London School of Economics and Political Science

The Expansion of Public Health Insurance in Mexico

Health, Financial and Distributional Effects

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Declaration of Authorship

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Statement of conjoint work

I confirm that Chapter 6 was jointly co-authored with Dr. Joan Costa and Professor Frank Cowell, who provided guidance on the structure of the chapter and empirical strategy. I conceived the idea for the analysis, wrote all the sections of the Chapter and carried out all the estimates. Overall, I contributed 85% of this work.

Abstract

During the past decade, the Mexican government launched an ambitious expansion of public health insurance through the Seguro Popular programme (SP). As a result, health care access was legislated as citizens' entitlement, a generous benefit package was offered, and public health expenditure was significantly increased. In 2011, the programme had reached 52 million affiliates. However, there is limited evidence on its effects on a number of outcomes and their distribution.

This thesis analyses three aspects that are key to evaluate health system performance. Specifically, using quasi-experimental methods and recent distributional measures of pure health, it examines the effect of universal insurance coverage on infant mortality, non-medical consumption, and health inequalities.

Drawing on municipality-level data, the first article finds that the programme led to a 3.9 per cent decrease in infant and neonatal mortality. These reductions were concentrated in more populated, urban, and less marginalised municipalities, however, probably because this type of municipalities have been traditionally better equipped and are thus better prepared to offer all the interventions from the benefit package.

Based on data from the Mexican Family Life Survey (MxFLS), the second article shows that unexpected health events such as accidents and deterioration in physical capacity are associated with large declines in non-medical consumption. Social security seems to provide protection against both types of shocks, but endogeneity-corrected estimates show that the SP only protects consumption against accidents. This suggests that income losses associated with disability shocks for which the programme does not offer protection, are likely larger than medical care

expenditures, and poses the question of whether other social security benefits, such as disability insurance, should also be extended.

Finally, the third article analyses the distribution of health in the context of the SP implementation. Unlike traditional studies, pure health inequality and mobility are analysed using a recently developed class of indices appropriate for categorical data. If a downward-looking definition of status is employed, the distribution of health appears stable, but if an upward-looking definition is adopted, a significant increase in inequality is observed. Evidence of strong persistence in health was also found. This lack of improvement in the health distribution suggests that factors other than health insurance coverage, such as institutional performance, are more important determinants of health inequalities.

Overall, this thesis finds important health effects from extending health insurance coverage but limited effects on economic welfare and the distribution of health status across the entire population.

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This thesis is dedicated to the memory of my father.

Contents

List of Abbreviations[1]

ADL	Activities of daily living
CAUSES	Universal Catalogue of Essential Health Services
CI	Concentration index
CONAPO	National Population Council
CONASAMI	National Minimum Wages Commission
CONEVAL	National Council for the Evaluation of Social Development Policy
CNPSS	National Commission for Social Protection in Health
DOF	Official Journal of the Federation
ENADID	National Survey of Demographic Dynamics
ENCASEH	Household Socioeconomic Characteristics Survey
FPGC	Fund for Protection against Catastrophic Health Expenditures
GDP	Gross Domestic Product
IFAI	Federal Institute of Access to Public Information
IMR	Infant Mortality Rate
IMSS	Mexican Institute of Social Security
INEGI	National Institute of Statistics and Geography
INPC	National Consumer Price Index
INSP	National Institute of Public Health
ISSSTE	Mexican State's Employees' Social Security
IV	Instrumental variables
LGS	General Health Law

[1] Most acronyms correspond to official names in Spanish. The first time each term is mentioned in the text, the full name in Spanish is also provided.

LMIC	Low- and Middle-Income Countries
MDGs	Millenium Development Goals
MxFLS	Mexican Family Life Survey
NMR	Neonatal Mortality Rate
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PEMEX	Petróleos Mexicanos (the state-owned oil company)
PROSPERA	Social Inclusion Programme PROSPERA
SAH	Self-assessed health
SDGs	Sustainable Development Goals
SEDENA	Ministry of National Defence
SEMAR	Ministry of Navy
SICUENTAS	Federal and State Health Accounts System
SINAIS	National Health Information System
SINERHIAS	Equipment, Human Resources and Infrastructure Information System
SMSXXI	XXI Century Medical Insurance
SP	Seguro Popular
SPSS	System of Social Protection in Health
VSL	Value of a statistical life
WHO	World Health Organization

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1. Introduction

By the end of the last century, most low- and middle-income countries (LMIC) still failed to provide access to health services and financial protection to important shares of the population. In recent years, however, a number of those countries managed to implement important reforms to their health systems to address this problem (World Health Organization 2010). In particular, the Mexican government started in 2002 an expansion of health services through a publicly funded, voluntary health insurance known as *Seguro Popular* (SP),[2] for over 50 million individuals who had been previously excluded from social insurance. By 2012, it was announced that universal coverage had been achieved in the country (Knaul et al. 2012).

The expansion of health insurance is expected to improve health mainly through increased health care utilisation (Gruber 2003). Empirical evidence, however, is not conclusive. Studies that have analysed the effects of insurance on health have found limited or no effects (Giedion and Díaz 2010, Levy and Meltzer 2008, Finkelstein et al. 2012). The expansion of health insurance is also expected to protect consumption against health shocks (Chetty and Looney 2006), but this has been scarcely analysed. Likewise, although the effects of insurance expansions on individuals' perception of their health are clearer (Finkelstein et al. 2012, Sommers et al. 2017), little is known about the distribution of these effects. This thesis

[2] Seguro Popular is often translated as "Popular Insurance" but "Insurance for the People" would be more adequate. Throughout this thesis I use the name in Spanish or the correspondent acronym, SP.

attempts to contribute filling these gaps. Specifically, the thesis is made of three papers that draw on the unique Mexican experience to analyse: 1) the effect of the expansion of health insurance on infant mortality, 2) the welfare consequences of health shocks and the role of public health insurance, and 3) whether insurance coverage is associated with improvements in the distribution of health.

Mexico provides a suitable setting to conduct this research for at least three reasons. First, Mexico was one of the first LMIC to increase health care coverage through the expansion of public health insurance. Due to financial and infrastructural constraints at the time of the policy intervention, the health insurance expansion was gradual, which resulted in a quasi-natural experiment that allows the use of quasi-experimental methods to analyse its effects. Second, public health insurance was limited before the introduction of the SP, so as expected, marked inequalities prevailed. Third, Mexico is one of the few LMIC with good quality vital statistics at the national and subnational levels and a longitudinal survey that covers the period before and after the implementation of the SP.

This thesis is organised as follows. Chapter 2 describes the setting for all the analyses, i.e., explains the configuration of the Mexican health system and the implementation of the SP to extend insurance coverage to all the population. Chapter 3 describes the two types of data employed in the analyses, namely aggregated data at the municipality level (vital statistics, administrative records, and Census data), and individual level data (survey data). Chapter 4 studies the effects of health insurance on infant and neonatal mortality. Chapter 5 examines the effects of unexpected health events on the consumption of Mexican households and the role of public insurance to protect against consumption fluctuations. Chapter 6 analyses the pattern in health inequality and mobility during the health insurance expansion.

Finally, conclusions are presented in Chapter 7.

2. Public Health Insurance in Mexico

As in many other LMIC, the Mexican health system is characterised by its fragmentation. Social security institutions created in the 1940s and 1950s, on the one hand, cover formal workers and their families, which account for approximately half of the population. The other half, on the other hand, have access to public facilities run by the Ministry of Health for a fee until the most recent reform, which created the Seguro Popular programme and wiped out the health care fee for treatments covered in the health care package. The next two sections explain the main characteristics of both types of public health insurance to better understand the implications of the SP.

A wide range of private providers also offer health services in Mexico, but since only a small share of the population has private insurance —3 per cent according to the Organisation for Economic Co-operation and Development (2005; OECD)— these are mainly funded through out-of-pocket expenditure.

2.1 Antecedents of the Seguro Popular Programme: The Divide between Formal and Informal Workers

The main social security providers in Mexico have been the Mexican Institute of Social Security (*Instituto Mexicano del Seguro Social*, IMSS) and the Mexican State's Employees' Social Security (*Instituto de Seguridad y Servicios Sociales para* *los Trabajadores del Estado*, ISSSTE). The IMSS was created in 1943 to provide health services and other social security benefits to private sector workers and their families, while the ISSSTE was created in 1959 to provide similar benefits to public sector workers. The Ministry of National Defence (*Secretaría de la Defensa Nacional*, SEDENA), the Ministry of Navy (*Secretaría de Marina*, SEMAR), the state-owned oil company (*Petróleos Mexicanos*, PEMEX), and the 31 states that comprise the Mexican federation also provide social security benefits to their employees and their families, but cover a small share of the population.[3] According to administrative records, nearly 60 per cent of the population had access to social security at the beginning of the last decade (Table 2.1), which implies that the remaining 40 per cent were uninsured. Other sources such as the 2000 Census indicate that the uninsured could have accounted for at least 57 per cent of the population (Table 2.2).[4]

[3] There are 31 states in Mexico, plus a Federal District that will formally become the 32nd state (*entidad federativa*) in 2018 and will be named *Ciudad de México*, or Mexico City.
[4] Census data are publicly available on the website of the National Institute of Statistics and Geography (INEGI); see section 3.1 of Chapter 3 below. According to the 2000 Census, there were 55.6 million uninsured individuals, 39.1 million insured, and 2.8 million had no insurance status information.

Table 2.1. Social security beneficiaries in Mexico, 2000-2015

(million individuals)

Year	IMSS	ISSSTE	PEMEX	SEDENA	SEMAR	States	Total	Beneficiaries as a percentage of the total population
2000	45.05	10.07	0.65	0.49	0.19	1.31	57.75	57%
2001	44.72	10.24	0.67	0.51	0.21	1.43	57.78	57%
2002	45.35	10.31	0.68	0.54	0.21	1.37	58.46	57%
2003	41.52	10.35	N/A	N/A	N/A	N/A	51.87	50%
2004	43.01	10.46	0.69	0.68	0.21	1.47	56.52	53%
2005	44.53	10.61	0.71	N/A	0.2	1.44	57.49	54%
2006	46.64	10.8	0.71	N/A	0.2	1.54	59.88	55%
2007	48.65	10.98	0.71	N/A	0.2	1.42	61.97	56%
2008	48.91	11.3	0.73	N/A	0.22	N/A	61.16	55%
2009	49.13	11.59	0.74	0.87	0.23	0.95	63.51	56%
2010	52.31	11.99	0.74	1.05	0.24	1.94	68.28	60%
2011	54.91	12.21	0.75	0.81	0.26	1.95	70.89	61%
2012	57.48	12.45	0.76	0.83	0.28	1.68	73.47	63%
2013	59.51	12.63	0.76	0.83	0.29	1.55	75.58	64%
2014	59.49	12.8	N/A	N/A	N/A	N/A	72.29	60%
2015	61.87	12.97	N/A	N/A	N/A	N/A	74.84	62%

Notes: The acronyms correspond to the names in Spanish of each social security institution —IMSS for the Mexican Institute of Social Security; ISSSTE for the Mexican State's Employees' Social Security; SEDENA for the Ministry of National Defence; SEMAR for the Ministry of Navy; and PEMEX for the state-owned oil company. The states that comprise the Mexican federation also have specific social security institutions. N/A = not available.

Source: Data on beneficiaries come from the National Institute of Statistics and Geography (INEGI) but is based on information from administrative records of social security institutions; total population figures used to calculate the percentages are available on the website of the National Population Council (CONAPO).

Table 2.2. The Mexican health system before the Seguro Popular programme

	Social security beneficiaries	Uninsured
Population share in 2000	40 per cent or 39 million (formal sector workers and their families).	57 per cent or 56 million (informal sector workers and their families).
Provider of health services	Government; facilities run by social security institutions, centralised administration.	Government; facilities run by the Ministry of Health, decentralised administration.
Funding	Payroll taxes, employer contributions and general revenues.	General revenues and progressive fees.
Per capita public expenditure in 2000	MX$3,197.5	MX$1,482.4
Benefit package	Includes a wide range of services and prescription drugs, as well as disability benefits, housing loans and severance payments, among other benefits.	Not available. Other health services such as vaccination campaigns also provided to the general population.

Notes: MX$ = Mexican Pesos. Insurance affiliation is measured for population five years and older; the insurance status of 3 per cent of this population is not specified.

Source: Data on population coverage come from the 2000 Census available on the website of the National Institute of Statistics and Geography (INEGI); per capita public health expenditure is from the Federal and State Health Accounts System (SICUENTAS) available on the website of the Ministry of Health.

Social security services are funded through payroll taxes, employer contributions, and general revenues; no co-payments apply. The institutions that provide these services have their own facilities and budgets, and are centrally administered by the federal government. Apart from health care access, social security benefits include temporary disability subsidies (for sickness, risks at work, and maternity), disability pensions for workers who suffer permanent disabilities, old-age pensions, and housing credits, among others.[5] Hence, social security provides protection from both effects of health shocks, income losses, and catastrophic health expenditures (see Chapter 5).

The uninsured population have access to health services provided by the Ministry of Health at a fee. The fees are based on self-reported income, and are well below the real cost. By the end of the 1980s the decentralization of these services started in some states, but it was not until the mid-1990s that the Ministry of Health resumed the decentralization process (González-Pier et al. 2006).

Although the government is the provider of health services through both social security and Ministry of Health facilities, the latter were severely underfunded. While public per capita expenditure was 3,197.5 pesos in 2000 for social security beneficiaries, the corresponding figure for the uninsured was less than half (1,482.4 pesos; Table 2.2).[6] This resulted in marked disparities in access to health care and health status, underinvestment in infrastructure, and high out-of-pocket expenditures (Organisation for Economic Co-operation and Development 2005, Knaul et al. 2012). Between 2 and 4 million households suffered catastrophic and impoverishing health care spending in 2000; 86 per cent of these households were uninsured (Knaul et al. 2006). In fact, Mexico was ranked 144th out of 191 countries in fairness of health care by the World Health Organization (2000; WHO) at the beginning of this century.

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[5] To qualify for these benefits, the affiliates must fulfil certain requisites. For example, to qualify for a disability pension, the worker must have contributed for 150 to 250 weeks before the event that causes the permanent disability.

[6] Figures in constant pesos. Health expenditure data are publicly available on the Federal and State Health Accounts System (*Sistema de Cuentas en Salud a Nivel Federal y Estatal*, SICUENTAS) administered by the Ministry of Health.

2.2 The Seguro Popular Programme: Health Access for All as Citizens' Entitlement

The implementation of the Seguro Popular programme implied a fundamental change in the notion of health care access. Instead of a model based in labour status, the objective was to transition to a model of social protection to guarantee access to health care as a universal right. Formally, the reform that came into force in 2004 created the System of Social Protection in Health (*Sistema de Protección Social en Salud*, SPSS), with the SP as the insurance component. Affiliation to the SP is voluntary, and the only eligibility criterion is not being a beneficiary of social security (Table 2.3). Once affiliated, beneficiaries receive a Chart of Rights and Duties (*Carta de Derechos y Obligaciones*) that clearly indicates the services to which they are entitled and the facilities where they can have access to those services.

According to the rules of the SP, the funding comes from the federal government, which contributes with an annual transfer equivalent to 3.92 per cent of the minimum wage per beneficiary known as *cuota social* plus an additional contribution of 1.5 times the *cuota social*; the state government, which contributes with 0.5 times the *cuota social*; and progressive contributions from beneficiaries —the poorest being exempt (see General Health Law or *Ley General de Salud*, LGS and its regulations).[7] In practice, however, the SP has virtually operated as non-

[7] Before 2010 the financing unit was the family instead of the individual, and the *cuota social* was 15 per cent of the minimum wage per enrolled family. This created some disparities in the per capita allocation of resources across states, however, as the average family size is smaller in wealthier than in poorer states (Knaul et al. 2012). In addition, the SP rules originally indicated that beneficiaries in the first two income deciles would be exempt from the beneficiary contributions, but in 2010 this was extended to those in the first four income deciles. The SP rules also stipulate a few other cases in which beneficiary contributions are waived, e.g., for residents in localities with less than 250 inhabitants (article 127 of the Reglamento de la Ley General de Salud en materia de Protección Social en Salud). In 2010, the *cuota social* was equivalent to 812.07 pesos.

contributory health insurance since contributions from beneficiaries are negligible. According to the National Commission for Social Protection in Health (*Comisión Nacional de Protección Social en Salud*, CNPSS) that administers the SP, the family contributions amount to less than 1 per cent the SP yearly budget between 2004-2014 (Comisión Nacional de Protección Social en Salud 2015). Moreover, the average contribution per beneficiary has declined over the years, from 11.77 pesos in 2004 to 0.52 pesos in 2014 (Presidencia de la República 2015).[8]

Table 2.3. Characteristics of the Seguro Popular programme

Eligibility	Individuals not covered by social security.
Provider	Government; facilities run by the Ministry of Health.
Funding	Federal contribution + state contributions + progressive contribution of beneficiaries (the poorest exempt).
Benefit package	Medical services and drugs listed in a catalogue (CAUSES) that covers most of the causes of morbidity and mortality (this catalogue included 91 services in 2004 but was progressively expanded to reach 275 in 2010-2011, 284 in 2012, and 285 in 2013-2014; the number of drugs increased from 142 in 2004 to 609 in 2013).

Notes: The description of the funding comes from the programme rules but in practice the contributions from beneficiaries are negligible.

Source: General Health Law (LGS), Comisión Nacional de Protección Social en Salud (various years).

[8] In 2002 and 2003, the pilot years of the SP (i.e. before the law that formally created the SP became in force), the average contribution per beneficiary was the highest registered so far (24.43 pesos and 62.78 pesos, respectively). This is probably related to the low coverage of those years (1.1 million and 2.2 million individuals, respectively), which could have facilitated the collection of these contributions. In 2004, however, the average contribution radically fell (to 11.77 pesos per beneficiary), and it continued falling as the coverage expanded (it only slightly recovered in 2012).

The SP benefit package guarantees access to a wide range of preventive and treatment interventions, described in the *Catálogo Universal de Servicios Esenciales de Salud* (CAUSES, Universal Catalogue of Essential Health Services; Comisión Nacional de Protección Social en Salud 2012), that cover most of the causes of morbidity and mortality (González-Pier et al. 2006).[9] Moreover, several services have been added over the years; between 2004 and 2014, the interventions offered increased from 91 to 285. The government estimates that these interventions cover 100 per cent of the demand for primary care and 85 per cent of the demand for hospitalisation and surgery (Comisión Nacional de Protección Social en Salud 2015). Nearly 60 costly, specialised procedures such as intensive neonatal care and cervical cancer are also covered.[10]

The implementation of the SP also drastically changed the allocation of public resources. To ensure an adequate supply of health services, public health expenditure grew from 2.6 per cent of Gross Domestic Product (GDP) in 2000 to 3.1 per cent in 2011, which is equivalent to 2,325 and 4,001 constant pesos per capita, respectively (Table 2.4). This resulted in over a half percentage point increase in total health expenditure as percentage of GDP in the same period (from 5.6 per cent to 6.2 per cent). The gap in public per capita expenditure between those with and without social security beneficiaries also narrowed (Figure 2.1). Additionally, 15

[9] The catalogue included 91 services in 2004 but was expanded to 155 in 2005, 249 in 2006, 255 in 2007, 266 in 2008-2009, 275 in 2010-2011, 284 in 2012, and 285 in 2013-2014.

[10] The LGS indicates that 8 per cent of the SP funds have to be allocated to the Fund for Protection against Catastrophic Health Expenditures (*Fondo de Protección contra Gastos Catastróficos*, FPGC) to finance the costliest interventions included in the SP benefit package. Up to 2010, the FPGC funded 49 interventions such as cervical cancer, HIV/AIDS, intensive neonatal care (premature births, sepsis, respiratory distress syndrome), other cancers, transplants, and Non-Hodgkin lymphoma among other; the number of interventions increased to 56 in 2011 and 59 in 2013. In 2013, 1,037.46 million pesos were used to attend nearly 22 thousand cases that required intensive neonatal care, which amounted to 14 per cent of the FPGC budget. A similar proportion is observed for other years between 2007 and 2012 (Comisión Nacional de Protección Social en Salud, various years).

high-specialty centres were built between 2001 and 2011 (Knaul et al. 2012), as well as 176 hospitals and 2,525 clinics; the ratio of physicians, hospitals and clinics per 1,000 population increased 14 per cent, 15 per cent, and 9 per cent during the same period, respectively (Table 2.5).

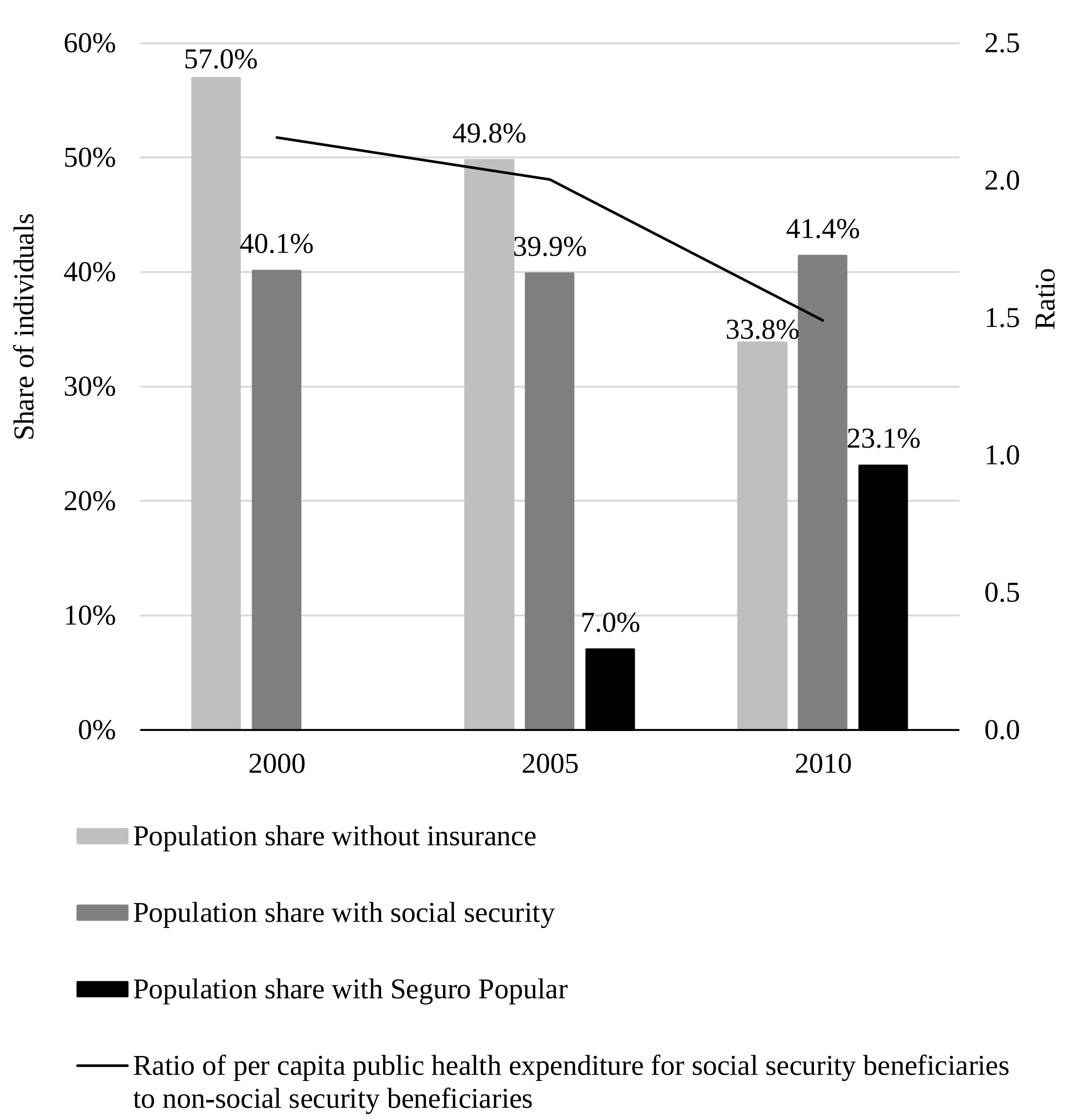
Table 2.4. Health expenditure in Mexico, 2000-2011

	Public health expenditure as percentage of GDP	Total health expenditure as percentage of GDP	Public per capita health expenditure		
			Population with social security	Population without social security	Total
2000	2.6	5.6	3,197.5	1,482.4	2,325.0
2001	2.7	6.0	3,323.8	1,533.1	2,396.8
2002	2.7	6.2	3,414.8	1,576.7	2,447.3
2003	2.6	5.8	3,809.5	1,638.0	2,648.5
2004	2.7	6.0	4,393.3	1,795.6	2,983.4
2005	2.6	5.9	4,177.2	2,085.5	3,025.6
2006	2.6	5.7	4,203.6	2,276.4	3,143.6
2007	2.6	5.8	4,391.5	2,513.5	3,359.4
2008	2.7	5.8	4,263.1	2,867.7	3,500.4
2009	3.1	6.4	4,474.9	3,053.5	3,694.4
2010	3.1	6.3	4,729.5	3,172.2	3,880.0
2011	3.1	6.2	4,899.2	3,251.6	4,000.6

Notes: Public per capita health expenditure is in constant Mexican pesos of 2011.

