seguro Social*), 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



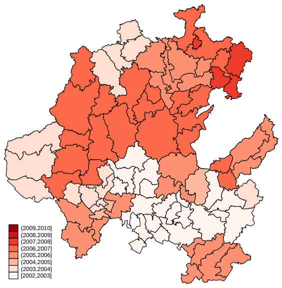
(a) Aguascalientes (b) Baja California (c) Baja California Sur

(d) Campeche (e) Coahuila (f) Colima

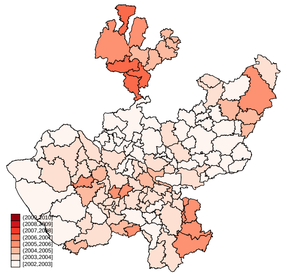
(g) Chiapas (h) Chihuahua (i) Distrito Federal

(j) Durango (k) Guanajuato (l) Guerrero

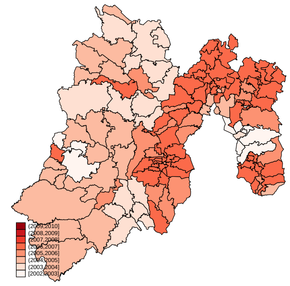
Figure A.4: Year of Introduction of SP in a Municipality, By State (cont.)



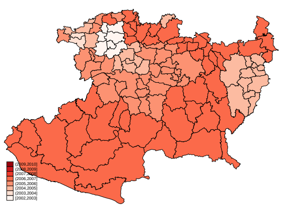
(a) Hidalgo



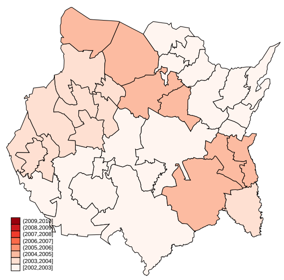
(b) Jalisco



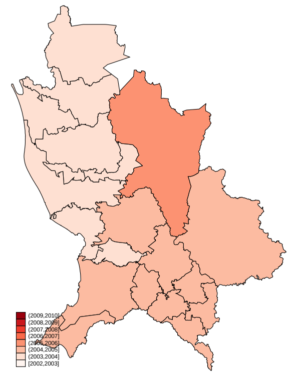
(c) México



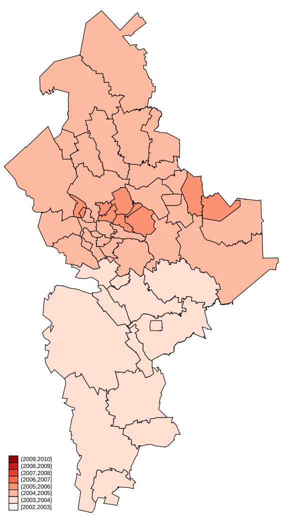
(d) Michoacán



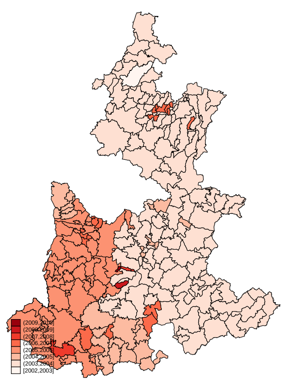
(e) Morelos



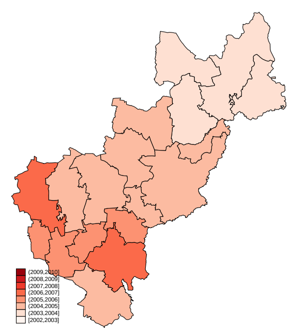
(f) Nayarit



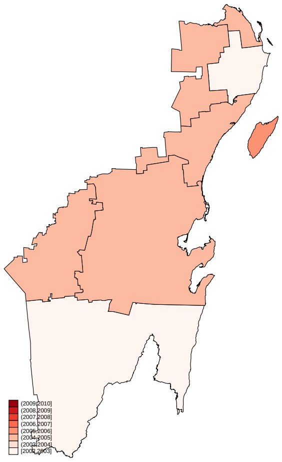
(g) Nuevo León



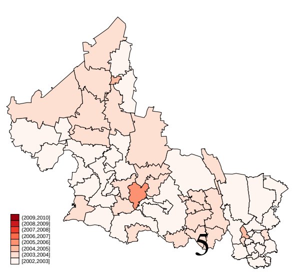
(h) Puebla



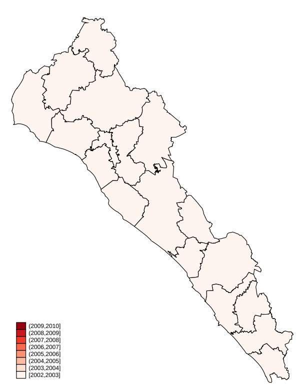
(i) Querétaro



(j) Quintana Roo

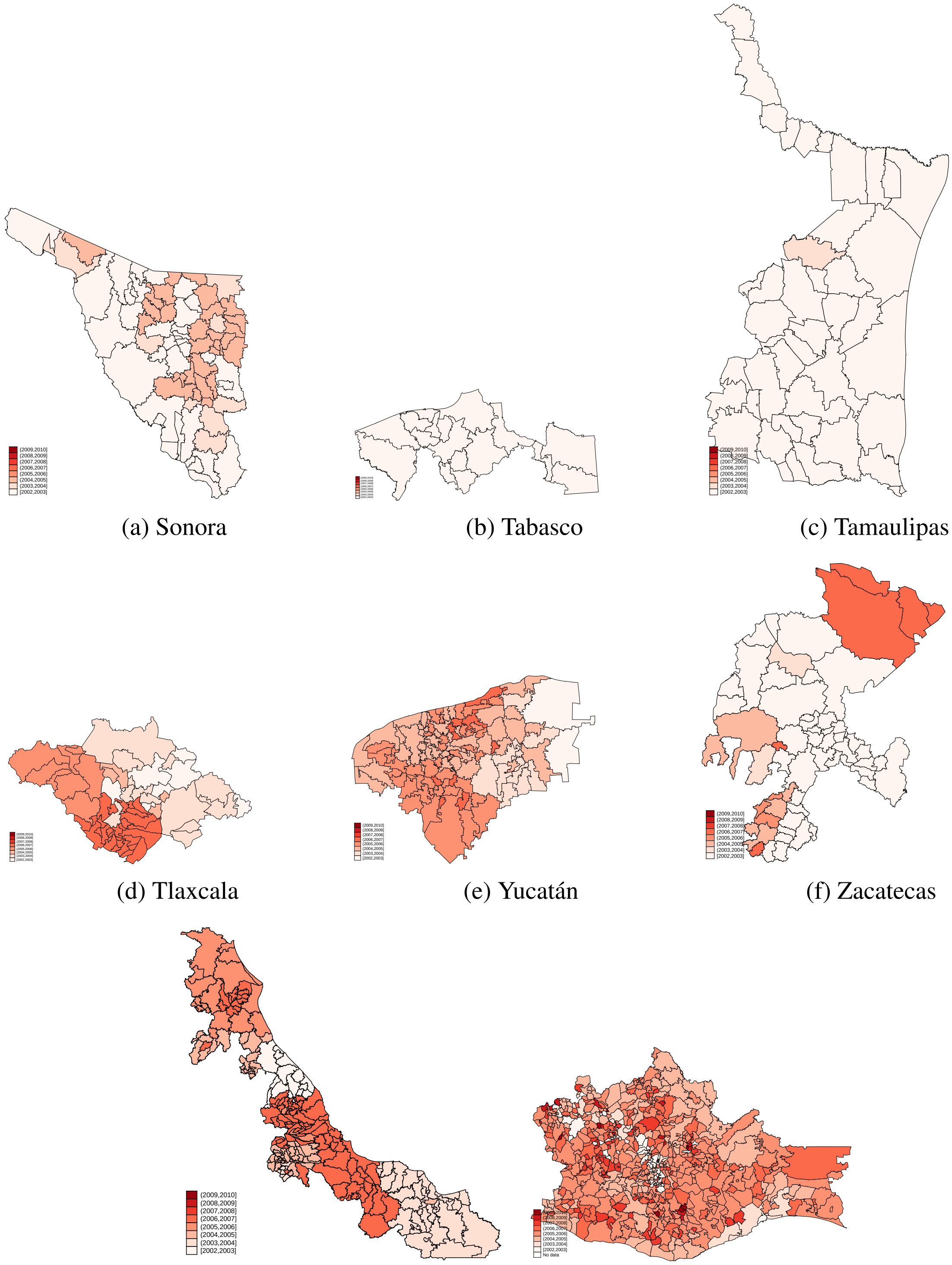


(k) San Luis Potosí



(l) Sinaloa

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



(a) Sonora

(b) Tabasco

(c) Tamaulipas

(d) Tlaxcala

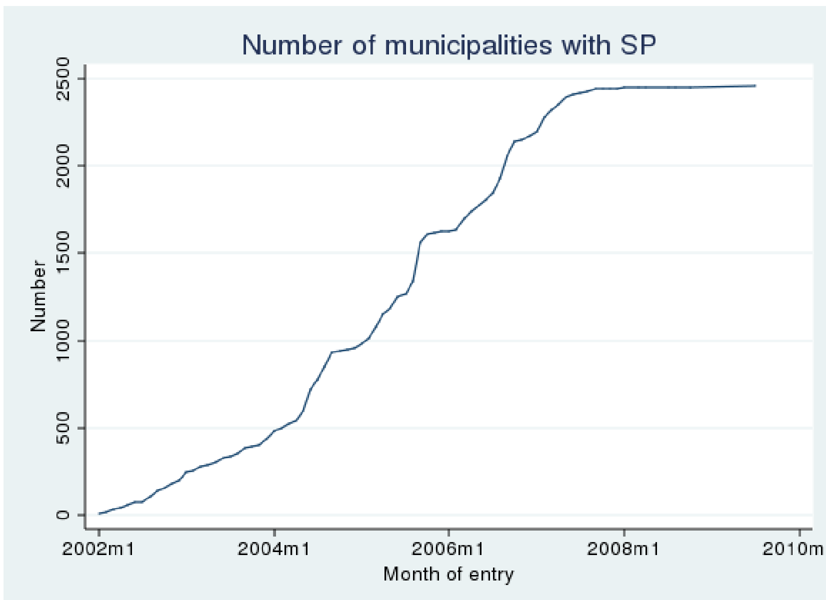
(e) Yucatán

(f) Zacatecas

(g) Veracruz

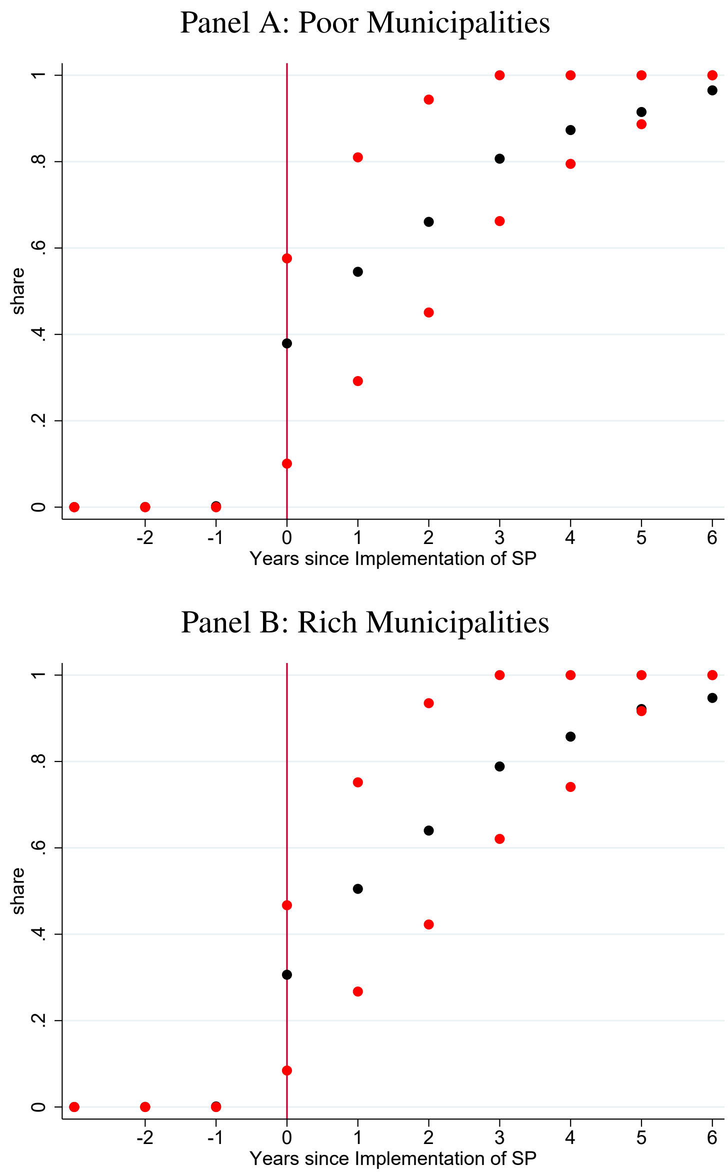
(h) Oaxaca

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.