Source: Federal and State Health Accounts System (SICUENTAS) available on the website of the Ministry of Health.

Figure 2.1. Health insurance coverage and public health expenditure in Mexico, 2000-2010



Notes: Insurance affiliation refers to population five years and older; the percentages do not add up to 100 for each year since some insurance information is missing. Public per capita health expenditure is in constant Mexican pesos of 2011.

Source: Data on population coverage come from the 2000 and 2010 censuses and the 2005 Conteo available on the website of the National Institute of Statistics and Geography (INEGI); per capita public health expenditure is from the Federal and State Health Accounts System (SICUENTAS) available on the website of the Ministry of Health.

Table 2.5. Health infrastructure and personnel in Mexico, 2001-2011

	Physicians		Hospitals		Clinics	
	n	rate	n	rate	n	rate
2001	67,597	0.6619	575	0.0056	10,900	0.1067
2002	70,345	0.6802	586	0.0057	11,142	0.1077
2003	53,447	0.5104	590	0.0056	11,266	0.1076
2004	58,037	0.5478	615	0.0058	11,441	0.1080
2005	60,658	0.5661	636	0.0059	11,607	0.1083
2006	64,514	0.5951	659	0.0061	11,761	0.1085
2007	69,194	0.6303	668	0.0061	11,866	0.1081
2008	72,849	0.6545	693	0.0062	12,447	0.1118
2009	78,264	0.6935	716	0.0063	12,918	0.1145
2010	80,207	0.7020	736	0.0064	13,272	0.1162
2011	87,058	0.7526	751	0.0065	13,425	0.1161

Notes: n = number, rate = rate per 1,000 population.

Source: Infrastructure and personnel data come from the Equipment, Human Resources and Infrastructure Information System (SINERHIAS) available on the website of the Ministry of Health; total population figures used to calculate the rates are available on the website of the National Population Council (CONAPO).

While affiliation to the SP is voluntary for all uninsured individuals, PROSPERA beneficiaries are particularly encouraged to affiliate.[11] PROSPERA is a conditional cash transfer programme that started in 1997 and currently benefits 6 million families (see more information in section 4.2.2 of Chapter 4). In 2004, 659,054 families affiliated to the SP were also PROSPERA beneficiaries, i.e., 13 per cent of the families covered by PROSPERA. But this number increased to 2.8 million families in 2008 and nearly 3.6 million in 2014, which is more than half the total number of PROSPERA beneficiaries in each year (Comisión Nacional de Protección Social en Salud, various years). PROSPERA families that are

[11] Eligibility criteria and affiliation procedures to the SP are the same for PROSPERA beneficiaries as for the rest of the population, but according to the CNPSS, strategies to encourage affiliation have been particularly directed to PROSPERA beneficiaries and other vulnerable groups (Comisión Nacional de Protección Social en Salud, various years).

incorporated to the SP move from the PROSPERA benefit package of 13 interventions (known as *Paquete Básico de Salud* or Basic Health Package) to the SP benefit package of nearly 300 interventions.[12] It is important to consider, however, that the facilities that attend the poorest beneficiaries of PROSPERA cannot be generally certified as able to provide the SP interventions due to the lack of adequate infrastructure (Instituto Nacional de Salud Pública 2005). While PROSPERA beneficiaries who affiliate to the SP may be transferred to other health units that have the capacity to offer more specialised procedures if they require attention in the second or third level, urgency services or complex procedures, this certainly limits the capacity of the SP programme to affiliate PROSPERA beneficiaries.

The implementation of the SP started as a pilot in 2002 and was gradually expanded due to financial reasons. The pilot rules indicated that the programme would start operating in 26 municipalities of five states;[13] these regions were selected based on the following characteristics: high social security coverage, adequate capacity to supply the services, large urban or semi urban concentrations, and the existence of beneficiaries of social programmes from the federal government (Secretaría de Salud 2002). According to administrative records, however, over 200 municipalities in 20 states had at least ten beneficiaries in 2002; Colima and Sinaloa

[12] From 2013, the health units that provide services for PROSPERA beneficiaries are progressively expanding the Basic Health Package to provide 27 interventions from the CAUSES. Since these new interventions are mainly preventive, can be generally provided in the same first-level health units.
[13] States are divided into municipalities, which are the smallest autonomous political entities; there are currently 2,457 municipalities. The five states considered in the pilot rules were: Colima (municipalities of Colima and Villa de Álvarez), Jalisco (municipalities of Acatic, Atotonilco, Ayotlán, Cabo Corrientes, Arandas, Encarnación de Díaz, Jalostotitlán, Jesus María, Puerto Vallarta, San Julián, San Miguel el Alto, San Sebastián del Oeste, Tepatitlán de Morelos, Tomatlán, Valle de Guadalupe and Cañadas de Obregón), Aguascalientes (municipality of Aguascalientes), Tabasco (municipalities of Comalcalco and Cunduacán) and Campeche (municipalities of Calkiní, Hecelchakán, Tenabo, Campeche and Holpechén). The pilot rules also indicated that the affiliation of individuals in the first (poorest) six deciles of the income distribution, with no access to social security, had to be prioritised.

in the west coast of Mexico had the highest coverage in that year (Table 2.6). By 2003, the programme had reached 417 municipalities in 25 states and the number of beneficiaries had doubled (from 1.1 to 2.2 million).

Table 2.6. Coverage of the Seguro Popular programme by state in the pilot years, Mexico 2002-2003

State	Municipalities with at least ten beneficiaries		Number of beneficiaries		Municipalities covered		Population covered	
	2002	2003	2002	2003	2002	2003	2002	2003
Aguascalientes	1	1	33,426	79,674	9%	9%	3.4%	7.8%
Baja California	5	5	70,612	129,622	100%	100%	2.7%	4.8%
Baja California Sur	0	4	0	16,108	0%	80%	0%	3.4%
Campeche	4	4	10,201	27,865	80%	80%	3.2%	8.7%
Coahuila	20	20	32,902	0	53%	53%	1.4%	0.0%
Colima	10	10	127,838	265,501	100%	100%	23.1%	47.6%
Chiapas	1	12	19,003	143,337	1%	11%	0.5%	3.5%
Guanajuato	4	10	39,581	56,964	9%	22%	0.8%	1.2%
Guerrero	4	5	24,607	22,025	6%	7%	0.9%	0.8%
Hidalgo	8	26	16,763	58,990	10%	31%	0.7%	2.6%
Jalisco	25	53	32,658	104,195	20%	43%	0.5%	1.6%
Estado de México	6	12	29,365	28,211	5%	10%	0.2%	0.2%
Michoacán	0	9	0	11,976	0%	8%	0%	0.3%
Morelos	6	16	9,097	31,644	18%	48%	0.6%	2.0%
Oaxaca	7	17	28,639	34,908	1%	3%	0.8%	1.0%
Quintana Roo	4	4	34,456	31,333	50%	50%	3.5%	3.0%
San Luis Potosí	17	40	82,755	188,119	29%	69%	3.5%	8.0%
Sinaloa	18	18	217,036	337,624	100%	100%	8.5%	13.1%
Sonora	23	31	95,214	47,246	33%	44%	4.2%	2.0%
Tabasco	3	16	37,507	268,040	18%	94%	1.9%	13.7%
Tamaulipas	24	42	87,483	179,682	56%	98%	3.1%	6.2%
Tlaxcala	0	9	0	10,038	0%	15%	0%	1.0%
Veracruz	0	14	0	45,154	0%	7%	0%	0.7%
Yucatán	0	2	0	12,486	0%	2%	0%	0.7%
Zacatecas	25	37	35,090	60,007	51%	76%	2.7%	4.6%
TOTAL	215	417	1,064,233	2,190,749				

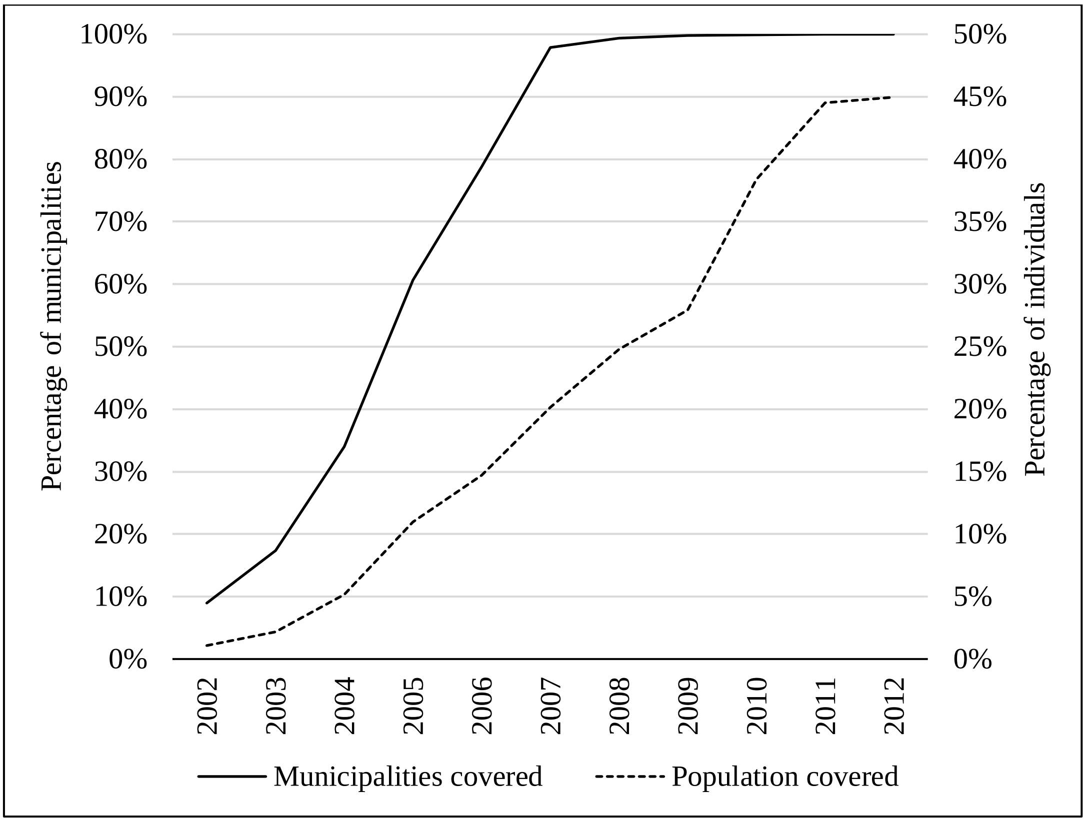
Notes: Figures estimated with panel municipalities (n=2399; see section 3.1 of Chapter 3).

Source: Own estimates based on administrative records of the Seguro Popular programme (CNPSS).

Once the modifications to the LGS that formally created the Seguro Popular became in force in 2004, the states that wanted to implement the programme had to sign a coordination agreement with the federal government, and negotiate the target of families to be enrolled every year.[14] While the LGS indicated that the affiliation of individuals in the first two income deciles, in more marginalised, rural and indigenous areas had to be prioritised, no specific guidelines for the expansion of the programme across municipalities was provided. Previous analysis of the determinants of the SP implementation have found that more populated municipalities implemented the programme earlier (Azuara and Marinescu 2013, Bosch and Campos 2014, Pfutze 2015; see section 5.2.1), but no other salient pre-programme characteristics seem to be correlated with the implementation. In practice, after the passage of the reforms to the LGS, a steady increase in municipality coverage continued. Figure 2.2 summarises the expansion of the SP; the strong line shows that most municipalities had at least ten beneficiaries in 2007. At the same time, affiliation to the programme progressively expanded so that nearly half of the population was already affiliated by 2011 (dotted line).

[14] The states proposed annual targets but the amount of federal resources available determined the final number. To guarantee an adequate flow of resources from the federation to the states, the annual number of new affiliates could not exceed 14.3 per cent of the potential beneficiaries. With this procedure, the SP was projected to reach universal coverage in 2010, although this was later adjusted to 2012. Overall, the negotiation process between the states and federal government since the SP inception has been far from easy; Lakin (2010) provides a detailed description of the policy process that led to the SP adoption and implementation.

Figure 2.2. Cumulative percentage of municipalities and individuals with Seguro Popular. Mexico, 2002-2012



Notes: Figures estimated with panel municipalities (n=2399); a municipality is defined to be covered in year t if at least ten individuals were affiliated to the SP in that year (see section 3.1 of Chapter 3).

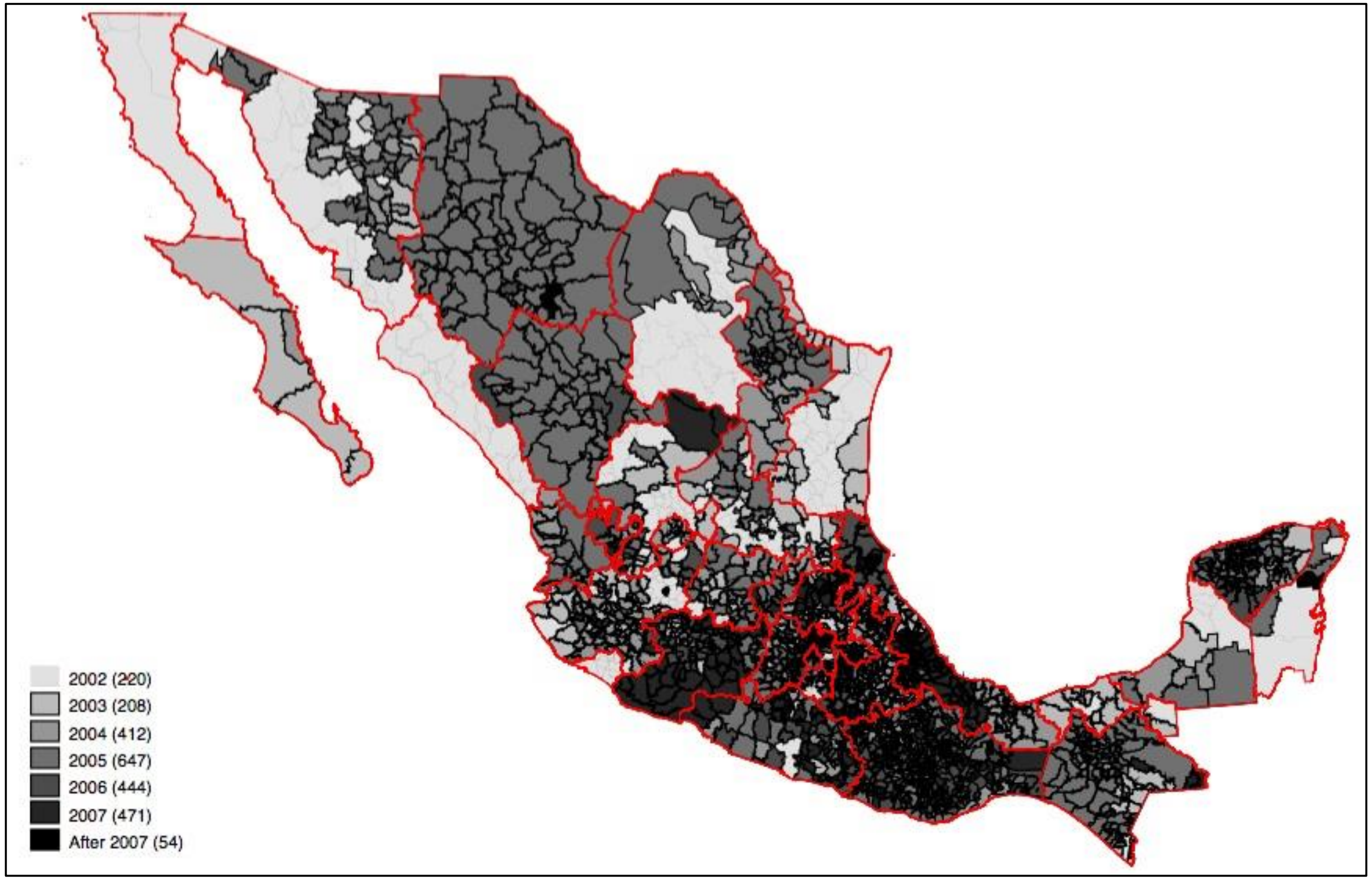
Source: Own estimates based on administrative records of the Seguro Popular programme (CNPSS).

To visualise more clearly the geographic variation in the SP implementation, Figure 2.3 shows the timing of introduction by municipality.[15] The shading is assigned by start-up date, with darker shading denoting a later start-up date. Although some detail is missed due to the large number of municipalities in some central and southern states, it can be seen that there is great variation between and within states. Figure 2.4 further explores within-state variation. While the expansion of the programme took place in a short period in some states such as Aguascalientes

[15] A similar map is included in section 3.2 of Chapter 3 to show the timing of introduction of the SP only for the municipalities included in the MxFLS sample (300 municipalities), which is the longitudinal survey employed in Chapters 5 and 6.

(in central Mexico), where municipalities were covered within 3 years, the expansion in other states such as Oaxaca (in the southwest coast), was more gradual. In general, the roll-out period of the programme within states went from one year (e.g. Baja California) to nine (e.g. Oaxaca); in over half of the states (15 out of 32), all municipalities had been covered after four years.

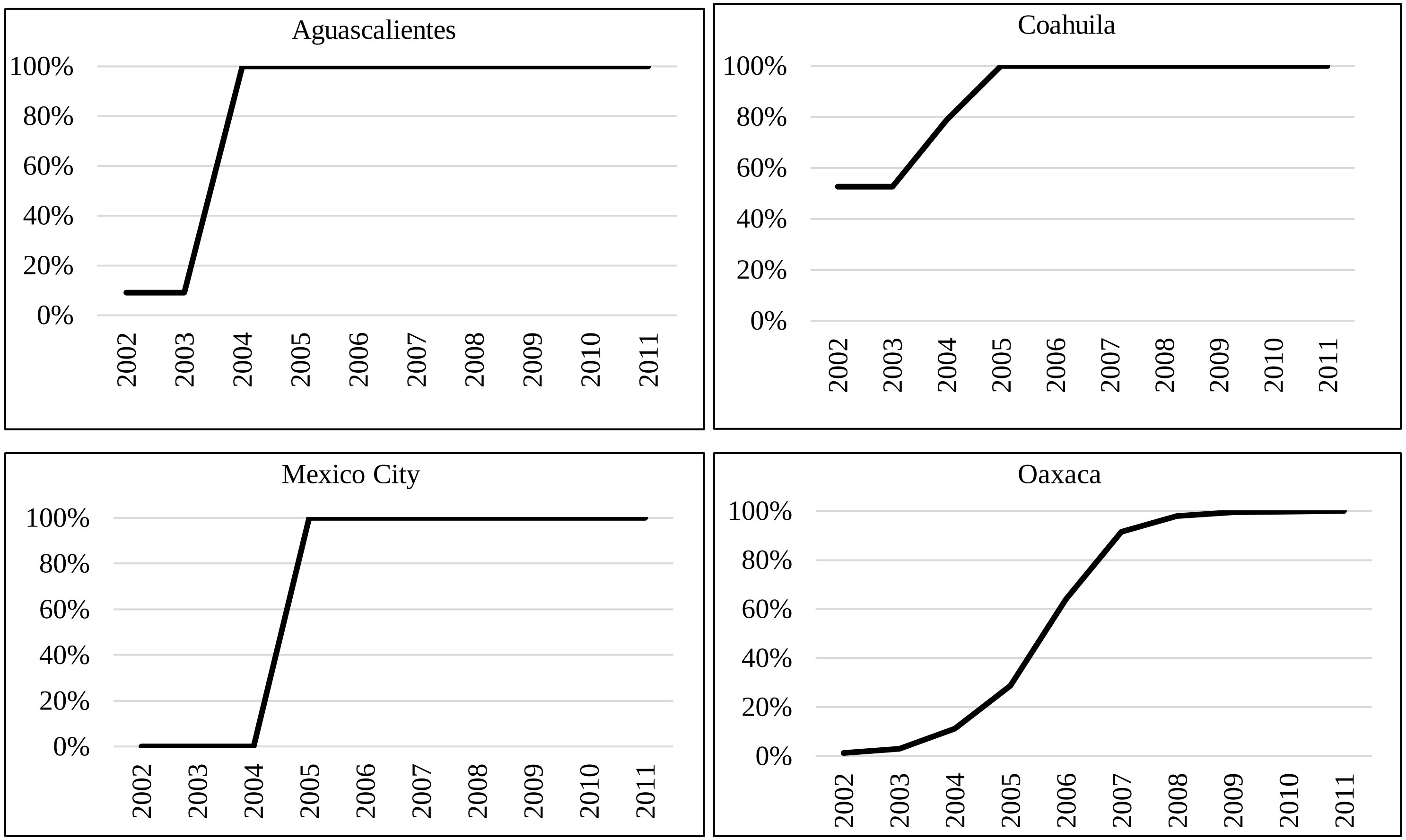
Figure 2.3. Start date of the Seguro Popular programme by municipality, Mexico 2002-2011



Notes: Red lines indicate state limits. A municipality is defined to be covered in year t if at least ten individuals were affiliated to the SP in that year (see section 3.1 of Chapter 3). The number of municipalities in each category is in parenthesis.

Source: Own estimates based on administrative records of the Seguro Popular programme (CNPSS).

Figure 2.4. Cumulative percentage of municipalities with Seguro Popular in selected states, Mexico 2002-2011



Notes: A municipality is defined to be covered in year t if at least ten individuals were affiliated to the SP in that year (see section 3.1 of Chapter 3).

Source: Own estimates based on administrative records of the Seguro Popular programme (CNPSS).

During the second half of the last decade, the SP was further extended in two ways. First, the benefit package for children born on 1/December/2006 and after was expanded through the *Seguro Médico Siglo XXI programme* (SMSXXI, XXI Century Medical Insurance, before *Seguro Médico para una Nueva Generación* or Health Insurance for a New Generation). Children who are affiliated to this programme are automatically affiliated to the SP so the same SP affiliation rules apply, i.e., affiliation is voluntary (the mother has to apply even if she is already affiliated to the SP) and the children (or their parents) should not be beneficiaries of social security. The SMSXXI covers 131 (originally 110) additional interventions during the first five years of life. By the end of 2007, 786,171 children from all over the country had been affiliated to both the SP and the SMSXXI (Comisión Nacional de Protección Social en Salud 2008); by 2015, the joint coverage reached 5.6 million children (Comisión Nacional de Protección Social en Salud 2016). The second expansion of the SP was introduced in May 2008. Specifically, the *Embarazo Saludable* (Healthy Pregnancy) strategy was implemented to encourage the affiliation of pregnant women to the programme. This strategy consisted in waiving the beneficiary contributions for pregnant women in the first seven deciles of the income distribution. As mentioned earlier, however, most SP beneficiaries are in practice exempted from beneficiary contributions. Since the CAUSES already included 100% of the services offered to pregnant women in the first level of attention, 95% of the services offered in the second level of attention, and 100% of the services to attend complication before, during, and after the childbirth, no additional interventions were incorporated as part of this strategy (Comisión Nacional de Protección Social en Salud 2008).