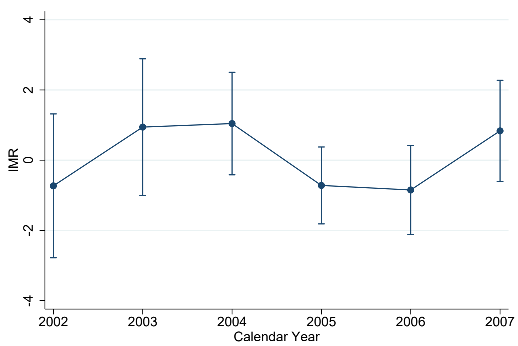
Figure A.7: Average Share of Families Eligible Enrolled in SP: By Poverty Level in 2000.



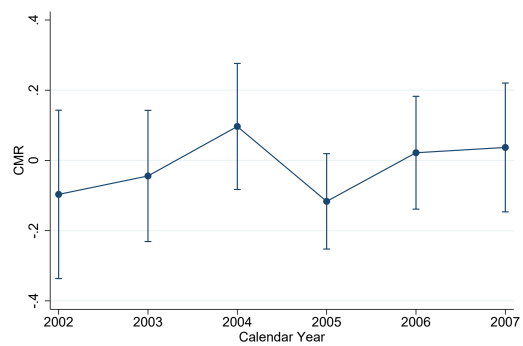
Note: The figure include the mean of the share of families eligible to SP enrolled in the program (black dots) in each year around the introduction of SP in a municipality (year 0). The red dots are the percentiles 25 and 75 of this share. Municipalities are divided into ”Poor” and ”Rich”. A municipality is defined poor by the Mexican authorities if the 2000 marginalization index is high or very high, as opposed to very low, low or medium. Source: Own calculations from the *Padron* (the administrative data of all households affiliated to SP)

Figure A.8: Year of Implementation of SP and Pre-Existing Characteristics: Poor municipalities.

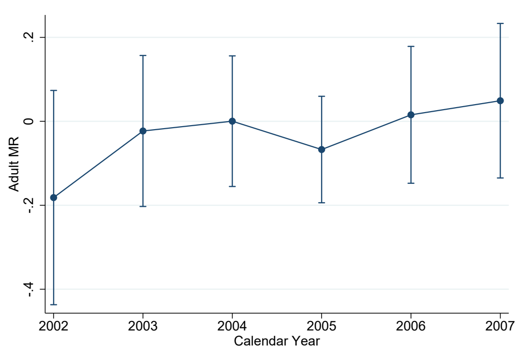
(a) IMR



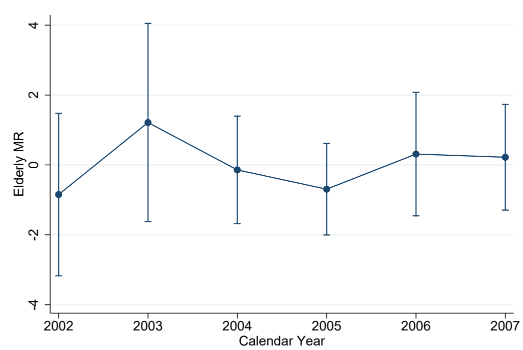
(b) Child (1-4) MR



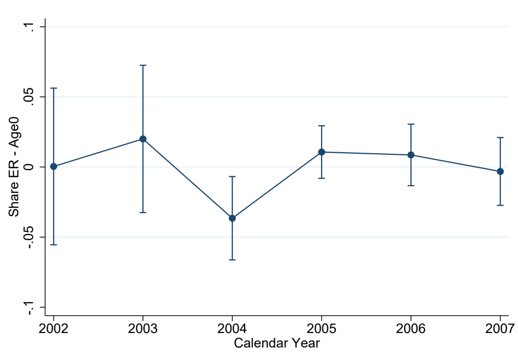
(c) Adult MR



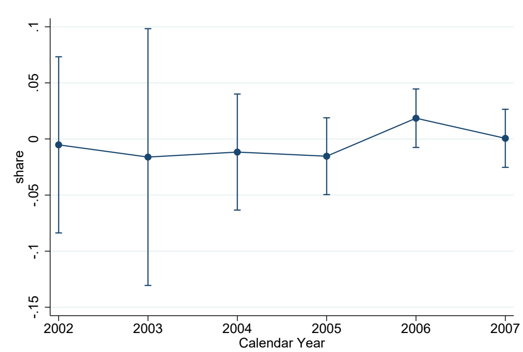
(d) Elderly MR



(e) Admissions via ER (Age 0)



(f) Political Alignment

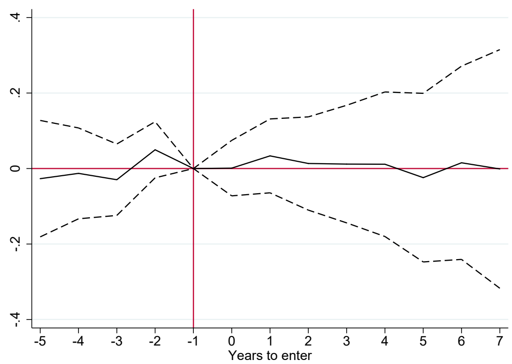


Note: The figures plot the coefficient on the indicator variables for year of implementation of SP, where the dependent variable is the variable on the title of the graph residualized from state-year fixed effects. y_{mst} is measured in the years before the introduction of the SP in a given municipality to which data is available. Since only 3% of the municipalities implemented SP between 2008 and 2010, for sake of precision, we assign to them 2007 as the year of introduction. The bands are 99% confidence intervals.

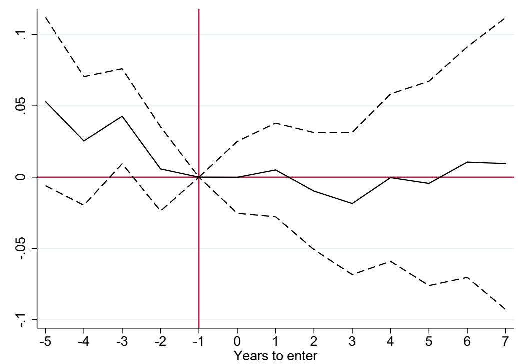
Figure A.9: Impact of SP on Mortality, by Poverty of the Municipality.

Panel A: Child MR (1-4)

(a1) Poor Municipalities

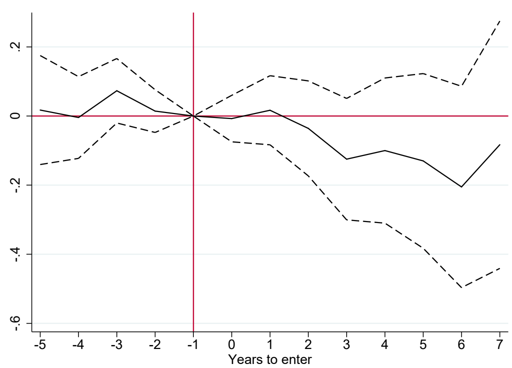


(a1) Rich Municipalities

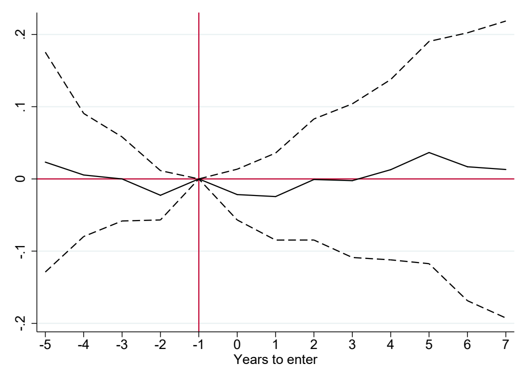


Panel B: Adult MR (20-59)

(b1) Poor Municipalities

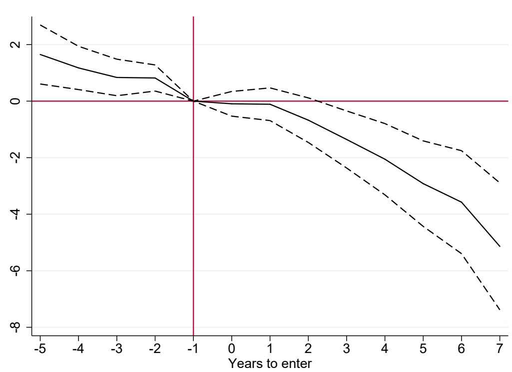


(b2) Rich Municipalities

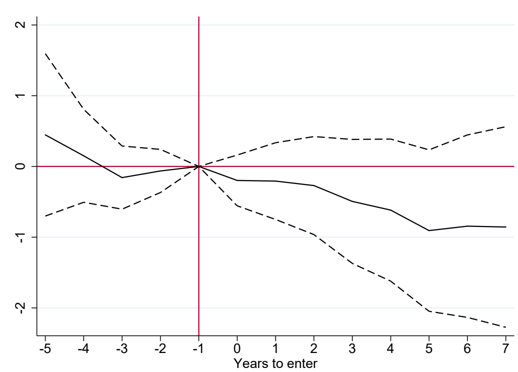


Panel C: Elderly MR (60+)

(c1) Poor Municipalities



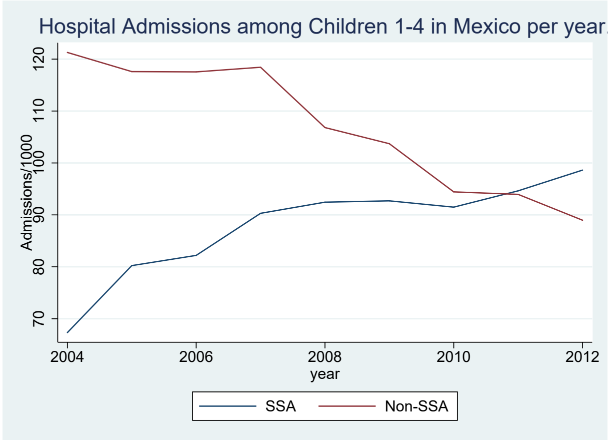
(c2) Rich Municipalities



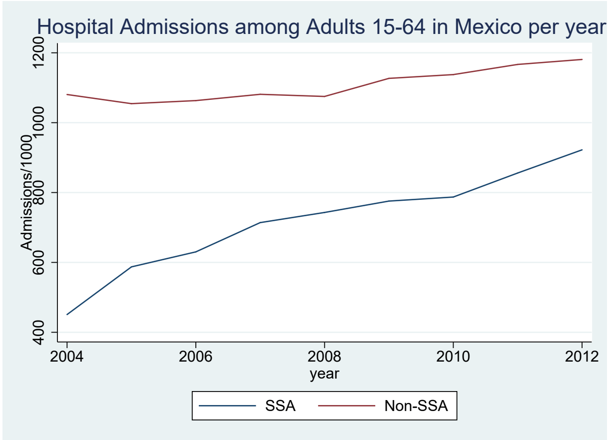
Note: The figures plot weighted least square estimates of β from specification (1). The dependent variable is the mortality rate at different ages. The dashed lines are 90% confidence intervals. Data source: Mortality Registry 1998-2012.

Figure A.10: Hospital Admissions among children, adults and elderly in SSA and non-SSA Hospitals.

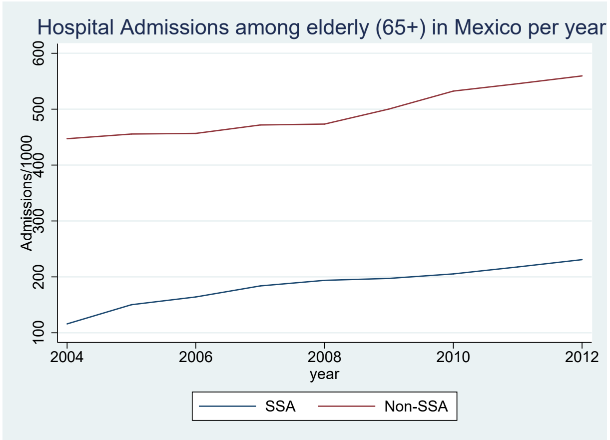
Panel A: Children Ages 1-4.



Panel B: Adults 15-64 (excluding obstetric related admissions).



Panel C: Elderly (65+ year old).



Note: Panel A shows the number of hospital admissions in all public hospitals in Mexico between 2004 and 2012 for children 1–4. Panel B includes all admissions among adults 15–64 (excluding obstetric related admissions) and Panel C includes admissions for individuals 65 or older. Age is grouped in pre-defined intervals in the administrative data for admissions to any public hospital. "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.

B Additional Tables

Table B.1: The Impacts of SP on Health Outcomes: Literature Review.