3. Data

This thesis draws upon municipality and individual level data. Aggregated indicators at the municipality level and the corresponding sources are described in the first section of this chapter. The second section describes the survey that provided information at the individual level.

3.1 Municipality Level Data

Municipality level data was employed to analyse the effects of the Seguro Popular programme on infant mortality. The information was obtained from different sources, namely vital statistics, administrative records from the Seguro Popular and PROSPERA programmes, and censuses. Most of these data can be easily downloaded from the websites of the corresponding institutions. Details are provided below.

In 1990 there were 2403 municipalities, but new municipalities have been created over the years, so the number increased to 2428 in 1995, 2443 in 2000, 2454 in 2005, 2456 in 2010, and 2457 from 2011 (Appendix). To build a balanced panel of municipalities, the information of those that were split was merged. Municipalities that were segregated from more than one municipality were excluded (both the new municipality and the original municipalities). This resulted in a balanced panel of 2,399 municipalities.

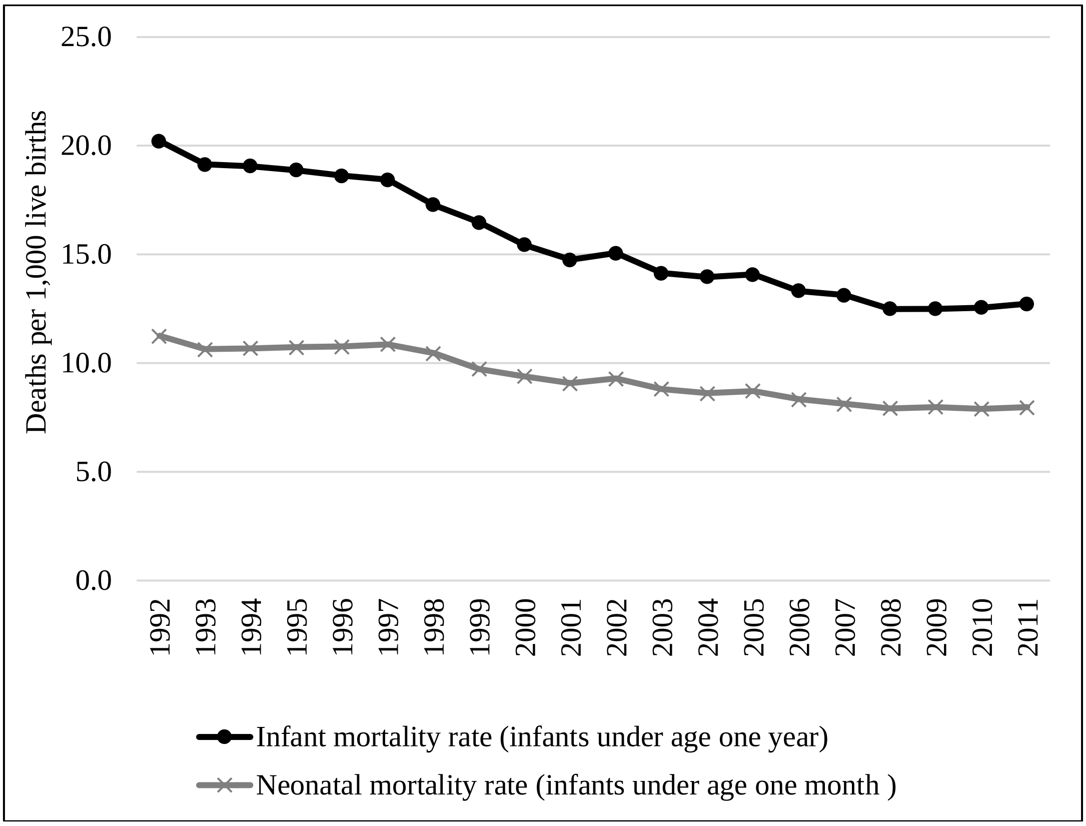
3.1.1 Infant Mortality

Mortality indicators were constructed using 1990 to 2014 vital statistics. Vital statistics contain information on all certified deaths and births throughout the country and are publicly available on the website of the National Institute of Statistics and Geography (*Instituto Nacional de Estadística y Geografía*, INEGI).[16] Information on the municipality of residence of the infant who died or the mother of the newborn was used to aggregate the data at the municipality level. The infant mortality rate (IMR) was defined as the number of deaths of infants under age one year for every 1,000 live births in a calendar year (Haupt et al. 2011). Natality data for 1990 and 1991 do not distinguish live from stillbirths, hence the IMR was calculated from 1992 onwards.[17] Figure 3.1 shows a declining trend in IMR, which is especially stark after 1997.

[16] Vital statistics are also publicly available on the National Health Information System (SINAIS) website, administered by the Ministry of Health. Since both institutions collaborate to build these registries, deaths and births data from the Ministry of Health and INEGI are identical, except for birth registries from 2008 onward. From 2008, the Ministry of Health only reports births occurred and registered on the same year, while INEGI continues reporting all the births registered each year, which includes extemporaneous registrations (births that occurred before the year of registry).

[17] Between 0.6 per cent and 1.4 per cent of the births registered and occurred between 1992 and 2014 were stillbirths.

Figure 3.1. Infant and neonatal mortality rate in Mexico, 1992-2011



Notes: Only municipalities of balanced panel considered (n=2,399).

Source: Own estimates based on vital statistics (INEGI).

Since the main causes of death for children under one month differ from those for older children, neonatal mortality rates (NMR), defined as the number of deaths of children under one month per every 1,000 live births, were also analysed (Figure 3.1). According to the registries, the share of neonatal deaths has increased from nearly half the total infant deaths in 1990 to two thirds in 2011 (Table 3.1). Also, although the share of infant deaths due to infectious diseases (respiratory and intestinal) has decreased over the past two decades, 35 per cent post-neonatal deaths were still attributed to this cause in 2000 in contrast to one per cent neonatal deaths.

Table 3.1. Infant and neonatal deaths by aggregated causes in Mexico, 1990-2011

	Infant deaths			Neonatal deaths			
		Due to infectious diseases	Due to non-infectious diseases		As a percentage of total infant deaths	Due to infectious diseases	Due to non-infectious diseases
1990	64,095	31%	50%	30,946	48%	10%	84%
1991	56,154	29%	55%	29,670	53%	10%	85%
1992	52,257	25%	58%	29,103	56%	8%	87%
1993	48,957	24%	59%	27,239	56%	7%	88%
1994	48,738	23%	59%	27,314	56%	7%	89%
1995	47,496	22%	61%	26,994	57%	6%	90%
1996	44,949	21%	62%	25,973	58%	6%	90%
1997	43,843	20%	64%	25,870	59%	5%	91%
1998	41,635	16%	68%	25,192	61%	3%	92%
1999	39,772	15%	67%	23,488	59%	1%	95%
2000	38,377	14%	70%	23,364	61%	1%	95%
2001	35,400	13%	71%	21,777	62%	1%	95%
2002	35,913	13%	71%	22,161	62%	1%	95%
2003	32,978	12%	72%	20,556	62%	1%	95%
2004	32,318	12%	72%	19,936	62%	1%	95%
2005	32,165	12%	72%	19,922	62%	1%	95%
2006	30,335	11%	73%	18,986	63%	1%	96%
2007	30,060	10%	72%	18,629	62%	1%	95%

(continues) Table 3.1. Infant and neonatal deaths by aggregated causes in Mexico, 1990-2011

2008	28,911	9%	73%	18,321	63%	1%	94%
2009	28,697	8%	74%	18,344	64%	1%	94%
2010	28,442	8%	74%	17,893	63%	1%	94%
2011	28,646	8%	75%	17,962	63%	1%	95%

Notes: Only municipalities of balanced panel considered (n=2,399). Infectious diseases include respiratory and intestinal infections, while non-infectious diseases include conditions originating in the perinatal period, congenital anomalies, and nutritional aspects. The percentages across causes of death do not add up to 100 since some causes of death are not specified.

Source: Own estimates based on vital statistics (INEGI).

Under-reporting of infant deaths is a common problem of vital statistics. While Mexico has been ranked in the top group of countries for high quality mortality data (Mathers et al. 2005, World Health Organization 2012), incomplete reporting of deaths is still an issue, especially in rural areas (Braine 2006, Lozano-Ascencio 2008). There is also evidence of under-reporting in births data (González and Cárdenas 2005), although this is mostly related to extemporaneous registration. A comparison with official mortality rates based on pregnancy histories drawn from the National Survey of Demographic Dynamics (*Encuesta Nacional de la Dinámica Demográfica*, ENADID) and Census data, shows that the estimates derived from vital statistics are lower.[18] For example, the infant mortality rate in 2000, just before the start of the Seguro Popular programme, is 20.9 deaths per 1,000 live births according to official figures and 15.4 according to vital statistics (Table 3.2).

Nevertheless, adjustments for under-reporting can bias the results too. In particular, these adjustments may smooth changes related to public interventions such as the Seguro Popular programme (Barham 2011). I use, hence, unadjusted data from vital statistics as the main data source, though I further discuss the potential effects of underreporting in section 4.5.2.[19] Additionally, I have restricted the end of the study period to 2011, but I take advantage of the available data on birth registries for 2012-2014 to account for extemporaneous registration of births occurred during the period under analysis. According to Eternod (2012), 85 per cent of the births in

[18] Official figures are publicly available on the website of the National Population Council (CONAPO). This information is also included in the Annual Government Reports of the president (Presidencia de la República 2013, 2015) and was used to monitor the progress made towards the Millennium Development Goals or MDGs (Instituto Nacional de Estadística y Geografía 2013). Consejo Nacional de Población (2012) describes the methods used to calculate these mortality estimates.

[19] Unfortunately, CONAPO only provides adjusted births data at the municipality level (adjusted mortality figures and/or adjusted mortality rates per municipality are not publicly available). Therefore, one of the robustness checks in section 4.5.2 consists of replacing births data from vital statistics with births data from official estimates to calculate municipality IMR and NMR.

Mexico are registered within the first year after occurrence, 92 per cent within the second, and over 95 per cent by the 32th month after the birth occurred; therefore, estimates that take into account registries for up to three years after the year of interest are fairly accurate.

Table 3.2. Comparison of infant mortality rates from different sources. Mexico, 1992-2011

	Official estimates based on fertility surveys and censuses	Own estimates based on vital statistics
1992	29.8	20.2
1993	28.5	19.1
1994	27.3	19.1
1995	26.1	18.9
1996	24.9	18.6
1997	23.8	18.4
1998	22.8	17.3
1999	21.8	16.5
2000	20.9	15.4
2001	20.0	14.7
2002	**19.2**	**15.1**
2003	**18.4**	**14.1**
2004	**17.6**	**14.0**
2005	**16.9**	**14.1**
2006	**16.3**	**13.3**
2007	**15.7**	**13.1**
2008	**15.1**	**12.5**
2009	**14.6**	**12.5**
2010	**14.1**	**12.6**
2011	**13.6**	**12.7**

Notes: Estimates based on vital statistics are for the balanced panel of municipalities (n=2,399; see section 3.1 of Chapter 3).

Source: Own estimates based on vital statistics (INEGI) and official figures from the National Population Council (CONAPO).

3.1.2 Seguro Popular Coverage

Seguro Popular administrative records were used to create treatment indicators. This information is not publicly available but was requested to the CNPSS through the Federal Institute of Access to Public Information (*Instituto Federal de Acceso a la Informacion*, IFAI). The records indicate the number of individuals affiliated to the programme in each quarter from 2002 to 2014. Following Bosch and Campos (2014), I consider that the SP was operating in a given municipality if the yearly number of affiliates was greater than ten. This rule is used since some municipalities present a very low number of affiliates for some years, which makes difficult to determine whether the programme was actually active.[20] According to this definition, all the municipalities had joined the SP by 2011. Alternative definitions were tested as robustness checks though (see section 4.5.2 of Chapter 4). In particular, a stricter definition that considers the SP was operating in a given municipality if the number of affiliates was greater than ten in at least two consecutive years, as well as a more relaxed definition that considers at least one affiliate, were used.

3.1.3 PROSPERA Coverage

The PROSPERA programme has been a key intervention to improve children's health (see section 4.2.2 in Chapter 4). Therefore, a binary variable that indicates whether this programme was operating in a certain municipality-year is included in the models in Chapter 4. This information was created using PROSPERA

[20] 126 municipalities are in this situation. For example, according to the programme records the municipality of San Francisco de los Romo in the state of Aguascalientes had two affiliates in 2002, none (zero) in 2003 and 8,363 in 2004. Similarly, the municipality of Frontera in the state of Coahuila had six affiliates in 2002, none in 2003 and 1,293 in 2004.

administrative records publicly available on the programme's website. Information is reported per locality, so it had to be aggregated at the municipality level. Since PROSPERA public records start in 1998, one year after the programme was launched, the Household Socioeconomic Characteristics Survey (*Encuesta de Características Socioeconómicas de los Hogares*, ENCASEH), also publicly available on the programme's website, was used to identify the municipalities where the programme started operating in the second half of 1997.

3.1.4 Municipality Characteristics

Additional data on municipality characteristics were taken from the INEGI 1990, 2000 and 2010 Censuses, and the 1995 and 2005 Conteos.[21] All the information at the municipality level is publicly available on INEGI's website. The indicators considered were total population and the proportion of population in localities with less than 2,500 inhabitants (rural areas). The marginalisation index estimated by the National Population Council (*Consejo Nacional de Población*, CONAPO), that summarises other information from INEGI Censuses and Conteos, was also used. This index is publicly available on CONAPO's website and is calculated using principal component analysis to reduce the dimensionality of nine socioeconomic indicators (Consejo Nacional de Población 1994, 2001, 2006, 2011).[22] Linear interpolation was used to obtain values for the years for which data is not available.

[21] The Conteos are shorter versions of the Census that are collected in between Census periods.
[22] The indicators used to calculate the index are: percentage of people aged 15 years or older who are illiterate, percentage of people aged 15 years or older with no primary school completed, percentage of people living in houses without piped water, percentage of people living in houses without drainage connected to the public system and without toilets, percentage of people living in houses with dirt floor, percentage of people living in houses with no electricity, percentage of houses with some level of overcrowding, percentage of population in localities with less than 5,000 inhabitants, and percentage of employed people with an income up to two minimum wages.

3.1.5 Health Supply

Health supply data are also from administrative records publicly available on the website of the National Health Information System (*Sistema Nacional de Información en Salud,* SINAIS), specifically, on the Information Subsystem of Equipment, Human Resources and Infrastructure (*Subsistema de Información de Equipamiento, Recursos Humanos e Infraestructura,* SINERHIAS). These data cover the facilities run by the central and state governments, which provide health care to Seguro Popular beneficiaries. In particular, the number of doctors per 1,000 population is used as an indicator of health supply. This information is only available from 2001.

3.2 Individual Level Data

Individual level data was employed to analyse whether the Seguro Popular programme was providing financial protection in the event of unexpected changes in health (Chapter 5). It was also used to analyse health inequality and mobility during the expansion of the programme (Chapter 6). These data come from the Mexican Family Life Survey (MxFLS), a longitudinal survey that covers most of the past decade. Three waves are available.[23] The first wave, conducted in 2002, included more than 35,000 individuals from approximately 8,440 households, of which nearly 90 per cent were followed-up in 2005-2006 and 2009-2010. [24]

[23] All the data bases, questionnaires, and supplementary information of the MxFLS are available in Spanish and English at http://www.ennvih-mxfls.org. Rubalcava and Teruel (2006, 2008, 2013), also available at the website of the MxFLS, describe the planning and design of the survey, as well as the content and structure of the data sets.

[24] 7,572 (89.7 per cent) and 7,912 (93.8 per cent) of the original sampled households were re-interviewed in the second and third rounds of the MxFLS, respectively. Additionally, the second and third rounds included 865 and 1,492 new participants each. 718 (83 per cent) of the new households added in the second round were re-interviewed in the third round. A few households were interviewed for the second and third round in 2007 and 2011-13, respectively.

The MxFLS employed probabilistic, stratified, and multi-staged sampling design, and is representative at the national level, for rural and urban areas (less than 2,500 inhabitants and 2,500 inhabitants or more, respectively), and for five regions: south-south east, centre-occident, centre, northeast, and northwest.[25]

The information collected in the MxFLS covers a wide variety of topics. Indicators of expenditure, land use, economic shocks, and violence and victimisation, among others, are provided at the household level. Other information such as education, labour supply, marital and fertility history, migration history, time allocation, health status, health care utilisation, and cognitive ability is collected at the individual level. Finally, qualitative and quantitative information at the community level is also available, including commercial infrastructure; education, health, and transportation services; and prices of goods and services.

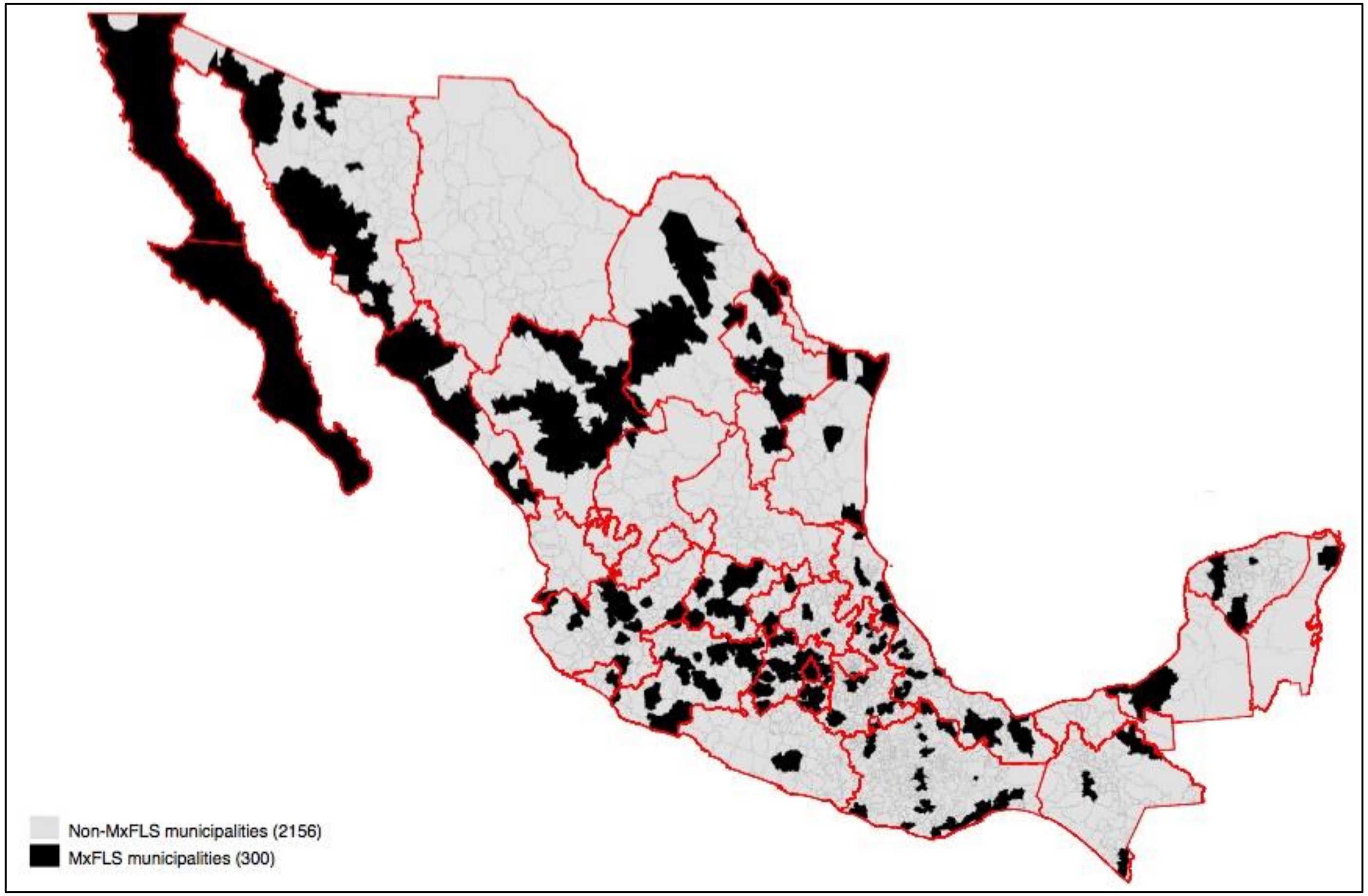
The MxFLS interviews were implemented as follows. One or two adults reported all the information related to the socioeconomic status and demographic composition of the household. In parallel, each household member 12 years and older was interviewed to collect the information at the individual level. The information for children under 12 years was provided by an adult member of the household (their primary caregiver if possible). If any adult 15 years and older was not present at the moment of the interviews, proxy information was collected from

[25] These regions correspond to those considered in the National Development Plan (*Plan Nacional de Desarrollo*) for 2000-2006 and are defined as follows: 1) the south-south east region covers the states of Campeche, Yucatán, Chiapas, Oaxaca, Quintana Roo, Tabasco, Guerrero, and Veracruz; 2) the centre-occident region covers the states of Jalisco, Michoacán, Colima, Aguascalientes, Nayarit, Zacatecas, San Luis Potosí, Guanajuato; 3) the centre region covers the states of Mexico City, Querétaro, Hidalgo, Tlaxcala, Puebla, Morelos, and Mexico; 4) the northeast region covers the states of Tamaulipas, Nuevo León, Coahuila, Chihuahua, and Durango; and 5) the northwest region covers the states of Baja California, Baja California Sur, Sonora, and Sinaloa.

other household members. This information is reported in a separate book so it can be easily identified.

Since Chapter 5 uses the SP coverage across MxFLS municipalities in some specifications (see section 5.4.1 of Chapter 5), Figure 3.2 shows in black the municipalities included in the MxFLS sample, while Figure 3.3 shows the timing of introduction of the SP in those municipalities. Similar to Figure 2.3 (see Chapter 2), a darker shading denotes a later start-up date.