Authors	Data	Methodology	Results
Knaul et al. (2006)	ENSA 2000; ENSANUT 2006	Regression analysis using an indicator for type of insurance provider	Negative association between out-of-pocket health spending/catastrophic spending and coverage of SP.
Gakidou et al. (2006)	ENIGH 1992-2004 (every 2 years); ENSANUT 2006; ENED 2002-03; ENIGH 2000-2004; Census and Padrón SP 2002-06; Hospital discharges of Health Ministry 2000-05; SICUENTAS and the Health Statistics Bulletin 2000-2005 for health; SEED 1995-2005 for mortality rates; SINERHIAS for the concentration of doctors and nurses	Descriptive Statistics; logistic model using affiliation to SP as independent variable	Affiliation is preferentially reaching the poor and the marginalized communities; Federal non-SS expenditure increased by 38% from 2000 to 2005; proportion of individuals paying for medication among SP affiliates is 41.3%, in uninsured people is 73.8% and in individuals in SS is 30.7%; Equity of public-health expenditure across states improved; SP affiliates used more inpatient and outpatient services than uninsured people; effective coverage of 11 interventions has improved between 2000 and 2006; Catastrophic expenditures for SP affiliates are lower than for uninsured people.
Scott (2006)	ENIGH 2004	Descriptive statistics	Higher utilization rates of public health services for SP affiliates than for the rest of the uninsured, and higher for higher income groups; household health expenditures lower for SP beneficiaries; incidence of catastrophic health expenditures lower across deciles for SP beneficiaries.
Gallardo-García (2006)	Mexican Family Life Survey 2002	Dynamic discrete choice model, where SP is introduced as a zero-price health insurance scheme	Positive impact on birth weight.
Sosa-Rubí et al. (2009)	ENSANUT 2006	State year of entry in SP as IV for affiliation in SP	Positive impact of SP on pregnant women's access to obstetrical services.
Harris and Sosa-Rubí (2009)	ENSANUT 2006	Locality coverage of SP among uninsured is instrument for own affiliation in SP	Enrollment in SP is associated with a mean increase in 1.65 prenatal visits during pregnancy; 59% of this treatment effect is the result of increased prenatal care among women who had little or no access to care.
Hernández-Torres et al. (2008)	SP Impact Evaluation Survey 2002 (Campeche and Colima)	Probit model	8% reduction in catastrophic expenditure on health, independent of the economic level or the kind of service.
King et al. (2009)	Experimental design	Define 100 health clusters in 7 states, of which 50 are assigned to SP. About 30,000 households in each type of cluster and half surveyed. Baseline survey was conducted around August 2005, follow-up 10 months later.	23% reduction in catastrophic expenditures. The intention-to-treat effect on health spending in poor households was 426 pesos; the complier average causal effect was 915 pesos; no effects on medication spending, health outcomes, or utilization. Largest impacts among the poorest.

The Impacts of SP on Health Outcomes: Literature Review (cont.).

Authors	Data	Methodology	Results
Spenkuch (2012)	King et al. (2009) data	Uses King et al (2009) randomized design	Individuals in poor self-assessed health prior to the intervention have, all else equal, a higher propensity to take up insurance; insurance coverage reduces the demand for self-protection in the form of preventive care; individuals do not sort based on objective measures of their health.
Barros (2008)	ENSA 2000; ENSANUT 2006; ENIGH 2000, 2004, 2005, 2006	Triple difference: taking differences over targeted state intensity (in 2006), over time (pre vs post-program), and over individual SP eligibility	SP decreases households health expenditures: 4.2% increase in savings; 40% reduction of people not seeking care due to financial constraints; negligible effect on health status.
Bernal and Grogger (2013a)	King et al (2009) data; Hospital discharges of Health Ministry 2005-06	Uses King et al (2009) randomized design	Increase of births in covered facilities.
Bernal and Grogger (2013b)	King et al (2009) data; Neonatal and Perinatal deaths from Mortality Records for children who died between 2002 and 2006	Uses King et al (2009) randomized design	Increase in use diagnostic procedures during prenatal care visits, but no impact on utilization of prenatal care. Increase of childbirths in public facilities. No effect on fertility, perinatal or neonatal mortality.
Pfutze (2014)	CENSUS 2010	Proportion of population in municipality enrolled as fraction of all families enrolled in SP by Sep2011 by month of birth/beginning of pregnancy	Reduction in infant mortality rate by 5 in 1000 births.
Grogger et al. (2015)	King et al (2009) data; ENIGH	Uses King et al (2009) randomized design	Catastrophic health expenditures fell for rural households with access to well-staffed health facilities, but they fell little for rural households with access to poorly staffed facilities.
Knox (2015)	ENCELURB 2002, 2004, 2005, 2009	Families that are exposed to the program in 2004 vs. 2007, 2008 or 2009 (within family variation)	Increase in use of medical care. Decreased reporting of inability to perform usual daily activities. No health effects were found for children. Decreases in household medical spending for beneficiary families.
Pfutze (2015)	ENADID 2009	Probit model with municipality and monthly fixed effects; the treatment variable is the s the proportion of the number of beneficiaries in SP per month, relative to the total enrolled by September 2011	SP reduced the risk of a miscarriage by around 0.04% points for each percentage point increase in coverage of the target population.
Turrini et al. (2015)	MxFLS 2002, 2005/6, 2009/12	Differences-in-differences estimator based on availability of SP in municipality of residence	Small impacts on height-for-age, concentrated in the upper end of the distribution of height-for-age and for for children who were exposed to SP their entire life.

Note: The first eight rows of this table are based on Table 2.1 of Bosch, Cobacho and Pages, 2014. SP: Seguro Popular; ENSA/ENSANUT: Encuesta Nacional de Salud y Nutrición (National Health and Nutrition Survey); ENIGH: Mexican National Household Income and Expenditure Survey; ENCELURB: Encuesta de Evaluación de los Hogares Urbanos (Urban Household Evaluation Survey); SEED: Subsistema Epidemiológico y Estadístico de Defunciones (Ministry of Health death certificate registry); SICUENTAS: Sistema de Cuentas en Salud a Nivel Federal y Estatal (Record of national and state public health expenditure); SINERHIAS: Subsistema de Información de Equipamiento, Recursos Humanos e Infraestructura para la Salud (Ministry of Health Infrastructure Database); SS: Social Security; ENADID: Encuesta Nacional de la Dinámica Demográfica (National Survey on Demographic Dynamics); MxFLS: Mexican Family Life Survey.

Table B.2: Health Ministry Medical Units, 2001-2010.

Type	Year									
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Outpatient Units										
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
Brigada movil (Mobile Brigate)	453	462	453	449	465	478	485	651	625	147
Specialized clinic	72	81	80	86	93	96	93	93	100	98
Consultorio delegacional (Borough Office)	65	65	46	17	17	12	12	15	21	13
Unidad ministerio publico (Public sector unit)	46	48	47	52	52	60	50	51	51	68
Casa de salud (Health Center)	0	0	0	0	17	37	57	134	142	602
Unidad de Especialidades Médicas (UNEMES)	0	0	0	0	0	29	50	108	313	469
Centros Avanzados de Atención Primaria a la Salud (CAAPS)	0	0	0	0	0	29	33	50	63	77
Centros de Salud con Servicios Ampliados (Health Centers with Extended Services)	0	0	0	0	0	0	0	11	18	25
Inpatient Units										
Community Hospital (*Hospital integral/comunitario*)	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.3: 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) and medical personnel (Panel B) 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.4: 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. 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.5: Sources of variables used for to study the determinants of rollout.

Variable	Source
Socio-demographic and political Indicators (2000)	
Log population	CONAPO (http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos)
Marginalization Index	CONAPO (http://www.conapo.gob.mx/es/CONAPO/Datos_Abiertos_del_Indice_de_Marginacion)
% of individuals 0-4 years	CONAPO (http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos)
% eligible population	CONAPO (http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos)
Alignment b/w party in power in municipality and state	CIDAC (Centro de Investigacin para el Desarrollo, A.C.) http://elecciones.cidac.org
Supply of Health Care (2001) and Health (2000)	
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 http://www.sinais.salud.gob.mx/basesdedatos/recursos.html
Child Mortality Rate in 2000	Mortality Records http://www.dgis.salud.gob.mx/contenidos/basesdedatos/bdc_defunciones.html

Table B.6: Year and Quarter of Implementation of SP.

	N	Percent
	Panel A: Year of Implementation	
2002	241	9.94
2003	171	7.05
2004	402	16.58
2005	620	25.58
2006	488	20.13
2007	420	17.33
2008	59	2.43
2009	14	0.58
2010	9	0.37
	Panel B: Quarter of Implementation	
1	489	20.17
2	676	27.89
3	961	39.65
4	298	12.29
Total	2,424	100

Note: Panel A includes the number of municipality launching SP in a given year. Panel B includes the quarter of the year in which municipalities introduced SP.

Table B.7: Impact of SP on Child Mortality (ages 1-4), By Condition (Sample of Poor Municipalities).

	(1) All	(2) Cancer ICD10 C, D	(3) Bacterial/Intest. Malnutrition Respiratory ICD10 A, E J	(4) Infectious & Parasitic Diseases ICD10 A	(5) Endocrine Diseases ICD10 E	(6) Respiratory Infections ICD10 J	(7) Infectious & Parasitic ICD10 B	(8) Congenital Malformat. ICD10 Q	(9) Heart and Cardiovasc. ICD10 I	(10) Digestive System ICD10 K	(11) External Causes ICD10V, W, X	(12) All Other Conditions Not in col. 2-11
2+ years (incl.) before SP (β_1)	0.021	-0.001	0.004	0.020	0.002	-0.019	-0.004	0.007	-0.003	0.009	0.009	-0.001
	(0.037)	(0.010)	(0.025)	(0.015)	(0.011)	(0.016)	(0.007)	(0.011)	(0.004)	(0.007)	(0.016)	(0.012)
0-2 years after SP (β_2)	0.003	0.001	-0.007	0.006	0.010	-0.023	-0.008	0.017	-0.006	-0.005	0.011	0.000
	(0.038)	(0.010)	(0.026)	(0.015)	(0.011)	(0.016)	(0.007)	(0.012)	(0.005)	(0.007)	(0.015)	(0.014)
3+ years after SP (β_3)	-0.019	-0.023	-0.010	0.003	-0.012	-0.001	-0.008	0.015	-0.010	-0.012	0.015	0.013
	(0.057)	(0.014)	(0.036)	(0.022)	(0.017)	(0.021)	(0.010)	(0.018)	(0.007)	(0.010)	(0.022)	(0.020)
p-value $H_0 : \beta_2 = \beta_3 = 0$	0.825	0.0801	0.957	0.905	0.0517	0.0859	0.513	0.387	0.321	0.505	0.742	0.613
Mean in 2000	1.360	0.081	0.651	0.244	0.165	0.242	0.045	0.118	0.014	0.059	0.179	0.214
S.D.	2.071	0.407	1.364	0.821	0.655	0.731	0.256	0.680	0.130	0.594	0.596	0.975
Observations	18,015	18,015	18,015	18,015	18,015	18,015	18,015	18,015	18,015	18,015	18,015	18,015
Nb. Municip.	1201	1201	1201	1201	1201	1201	1201	1201	1201	1201	1201	1201
% of all Deaths	100%	6%	48%	18%	12%	18%	3%	9%	1%	4%	13%	16%
Covered by SP in 2002?	31%	1%	59%	83%	1%	65%	20%	0%	3%	6%	0%	33%
Covered by SP in 2006?	48%	45%	74%	81%	61%	75%	42%	62%	22%	68%	0%	52%
Covered by SP in 2010?	54%	47%	77%	99%	64%	67%	38%	90%	27%	48%	1%	57%

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 mortality rate among children 1-4 years old. Each column presents results for separate weighted regressions, where the weights are given by the population ages 1-4 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 B.8: Impact of SP on Adult Mortality (ages 20-59), By Condition (Sample of Poor Municipalities).

	(1) All	(2) Infectious and Parasitic Diseases ICD10 A	(3) Infectious and Parasitic Diseases ICD10 B	(4) Endocrinic Diseases ICD10 E	(5) Cancer ICD10 C, D	(6) Heart and Cardiovascular ICD10 I	(7) Respiratory Infections ICD10 J	(8) Digestive System ICD10 K	(9) Obstetric (Women only) ICD10 O	(10) Urinary System ICD10 N	(11) External Causes ICD10 V, W, X	(12) All Other Conditions Not in col. 2-11
2+ years (incl.) before SP (β_1)	0.032	0.015***	0.002	0.007	-0.001	-0.003	0.005	-0.006	0.005	-0.003	0.004	0.006
	(0.035)	(0.005)	(0.005)	(0.009)	(0.011)	(0.010)	(0.006)	(0.013)	(0.004)	(0.005)	(0.013)	(0.017)
0-2 years after SP (β_2)	-0.007	0.002	0.008*	0.025***	-0.011	-0.000	0.012**	-0.013	0.000	0.001	-0.009	-0.023
	(0.037)	(0.005)	(0.005)	(0.010)	(0.011)	(0.009)	(0.006)	(0.012)	(0.003)	(0.004)	(0.012)	(0.022)
3+ after SP (β_3)	-0.118**	-0.006	0.016**	0.018	-0.030**	-0.020	0.008	-0.037**	-0.007	-0.001	-0.017	-0.045
	(0.057)	(0.007)	(0.007)	(0.015)	(0.015)	(0.014)	(0.008)	(0.018)	(0.005)	(0.006)	(0.018)	(0.033)
p-value $H_0 : \beta_2 = \beta_3 = 0$	0.006	0.074	0.069	0.018	0.118	0.116	0.057	0.109	0.061	0.945	0.656	0.403
Mean in 2000	3.306	0.138	0.063	0.279	0.429	0.367	0.127	0.636	0.048	0.071	0.442	0.692
S.D.	2.037	0.354	0.238	0.461	0.621	0.557	0.293	0.935	0.179	0.222	0.713	0.840
Observations	19,230	19,230	19,230	19,230	19,230	19,230	19,230	19,230	19,230	19,230	19,230	19,230
Nb. Municip.	1282	1282	1282	1282	1282	1282	1282	1282	1282	1282	1282	1282
% of all Deaths in 2000	100%	4%	2%	8%	13%	11%	4%	19%	1%	2%	13%	21%
Covered by SP in 2002?	13%	29%	21%	80%	0%	31%	52%	6%	0%	2%	0%	6%
Covered by SP in 2006?	21%	37%	31%	59%	38%	10%	66%	12%	69%	4%	0%	12%
Covered by SP in 2010?	30%	72%	22%	93%	37%	92%	64%	13%	72%	4%	0%	21%