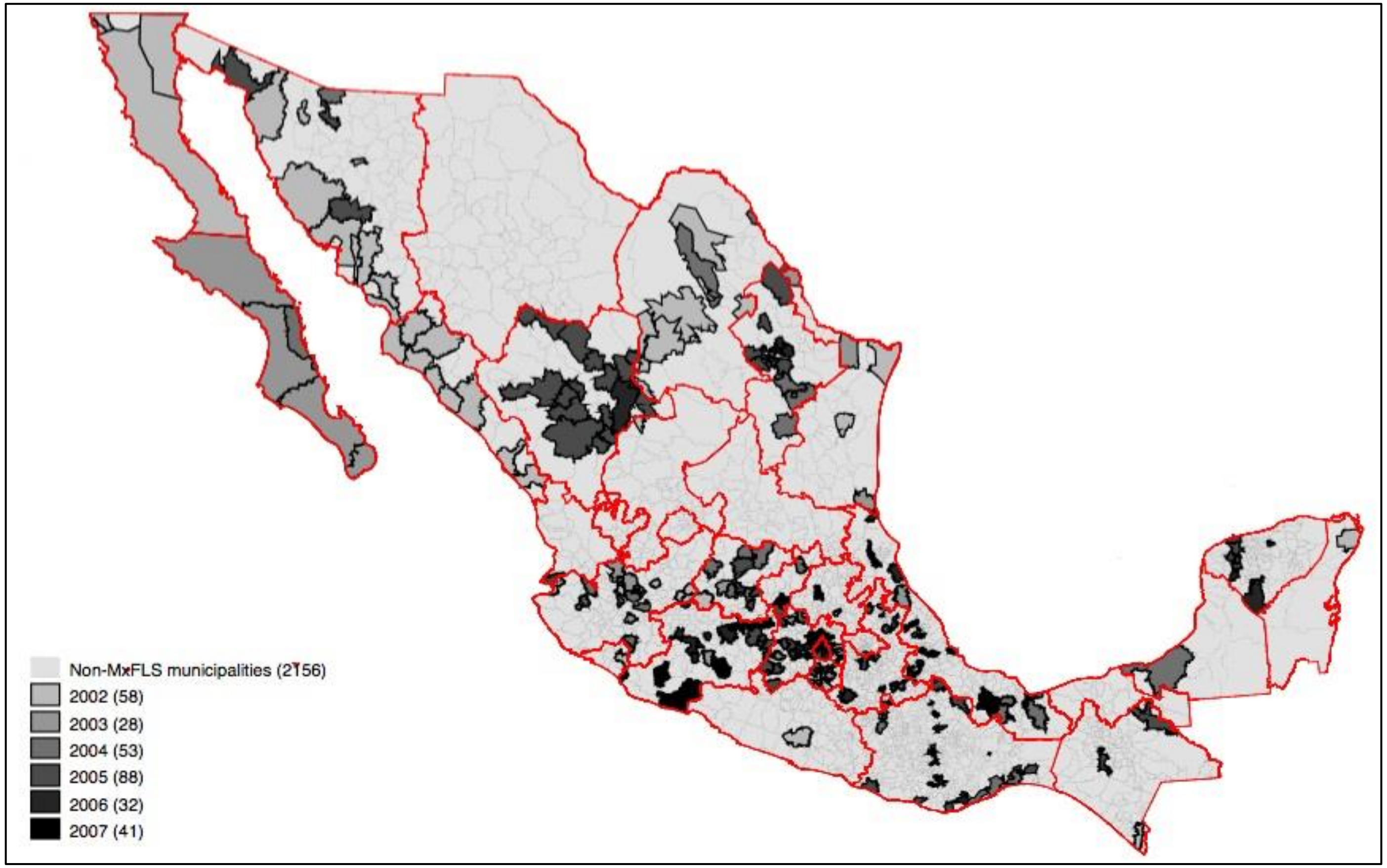
Figure 3.2. Municipalities in the MxFLS sample



Notes: Red lines indicate state limits. The number of municipalities in each category is in parenthesis.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Figure 3.3. Start date of the Seguro Popular programme by MxFLS municipalities



Notes: Red lines indicate state limits. The number of municipalities in each category is in parenthesis. A municipality is defined to be covered in year t if at least ten individuals were affiliated to the SP in that year (see section 3.1 of this Chapter).

Source: Own estimates based on the Mexican Family Life Survey (MxFLS) and administrative records of the Seguro Popular programme (CNPSS).

4. The Effect of Health Insurance on Infant Mortality

4.1 Introduction

By the beginning of the century, many health systems still showed signs of failure in providing timely access to health care and financial protection for all. As a consequence, millions of individuals perished of preventable diseases and were at risk of poverty. According to the World Health Report of 2000 (World Health Organization 2000), nearly 3 million children died every year from diseases that could be preventable with available vaccines, and millions of families in large, middle-income countries such as Brazil, Mexico, Bulgaria, Kyrgyztan, and Peru had to spend 50 per cent or more of their non-food expenditure on health. To address this situation, about 30 middle-income countries modified their health systems to reach universal health coverage (Giedion et al. 2013). While the reforms have varied in their design and implementation process, a common objective is to improve the health conditions of the population.

The expansion of health insurance is hypothesized to exert an effect on health status mainly through increased utilisation of health care and increased non-medical consumption. The expansion of insurance coverage reduces the price of health care, which is expected to increase the utilisation of health services (Gruber 2003, Meer and Rosen 2004). Also, access to health insurance frees resources that households may invest in consumption of non-medical items, some of which could be beneficial to health (Wagstaff and Pradhan 2005). Recent literature reviews, however, conclude there is little robust evidence on whether health insurance improves health (Giedion and Díaz 2010, Levy and Meltzer 2008). Although a large number of studies show positive correlations between insurance and health outcomes, they generally fail to overcome the problem of omitted joint determinants of both variables. Only a handful of studies have been able to use randomisation to address this problem, and have found limited or no effects (Brook et al. 1983, Newhouse 1993, Baicker et al. 2013). So far, the only health measure for which more evident results have been observed is self-reported health status (Finkelstein et al. 2012).

Other studies that have used quasi-experimental designs, such as those that analyse the expansion of the Medicaid in the US, a programme that provides public health insurance for the poor, show mixed results. While Currie and Gruber (1996) found that the extended eligibility of Medicaid reduced infant mortality in 5.1 per cent, Dubay et al. (2001) found only a small impact on birth weight. More recent analyses of subsequent insurance expansions in the US also have conflicting findings (see a summary in Sommers et al. 2017).

Existing studies for middle-income countries are scarcer but also provide mixed evidence. Dow and Schmeer (2003), for example, found that health insurance had no effect on infant and child mortality in Costa Rica, but Camacho and Conover (2013) found that the expansion of a subsidised health insurance in Colombia reduced the incidence of low birth weight in 1.7 to 3.8 percentage points. The present chapter adds to this literature by specifically addressing the effect of a large expansion of public health insurance on infant mortality in a middle-income country.

As Chapter 2 explains, Mexico is one of the countries that started an ambitious expansion of health insurance in the first half of the 2000s. The Seguro Popular programme, a voluntary health insurance, was created to provide access to a generous benefit package to over half of the population. In 2007 most municipalities were covered by the SP and affiliation continued increasing so that nearly half of the population is currently affiliated to the SP. In this chapter, I exploit the phasing-in over time of the SP to analyse the effect of health insurance on an important indicator of children's health, infant mortality. Infant mortality is defined as the number of deaths of infants under one year per 1,000 live births and is constructed using vital statistics.

Whether the SP insurance expansion had an effect on infant mortality is an important and feasible question to address for at least two reasons. First, Mexican mortality data is regarded as high-quality data according to international classifications (Mathers et al. 2005, World Health Organization 2012). Second, it is well known that infant mortality is particularly sensitive to health care improvements. In fact, Nolte et al. (2006) classify infant mortality as one of the causes of death amenable to health care, which are defined as those that could have been averted if effective care had been provided. In particular, it is plausible to expect positive effects of the SP on infant mortality, as its benefit package includes several interventions to address the main causes such as prenatal care, attention during delivery, new-born care, vaccination, and treatment for the most common transmittable diseases, among many others (Comisión Nacional de Protección Social en Salud 2012).

Notwithstanding the large amount of resources allocated to the SP and its rapid expansion, few studies have examined the effects of the programme on health outcomes. Using randomised encouragement to uptake the programme, King G. et al. (2009) found no effects on self-assessed health, blood pressure, and glucose levels, although the assessment period was less than a year (Victora and Peters 2009). Bleich et al. (2007) and Sosa-Rubí et al. (2009), however, found that the SP enrolment improved blood control among hypertensive adults in the first case, and blood glucose levels among adults with diabetes in the second case. Similarly, Teruel et al. (2012) found evidence of positive effects on self-assessed health.

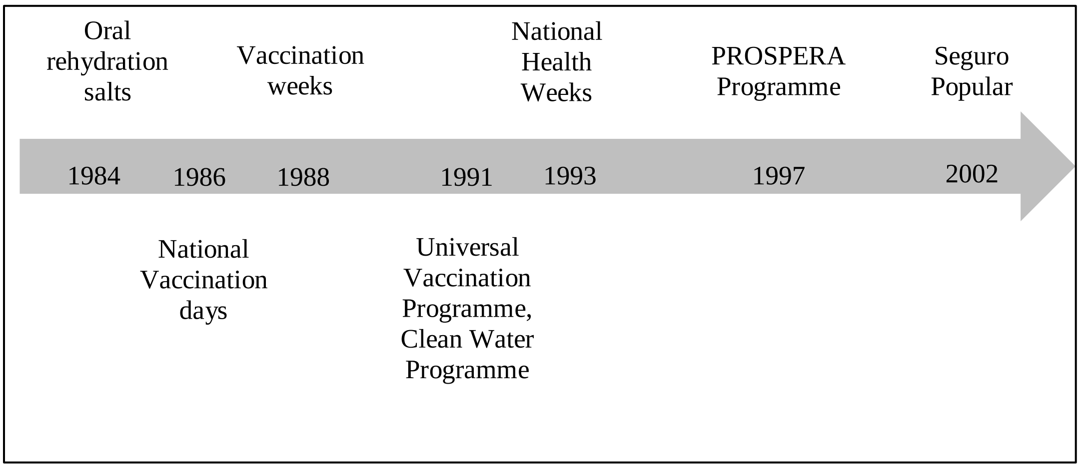
More recently, Pfutze (2015) also analysed the effect of the SP on infant mortality using the micro sample from the 2010 Census. Since this sample only reports information on the last live birth per woman, infant mortality estimates were reconstructed and used in a weighted binary model, where yearly UNICEF (United Nations Children's Fund) estimates of infant mortality are treated as population proportions. However, the data used in this chapter has several advantages. First, vital statistics provide a direct measure of infant mortality that minimises recall and other measurement errors that are more common in survey and self-reported data. Second, vital statistics provide information for all municipalities in Mexico. And third, vital statistics are available for the pre-programme period, which allows a better assessment of the strategy employed to identify causal effects.

The chapter is organised as follows. First, I describe some important interventions that were implemented before the SP to improve children's health. Then, I review the literature on the expected effects of health insurance on health outcomes, as well as the empirical evidence available. Afterwards, I describe the identification strategy and the empirical model employed. The last two sections present the results and the discussion of these results.

4.2 Public Interventions to Improve Child Survival before the SP

Chapter 2, describing the health system in Mexico, explains that health care access in Mexico was segmented by labour status before the Seguro Popular. The federal government, however, provided some health services for the general population (see Table 2.2 in Chapter 2). These services included vaccination campaigns among others, that were largely intended to address the main causes of morbidity and mortality in children. Prior to the SP, a conditional cash transfer programme called PROSPERA is another intervention that merits special attention. This programme, introduced in 1997, covers the poorest population and has a health component that targets children and pregnant women. Both types of public intervention are important to understand the evolution of infant mortality before the implementation of the SP and are thus briefly described below (Figure 4.1).

Figure 4.1. Main public health interventions to improve child survival in Mexico in recent decades



Source: Own design based on Sepúlveda et al. (2006a).

4.2.1 Oral Rehydration Salts and Vaccination Programmes during the Eighties and Nineties

One of the most important interventions implemented in the first half of the1980s, when diarrhoea was the main cause of death among children, was the provision of rehydration salts through the Oral Rehydration Programme introduced in public hospitals (Sepúlveda et al. 2006a).[26] Vaccination campaigns were also essential. Until the second half of the 1980s, vaccines were only given to children at public health facilities if requested by the mother. Between 1986 and 1991, however, different vaccination campaigns were implemented: vaccination days in 1986, vaccination weeks in 1988, and the Universal Vaccination Programme (UVP) in 1991. By 1993, immunisation activities had been incorporated to the National Health Weeks, designed to reach all preschool children. The National Health Weeks take place twice a year and provided a complete package of vaccines to children at their homes, school and clinics, as well as other health services that include active promotion of oral rehydration salts, distribution of mega-doses of oral vitamin A, and mass anthelmintic therapy. Parallel to the expansion of immunisation coverage, vaccination registries were also improved. During the first half of the 1990s, computerised, personal records of vaccines received were created for every child. In this period, vaccination coverage exceeded 92 per cent. As a result of these efforts, the last notifications of polio, diphtheria and autochthonous measles, were in 1990, 1991 and 1996, respectively.

In addition to vaccination campaigns, the Clean Water Programme has been implemented since the beginning of the 1990s as a response to the outbreak of

[26] This section is mainly based on Sepúlveda et al. (2006a). Additional references used are cited where it corresponds.

cholera in the country. The objective of this programme is to improve the quality of water for human consumption trough chlorination of supplies outside the households, and through boiling and chlorination inside the house. Other activities to strengthen basic sanitation such as adequate disposal of waste and the creation of sewage-treatment plants are also included. In 2001, the operation rules of the programme were published for the first time. These rules formally regulated the decentralisation to the states, as well as the implementation of its components. According to Sepulveda et al. (2006b), the implementation of the Clean Water Programme was associated with a decrease in the incidence of cholera from over 16,000 cases in 1995 to no cases in 2002; this was also associated to a decrease in child mortality from diarrhoeal diseases.

4.2.2 The PROSPERA Programme

The PROSPERA programme (originally named Progresa and later on Oportunidades) was one of the first conditional cash transfer programmes aimed at breaking the intergenerational transmission of poverty, and the first social programme in Mexico with a rigorous, external evaluation.[27] From 1997 to 2001, PROSPERA focused on rural areas (localities with less than 2,500 habitants), but the results obtained in this period motivated its expansion to urban areas. PROSPERA currently benefits 6 million families and covers all the municipalities in the country (Table 4.1).

[27] PROSPERA was originally targeted to the most marginalised rural localities that had access to primary and secondary schools, and to permanent health clinics to ensure that the beneficiaries could meet the conditionalities (see more about the targeting of PROSPERA in Skoufias et al. 1999). Due to budgetary and physical constraints (e.g. lack of infrastructure), however, the programme was gradually expanded to all the localities that fulfilled the targeting characteristics. This process allowed using randomisation at the initial stage, which resulted in rigorous evaluations of the programme.

Table 4.1. PROSPERA programme coverage

	Municipalities	Families
1997	151	292,542
1998	1,465	1,595,604
1999	1,986	2,306,325
2000	2,166	2,476,430
2001	2,310	3,116,042
2002	2,354	4,240,000
2003	2,360	4,240,000
2004	2,429	5,000,000
2005	2,435	5,000,000
2006	2,441	5,000,000
2007	2,444	5,000,000
2008	2,445	5,049,206
2009	2,445	5,209,359
2010	2,445	5,818,954
2011	2,448	5,827,318
2012	2,449	5,845,056
2013	2,451	5,922,246
2014	2,456	6,129,116

Source: Own estimates based on administrative records of the PROSPERA programme.

The maximum transfer PROSPERA beneficiaries can receive has evolved over the years, from 550 Mexican pesos per month in 1997 to 1,825 in 2015 for families with students in primary and secondary level or 2,945 for families with students in high school. This amount includes a transfer for food consumption, student scholarships, and (from 2007) a transfer for energy consumption. The 1997 maximum transfer was equivalent to 75 per cent the minimum wage in that year, while the 2015 maximum transfers were equivalent to 89 per cent and 144 per cent the minimum wage in that year (or 117 and 188 US dollars, respectively).

Beneficiaries can also receive separate transfers for the elderly and to buy school materials.

The conditions to provide PROSPERA cash transfers are regular school attendance and visits to health clinics. In particular, the health component targets children and pregnant and lactating women and was designed to address the main causes of disease. Children from birth to two years of age are required to have eleven check-ups per year, older children are required to have between one to three check-ups per year, pregnant women are required to have a minimum of five check-ups during prenatal period and two check-ups after birth, and adults are required to have one annual check-up. Mothers also have to attend health educational talks, and food supplements are provided to pregnant and lactating women, children 4 to 24 months, and underweight children 2 to 5 years old.

PROSPERA beneficiaries are entitled to a basic health package (*Paquete Básico de Servicios de Salud* or Basic Health Services Package) that includes 13 interventions, mainly preventive: basic sanitation; family planning; prenatal and puerperal care; supervision of nutrition and children's growth; vaccinations; prevention and treatment of diarrhoea and respiratory infections; prevention and control of tuberculosis, high blood pressure, and diabetes; anti-parasite treatment; accident prevention and first-aid for injuries; community training for health care self-help; and (from 2001) prevention and control of cervical cancer. From 2014, PROSPERA beneficiaries will progressively receive other 27 interventions included in the benefit package of the SP, such as ten additional immunogens for children and adolescents under 14 years and five for adolescents and adults 14 years or older, as well as other preventive services. PROSPERA beneficiaries who join the SP, however, are entitled to all the interventions in the SP benefit package (see section 2.2 in Chapter 2).

Several studies have shown PROSPERA improved the health condition of infants. A summary by Skoufias and McClafferty (2001) for the first years of operation of the programme, for example, shows PROSPERA children under 5 years had a 12 per cent lower incidence of illness than those without the programme. Rivera et al. (2004) also found the programme was associated with better gain in height (1.1 cm) and lower anaemia (10 percentage points) after two and one years of enrolment, respectively. The study of Barham (2011) is particularly relevant for this analysis, as she shows Progresa reduced the rural infant mortality rate in 17 per cent, although no effects were found on average neonatal mortality rate.

4.3 Literature Review

4.3.1 Expected Effects of Health Insurance on Health

Increased health care utilisation is the main channel through which insurance coverage is expected to improve health outcomes. The provision of public health insurance is theoretically expected to exert both an income and a price effect (Currie and Thomas 1995, Cutler and Zeckhauser 2000). Indeed, the expansion of insurance coverage reduces the share of income that is spent when someone gets sick; this is the income effect. Insurance coverage also reduces the price of health care services, which is expected to increase the demand of health care; this is the price (or substitution) effect. The additional use of medical care was traditionally attributed to moral hazard, but Nyman (1999; 2001) has argued that this increase may be partly due to the fact that insurance provides access to treatments that would be otherwise unaffordable; this effect has been called the income transfer effect. In the case of SP this effect could actually be considerable, as it covers some very costly interventions, such as child cancer treatment (see Chapter 2).

Nonetheless, health insurance does not necessarily increase health care utilisation. According to Gruber (2003), this depends on whether those previously uninsured take up the benefits to which they are entitled; adequate supply of health care services (both in terms of quantity and quality) and transportation costs, among other factors, may also influence the extent to which health insurance coverage increases health care utilisation. There is a large body of evidence, however, that indicates that health insurance coverage is generally associated with increases in health care utilisation. In particular, the randomised trials on health insurance (the RAND experiment, and more recently the Oregon experiment) are key pieces in this literature due to the robustness of their design (Brook et al. 1983, Newhouse 1993, Finkelstein et al. 2012).

Increased utilisation of health services, on the other hand, may not translate into improved health outcomes (e.g., Lagarde and Palmer 2011, De Allegri et al. 2012, Dzakpasu et al. 2014), either because the quality and quantity of health care is insufficient, or because behavioural and environmental factors are relatively more relevant.[28] An important branch of the literature on the determinants of health, however, has shown that health care can improve at least some conditions (so called "health-care-amenable conditions"). In fact, Nolte et al. (2006) have proposed a

[28] Gruber (2003) explains that for many economists other behavioural and environmental factors that affect the health status of low-income persons are relatively more important than health care. For the case of infant mortality, studies that have analysed determinants of child mortality have also highlighted the importance of socioeconomic factors that work through an intermediate level of environmental and behavioural risk factors that lead to the proximal causes of death. Additional care could in some cases be harmful for the patient too when health insurance plans create incentives for physicians to increase their income (Cutler and Zeckhauser 2000), but that is not a concern for the case of non-contributory health insurance programmes such as the SP.

metric to evaluate health systems based on amenable deaths, i.e., deaths that would have not occurred if effective health care had been provided. In particular, most infant deaths are avoidable in the sense that they can be averted through preventive interventions such as measles vaccines and clean deliveries, or through treatment interventions such as antibiotics for pneumonia, sepsis or dysentery (Jones et al. 2003, Bryce et al. 2013).

Still, the available evidence on the effects of health insurance on health is not conclusive. Recent reviews have found that many studies fail to provide robust evidence since the correlation between insurance and good health may be driven by unobservable factors (selection problem); the studies with more robust designs only provide limited evidence (Levy and Meltzer 2008, Giedion and Díaz 2010). The RAND experiment in specific found no effects on health status and health habits; (Brook et al. 1983, Newhouse 1993). Likewise, the results of a more recent randomised trial, the Oregon experiment, found no effects of the expansion of Medicaid, a programme that provides public health insurance in the US, on measured health outcomes (Baicker et al. 2013). While the analysis after one year of implementation indicated that the treatment group had better self-reported health than the control group (Finkelstein et al. 2012), the assessment of measured physical health outcomes after two years of implementation (high cholesterol levels and glycated haemoglobin levels) found no differences between the treatment and control group.

Yet, quasi-experimental studies provide some evidence of positive effects of insurance coverage on mortality. For example, Currie and Gruber (1996) found that the expansion of Medicaid eligibility during 1984-1992 reduced infant mortality in 5.1 per cent, while Sommers et al. (2012) found that the expansion of the same programme in three US states in the 2000s led to a 6 per cent decrease in all-cause adult mortality. While the different findings of randomised trials and observational studies could be related to evident differences in the study design, Sommers et al. (2017) argue that other factors such as the definition of the outcome variables as well as the timing and sample sizes of the studies could better explain these discrepancies.

4.3.2 Empirical Evidence from Middle-income Countries

The available evidence on the effect of health insurance and health outcomes in middle income countries is scarce and often faces the selection problem mentioned before. Dow and Schmeer (2003) is one of the first studies that analysed this issue with the expansion of the Costa Rican health insurance during the 1970s as setting. Using fixed effects models at the county level, as well as instrumental variables estimation, they found that after controlling for maternal, household and community characteristics, insurance had no effect on infant and child mortality. A more recent study, however, found that the insured have better self-perceived health (Cercone et al. 2010). Instead of vital statistics, Cercone et al. (2010) used nationally representative surveys but also relied in instrumental variables estimates to try to identify the effect of insurance.

Two studies that analyse the expansion of the subsidised health insurance for the poor in Colombia also provide mixed evidence. While Camacho and Conover (2013) found that this insurance reduced the incidence of low birth weight in 1.7 to 3.8 percentage points, Giedion et al. (2010) found no effect on complications after delivery and extremely low birthweight. The former used regression discontinuity design and administrative records for a single urban municipality, whereas the second used the Demographic and Health Surveys and propensity score matching.

Importantly, Gruber et al. (2014) examined a supply-side intervention implemented in Thailand in 2001, the 30 Baht programme. Instead of increasing eligibility, this programme increased the funding available for hospitals to provide health care for the poor and reduced the co-payments to 30 Baht. The analysis of vital statistics indicated the programme reduced infant mortality in 13 to 30 per cent.

Despite the large amount of resources allocated to the Seguro Popular and its rapid expansion, relatively few studies have focused on the effects of the programme on health outcomes (see a comprehensive review in Bosch et al. (2012) and Knaul et al. (2012)). In 2006, just a few years after the creation of the programme, The Lancet published a series of six papers about the health system reform in Mexico (Horton 2006). These papers discussed different aspects of the design and implementation of the Seguro Popular, and analysed short-term results (Frenk et al. 2006, González-Pier et al. 2006, Lozano et al. 2006, Knaul et al. 2006, Gakidou et al. 2006, and Sepúlveda et al. 2006a). In particular, based on the analysis of several data sources (e.g. national surveys and administrative records), Gakidou et al. (2006) studied the effects of the programme on different dimensions. Among the key findings were that the SP coverage was predominantly increasing in poor and marginalised areas; the federal expenditure for public health facilities other than those administered by social security institutions increased 38 per cent between 2000 and 2005 in real, per capita terms; the effective coverage of eleven interventions improved; SP beneficiaries were using more inpatient and outpatient services that the uninsured; and catastrophic health expenditures for SP affiliates were lower than for the uninsured. These analyses, however, were mostly descriptive.