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 mortality rate among individuals 20-59 years old. Each column presents results for separate weighted regressions, where the weights are given by the population ages 20-59 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 B.9: Impact of SP on Elderly Mortality (ages 60+), By Condition (Sample of Poor Municipalities).

	(1) All	(2) Infectious Diseases ICD10 A	(3) Cancer ICD10 C, D	(4) Endocrinic Diseases ICD10 E	(5) Heart and Cardiovascular ICD10 I	(6) Respiratory Infections ICD10 J	(7) Digestive System ICD10 K	(8) Urinary System ICD10 N	(9) External Causes (ICD10 V, W, X)	(10) All Other Conditions Not in col. 2-9
Up to 2 years (incl.) before SP (β_1)	0.193	-0.005	-0.021	0.012	-0.119	0.133*	0.049	-0.031	0.023	0.153
	(0.254)	(0.036)	(0.085)	(0.098)	(0.140)	(0.079)	(0.067)	(0.042)	(0.039)	(0.111)
0 to 2 years after SP (β_2)	0.480**	-0.011	0.030	0.047	0.253**	0.123*	0.112	0.028	0.048	-0.152
	(0.237)	(0.033)	(0.081)	(0.088)	(0.125)	(0.074)	(0.069)	(0.040)	(0.039)	(0.099)
3 or more years after SP (β_3)	-0.077	-0.032	-0.089	0.008	-0.037	0.109	0.025	-0.007	0.027	-0.090
	(0.356)	(0.048)	(0.115)	(0.127)	(0.208)	(0.111)	(0.099)	(0.057)	(0.056)	(0.146)
p-value $H_0 : \beta_2 = \beta_3 = 0$	0.005	0.751	0.235	0.776	0.0064	0.241	0.094	0.505	0.349	0.190
Mean in 2000	31.880	1.005	4.218	4.289	9.417	3.491	3.086	1.147	1.031	4.184
S.D.	12.36	2.163	3.627	4.355	6.685	3.793	3.348	1.908	1.591	5.286
Observations	19,245	19,245	19,245	19,245	19,245	19,245	19,245	19,245	19,245	19,245
Nb. Municip.	1283	1283	1283	1283	1283	1283	1283	1283	1283	1283
% of all Deaths in 2000	100%	3%	13%	13%	30%	11%	10%	4%	3%	13%
Covered by SP in 2002?	18%	44%	0%	69%	4%	35%	15%	4%	0%	2%
Covered by SP in 2006?	31%	52%	24%	56%	16%	73%	32%	11%	1%	9%
Covered by SP in 2010?	38%	70%	23%	87%	15%	76%	32%	13%	1%	27%

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 mortality rate among individuals 60 or older. Each column presents results for separate weighted regressions, where the weights are given by the population 65 or older 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 B.10: Impact of SP on Infant Mortality and Hospital Admissions in Poor Municipalities (age 0): Robustness to alternative definitions of implementation of SP.

	(1)	(2)	(3)	(4)	(5)	(6)
	5 Families		15 Families		20 Families	
Outcome	IMR	Admissions	IMR	Admissions	IMR	Admissions
Up to 2 years (inclusive) before SP (β_1)	0.245	-0.002	0.254	0.002	0.310	0.004
	(0.286)	(0.024)	(0.286)	(0.023)	(0.286)	(0.023)
0 to 2 years after SP (β_2)	-0.267	0.067**	-0.423	0.068***	-0.370	0.070***
	(0.286)	(0.026)	(0.286)	(0.026)	(0.285)	(0.026)
3 or more years after SP (β_3)	-1.377***	0.069*	-1.622***	0.074*	-1.572***	0.076**
	(0.501)	(0.038)	(0.495)	(0.038)	(0.494)	(0.038)
p-value $H_0 : \beta_2 = \beta_3 = 0$	0.003	0.041	0.001	0.034	0.001	0.029
Observations	19,197	16,640	19,168	16,614	19,123	16,575
Nb. Municipalities	1280	1,280	1278	1,278	1275	1,275

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 infant mortality rate (columns 1, 3 and 5) and the log number of discharges (columns 2, 4 and 6). Each column presents results for separate weighted regressions, where the weights are given by the births 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 sources: Mortality Registry 1998-2012 and Registry of Admissions to SSA Hospitals 2000-2012.

Table B.11: Impact of SP on Admissions among Infants, Robustness (Sample of Poor Municipalities).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Up to 2 years (incl.) before SP (β_1)	0.003	0.037	0.003	0.022	0.027	0.001	0.032	0.042*	0.043*
	(0.024)	(0.030)	(0.048)	(0.023)	(0.022)	(0.025)	(0.022)	(0.024)	(0.024)
0 to 2 years after SP (β_2)	0.070***	0.086***	0.070	0.064**	0.060**	0.071***	0.057**	0.063**	0.063**
	(0.026)	(0.031)	(0.046)	(0.026)	(0.026)	(0.026)	(0.023)	(0.025)	(0.026)
3 or more years after SP (β_3)	0.074*	0.116***	0.074	0.076**	0.064*	0.075*	0.052	0.069*	0.072*
	(0.038)	(0.045)	(0.059)	(0.038)	(0.037)	(0.039)	(0.033)	(0.037)	(0.037)
p-value $H_0 : \beta_2 = \beta_3 = 0$	0.029	0.020	0.319	0.053	0.079	0.025	0.049	0.045	0.051
Observations	16,640	14,365	16,640	16,640	15,360	16,640	16,640	16,640	16,640
Year FE	x	x	x	x	x	x	x	x	x
Municipality FE	x	x	x	x	x	x	x	x	x
Trends in 2000 Municipality Xs				x	x		x	x	x
Political Alignment					x				
Pre-SP Linear Municipality Trend						x	x		
State Cubic Trend							x		
State -Year FE								x	x
Dummy for years since Oportunidades									x
Cohorts	02-10	04-07	02-10	02-10	02-10	02-10	02-10	02-10	02-10
Cluster of SE	Mun.	Mun.	State	Mun.	Mun.	Mun.	Mun.	Mun.	Mun.

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 births in municipality m in state s in 2000. The baseline municipality Xs (in cols. 4, 5, 7, 8 and 9) 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). We estimate municipality-specific trends in cols. 6 and 7 using data before the implementation of SP, and we obtain a slope estimate λ_{ms} for each municipality. We then extrapolate the pre-expansion time trends to the post-reform period as follows (see also Bhuller et al., 2013):

$$y_{mst} = \beta_1 SP_{mst}\mathbf{1}\left[t - T_m \leq -2\right] + \beta_2 SP_{mst}\mathbf{1}\left[0 \leq t - T_m \leq 2\right] + \beta_3 SP_{mst}\mathbf{1}\left[t - T_m \geq 3\right] + \delta\widehat{\lambda_{ms}}t + \mu_{ms} + \pi_t + \varepsilon_{mst}.$$

*** Significant at 1%, ** Significant at 5%, * Significant at 10%. Data source: Registry of Admissions to SSA Hospitals 2000-2012.

Table B.12: Impact on the Place of Birth.

	(1) Birth at SSA	(2) Birth at other hosp	(3) Birth at other place
1[SP=1] (β_1)	0.011	-0.029	0.018
	[0.047]	[0.046]	[0.023]
1[SP=1]xPoor (β_2)	0.098*	0.047	-0.145***
	[0.054]	[0.053]	[0.040]
p-value $H_0 : \beta_1 + \beta_2 = 0$	0.101	0.786	0.001
Observations	4,580	4,580	4,580
Mean in 2000: Poor	0.678	0.288	0.034
Mean in 2000: Rich	0.342	0.612	0.046

Note: The sample is restricted to infants. Controls excluded from the table but included in all the estimated specifications are: an indicator for gender of the infant, 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 state of residence. The following characteristics of municipalities are included as controls: 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: ENSA2000, ENSANUT2006 and ENSANUT2012.

Table B.13: Impact of SP on Births.

Sample of Municipalities	(1) Poor	(2) Rich
Up to 2 years (inclusive) before SP (β_1)	-20.462	-5.594
	(12.964)	(225.894)
0 to 2 years after SP (β_2)	-0.470	18.765
	(12.212)	(100.675)
3 or more years after SP (β_3)	-3.488	-145.330
	(31.892)	(200.794)
p-value $H_0 : \beta_2 = \beta_3 = 0$	0.976	0.620
Mean 2000	433.7	1698
SD	605	4019
Observations	19,197	17,159
Nb. Municipalities	1,280	1,144

Note: This table displays weighted least squares estimates of our baseline specification (2) on the births data, aggregated at municipality-year level. The model estimated is the following (see equation 2):

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

where the dependent variable y_{mst} is the number of births in municipality m of state s in year t. Each column presents results for separate weighted regressions, where the weights are given by the births in municipality m in state s in 2000. Controls include fixed effects for year (π_t) and municipality of residence (μ_{ms}). Standard errors (in parentheses) are clustered at the level of the municipality. *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Data source: Birth Registry 1998-2012.

Table B.14: Impact of SP on outpatient visits and medical personnel (poor municipalities).

	(1)	(2)	(3)	(4)	(5)	(6)
	Outpatients visits p.c.			Medical Personnel p.c.		
	All public providers	Non-SSA Units	SSA Units	All public providers	Non-SSA Units	SSA Units
≥2 years (inclusive) before SP (β_1)	0.011	0.023*	-0.014	0.170	0.140	0.028
	-0.024	(0.013)	(0.019)	(0.241)	(0.176)	(0.081)
0-2 years after SP (β_2)	-0.080***	-0.057***	0.011	0.019	0.135	-0.136*
	(0.026)	(0.018)	(0.017)	(0.293)	(0.274)	(0.072)
3+ years after SP (β_3)	-0.205***	-0.235***	0.110***	0.031	0.344	-0.372
	(0.053)	(0.040)	(0.038)	(0.931)	(0.738)	(0.284)
p-value $H_0 : \beta_2 = \beta_3 = 0$	0.001	0.000	0.003	0.994	0.884	0.159
Observations	16,128	15,926	17,265	17,398	17,128	17,357
Mean in 2000	1.880	1.052	1.395	3.514	2.500	2.096

Note: This table presents estimates obtained using the SIMBAD data for the years 1996-2011. The dependent variable in columns 1-3 is the log of the number of outpatient visits per 1,000 individuals in a municipality in a year, and in columns 4-6 is the log of the number of doctors, nurses and other health personnel per 1,000 individuals in a municipality in a year. The estimates are presented for three different types of providers of health services: columns 1 and 4 include all public providers of health services, that is, the Health Ministry (SSA), IMSS, ISSSTE, PEMEX, IMSS-Oportunidades and any other public institutions. Columns 2 and 5 include any public institution other than SSA, and columns 3 and 6 include only the SSA. Standard errors are clustered at the level of the municipality. *** Significant at 1%, ** Significant at 5%, * Significant at 10%.

Table B.15: Characteristics of families at entry in SP (Poor Municipalities).

Family Charact.	(1) 1^{st} income decile	(2) Male headed	(3) Any member disabled	(4) Head married	(5) In *Oportunidades*	(6) Family size	(7) Children 0-4 present	(8) Head educ. primary/more	(9) Head age
	-0.439***	0.346***	-0.879***	-0.202***	-0.884***	-0.154***	-0.104***	0.105***	-0.011***
	(0.030)	(0.026)	(0.109)	(0.031)	(0.043)	(0.006)	(0.016)	(0.030)	(0.001)
N	4,463,955	4,463,886	4,463,955	4,463,955	4,463,955	4,463,955	4,457,238	4,463,955	4,455,807
Mean	0.731	0.199	0.0356	0.474	0.359	2.805	0.269	0.846	38.090
SD	0.443	0.399	0.185	0.499	0.480	1.825	0.443	0.361	16.830

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%.