Six years later, other article published in The Lancet celebrated the fact that Mexico had reached universal coverage that year (Knaul et al. 2012). The detailed analysis of the available evidence on the effects of the SP included in this article made it clear that some aspects of the programme had been more extensively studied such as the labour market effects (e.g., Azuara and Marinescu 2013, Campos and Knox 2013, Bosch and Campos 2014), while other remained understudied. For the specific case of infant mortality, Knaul et al. (2012) found that it had declined more for those without social security, by then mostly covered by the SP, than for those with social security (11 per cent vs. 5 per cent), and concluded that "although causality cannot be inferred from the available data on mortality and coverage, a likely association with the expansion of Seguro Popular merits further research" (Knaul et al. 2012 p. 1269).

Among the evidence available on the effects of the SP on health outcomes, the short-term assessment conducted by King G. et al. (2009) is particularly relevant for the characteristics of its design. While affiliation to the programme could not be randomised (for ethical reasons but also because affiliation to the SP is voluntary), this study used randomised encouragement to enrol to analyse the programme effects. In addition to media campaigns in treatment areas, programme offices were established to reduce barriers to affiliation, and funding was provided to participant states to improve health facilities and provide medications in these areas. The results indicated the SP led to a 23 per cent reduction in catastrophic expenditures, but no effects on health care utilisation or health outcomes were found. According to the authors, the lack of effects on health outcomes may be related to the short duration of treatment (only ten months). Victora and Peters (2009) also argue that the implementation period could have precluded the identification of such effects, as health outcomes normally change more slowly.

Similarly, exploiting the phasing-in of the programme across states and different cross-sectional surveys, Barros (2008) found evidence of important reductions in out-of-pocket health expenditure associated to the SP, but no evidence of improvements in health outcomes (incidence of hypertension and self-reported health status). Other studies that used the first two waves of the MxFLS and propensity score marching to create a comparable control group of uninsured, also found that the SP reduced health expenditures (Consejo Nacional de Evaluación de la Política de Desarrollo Social 2013), but no effects on health outcomes such as morbidity, blood pressure, glucose levels and weight measures were observed (Parker and Rubalcava 2011). Using the three waves of the MxFLS and propensity score matching, however, Teruel et al. (2012) found that the SP improved self-reported health. Likewise, using the National Health and Nutrition Survey 2005-06 and a similar design, Bleich et al. (2007) and Sosa-Rubí et al. (2009) found that the SP enrolment improved access to treatment and blood/glucose control among hypertensive adults in the first case and adults with diabetes in the second case.

More recently, Pfutze (2015) found that the SP reduced infant mortality by nearly 5 out of 1,000 births. Unlike this Chapter, however, Pfutze used data on births reported in the micro sample from the 2010 Census. Since this sample only reports information on the last live birth per woman, the probability of observing a surviving child is higher than the probability of observing a non-surviving child, which bias the reconstruction of infant mortality. In fact, while other sources indicate a clear downward trend in infant mortality, the rate calculated with this sample exhibits an upward trend. The author corrects for this selection problem by using a weighted binary model (weighted exogenous sampling maximum likelihood to model the probability of death on the first month/year of life), with the weight equal to yearly

UNICEF estimates of IMR divided by the rates observed in the sample for each year. This adjustment, however, implicitly assumes that the selection problem is the same across subpopulation groups, which is not necessarily the case. Moreover, the data used here has at least two advantages: vital statistics provide a direct measure of infant mortality as well as information for all the municipalities in Mexico.

4.4 Data and Methods

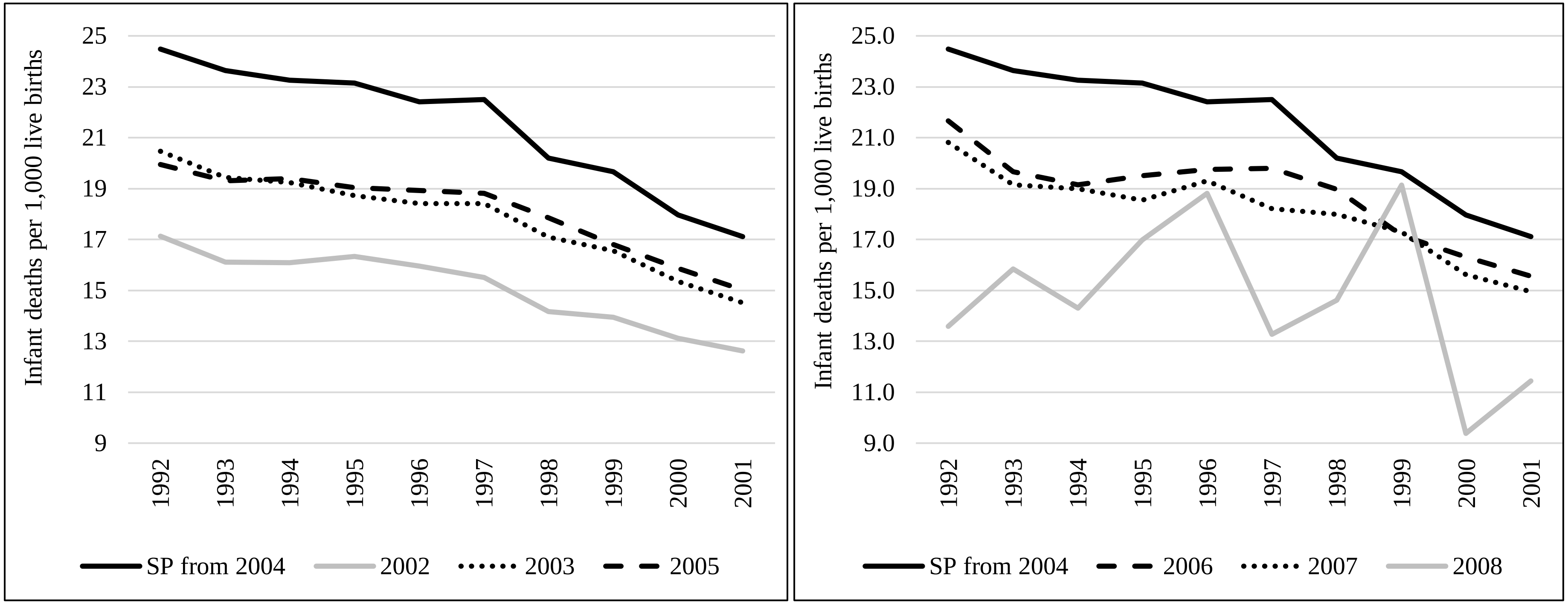
4.4.1 Data

Information for this Chapter was obtained from different sources. Since the research design is based on the staggered roll out of the SP across municipalities, all the data was collected at the municipality level. Please refer to Chapter 3, section 3.1 for a detailed description.

4.4.2 Identification Strategy

The research strategy to estimate the effects of the SP on infant mortality consists of comparing those municipalities that were incorporated to the programme at earlier stages (treatment group) with those incorporated later on (control group). The main assumption of this strategy is that the infant mortality trends in the comparison group reflect the trends that would have been observed in the absence of the programme. Although this cannot be formally proved, I study below whether pre-programme trends in infant mortality were the same across municipalities that started implementing the SP at different years. A visual inspection indicated that IMR trends between 1992 and 2001 were similar in municipalities that started offering the programme in 2002-2005, but presented more evident variations in municipalities that introduced the programme at later stages (Figure 4.2); therefore, the latter were excluded from the analysis.

Figure 4.2. Pre-programme trends in municipality infant mortality rate by initial year of operation



Notes: SP = Seguro Popular. Since less than ten municipalities started offering the programme in 2009-2011, trends are erratic and are therefore excluded. The averages are calculated for panel municipalities (n=2,399) and are weighted by municipality population.

Source: Own estimates based on information from vital statistics (INEGI) and SP administrative records (CNPSS).

Following Barham (2011), pre-programme mortality rates were further analysed with the following equation:

$$IMR_{mt} = \alpha + \lambda_m + \sum\nolimits_{j=1992}^{2001} \mu_j year_{jt} + \sum_{j=1992}^{2001} \sum\nolimits_{i=1}^{4} \theta_{ji}\, year_{jt} * spstart_{im}$$

$$+\varepsilon_{mt} \qquad (4.1)$$

where the left-hand side variable, IMR_{mt}, is the infant mortality rate in municipality m in year t; $year_j$ are binary variables for the pre-programme years, 1992-2001, with 1992 as the reference year; and $spstart_i$ indicates the start date of the programme normalised to 1 in 2002, with 3 as the reference category. The θ's give the difference in mean municipality IMR since 1992 between municipalities that started offering the programme in 2004 and municipalities with other SP start dates. Municipality fixed effects were also included (λ_m). The results of these estimates are reported in Table 4.2.

In general, the estimated θ's are not significantly different from zero, which indicates that the IMR pre-intervention trends for municipalities incorporated to the programme between 2002 and 2005 are statistically similar. Only few IMR differences that correspond to municipalities with SP start dates equal to 2002 and 2003 were different from zero but are arguably small in magnitude and similar to other nonsignificant differences.[29] Therefore, these four groups of municipalities

[29] As explained below, a Poisson distribution is a better choice for the functional form of the IMR (see section 4.5.2). If equation 4.1 is estimated using Poisson regression instead of OLS, none of the estimated θ's is statistically different from zero. I include the OLS results as they have a more intuitive interpretation though. Section 4.6.2 further analyses whether pre-programme trends in infant mortality could be a source of bias.

were included in the analysis, resulting in a total analytic sample of 28,989 municipality-year observations.[30]

Table 4.2. Average difference in infant mortality rates between municipalities that started offering the Seguro Popular programme in 2004 and municipalities with other start dates, by pre-programme year

	Infant Mortality Rate			Neonatal Mortality Rate		
	SP from 2002	SP from 2003	SP from 2005	SP from 2002	SP from 2003	SP from 2005
1993	-0.176	-0.131	0.206	-0.089	0.167	0.108
	(.598)	(.660)	(2.012)	(.462)	(.471)	(1.328)
1994	0.191	0.061	0.692	0.412	0.518	0.687
	(.787)	(.805)	(2.074)	(.620)	(.594)	(1.384)
1995	0.319	-0.270	0.426	0.338	-0.186	0.220
	(.800)	(.741)	(2.06)	(.673)	(.605)	(1.326)
1996	0.697	0.221	1.097	0.238	0.136	0.478
	(.971)	(.937)	(2.076)	(.761)	(.718)	(1.431)
1997	0.138	0.142	0.898	-0.290	-0.204	0.019
	(.871)	(.852)	(2.038)	(.793)	(.721)	(1.411)
1998	1.102	1.198	2.268	0.138	0.384	0.696
	(.939)	(.881)	(2.089)	(.764)	(.726)	(1.447)
1999	1.402	1.219	1.767	0.501	0.602	0.622
	(.980)	(.840)	(2.089)	(.874)	(.838)	(1.461)
2000	2.288**	1.872**	2.637	1.042	0.743	1.190
	(1.059)	(.923)	(1.977)	(.893)	(.794)	(1.389)
2001	2.616**	1.907*	2.652	0.991	0.743	1.018
	(1.072)	(1.037)	(2.061)	(.885)	(.899)	(1.416)

Notes: Data at the municipality level for the pre-programme period (1992-2001). The IMR and NMR are defined as the number of deaths of infants under 12 months and 1 month of age per every 1,000 live births, respectively. Robust standard errors (in parenthesis) are clustered on municipality; all estimates control for municipality fixed effects and are weighted by municipality population to mimic the regression analysis. * $p<0.10$, ** $p<0.05$; *** $p<0.01$.

Source: Own estimates based on information from vital statistics (INEGI).

[30] 131 municipalities (i.e. less than 0.5 per cent of the sample) had incomplete information of births and/or population size and were excluded from the analyses.

4.4.3 Empirical Model

I used the following differences-in-differences model to estimate the effects of the SP on infant mortality:

$$log\ (Y_{mt}) = \alpha + \lambda_m + \mu_t + \gamma_m t + \beta SP_{mt} + \varepsilon_{mt} \quad (4.2)$$

where Y_{mt} is the infant mortality rate in municipality m in year t, SP_{mt} is an indicator variable equal to one if municipality m has the SP programme in year t, λ_m are municipality fixed effects, μ_t are year effects, $\gamma_m t$ are municipality-specific linear time trends, and ε_{mt} is a disturbance term. Municipality fixed effects are included to control for time-invariant unobserved characteristics of municipalities, while time effects are included to control for time trends common to all municipalities. All estimates are weighted by municipality population to adjust for the fact that the data is not observed at the individual level but is instead aggregated (Davidson and MacKinnon 2004); the standard errors are adjusted for clustering at the municipality level.

The log in equation 4.2 comes from the selection of the functional form. Since mortality rates are count variables (counts of infant deaths per 1,000 live births in this case), I assumed that grouped mortality data follows a Poisson distribution, as commonly done in the epidemiological literature (Avendano 2012, Le and Eberly 2016). The models were thus estimated using Generalised Linear Models (GLM) with the log link and the Poisson family in Stata software. This functional form is also more suitable to model the typical right-skewed distribution of the IMR, with 12.9 per cent of the total observations (or 3,736) with zero mortality. The coefficient of interest, β, can be interpreted as a semielasticity (Cameron and Trivedi 2009).

4.5 Results

4.5.1 Main Results

The difference-in-difference results obtained using equation 4.2 are in Table 4.3. The first column only includes municipality and year fixed effects, while the second column also includes municipality-specific time trends. Although the programme effects estimated are similar in both cases, the latter are more robust and are therefore preferred.[31]

Column 2 of panel A shows that the coefficient of the SP variable, -0.039, is statistically significant ($p<0.001$), indicating that the SP led to a 3.9 per cent decrease in infant deaths per 1,000 live births. The decrease was similar for infants under one month (-0.039, $p<0.5$; column 2 of panel B). With an average IMR of 13.19 between 2002 and 2011, the expansion period of the SP, the estimated reduction attributed to the programme is thus equivalent to 0.5 infant deaths per 1,000 live births (or one infant death per 2,000 live births).

[31] Additionally, municipality-specific time trends are significant in many cases.

Table 4.3. Effects of the Seguro Popular programme on infant mortality in Mexico

	IMR						IMR lagged ten years
	1	2	3	4	5	6	7
Panel A. Infant mortality rate							
Seguro Popular	-0.037**	-0.039***	-0.040***	-0.047***	-0.040***	-0.037***	-0.011
	(0.015)	(0.014)	(0.014)	(0.016)	(0.015)	(0.014)	(0.023)
Panel B. Neonatal mortality rate							
Seguro Popular	-0.036*	-0.039**	-0.040**	-0.045**	-0.038**	-0.038**	-0.016
	(0.020)	(0.018)	(0.019)	(0.020)	(0.019)	(0.018)	(0.027)
Observations	28,989	28,989	28,679	28,985	28,989	28,989	14,557
Fixed year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed municipality effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality time trends	No	Yes	Yes	Yes	Yes	Yes	Yes
Municipality characteristics	No	No	Yes	No	No	No	No
Adjusted births	No	No	No	Yes	No	No	No
Original treatment definition	No	No	No	No	Yes	No	No
Stricter treatment definition	No	No	No	No	No	Yes	No

Notes: The infant mortality rate (IMR), calculated as infant deaths per 1,000 live births, is the dependent variable. Only 1,456 municipalities that started offering the SP in 2002-2005 are included in the analyses. Seguro Popular is a binary variable equal to one if the Seguro Popular programme was operating in the corresponding municipality-year. Municipality characteristics include the log of total population, the marginalisation index, and a binary variable that indicates whether the PROSPERA programme was operating in each municipality-year observation. The IMR for the estimates in column 4 are calculated using adjusted births from CONAPO instead of registered births. All regressions are weighted by municipality population and standard errors (in parenthesis) are clustered on municipality. * p<0.1; ** p<0.05; *** p<0.01.

Source: Own estimates based on information from vital statistics (INEGI), SP administrative records (CNPSS), and Census data (INEGI).

4.5.2 Robustness Checks

Different robustness checks were conducted to assess the validity of the main results.

Time-varying observable characteristics

First, I explicitly consider the trends in some observable municipality characteristics that could be associated with the phasing-in of the SP over time, as well as with the outcome. In particular, since previous studies found that more populated municipalities implemented the programme earlier (Azuara and Marinescu 2013, Bosch and Campos 2014, Pfutze 2015), the log of total population was included as a control. The marginalisation index, that summarises key determinants of the IMR such as reduced access to piped water and drainage (Sartorius and Sartorius 2014), was also used as a control. Finally, since the health component of the PROSPERA programme was especially focused on maternal and child health, and previous evaluations have found positive impacts on both (Barham 2011, Skoufias and McClafferty 2001), a binary variable that indicates whether this conditional cash-transfers programme was operating in each municipality-year observation was added to the models. The third column of Table 4.3 shows that including these variables does not affect the results, as the confidence interval of the estimates is well within the 95 per cent confidence interval of the estimated effects without controls.

Placebo test

The second robustness check further explores whether pre-programme trends of infant mortality were related to the SP coverage. Basically, the same specification was estimated using 10 lags of the dependent variable as a falsification test (Barham 2011). Since the SP implementation across municipalities took place between 2002 and 2011, this number of lags implies using infant mortality rates for the former ten-years period, 1992-2001. Column 7 of Table 4.3 shows that the standard errors are considerably larger than the coefficients on the treatment variable, indicating the effects are not statistically different from zero for both total and neonatal infant mortality ($p>0.1$; panels A and B, respectively). This result confirms that pre-existing trends in infant mortality are not biasing the results.

Underreporting

As mentioned before, underreporting in vital statistics is a cause of concern in infant mortality analyses in general. The municipality fixed effects included in the models control for underreporting in Mexican registries, provided this is constant over the period studied. The implementation of the SP programme, however, could have affected the reporting of deaths and births, which would bias the results.

Since 1950 Mexico uses the death certification system recommended by the WHO. Initially, informants (e.g. hospitals) captured all the deaths occurred within a month in a single report, but from 1987 individual death certificates have been employed. This certification system requires a doctor (or an authorised health official) to certify the death, which also involves determining the cause. Once the death certificate is issued, it can be exchanged in an office of the Civil Registry for the only document legally valid known as *acta*. Therefore, underreporting normally occurs in rural areas where the presence of health officials is more limited, and among very poor families who cannot afford calling a private doctor to issue a certificate when public personnel is not available (Braine 2006). The registration of births follows a similar process, except that until 2008 each state determined the type of document required to have an *acta* issued, i.e. the birth certificate or any other such as a birth notice or *aviso de nacimiento* (Secretaría de Salud 2011). Births underreporting that remains after accounting for extemporaneous registration is, thus, more common in rural and more marginalised areas too.

Important increases in skilled birth attendance (from 87.6 per cent in 2000 to 93.4 per cent in 2006 and 94.5 per cent in 2012) and antenatal care (from 72.8 per cent in 2000 to 81.5 per cent in 2006 and 84.3 per cent in 2012; Gutiérrez et al. 2012), however, suggest that the reporting of infant deaths and births may have in any case improved during the expansion period of the SP. Some modifications to the administrative process also point in the same direction. In particular, since 2008 the birth certificate is mandatory in all the country and indispensable to obtain the *acta* (Secretaría de Salud 2011).

If registry improvements reduced overall underreporting of infant mortality rates, the effects of the SP would be, if anything, underestimated. But if these improvements were particularly focused on births, the observed reductions in infant mortality could be related to increases in birth registries. Two tests were conducted to address this issue. First, I used an alternative denominator to calculate infant mortality rates, namely adjusted births based on pregnancy histories drawn from the National Survey of Demographic Dynamics (*Encuesta Nacional de la Dinámica Demográfica*, ENADID) and Census data (Consejo Nacional de Población 2012). Second, I estimated equation 4.2 using the logarithm of registered births as the dependent variable instead of infant mortality to analyse whether the SP affected birth registries (Gruber et al. 2014).

Column 4 in Table 4.3 shows that the estimated effect of the SP is similar when adjusted births for underreporting are used ($\beta = -0.047$; $p<0.01$), which indicates that the results observed before are not likely associated to an increase in registered births correlated with the programme. The results obtained using registered births as the dependent variable also support this conclusion, since the coefficient of the SP is small and not statistically significant ($\beta = -0.011$; $p>0.1$).

Treatment definition

The main specification considers that a given municipality started receiving the treatment if the yearly number of SP affiliates was greater than ten. To check the validity of this assumption, I used instead the original information, i.e., I considered a given municipality as treated from the year the records report at least one affiliate to the SP. I also used a stricter definition that considers municipalities as treated if the number of affiliates is greater than ten in at least two consecutive years. This definition is tested since the number of affiliates in some municipalities returns to zero after reaching a value greater than ten for a certain year. Columns 5 and 6 of Table 4.3 show that the results remain unaffected when these slightly different definitions of the treatment are used.

4.5.3 Heterogeneity of the Results

In this section I explore whether the effects of the SP varied by municipality size, marginalisation and mortality causes. First, the sample was split into two groups according to the median levels of total population and population share in localities with less than 2,500 inhabitants in 2000,[32] before the implementation of the SP. Columns 1 to 4 of Table

[32] The standard definition of rural area in Mexico is based on the population size at the locality level, namely rural areas are localities with less than 2,500 people. Since this analysis is done at the municipality level, however, I use the proportion of the population that lives in rural areas within each municipality (i.e. localities with less than 2,500 inhabitants) to classify them as rural or urban. If this proportion is above the 2000 sample median, 56 per cent, the municipality is classified as rural; if the proportion is equal to or below this threshold, the municipality is classified as urban. Similar results are obtained if an arbitrary threshold of 50 per cent is used, i.e., if municipalities are classified as rural if over half of the population live in rural localities.

4.4 show that the effect of the SP was basically restricted to more populous (over 15,700 inhabitants), urban municipalities. For those groups, the estimated effects of the SP were similar to the estimated effects for the complete sample (between -0.041 and -0.039 for both total and neonatal mortality).

The results by marginalisation are in columns 5 and 6 of Table 4.4. The municipalities in the two highest marginalisation index quintiles in 2000 were classified as high, while those in the three lowest quintiles were classified as low. The effect of the Seguro Popular was only statistically significant for municipalities with low pre-programme levels of marginalisation, and was similar to the estimated effect for the complete set of municipalities (-0.041 and -0.043 for TMI and NMR, respectively).

In sum, the SP was less successful in small, rural municipalities and those with high levels of marginalisation. Since medical supply in these areas has been traditionally behind, a possible explanation for this result is that despite aforementioned improvements in birth attendance and antenatal care, health services provided in this type of municipalities are still inadequate to offer all the interventions covered by the SP, in particular, specialised procedures needed to address the causes of death that have become more relevant due to the epidemiological transition that is taking place in the country (see Table 4.5 and explanation below)**.** In fact, the SP was designed to begin in areas where health facilities were appropriately equipped to provide the services included in the programme package (see Chapter 2).

While supply data cannot be included in the models since this information is only available from 2001 and is likely endogenous, it is possible to analyse whether the SP effect varies across municipalities with different pre-programme health supply levels. The last two columns of Table 4.4 show that the SP effect was significant only for municipalities with high initial levels of medical supply, defined as those with a rate of doctors above the pre-programme median.[33] This result is consistent with a recent study that found stronger effects of the SP on health care access in areas with greater supply of health professionals (Bleich et al. 2007), and with a number of studies that provide evidence on the link between health-care resources and health outcomes in general (Shi and Starfield 2001, Macinko et al. 2003). Grogger et al. (2015) also found that the effect of the SP on catastrophic spending was concentrated in urban areas and rural areas with well-staffed facilities, while the effect on residents of rural areas with limited infrastructure (either single-nucleus facility or to no facility), that account for nearly 40 per cent of the eligible rural households, was null.

[33] The rate is defined as the number of doctors in contact with patients per 1,000 population. Health supply data are from the Information Subsystem of Equipment, Human Resources and Infrastructure (SINERHIAS), and are publicly available on the Ministry of Health website from 2001 onwards. These data cover the facilities run by the central and state governments, which provide health care to Seguro Popular beneficiaries.

Table 4.4. Effects of the Seguro Popular by selected municipality characteristics

	Population				Marginalisation		Health supply	
	≤Pre-SP median	>Pre-SP median	Rural	Urban	High	Low	≤Pre-SP median	>Pre-SP median
	1	2	3	4	5	6	7	8
Panel A. Infant mortality rate								
Seguro Popular	-0.006	-0.041***	-0.014	-0.040***	-0.031	-0.041***	-0.024	-0.068**
	(0.041)	(0.015)	(0.027)	(0.015)	(0.029)	(0.016)	(0.015)	(0.028)
Panel B. Neonatal mortality rate								
Seguro Popular	0.025	-0.041**	0.012	-0.038**	-0.005	-0.043**	-0.012	-0.084**
	(0.055)	(0.019)	(0.033)	(0.019)	(0.038)	(0.020)	(0.020)	(0.036)
Observations	14,519	14,470	14,304	14,388	12,345	16,644	14,002	14,047
Fixed year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed municipality effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Seguro Popular is a binary variable equal to one if the Seguro Popular programme was operating in the corresponding municipality-year. The median population in 2000, before the implementation of the SP, was 15,700. Rural (urban) municipalities are those with a population share in localities with less (equal or more) than 2,500 people above 56 per cent, the median in 2000. The high marginalisation group consists of the last two (highest) marginality index quintiles in 2000. The indicator of health supply is the rate of doctors per 1,000 population; the mean in 2001 was 0.88. All regressions are weighted by municipality population and standard errors (in parenthesis) are clustered on municipality. * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Source: Own estimates based on information from vital statistics (INEGI)), SP administrative records (CNPSS), and Census data (INEGI).

Finally, Table 4.5 presents the SP effects for the main causes of death grouped as infectious and non-infectious diseases. Infectious diseases include respiratory and intestinal infections, while non-infectious diseases include conditions originating in the perinatal period and congenital anomalies.[34] Together, these causes of death account for over 80 per cent of the total infant deaths. The results indicate that the effect of the SP is statistically significant for non-infectious diseases; the average decline associated to the programme is 4.2 per cent for the NMR ($p<0.05$). There is also a marginally significant reduction of 5.1 per cent in the post-neonatal mortality rate related to infectious diseases ($p<0.1$), defined as the number of deaths of children between one month and one year old per 1,000 live births. The stronger effect of the programme on non-infectious diseases is reasonable, however, as it was designed to address the causes of death that had become more prevalent (Sepúlveda et al. 2006a). By the beginning of the 1990s, respiratory and intestinal infections accounted for 31 per cent of the total infant deaths, but a decade after the deaths attributed to these causes had fallen to 14 per cent (Table 3.1). In contrast, the main non-infectious diseases increased from half of the total infant deaths in 1990 to 70 per cent in 2000. Similarly, neonatal deaths, mainly attributed to non-infectious diseases, increased from 48 per cent of the total deaths of infants under one year in 1990 to 62 per cent in 2000.

[34] Similar results (not shown) are obtained if deaths attributed to nutritional deficiencies are included as non-infectious diseases.

Table 4.5. Effects of the Seguro Popular programme by type of disease

	Infectious diseases	Non-infectious diseases
Panel A. Infant mortality		
Seguro Popular	-0.042	-0.038**
	(0.028)	(0.017)
Panel B. Neonatal mortality		
Seguro Popular		-0.042**
		(0.019)
Panel C. Post-neonatal mortality		
Seguro Popular	-0.051*	-0.022
	(0.029)	(0.032)
Observations	28,989	28,989
Fixed year effects	Yes	Yes
Fixed municipality effects	Yes	Yes
Municipality time trends	Yes	Yes

Notes: Seguro Popular is a binary variable equal to one if the Seguro Popular programme was operating in the corresponding municipality-year. All regressions are weighted by municipality population and standard errors (in parenthesis) are clustered on municipality. * p<0.1; ** p<0.05; *** p<0.01.

Source: Own estimates based on information from vital statistics (INEGI) and administrative records of the SP programme (CNPSS).

4.5.4 Benefit-cost Analysis

So far, I have shown that the estimated reduction in the IMR associated to the SP is 3.9 per cent. To put this number into perspective, I compare in this section the benefits brought by the SP programme in terms of infant mortality reductions to the costs of insuring newborns. Below is the description of the procedure to estimate both the benefits and costs.

Programme costs

To estimate the programme costs, the annual cost per person was first calculated by adding the required federal and state transfers per beneficiary: the *cuota social* (3.92 per cent the minimum wage), the additional federal contribution of 1.5 times de *cuota social*, and the state contribution of 0.5 times de *cuota social* (column B of Table 4.6). Then, the cost of covering the newborns was estimated as the product of the annual cost per person and the number of newborns covered by the SP in each year (column D of table 4.6). Since the latter is unknown, I assumed that the coverage ratio per municipality also applied to newborns, i.e., I estimated the coverage of newborns as the product of the average coverage share in each year (between 5 per cent to 45 per cent) and the total number of newborns in municipalities covered by the SP (column C of Table 4.6).

The total federal and state transfers for newborns in 2004-2011 were equal to 10,751 million pesos and represent 3.2 per cent of the total federal and state transfers reported by the CNPSS. The corresponding share (3.2 per cent) of the annual operation costs of the CNPSS was also considered (column E of Table 4.6). Since the formula to calculate the transfers per beneficiary was applied until 2004, it was assumed that the total cost of covering the newborns in the pilot years of the programme, 2002-2003, was equivalent to 3.2 per cent of the total budget allocated to the SP in those years. The total cost of insuring newborns was estimated in MX2011$10,988 million or US2011$879 million.

Table 4.6. Cost of covering newborns, million pesos of 2011

	Daily minimum wage A	Public transfers per beneficiary B	Newborns with SP coverage C	Total transfers for newborns D = B * C	CNPSS operation costs E	Total cost of covering newborns F = D + E
2002			25,104			62.05
2003			50,830			34.43
2004	60.43	2,558.33	121,030	309.63	5.01	314.64
2005	60.12	2,545.05	248,219	631.73	11.93	643.66
2006	60.33	2,554.04	334,748	854.96	23.44	878.40
2007	60.29	2,552.50	461,432	1,177.80	14.40	1,192.20
2008	59.64	2,525.05	572,932	1,446.68	17.07	1,463.75
2009	59.02	2,498.79	641,045	1,601.83	12.02	1,613.85
2010	59.42	2,515.52	870,216	2,189.04	26.08	2,215.12
2011	59.82	2,532.54	1,002,802	2,539.63	29.85	2,569.49
Total			4,328,357	10,751.32		10,987.59

Notes: Between 2004-2009 the required public transfers were calculated per family, thus, the formula to calculate the required federal and state transfers per individual beneficiary in force since 2010 was applied to the complete study period (column B). To calculate the number of newborns with SP coverage in column C, the average share of the population covered by the programme in each year was multiplied by the total number of newborns in municipalities covered by the SP. Since the total transfers for newborns in 2004-2011 (10,751 pesos of 2011) are equivalent to 3.2 per cent of the total federal and state transfers for the same period (340,204 million pesos of 2011 according to the CNPSS), the corresponding share of the operation costs of the CNPSS for each year is considered in column E. Finally, it was assumed that the total cost of covering newborns in the pilot years of the programme, 2002-2003, was equivalent to 3.2 per cent of the total budget allocated to the SP in those years.

Source: Own estimates based on daily minimum wages from the National Minimum Wages Commission (*Comisión Nacional de los Salarios Mínimos*, Conasami), vital statistics from the National Institute of Statistics and Geography (INEGI), SP costs from the Comisión Nacional de Protección Social en Salud (various years), and SP coverage from administrative records (CNPSS).

Programme benefits

According to the main specification (column 2 of Table 4.3), the SP programme reduced infant mortality in 3.9 per cent. Since the average IMR for 2002-2011 was 13.2, this is equivalent to 0.5 infant deaths per 1,000 live births. During the same period, it was estimated that 4.33 million newborns were covered by the SP (column C of Table 4.6), so the estimated number of averted deaths is 2,228. To monetarise these health benefits, the value of a statistical life (VSL), that indicates the willingness to trade wealth for a small reduction in the mortality risk, was used.

The estimates of the VSL vary widely depending on the methods used and are usually for high-income countries. Therefore, following a common procedure employed in the environmental literature (Viscusi and Gayer 2005), I adjusted the VSL estimated for the US in a meta-analysis, US2000$5.5 million or US2011$7.2 million (Viscusi and Aldy 2003), by the income ratio for Mexico and the US, and the income elasticity of the VSL (equation 4.3). While the same meta-analysis found income elasticities below 1, Hammitt and Robinson (2011) suggest that the income elasticity for developing countries should be above 1. To be on the conservative side, I used 1 and 1.5 as income elasticities. The income ratio, 0.23, was calculated with the average annual wages for the two countries reported by the OECD. The estimated VSL for Mexico was between 0.78 and 1.64 (Table 4.7).

$$VSL_{Mexico} = VSL_{US} * (income_{Mexico}/income_{US})^{elasticity} \tag{4.3}$$

<u>Benefit-cost ratio</u>

The final step was to compare the estimated costs and benefits. The bottom of Table 4.7 shows that the benefit-cost ratio is between 1.98 and 4.15, i.e., the benefits exceed the costs. Put differently, since the estimated VSL for Mexico is higher than the programme costs per averted death (US2011$0.39 million; Table 4.7), the benefits more than compensate for the programme costs.

Table 4.7. Benefit-cost analysis of the Seguro Popular programme

Value of a Statistical Life (VSL) for Mexico (million 2011 US dollars)	1.64	0.78
(income elasticity of VSL)	(1)	(1.5)
Benefits		
Average infant mortality rate 2002-2011	13.2	
Reduction in infant deaths due to the SP	3.9%	
Reduction in infant deaths per 1,000 live births due to the SP	0.5	
Estimated live births with SP coverage in 2002-2011	4,328,357	
Infant deaths averted 2002-2011	2,228	
Benefits = infant deaths averted * VSL, million 2011 US dollars	3,652	1,745
Costs		
Programme costs 2002-2011, 2011 million US dollars	879	
Benefit - cost ratio	4.15	1.98
Programme costs per averted death, million 2011 US dollars	0.39	

Notes: To calculate the VSL for Mexico, the VSL for the US (Viscusi and Aldy 2003) was adjusted with the income ratio for both countries (0.23) and two different income elasticities, 1 and 1.5. The income ratio was calculated as the ratio of the average annual wages for 2011 reported by the OECD.

Source: Own estimates based on vital statistics from the National Institute of Statistics and Geography (INEGI) and SP records (CNPSS).

4.6 Discussion

This chapter exploits the implementation of an ambitious health insurance programme in Mexico to analyse the effects of public insurance on infant mortality. The estimates indicate that the Seguro Popular led to a 3.9 per cent decrease in infant mortality, equivalent to one infant death per 2,000 live births. Since roughly 4.3 million newborns were covered by the SP in 2002-2011, this implies that 2.2 thousand deaths were averted. A simple benefit-cost analysis also showed that the health benefits of the programme more than compensate for its costs. Moreover, the benefits of this analysis are likely underestimated, since other benefits such as morbidity reductions are not considered.

So far, only a handful of studies have used randomisation to evaluate health insurance and have found no effects on health outcomes (Brook et al. 1983, Newhouse 1993, Baicker et al. 2013). This is also the case for the study that used randomised encouragement to evaluate the effects of the SP after ten months (King G. et al. 2009). These studies, however, have focused on measures of adults' health, and their sample size is normally not suited to analyse mortality in general. In contrast, the findings of this analysis are comparable to those of observational studies that also concentrate on infants' health, such as those that evaluate Medicaid expansions in the US (Currie and Gruber 1996) and those recently estimated for the SP (Pfutze 2014).

One of the most relevant findings was that the SP effectively reduced neonatal mortality, mostly related to non-infectious diseases. According to the results, the SP led to a 3.9 per cent decrease in neonatal deaths per 1,000 live births. This indicates that providing access to a comprehensive benefit package can be used to address the causes of death that are relatively more challenging and more prevalent in advanced stages of the epidemiological transition.

Unlike previous studies on the effects of the SP on infants' health (Pfutze 2014), this article uses infant mortality and live birth measures from vital statistics that are certified by health professionals, providing a more accurate measure. Such registry process minimises recall errors and other measurement problems more commonly present in self-reported and survey data. Underreporting in administrative records is probably the main concern when this type of information is employed, but the quality of the Mexican registries is ranked as high (Mathers et al. 2005, World Health Organization 2012), and some robustness checks conducted indicate this is not likely a source of bias.

Health insurance is expected to improve health outcomes through increased access to health care. Unfortunately, despite the advantages of infant mortality data from vital statistics, they provide limited information on access measures at the municipality level. While survey data indicates that the SP increased access to obstetrical services (Sosa-Rubí et al. 2009), and timely antenatal care for some population groups (Servan-Mori et al. 2015), more research into the channels through which public health insurance can affect infants' health is required.

The estimated effects of the SP were not homogeneous across population subgroups. More populated, urban municipalities and those in the lowest half of the marginalisation distribution where the municipalities that registered reductions in infant mortality associated to the SP. Since health facilities in this type of municipalities have been traditionally better equipped, a possible explanation for this result is that the programme had stronger effects where the supply was appropriate to provide all the interventions in the benefit package, in particular, more specialised procedures. In fact, the effect of the SP was only statistically significant for municipalities with high pre-programme levels of medical supply, and was twice the size estimated for the complete set of municipalities. This certainly rises distributional concerns that are beyond the scope of this study but should be addressed in future studies.

Many countries are currently considering the implementation of programmes to reach universal health coverage (Giedion et al. 2013). While it is clear that no single path applies to all contexts (World Health Organization 2010), these results are informative in evaluating how rapid expansion of insurance coverage worked in a middle-income country context. In particular, these findings should be of particular interest for countries in a similar stage of the epidemiological transition.

5. Consumption Smoothing and Health Insurance Expansion[35]

5.1 Introduction

One of the main objectives of health insurance is to protect households against the financial risks of ill health. In the absence of health insurance, households have to resort to informal mechanisms such as depleting savings, selling assets, or increasing labour supply to address health problems. In some cases, households may employ other mechanisms that have long-term consequences, such as reducing food consumption or school enrolment. If health events affect income earners, the welfare consequences can be even worse as the household's ability to generate income is diminished.

Evidence on the effects of health shocks on welfare is limited. Using data for Indonesia, Gertler and Gruber (2002) showed that households are not able to smooth consumption in the absence of health insurance. In particular, they found that reductions in the ability to perform daily life activities were associated with a 20 per cent drop in consumption. Using other indicators of major illness, such as sizeable drops in the body mass index of the household head, Wagstaff (2007) also showed that Vietnamese families are vulnerable to idiosyncratic shocks. In contrast, Mohanan (2011) found that households who suffered bus accident injuries in India were able to smooth food and housing

[35] Most of this chapter is available as a UNU-WIDER Working Paper (Sáenz de Miera-Juárez 2017).

consumption, but experienced reductions in educational spending. He also found that the main informal insurance mechanism households employed was debt, which led to important levels of indebtedness after experiencing the health shock.

For Latin America, the dearth of studies on the welfare consequences of health shocks is even more marked. Baeza and Packard (2006) analyse some related indicators for six Latin American countries, such as the percentage of households that fall into poverty due to health expenditures. They could not formally examine the impact of health shocks on consumption, however, due to the lack of longitudinal data. Chiapa (2008) provides some evidence using Mexican data, namely the evaluation survey of the conditional cash transfer program PROSPERA (see section 4.2.2 of Chapter 4 for more information about this programme). He found that having an ill child reduces the consumption of poor, rural households, although that program helps to mitigate this effect.

On the other hand, most studies on health insurance programs have focused on the analysis of welfare gains measured by increased utilisation of health services and health improvements. Importantly, there are at least two other ways to measure the benefits of insurance. First, following the studies of risk in developing countries, health insurance is expected to reduce fluctuations in consumption. Second, even when consumption is not sensitive to health shocks, Chetty and Looney (2006) show that health insurance can result in important welfare gains if it allows households to substitute costly coping mechanisms. Gruber (1997) is one of the few studies providing evidence of the consumption smoothing benefit of social insurance in general. He estimated that in the absence of unemployment insurance in the United States, consumption of the unemployed would fall by 22 per cent. More recently, Bronchetti (2012) reached a similar conclusion.

The Mexican case provides an interesting setting to analyse the welfare consequences of health shocks and the role of public insurance. As explained in Chapter 2, there are two types of public health insurance in Mexico: social security, which is compulsory for salaried workers and their families, and the SP, more recently introduced to cover those who are excluded from social security. In particular, the staggered expansion of health insurance that took place in Mexico through the implementation of the SP, offers a unique opportunity to identify the welfare effects that may be brought by reducing the health expenditure risk through formal insurance.

In principle, the SP is expected to provide consumption insurance in the event of health shocks, as previous studies have found the programme reduced actual medical care expenditures. According to Knaul et al. (2012), catastrophic and impoverishing health expenditures (30 per cent of the capacity to pay and expenditures that force households below or further below the poverty line, respectively) significantly decreased with the implementation of the SP. Between 2000 and 2010, the first fell from 3.1 per cent to 2 per cent, while the second fell from 3.3 per cent to 0.8 per cent. The evaluation based on the randomised encouragement to enrol in the Seguro Popular also found health expenditures were reduced after ten months of implementation of the program (King G. et al. 2009). Similarly, an evaluation based on the longitudinal survey employed in this analysis (MxFLS) found reductions in health expenditures among beneficiaries of the SP (Consejo Nacional de Evaluación de la Política de Desarrollo Social 2013). The potential of the SP to mitigate fluctuations in consumption would be reduced, however, if medical expenses were relatively small compared to wage losses. The SP is intended to protect households from large medical expenses but not from reduced earning capacity. Social security, on the other hand, provides coverage against both types of risks and can therefore help to elucidate their relative burden.

The objectives of this Chapter are to analyse whether Mexican households are able to smooth consumption after severe health shocks and the contribution of formal insurance both in the form of social security, and especially the Seguro Popular. The Chapter is organised as follows. Section 5.2 briefly describes the theoretical framework employed to analyse the protective effect of health insurance on the event of health shocks. Section 5.3 reviews some key studies on the topic. Section 5.4 describes the data, measures and empirical model. Sections 5.5 and 5.6 presents the results and the discussion of the results.

5.2 Theoretical Framework

Mainstream theoretical frameworks in economics such as the Arrow-Debreu model argue that households are able to smooth consumption over states of nature in the presence of complete private insurance markets (Arrow and Debreu 1954). This implies that households' consumption growth should be independent of idiosyncratic shocks such as health shocks (Cochrane 1991, Townsend 1994). But insurance markets can hardly be considered complete in practice, in particular in LMIC; therefore, public insurance is essential to maintain households' welfare (revealed in their consumption choices) in the face of negative, unexpected events. To formally see how public health insurance is expected to mitigate consumption fluctuations, consider the following framework originally developed by Baily (1978) and later expanded by Chetty and Looney (2006).

Assume there are two states of nature, good and bad (in this case, one with good health and one with bad health); also assume that the utility cost of obtaining consumption level c is θ_b in the bad state and θ_g in the good state, with $\theta_b > \theta_g$ (i.e. θ is an increasing function of health shocks); finally, assume utility is state independent. If agents have a constant relative risk aversion (CCRA) utility function:

$$u(c) = \frac{c^{1-\gamma}}{1-\gamma}$$

the consumption drop from the good to the bad state is:

$$\frac{\Delta c}{c} = \frac{c_g - c_b}{c_g} = 1 - \left(\frac{1}{\theta_b}\right)^{1/\gamma}$$

where γ is the coefficient of risk aversion, and c_g and c_b represent optimal consumption in the good and bad state, respectively. Therefore, consumption changes are decreasing in γ and increasing in θ_b. If private insurance markets were complete, $C_b = C_g$, i.e. consumption would be the same in both states, but if private insurance markets are incomplete as expected, θ_b will be likely high unless public insurance is provided. The expansion of public health insurance in Mexico can help distinguish whether the provision of public insurance can effectively reduce the cost of smoothing consumption.

5.3 Literature Review

Cochrane (1991) and Townsend (1994) were two of the first studies that tested the full insurance (or full risk sharing) hypothesis. The first used longitudinal data to test whether households were fully insured against idiosyncratic income shocks in the United States, either by formal institutions or informal mechanisms. He found that full insurance could not be rejected for short illness, spells of unemployment following involuntary job loss,

loss of work due to strike, and involuntary move. Long illness (more than 100 days of work lost) and involuntary job loss, however, were associated with consumption drops between 11 and 14 per cent for the former, and between 24 and 27 per cent for the latter. The second study used a general equilibrium model to test optimal risk sharing in consumption in three poor villages in southern India. Unlike Cochrane (1991), Townsend (1994) found that after controlling for village consumption, a proxy for village risk level, idiosyncratic income shocks such as sickness and unemployment did not affect much household consumptions, although landless labourers were less insured compared to land-owners in the villages analysed.

More recently, Gertler and Gruber (2002) analysed the effect of major illness on households' consumption growth in Indonesia. They found that decreases in the ability to perform activities of daily living (ADL) reduced non-medical consumption by 8-17 per cent —depending on whether the reduction was on intermediate or basic ADL. To explain the difference between their findings and those of previous studies that indicated no effects of idiosyncratic shocks (e.g. Townsend 1994), they argue that the latter had analysed health measures that reflected small changes in health status that were easier to insure. Using other indicators of major illness, such as sizeable drops in the body mass index of the household head, Wagstaff (2007) also showed that Vietnamese families were vulnerable to income shocks.

The studies mentioned, however, evidence two important gaps. First, they do not address the role of informal insurance, i.e., the mechanisms behind consumption shares that households manage to insure. According to Chetty and Looney (2006), some households may resort to costly mechanisms such as pulling children out of school to smooth consumption. One of the few studies that analyses this issue is Mohanan (2011). He shows that Indian households who were able to smooth food and housing consumption after suffering bus accident injuries, incurred important levels of indebtedness.

A second issue normally excluded in the health shocks literature is the role of formal insurance mechanisms. In fact, a literature review on the economic impact of health shocks in LMIC concludes that very few studies look at the implications of insurance for non-medical consumption (Alam and Mahal 2014). Wagstaff (2007) shows health shocks importantly increase medical spending, even among insured households, but does not further address the specific role of formal insurance in consumption smoothing. An exception is Levy (2002) who found that health shocks have no significant effect on consumption for both insured and uninsured in the United States, and no different effects on income and wealth by insurance status.

The role of other social insurance programmes in protecting consumption has been more extensively analysed. Gruber (1997) was one of the first studies that showed that unemployment insurance in the United States effectively prevented consumption drops across unemployment spells. Thereafter, other studies have used a similar framework to analyse different unemployment insurance programmes (Chetty and Finkelstein 2013). For example, Bronchetti (2012) found that the workers' compensation programme in the United States offsets the consumption drop of individuals who experienced unemployment due to injuries by 3 to 5 per cent. The analysis of unemployment insurance benefits differs at least in two aspects from the analysis of health insurance benefits, however. First, the former directly replaces income loses associated to the shock (unemployment spells), and second, the variation of this benefit can be normally measured with a cardinal variable. In this sense, the analysis of the effect of conditional cash transfer programmes on households' vulnerability to risk is comparable to the analysis of unemployment insurance benefits.

5.4 Data and Methods

5.4.1 Empirical Model

The model I use to analyse whether Mexican households are able to protect their consumption levels against health shocks, and especially examine the role of public insurance is the following:

$$\Delta ln(C_{it}) = \alpha_s + \mu wave_t + \delta\Delta h_{it} + \beta insurance_{it} + \gamma\Delta h_{it} * insurance_{it}$$
$$+\rho X_{it} + \varepsilon_{it} \quad (5.1)$$

where $\Delta ln(C_{it})$ is the change in the logarithm of per capita non-medical consumption of household *i* between *t* and *t-1*; α_s are state fixed effects to control for regional, time-invariant unobservable characteristics; Δh_{it} captures health shocks to household *i* that occurred between *t* and *t-1*; $insurance_{it}$ indicates whether the household has public medical insurance (either social security or SP) at time *t*; and X is a set of demographic variables at first interview. As I use information from three waves of the MxFLS (see details in section 3.2 of Chapter 3), the $wave_t$ variable indicates whether the information is measured at wave 2 (reference category) or wave 3 to allow for changes over time in the outcome. $\delta \neq 0$ would provide evidence against the full insurance hypothesis, while γ would indicate the protective effect of formal insurance. In particular, $\delta + \gamma = 0$ would indicate that households with public insurance are fully insured against health shock h.

The common problem of self-selection into insurance is a potential limitation of Equation 5.1, however (Giedion and Díaz 2010; Levy and Meltzer 2008). In particular, since social security is attached to formal employment as explained above, unobservable characteristics of social security beneficiaries are not only likely correlated with consumption levels, but also with short-term consumption growth. Likewise, households that gained public insurance through the SP may have unobservable characteristics that also affect consumption choices. Therefore, the following strategy based on the exogenous variation provided by the SP expansion is employed to identify the effect of public health insurance. First, I restrict the sample to households uninsured at baseline. Since no SP beneficiaries are reported at wave 1, this implies excluding social security beneficiaries, which results in a more homogeneous subsample. Second, the geographic variation in the roll-out of the SP is used as an instrument in a two-stage instrumental variable (IV) model (see more about the roll-out of the SP in section 2.2 of Chapter 2 and Figure 3.2 in Chapter 3). The specific instrumental variable is the yearly share of the population covered by the programme per municipality and indicates the SP availability to each household in the sample at time *t*. The idea is that municipality coverage entailed decisions at the state and federal level rather than at the household level (Sosa-Rubí et al. 2009). All models are estimated using robust standard errors.

5.4.2 Data and Measures

The data are from the three-wave Mexican Family Life Survey (MxFLS), a nationally representative longitudinal survey. Section 3.2 of Chapter 3 provides a description of the MxFLS.

The dependent variable, monthly non-medical consumption, is measured as the sum of household expenditures and the value of in-kind payments, gifts, and home-produced items. The section of the MxFLS questionnaire on food consumption is the most detailed, including 37 items plus a special segment on ten highly consumed products such as corn tortillas and soft drinks. The section on non-food consumption covers clothing, home services, and electronic appliances, among other durables and services. Consumption figures were adjusted for inflation using the National Consumer Price Index (*Índice Nacional de Precios al Consumidor*, INPC) from the National Institute of Statistics and Geography (INEGI) and are reported in Mexican pesos of December 2013 (MX$Dec13).

The main independent variable is the change in health status, i.e., the health shock indicator. Two health shock measures are used. The first is an index that captures physical performance. According to previous studies (Gertler and Gruber 2002, Gertler et al. 2009), this type of measure is more reliable than subjective measures such as self-reported symptoms. Also, this index better captures severe, exogenous health problems that households find more difficult to cope with, either using formal or informal mechanisms.

The MxFLS registers abilities to perform eight activities of daily living (ADL) among respondents 50 years and older: (1) carry out a heavy bucket for 20 meters, (2) walk five kilometres, (3) bend, sit on your knees or squat, (4) climb up stairs without help, (5) dress up without help, (6) stand up from a chair without help, (7) go to the bathroom without help, and (8) rise from the floor and get on your feet without help. The last four ADL can be further classified as basic ADL. For each ADL, participants can respond "easily" (coded as 2), "with difficulty" (coded as 1), or "could not do it" (coded as 0). The index is simply the standardised sum of the responses for the eight ADL:

$$ADL\ index_i = \frac{\sum_{j=1}^{8} ADL_{j,i} - Minumum[\sum_{j=1}^{8} ADL_j]}{Rank\ [\sum_{j=1}^{8} ADL_j]} \tag{5.2}$$

Therefore, those respondents who cannot perform any ADL have an ADL index equal to zero, while those respondents who can easily perform all the ADL have an ADL index equal to one. Likewise, increases in the ADL index indicate improvement in physical capacity, while declines indicate deterioration.

The ADL index constructed using the MxFLS has an important limitation, however, as the information on ability to perform ADL is only available for respondents 50 years and older. Older respondents are more likely to present disabilities and are also more likely to have lower contributions to household income (Gertler et al. 2009). I focus, though, on the physical performance of household heads, which is likely to have a more evident effect on consumption. I also analyse a second health shock measure that can be calculated for all the households in the sample. The MxFLS asks all adult household members if they have suffered severe accidents, and if so, their age and the date when the accident occurred. With this information, I am able to construct a variable that indicates whether household heads or any other adult household member had a severe accident between waves.

Following the description of the Mexican health system in Chapter 2, households can be broadly classified according to their insurance status: (1) beneficiaries of social security, (2) beneficiaries of SP (once available throughout the country), and (3) uninsured. Only a few households reported having private insurance and are excluded from the sample.[36] In particular, households are defined as publicly insured if at least one member of the household reported having either social security (IMSS, ISSSTE, PEMEX/ SEDENA/ SEMAR, or a state government insurance) or the SP.

[36] Only 73 households reported having private insurance exclusively (either at wave 2 or wave 3), which is less than one per cent of the total initial sample. After eliminating records with incomplete information in the variables of interest, these household-wave observations also account for less than one per cent of the sample (see section 5.4.3).

Supplementary data on SP coverage across municipalities comes from administrative records (see section 3.1 of Chapter 3); household interview dates and municipality of residence reported in the MxFLS were used to link these data. Municipality population, used to calculate the ratio of programme beneficiaries to total population, was obtained from the INEGI 2000 and 2010 Censuses and the 2005 Conteo (see section 3.1 of Chapter 3). Linear interpolation was used to calculate the values for the years for which data were not available. Population data for 2011-13 are publicly available on CONAPO's website.

Household head characteristics measured at first interview as well as changes in household composition are included in the models to account for preferences and changes in preferences. In particular, age, sex, marital status (whether married or not), participation in the labour market (whether employed in the 12 months before the first interview) and education (none, primary, secondary, high school, or more) of the household head; and changes in the logarithm of household size and in the proportion of members 0-5 years, 6-12 years, 13-15 years, 16-64 years, and 65 and more are used as controls. Rural/urban area of residence (less than 2,500 residents/2,500 residents and more) is included too.

5.4.3 Analytic Samples

The analytic sample for this study includes households with non-missing information for the relevant variables for at least two consecutive waves, whose head at first interview was part of the household in subsequent waves. This implies that households whose head according to first interview died or moved to another household are excluded from the analysis. In total, 12,614 and 4,344 household-wave observations are used to analyse the health shock measures described above, namely severe accidents and changes in physical capacity, respectively.[37] If these samples are restricted to uninsured households at baseline, we end up with 3,338 and 1,168 household-wave observations in each case.[38] Households uninsured at baseline are residents in 122 to 131 municipalities across 16 states.

Table 5.1 presents the characteristics of the households included in the analyses. The first and second columns include all publicly insured households (i.e. those with social security or SP once it became available) together with those uninsured, while the third and fourth columns include only uninsured households in 2002 that gained public insurance through the SP in subsequent years. The second and fourth columns focus on households whose head is 50 years and older, as these are the only household heads for which the ability to perform ADL is measured. Overall, most household heads are married, male, with no formal education or primary education only. Although labour-market participation is lower among older heads, as expected, over two-thirds of the heads 50 years and more worked in the reference period; this share reaches 75 per cent among the subsample of uninsured at baseline. Around 55 per cent of the households in the complete sample were insured at first interview. The main difference between the households in the complete

[37] The initial sample comprises households with consistent (not duplicated) head information: 8,439 households at wave 1 plus 824 new households at wave 2. The steps followed to obtain the final analytic sample were: (1) baseline households with no follow-up at wave 2 (969) and new wave 2 households with no follow-up at wave 3 (107) were removed; (2) households whose head had died or moved to another household by the time the subsequent wave was collected were excluded (391 baseline households and 146 households added at wave 2); (3) 73 households that reported having private insurance exclusively were eliminated (see footnote above); and (4) households with incomplete information were excluded (328). This resulted in 12,614 household-wave observations that correspond to 5,365 households with complete information in all waves, 1,139 households with complete information in waves 1 and 2, and 745 households with complete information in waves 2 and 3. Since changes in physical capacity are only measured for heads 50 years and older, the analytic sample in this case is smaller.

[38] Uninsured households at baseline that gained access to social security are also excluded (n = 950) so we can compare households that gained insurance through the SP to those that remained uninsured during the whole study period.

Table 5.1. Sample characteristics at first interview, means and standard deviations

	Complete sample		Uninsured at wave 1	
	All households	Households with heads 50+ years	All households	Households with heads 50+ years
Household head characteristics				
Age	45.969	60.440	47.163	61.421
	(15.816)	(9.837)	(15.948)	(10.329)
Male	0.802	0.737	0.774	0.729
	(0.398)	(0.440)	(0.418)	(0.445)
No formal education	0.152	0.287	0.256	0.452
	(0.359)	(0.453)	(0.437)	(0.498)
Last level of education primary	0.479	0.567	0.547	0.512
	(0.500)	(0.496)	(0.498)	(0.500)
Last level of education secondary	0.202	0.070	0.134	0.017
	(0.401)	(0.256)	(0.341)	(0.128)
Last level of education high school or more	0.168	0.076	0.062	0.019
	(0.374)	(0.264)	(0.242)	(0.138)
Worked in the 12 months before the interview	0.815	0.674	0.824	0.745
	(0.388)	(0.469)	(0.381)	(0.436)
Married	0.653	0.608	0.617	0.544
	(0.476)	(0.488)	(0.486)	(0.498)
Head's ADL index		0.842		0.841
		(0.209)		(0.208)

(continues) Table 5.1. Sample characteristics at first interview, means and standard deviations

Household composition variables				
Household size	4.239	3.948	4.175	3.508
	(2.032)	(2.326)	(2.201)	(2.326)
Proportion of members 0-5 years	0.112	0.042	0.116	0.035
	(0.158)	(0.092)	(0.164)	(0.089)
Proportion of members 6-12 years	0.133	0.072	0.153	0.077
	(0.173)	(0.132)	(0.183)	(0.142)
Proportion of members 13-15 years	0.057	0.047	0.058	0.047
	(0.108)	(0.101)	(0.111)	(0.107)
Proportion of members 16-64 years	0.604	0.636	0.552	0.576
	(0.267)	(0.322)	(0.285)	(0.354)
Proportion of members 65 years or older	0.092	0.201	0.118	0.261
	(0.235)	(0.326)	(0.276)	(0.374)
Household insurance status				
Has public insurance	0.553	0.582	0	0
	(0.497)	(0.493)		
Per capita monthly non-medical consumption (MX$Dec2013)	2,322.27	2,376.65	1,849.21	2,061.52
	(6,386.36)	(6,841.94)	(5,526.19)	(7,375.84)
Number of observations (households)	7,249	2,725	1,827	719

Notes: Standard deviations are in parenthesis. ADL = activities of daily living. The ADL index takes values 0 to 1; increases indicate improvements in physical capacity. MX$Dec2013 = Mexican pesos of December 2013.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

sample and those in the subsamples that exclude social security beneficiaries is that the latter are less educated.

The average health status of household heads 50 years and over, measured using the ADL index (0.84; Table 5.1), is good but declining. Nearly 45 per cent report drops in the capacity to perform ADL between waves, whereas only 28 per cent report improvements (Table 5.2, panel A). Declines in the capacity to perform basic ADL are also more prevalent than improvements (29 per cent vs 17 per cent; Table 5.3). No salient differences are observed between insured and uninsured households; in particular, current insurance status is not associated with larger declines in health. In fact, decreases in the household head's ADL index are more marked for the uninsured, especially in the subsample of uninsured at baseline, i.e. those that remain uninsured during the whole study period (-0.076 vs -0.047; Table 5.2).

Although the second health shock indicator, severe accidents, is measured among all household heads, only nearly 3 per cent experienced a health shock so defined (Table 5.3; panel B). Therefore, we also consider accidents among other adult members of the household, for which the percentage almost doubles. Unlike changes in physical capacity, insured households report more accidents than the uninsured for both the head (3.1 per cent vs 2.3 per cent) and other adults (6.1 per cent vs 3.4 per cent; Table 5.2).

Table 5.2. Average changes in health by current insurance status

	Complete sample			Uninsured at wave 1		
	Insured	Uninsured	Total	Insured	Uninsured	Total
Panel A. Households with heads 50+ years						
Change in head's ADL index	−0.049	−0.059	−0.052	−0.047	−0.076	-0.067
	(0.231)	(0.239)	(0.233)	(0.245)	(0.246)	(0.246)
Proportion reporting decline in ADL index	0.432	0.451	0.438	0.425	0.469	0.455
Proportion reporting increase in ADL index	0.277	0.272	0.275	0.304	0.257	0.271
Change in head's basic ADL index	−0.039	−0.051	−0.043	−0.023	−0.063	−0.051
	(0.224)	(0.230)	(0.226)	(0.226)	(0.235)	(0.233)
Proportion reporting decline in basic ADL index	0.288	0.309	0.294	0.276	0.341	0.321
Proportion reporting increase in basic ADL index	0.171	0.169	0.170	0.214	0.167	0.182
Number of observations (household-waves)	3,048	1,296	4,344	355	813	1,168

(continues) Table 5.2. Average changes in health by current insurance status

Panel B. All households						
Proportion reporting accident of head	0.031	0.023	0.028	0.036	0.022	0.026
Proportion reporting accident of other adults	0.061	0.034	0.053	0.070	0.031	0.043
Number of observations (household-wave)	8,553	4,061	12,614	1,003	2,335	3,338

Notes: Standard deviations are in parenthesis. ADL = activities of daily living. The ADL index takes values 0 to 1; increases indicate improvements in physical capacity. Changes in health (measured with changes in the ADL index or accidents) refer to changes occurring between wave 1 and wave 2 or wave 2 and wave 3 of the MxFLS.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

5.5 Results

5.5.1 The Effect of Health Shocks and the Role of Public Insurance

The results obtained using Equation 5.1 indicate uninsured Mexican households are unable to protect their consumption levels from severe health shocks to household heads (Table 5.3). Passing from being able to perform all ADL to being able to perform none reduces consumption by nearly 20 per cent among uninsured households ($\delta = 0.193$; $p < 0.10$; panel A, first column). If the shock affects male heads, whose contribution to household income is likely larger, the negative effect on consumption is over 30 per cent. Columns 3 and 4 further restrict the attention to potentially more important income earners, namely male working heads and male working heads between 50 and 70 years old;[39] as expected, the effect of health shocks to these household heads is larger.

Public insurance in the form of social security seems to have a protective effect, but the SP does not. While the coefficients of the interaction between ADL index changes and both types of insurance offset the main effect of the health shock (see the tests in the last row of panel A; $p > 0.10$), the results that involve the SP are not statistically significant.

Panel B of Table 5.3 shows similar results for basic ADL. A change in the head's ability to perform four basic ADL (from being able to perform all to being able to perform none) reduces the consumption of uninsured households by 31 per cent ($\delta =0.312$; $p < 0.01$). Again, the negative effect of the health shock is larger when relatively more important income earners are affected (columns 2-4). Beneficiaries of social security also seem to be insured against this health shock (see the tests in the last

[39] Mexico is the second OECD country with the highest effective retirement age, 70 in average (Organisation for Economic Co-operation and Development 2015).

row of panel B; $p > 0.10$). In this case, the effect of the SP is significant for some groups of heads.

The estimates using the second health shock measure, severe accidents, also suggest uninsured households are not able to maintain their consumption levels (second column of Table 5.4; $\delta = 0.152$; $p < 0.05$), although the effect is not statistically significant for accidents of the household head. This result, however, is likely related to the low prevalence of accidents among household heads; as mentioned above (Table 5.2), less than 3 per cent experienced accidents. The protective effect of social security is also observed (last row of Table 5.4), but the effect of the SP is not statistically significant.

Table 5.3. Effect of changes in household head's ADL index on non-medical consumption and the role of public insurance, OLS estimates (heads 50+ years)

	All	Male	Male, working	Male, working, <70
	1	2	3	4
Panel A. General ADL index				
Change in head's ADL index	0.193*	0.313**	0.395**	0.461**
	(0.111)	(0.142)	(0.158)	(0.185)
SP × change in head's ADL index	−0.049	−0.278	−0.263	−0.330
	(0.182)	(0.200)	(0.210)	(0.241)
SS × change in head's ADL index	−0.176	−0.399**	−0.429**	−0.412*
	(0.133)	(0.165)	(0.191)	(0.219)
Household has SP	0.052	0.020	0.034	0.012
	(0.049)	(0.053)	(0.054)	(0.059)
Household has SS	0.049	0.032	0.035	0.036
	(0.035)	(0.041)	(0.042)	(0.045)
State of residence fixed effects	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
R^2	0.07	0.08	0.10	0.09
Observations	4,344	3,171	2,451	2,170
Ho: $\delta + \gamma 1 = 0$; p > F	0.321	0.801	0.337	0.392
Ho: $\delta + \gamma 2 = 0$; p > F	0.821	0.315	0.752	0.678
Panel B. Basic ADL index				
Change in head's basic ADL index	0.312***	0.400***	0.459***	0.526**
	(0.116)	(0.149)	(0.171)	(0.209)
SP × change in head's basic ADL index	−0.164	−0.465**	−0.384	−0.500*
	(0.205)	(0.224)	(0.239)	(0.278)
SS × change in head's basic ADL index	−0.276**	−0.426**	−0.411**	−0.401*
	(0.137)	(0.171)	(0.206)	(0.243)

(continues) Table 5.3. Effect of changes in household head's ADL index on non-medical consumption and the role of public insurance, OLS estimates (heads 50+ years)

Household has SP	0.045	0.015	0.032	0.011
	(0.048)	(0.053)	(0.054)	(0.058)
Household has SS	0.046	0.034	0.040	0.040
	(0.034)	(0.040)	(0.042)	(0.045)
State of residence fixed effects	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
R^2	0.07	0.08	0.1	0.09
Observations	4,344	3,171	2,451	2,170
Ho: $\delta + \gamma 1=0$; p > F	0.385	0.7	0.654	0.884
Ho: $\delta + \gamma 2 = 0$; p > F	0.625	0.76	0.679	0.314

Notes: The dependent variable is the change in the logarithm of per capita non-medical consumption. The controls include characteristics of the household head (age, sex, education, marital status, and working status) and household composition variables (changes in household size and the share of members under 5 years, 6-12, 13-15, 16-64, and 65 and over). Robust standard errors are in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. ADL = activities of daily living, SP = Seguro Popular, SS = social security.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Table 5.4. Effect of severe accidents on non-medical consumption and the role of public insurance, OLS estimates

	All heads	Other adults
Accident	0.076	−0.152**
	(0.086)	(0.074)
SP × accident	0.086	0.054
	(0.156)	(0.102)
SS × accident	−0.121	0.158*
	(0.104)	(0.085)
Household has SP	0.031	0.037
	(0.025)	(0.025)
Household has SS	0.054***	0.045**
	(0.018)	(0.018)
State fixed effects	yes	yes
Controls	yes	yes
R^2	0.07	0.07
Observations	12,614	12,614
Ho: $\delta + \gamma 1 = 0$; p > F	0.209	0.163
Ho: $\delta + \gamma 2 = 0$; p > F	0.446	0.888

Notes: The dependent variable is the change in the logarithm of per capita non-medical consumption. Health shocks are measured with a binary variable that indicates whether the household head or any other adult in the household had a severe accident between waves. The controls include characteristics of the household head (age, sex, education, marital status, and working status) and household composition variables (changes in household size and the share of members under 5 years, 6-12, 13-15, 16-64, and 65 and over). Robust standard errors are in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. SP = Seguro Popular, SS = social security.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

5.5.2 A Closer Examination of the Seguro Popular in the Event of Health Shocks

Instrumental Variables Approach

The results presented so far indicate that health shocks can have sizeable effects on households' consumption, except for that of social security beneficiaries, who seem to be fully insured against these idiosyncratic shocks. No consistent evidence of a protective effect of the SP was observed. These estimates are potentially biased, however, as unobservable characteristics of publicly insured households can be correlated with consumption choices. Therefore, in this section I focus on the subsample of uninsured households at baseline that gained insurance through the SP and use the geographical variation in the SP coverage to instrument affiliation.

Overall, the results for the subsample also indicate that uninsured households are not able to protect their consumption levels from health shocks to the household head (Table 5.5). The effect is clearer for shocks to relatively more important income earners and for basic ADL (panel B of Table 5.5). Additionally, the magnitude of the main effect of changes in the heads' basic ADL index is similar to the one observed with the full sample: passing from being able to perform all basic ADL to being able to perform none reduces consumption by 32-52 per cent.

In line with the results from the previous section, the interaction of self-reported affiliation to the SP with the health shock offsets the main effect of the latter but is not statistically significant (columns 1 to 4 of Table 5.5). Columns 5 to 8 of Table 5.5 present the results using the SP municipality coverage to instrument the programme's affiliation. The last two rows of both panels, A for the general ADL index and B for the basic ADL index, indicate that the instrument is valid ($p < 0.01$) and that self-reported affiliation to the programme can be considered exogenous ($p > 0.10$), so OLS estimates are preferred.

Table 5.5. Effect of changes in head's ADL index on non-medical consumption and the role of the SP; OLS and IV estimates (heads 50 years and older)

	Subsample of uninsured at baseline, OLS				Subsample of uninsured at baseline, IV			
	All	Male	Male, working	Male, working, <70	All	Male	Male, working	Male, working, <70
	1	2	3	4	5	6	7	8
Panel A. General ADL index								
Δ head's ADL index	0.129	0.274	0.346*	0.442**	0.165	0.282	0.410**	0.503**
	(0.133)	(0.167)	(0.185)	(0.209)	(0.147)	(0.178)	(0.195)	(0.210)
SP × Δ head's index	0.046	−0.229	−0.217	−0.202	−0.058	−0.246	−0.355	−0.331
	(0.222)	(0.253)	(0.261)	(0.302)	(0.282)	(0.308)	(0.309)	(0.325)
Household has SP	0.065	0.021	0.071	0.044	−0.087	−0.009	−0.189	−0.274
	(0.067)	(0.077)	(0.080)	(0.088)	(0.284)	(0.303)	(0.331)	(0.368)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.07	0.08	0.10	0.10	0.06	0.08	0.09	0.08
Observations	1,168	844	722	605	1,167	843	721	604
Ho: instrument weak					$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$
Ho: SP exogenous					$p > 0.10$	$p > 0.10$	$p > 0.10$	$p > 0.10$

(continues) Table 5.5. Effect of changes in head's ADL index on non-medical consumption and the role of the SP; OLS and IV estimates (heads 50 years and older)

Panel B. Basic ADL index								
Δ head's ADL index	0.231	0.321*	0.439**	0.521**	0.266*	0.332*	0.511**	0.588**
	(0.145)	(0.184)	(0.200)	(0.245)	(0.156)	(0.198)	(0.213)	(0.248)
SP × Δ head's index	−0.148	−0.418	−0.385	−0.392	−0.233	−0.441	−0.514	−0.479
	(0.270)	(0.314)	(0.311)	(0.370)	(0.299)	(0.342)	(0.334)	(0.366)
Household has SP	0.054	0.014	0.063	0.038	−0.104	−0.029	−0.215	−0.300
	(0.067)	(0.076)	(0.080)	(0.088)	(0.275)	(0.298)	(0.327)	(0.360)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.07	0.08	0.11	0.10	0.06	0.08	0.09	0.08
Observations	1,168	844	722	605	1,167	843	721	604
Ho: instrument weak					$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$
Ho: SP exogenous					$p > 0.10$	$p > 0.10$	$p > 0.10$	$p > 0.10$

Notes: The dependent variable is the change in the logarithm of per capita non-medical consumption. The controls include characteristics of the household head (age, sex, education, marital status, and working status) and household composition variables (changes in household size and the share of members under 5 years, 6-12, 13-15, 16-64, and 65 and over). Robust standard errors are in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. Δ denotes changes, ADL = activities of daily living, SP = Seguro Popular.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Table 5.6 presents the results for the subsample of uninsured at baseline using severe accidents as the health shock measure. Since an even smaller share of the household heads in the subsample experienced accidents (2.6 per cent, Table 5.2), only accidents to all adults in the household (including heads) and adult members other than the head are analysed. The chi-square test in the last row of Table 5.6 indicates that the SP self-reported indicator should be considered endogenous and thus the IV estimates (columns 3 and 4) are preferred in this case ($p < 0.10$). In contrast to the results obtained for disability shocks, we observe that households that gained access to health insurance through the SP can mitigate the adverse effect of severe accidents ($\gamma = 0.398$, $p < 0.05$ in column 3; $\gamma = 0.386$, $p < 0.05$ in column 4 of Table 5.6). Uninsured households that experienced severe accidents, on the other hand, do suffer consumption drops that range between 16 per cent and 27 per cent (δ=-0.271, $p < 0.05$ in column 3; $\delta = -0.160$, $p < 0.10$ in column 4 of Table 5.6).

Taken together, the results of this section suggest that the SP effectively provided consumption insurance for unexpected health events such as accidents, but not for those that resulted in limited physical functioning.

Table 5.6. Effect of severe accidents on non-medical consumption and the role of the SP, OLS and IV estimates

	Subsample of uninsured at baseline			
	OLS		IV	
	Non-head	Any adult	Non-head	Any adult
	1	2	3	4
Severe accident	−0.192*	−0.076	−0.271**	−0.160*
	(0.107)	(0.077)	(0.118)	(0.093)
SP × severe accident	0.163	0.123	0.398**	0.386**
	(0.142)	(0.115)	(0.193)	(0.185)
Household has SP	0.032	0.028	−0.283	−0.315*
	(0.036)	(0.036)	(0.179)	(0.189)
State fixed effects	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
R^2	0.07	0.07	0.05	0.05
Observations	3,338	3,338	3,336	3,336
Ho: instrument weak			$p < 0.01$	$p < 0.01$
Ho: SP exogenous			$p < 0.10$	$p < 0.10$

Notes: The dependent variable is the change in the logarithm of per capita non-medical consumption. Health shocks are measured with a binary variable that indicates whether any adult had a severe accident between waves. The controls include characteristics of the household head (age, sex, education, marital status, and working status) and household composition variables (household size, share of members under 5 years, 6-12, 13-15, 16-64, and 65 and over). Robust standard errors are in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. SP = Seguro Popular.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

PROSPERA Robustness Check

As previous studies found that the conditional cash transfer programme PROSPERA mitigates the effect of health shocks among Mexican households (Chiapa 2008, Skoufias 2007), the models were recalculated using as an additional control a binary variable that indicates whether the households are beneficiaries of that programme. Tables 5.7 and 5.8 show, however, that the results are virtually unaffected.

Table 5.7. Effect of changes in head's ADL index on non-medical consumption. PROSPERA robustness check, OLS estimates (heads 50 years and older)

	Subsample of uninsured at baseline			
	All	Male	Male, working	Male, working, <70
	1	2	3	4
Panel A. General ADL index				
Change in head's ADL index	0.135	0.283*	0.356*	0.451**
	(0.133)	(0.168)	(0.186)	(0.210)
SP × change in head's ADL index	0.026	-0.260	-0.246	-0.228
	(0.224)	(0.257)	(0.264)	(0.306)
Household has SP	0.056	0.007	0.055	0.028
	(0.069)	(0.079)	(0.082)	(0.091)
Household has PROSPERA	0.069	0.082	0.085	0.082
	(0.081)	(0.092)	(0.100)	(0.109)
State of residence fixed effects	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
R^2	0.07	0.08	0.11	0.10
Observations	1,168	844	722	605
Ho: instrument weak	$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$
Ho: SP exogenous	$p > 0.10$	$p > 0.10$	$p > 0.10$	$p > 0.10$
Panel B. Basic ADL index				
Change in head's basic ADL index	0.235	0.330*	0.448**	0.528**
	(0.145)	(0.185)	(0.200)	(0.246)
SP × change in head's basic ADL index	-0.170	-0.459	-0.422	-0.426
	(0.273)	(0.320)	(0.317)	(0.376)
Household has SP	0.045	-0.002	0.047	0.022
	(0.068)	(0.078)	(0.082)	(0.091)
Household has PROSPERA	0.072	0.089	0.087	0.081
	(0.081)	(0.093)	(0.100)	(0.110)
State of residence fixed effects	Yes	Yes	Yes	Yes

(continues) Table 5.7. Effect of changes in head's ADL index on non-medical consumption. PROSPERA robustness check, OLS estimates

Controls	Yes	Yes	Yes	Yes
R^2	0.07	0.08	0.11	0.10
Observations	1,168	844	722	605
Ho: instrument weak	$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$
Ho: SP exogenous	$p > 0.10$	$p > 0.10$	$p > 0.10$	$p > 0.10$

Notes: The dependent variable is the change in the logarithm of per capita non-medical consumption. See the list of controls in the table below. Robust standard errors are in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. ADL = activities of daily living, SP = Seguro Popular.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Table 5.8. Effect of severe accidents on non-medical consumption. PROSPERA robustness check, IV estimates

	Subsample of uninsured at baseline		
	Heads	Other adults	Any adult
Accident	0.014	-0.271**	-0.164*
	(0.112)	(0.117)	(0.094)
SP × accident	0.350	0.392**	0.384**
	(0.240)	(0.192)	(0.184)
Household has SP	-0.308	-0.291	-0.324*
	(0.189)	(0.182)	(0.192)
Household has PROSPERA	0.076*	0.073*	0.076*
	(0.044)	(0.043)	(0.043)
State fixed effects	yes	yes	yes
Controls	yes	yes	yes
R^2	0.05	0.05	0.05
Observations	3,336	3,336	3,336
Ho: instrument weak	$p < 0.01$	$p < 0.01$	$p < 0.01$
Ho: SP exogenous	$p < 0.10$	$p < 0.10$	$p < 0.10$

Notes: The dependent variable is the change in the logarithm of per capita non-medical consumption. Health shocks are measured with a binary variable that indicates whether adult household members had a severe accident between waves. The controls include characteristics of the household head (age, sex, education, marital status, and working status) and household composition variables (household size, share of members under 5 years, 6-12, 13-15, 16-64, and 65 and over). Robust standard errors are in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. SP = Seguro Popular.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Exploring Changes in Household's Labour Supply

This final subsection of the Results explores whether households use labour supply as a copying mechanism in the event of health shocks, and whether this was altered by the implementation of the Seguro Popular. On the one hand, households may increase labour supply to cover additional health expenditures and income losses associated to health shocks, but the opposite could occur if caregivers are needed to assist the member(s) who experience health shocks.

Equation 5.1 was also used for this analysis, but the change in non-medical consumption was replaced by the change in the number of adult household members active in the labour market as the dependent variable. Changes in the number of hours worked for those active in the labour market before and after the health shock were not analysed because the sample size was insufficient. In the case of shocks to the household head, the labour supply of the head was excluded.

Table 5.9 shows that no evidence of labour supply adjustments to cope with shocks was found. Irrespective of insurance status, the coefficients of the health shocks are not statistically different from zero in any case ($p>0.10$). While this is consistent with the results of Lindelow and Wagstaff (2005) for China, it is important to consider that the outcome variable only reflects aggregate participation in the labour market. Other copying mechanisms may also be relatively more important in the event of health shocks. Future analyses should explore other informal risk-sharing mechanisms, including the intensive margin of labour supply (i.e. number of hours worked).

Table 5.9. Effect of health shocks on household's participation in the labour market and the role of the SP; IV estimates

	Subsample of uninsured at baseline								
	Change in head's general ADL index				Change in head's basic ADL index				Accidents
	All heads, 50+ years	Male heads, 50+ years	Male, working heads, 50+ years	Male, working heads, 50-70 years	All heads, 50+ years	Male heads, 50+ years	Male, working heads, 50+ years	Male, working heads, 50-70 years	Any adult
	1	2	3	4	5	6	7	8	9
Health shock	0.016	0.071	0.104	0.093	0.083	0.13	0.168	0.137	0.150
	(0.107)	(0.145)	(0.167)	(0.185)	(0.109)	(0.153)	(0.176)	(0.195)	(0.107)
SP × health shock	0.001	-0.287	-0.309	-0.153	-0.108	-0.241	-0.232	0.015	0.202
	(0.281)	(0.318)	(0.329)	(0.351)	(0.276)	(0.336)	(0.352)	(0.338)	(0.207)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.12	0.14	0.12	0.05	0.12	0.14	0.12	0.06	0.08
Observations	1,197	862	734	615	1,197	862	734	615	3,396
Ho: instrument weak	$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$
Ho: Sp exogenous	$p < 0.10$	$p < 0.10$	$p < 0.10$	$p < 0.10$	$p < 0.10$	$p < 0.10$	$p < 0.10$	$p < 0.10$	$p < 0.10$

Notes: The dependent variable is the change in the number of adult household members active in the labour market. SP = Seguro Popular; ADL = activities of daily living. The ADL index takes values 0 to 1; increases indicate improvements in physical capacity. Health shocks (measured with changes in the ADL index or accidents) refer to changes occurring between wave 1 and wave 2 or wave 2 and wave 3 of the MxFLS. The controls include characteristics of the household head (age, sex, education, marital status, and working status) and household composition variables (household size, share of members under 5 years, 6-12, 13-15, 16-64, and 65 and over). Robust standard errors are in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

5.6 Discussion

The contribution of this chapter is twofold. First, I provide evidence on the welfare consequences of incomplete insurance markets in a middle-income country with a fragmented health system; and second, I analyse the protective effect of public health insurance. The results indicate that uninsured Mexican families are not able to cope with the consequences of health shocks, which is consistent with previous analyses for Indonesia (Gertler and Gruber 2002) and Vietnam (Wagstaff 2007). Severe accidents are associated with declines in non-medical consumption that range between 16 per cent and 27 per cent. Likewise, changes in the health status of household heads, especially those who are relatively more important income earners, are associated with declines in non-medical consumption that can reach 50 per cent.

While the results concerning social security should be interpreted cautiously, it seems that this type of public insurance plays an important protective role against both types of shocks. Having social security fully offsets the main negative effect of physical capacity declines and accidents on non-medical consumption. On the other hand, the endogeneity-corrected estimates about the role of the SP differed depending on which health shock measure was taken into consideration. For the case of unexpected events such as severe accidents, the results indicate that the SP effectively provides consumption insurance to beneficiaries, but not so for the case of disability shocks measured by changes in the ability to perform ADL. This conclusion is not surprising, though, if we consider that income losses associated to disability shocks are likely larger than medical care expenditures (Gertler and Gruber 2002). Unlike social security that provides both health care at no cost at the point of service and disability pensions, the SP only provides the former. Hence, if disability shocks affect relatively more the income-earning capacity of the household, the protective effect of the SP will be limited.

One of the limitations of this study is that the role of risk aversion is ignored. According to the framework developed by Chetty and Looney (2006), zero or small consumption drops could also be observed if agents are very risk averse, i.e. if γ is high (see section 5.3). We observed, however, that the health shocks analysed generally resulted in consumption drops for those who remained uninsured during the study period. Further studies should consider adding indicators of risk aversion to the empirical specifications.

The results of this analysis add to the literature that had found reductions in medical care expenditures among beneficiaries of the SP (King G. et al. 2009; Knaul et al. 2012). Nonetheless, the study on consumption fluctuations provides an alternative measure of the welfare gains that can be obtained through the expansion of public insurance and, more importantly, highlights the sizeable economic costs that households face in the event of major illness when public insurance is not available. In this regard, it seems pertinent to consider whether other social security benefits such as disability insurance should be extended to non-beneficiaries. Certainly, large welfare gains could be obtained from insuring the income loss from severe disabilities. Section 7.3 further discusses the policy implications of these results, but more research is required to weight both the potential gains and the associated costs.

6. Measuring Pure Inequality and Mobility in Health during the Mexican Insurance Expansion

6.1 Introduction

The distribution rather than just overall attainment of health has become an important indicator to evaluate a country's health system performance (World Health Organization 2000), as well as the success of policy interventions to extend insurance coverage. Nonetheless, measuring changes in the distribution of health, and specifically changes in inequality and mobility in a population is far from straightforward. A growing number of studies have focused on both developing measurement tools and providing evidence for specific countries or groups of countries (van Doorslaer and Van Ourti 2011). Most of these studies, however, have only addressed health disparities across socioeconomic status, and more specifically, income-related inequalities by exploiting the existing covariance structure between income and health. While this approach has been helpful in drawing attention to dimensions of well-being other than income, it raises some conceptual and methodological concerns that we attempt to address in this chapter.

Approaches that focus on measuring socio-economic inequalities in health are problematic on a number of grounds. First, it may well be argued that all health inequalities should be a cause of concern and not only those related to socioeconomic status (Gakidou et al. 2000). Second, the analysis of health-related inequalities often draws on unsatisfactory cardinalisation procedures to deal with ordinal variables such as self-assessed health (SAH). Finally, socio-economic measures do not address the fact that income and health might well be codetermined, as evidence suggests. Similarly, with few exceptions (Contoyannis et al. 2004), studies that have concentrated on measuring health mobility also tend to focus on socio-economic mobility. Alternative distributional measures of pure health inequality and mobility are less problematic and more suitable to evaluate the potential effect of policy interventions.

This Chapter employs a recently developed class of indices suitable for ordinal data to analyse the pattern of pure health inequality and mobility between 2002 and 2009 in Mexico (Cowell and Flachaire 2016, 2017). The Mexican case provides an interesting setting for this study in view of the ambitious health reform that extended coverage to the entire population over that period (see details in Chapter 2).

Insurance coverage, whether public or private, provides financial security, and specifically reduces the risk of unpredictable medical costs that households would otherwise absorb. If such costs are too high, individuals go without health care, which can have undesirable consequences for their health. Health insurance provides access to primary care and preventive services too. In particular, if coverage is provided to the entire population (as in the case of the Seguro Popular), it could reduce pre-existing disparities in the access to health care inputs, and so reduce pure health inequalities. This would be expected to reduce the disparities in health across the population, and more specifically, improve the health of those with the poorest health, hence improving pure health mobility.

Nonetheless, the production of health depends on a large list of inputs in addition to health care access. Moreover, the universalisation of health insurance alone guarantees neither use, nor access to needed health care, especially preventive services. Whether increased access takes place, in particular to high value health care that improves health status is an empirical question. Overall, the consensus from recent studies drawing on insurance expansions in the US is that coverage improves individuals' perceived health (see a summary in Sommers et al. 2017). This is exemplified by the Oregon study, a key and paradigmatic randomised expansion of health insurance in the US, that found a 25 per cent increase in the likelihood of individuals reporting good or very good health after one year (Finkelstein et al. 2012). The evidence on the effects of the Seguro Popular is more limited, but Teruel et al. (2012) also found that the programme increased the probability of reporting good health by 6 per cent. However, little is known about the effects on the distribution of health. Evidence from China, a country that has also undergone important reforms to increase insurance coverage among poorer and rural families, suggests that health insurance is associated with reductions in health inequalities, but the overall trend seems to be largely driven by factors outside the health system (Wang and Yu 2016). In fact, health inequalities have increased in China between 1997 and 2009 in both rural and urban areas. While no causal interpretation can be given to our results, we expect to provide new evidence on the potential association between health insurance expansions and the distribution of health.

To fully exploit the information on individual changes in health status between points in time, we also analyse short-run mobility in health. According to Shorrocks' (1978) seminal paper in the income dynamics literature, the concept of mobility captures the extent to which inequality fades over time. Hence, the existence of health mobility would suggest that inequality declines could be expected in the long term. Likewise, a strong persistence in health would suggest that inequality declines are less likely. Since health is not a continuous measure, we use a recently developed mobility indicator that allows dealing with ordinal variables (Cowell and Flachaire 2016). A major contribution of this class of indices is that it separates the definition of status (i.e., the position in the distribution of health) from the definition of mobility.

This Chapter is organised as follows. Section 6.2 contains a critical guide to the relevant literature. Section 6.3 describes the measures, analytic sample, and the methods employed to analyse both inequality and mobility in health. Section 6.5 presents the results, including some robustness checks. Finally, section 6.6 discusses the results.

6.2 Relevant Literature

6.2.1 Health Inequalities

The study of health inequalities has been the focus of numerous studies over the past decades. Most analytic tools employed in these studies have been inspired by the income inequality literature. But there are salient differences between the nature of income —an unbounded, cardinal variable— and health —commonly measured with a categorical variable—, for which the real distance between the categories is unknown. In particular, concentration indices of health on income (CI) are the most popular tool to measure income-related health inequalities (see a survey in Wagstaff and van Doorslaer 2000, and van Doorslaer and Van Ourti 2011). The World Bank has even published a practical guide to facilitate the estimation of CI (O'Donnell et al. 2008). One of the features that makes this measure attractive is that it can be decomposed into the contributions of a set of characteristics, provided the relevant outcome can be written as a linear function of these characteristics (Wagstaff et al. 2003).[40] But as CI should only be used with cardinal variables, arbitrary cardinalisation methods have been commonly applied. For example, van Doorslaer and Jones (2003) use an ordered probit model to convert SAH categories into a continuous index that is then employed to measure inequality. According to Erreygers and van Ourti (2010), however, this rescaling procedure does affect the estimates. Indeed, Costa-Font and Hernández (2013) show in a meta-regression analysis that most of the variation in health inequality estimates comes from differences in the cardinalisation of health status.

Another aspect that makes the CI approach problematic is that the analysis is based on a measure of status that ranks individuals according to socioeconomic status, i.e., individual status is given by their position in the income (or consumption) distribution, as opposed to a natural health ranking akin to pure health inequalities. The use of CI implies that all socioeconomic inequalities are considered illegitimate (unfair and avoidable), and so ignores the fact that some income differences across individuals may be a matter of choice or may reflect variations in preferences (Fleurbaey and Schokkaert 2011), and that income and health may be co-determined. Furthermore, the CI approach neglects other aspects of inequalities in health. While health disparities due to demographics such as age and sex are normally considered legitimate (hence the demographic standardisation of health status is a common practice), the role of other factors as a source of (legitimate/illegitimate) inequalities is ignored. Systematic health disparities have been found with respect to race, ethnic origin, place of residence, and other characteristics,

[40] The literature on social determinants of health is largely based on the analyses of the contribution of different socioeconomic and demographic characteristics to health inequalities (Commission on Social Determinants of Health 2008).

however (e.g. King M. et al. 2009, Cook et al. 2010). Therefore, it has been argued that all health inequalities should be a cause of concern and not only those related to socioeconomic status (Gakidou et al. 2000).

In this study, we use an approach to measure pure health inequalities before and after the Mexican health insurance expansion that overcomes the technical and conceptual difficulties outlined above. In particular, we estimate a class of indices that do not require any cardinalisation and use a similar status concept to those used in poverty and relative deprivation analyses (Cowell and Flachaire 2017; see section 6.3.3).

While the analysis of income inequalities has evidenced that Mexico is one of the most unequal countries (Esquivel 2015), little is known about the distribution of health. A few studies that have addressed this issue, have employed the most common CI approach and have mainly focused on health care (Urquieta-Salomón and Villarreal 2016, Barraza-Lloréns et al. 2013). In the case of China, a country that has also recently increased health insurance coverage, the study of the distribution of health has received much more attention (e.g. Baeten et al. 2013, Tang et al. 2008), but again most analyses have focused on income-related health inequalities. The study by Wang and Yu (2016) is an exception that finds that health inequality considerably increased between 1997 and 2009 in China. The authors argue that this is likely related to factors outside the health system such as increasing income inequality and poverty, and environment deterioration. In fact, their results suggest that health insurance contributed to the reduction of health inequalities, although the overall pattern was in the opposite direction.

6.2.2 Health Dynamics

Health dynamics have been much less studied than health inequalities. Hauck and Rice (2004) and Contoyannis et al. (2004) are relatively recent exceptions that rely on measurement tools employed in the income dynamics literature. Hauck and Rice (2004) use variance components random effects models and linear dynamic regression models to analyse mobility in a cardinal indicator of mental health taken from the British Household Panel Survey (BHPS). In the first case, the measure of mobility is obtained from the proportion of the total variability in health attributed to the permanent component (i.e., unobserved individual heterogeneity); in the second case, the estimated coefficient of the lagged health variable indicates the extent of mobility. They find there is much mobility in mental health but important variation across socioeconomic groups are observed. In particular, the incidence and persistence of mental illness is higher among low income individuals. Contoyannis et al. (2004) also use a dynamic regression approach with data from the BHPS. Since their health measure is a categorical indicator of SAH, however, their specification is non-linear (namely a dynamic panel ordered probit). Unlike Hauck and Rice (2004), they provide evidence of substantial health persistence and hence limited pure health mobility. Additionally, they show that attrition does not alter their findings.

While these studies are important to assess the existence of mobility in health, a different approach is needed if the objective is to analyse pure health mobility patterns.[41] Here we use a class of measures to compare mobility during the first half of the Mexican

[41] Jones and López Nicolás (2004) developed a mobility measure that can be used to analyse the distribution of pure health with a longitudinal perspective. Although their application is to the CI of health on income discussed above, measures of total inequality in health, specifically the Gini coefficient of health can be estimated and decomposed in a similar way. A major limitation of this method, however, is that it requires a cardinal measure of health.

health insurance expansion with mobility during the second half of the expansion (see section 6.4.2).

6.3 Data and Methods

6.3.1 Data and Measures

This chapter uses information from the Mexican Family Life Survey (MxFLS), the longitudinal survey that is described in section 3.2 of Chapter 3.

The health variable employed is the response to the question *currently, do you consider your health is…?*, originally coded as very good (1), good (2), regular (3), bad (4), and very bad (5). This information is available for individuals 15 years and older, which constitute the basic unit of analysis. To calculate inequality indicators, the variable was recoded so that higher values represent better health (i.e., very bad health was recoded as 1, bad health was recoded as 2, and so on).

SAH information has been widely used in the literature that analyses the relationship between health and socioeconomic status (e.g. Adams et al. 2003, Deaton and Paxson 1998, Salas 2002), as well as in the studies that focus on the relationship between health and lifestyles (e.g. Contoyannis and Jones 2004). While SAH is a simple subjective indicator that provides an ordinal ranking of perceived health status, previous studies have shown that it is a good predictor of subsequent use of medical care (e.g. van Doorslaer et al. 2004) and subsequent mortality (e.g. Burström and Fredlund 2001). A number of studies, however, have suggested that SAH may be measured with error if different groups of the population systematically consider different cut point levels when reporting SAH (Groot 2000, Sadana et al. 2000, Murray et al. 2001). Using SAH information from the Canadian National Population Health Survey Lindeboom and van Doorslaer (2004) found that cut points varied with sex and age, although not with income and education. Our analysis of inequalities is therefore conducted for different population groups defined by sex, age, and type of residence area.

Proxy information of SAH was used if available to increase the sample size (see a detailed discussion of the sample size and the effect of non-response in section 6.3.2). Since this could be a potential source of bias due to the subjective nature of the variable, section 6.5.3 discusses the implications.

Other variables employed in the analyses include sociodemographic characteristics at baseline, namely binary variables to indicate whether the individual was female, lived in rural areas, and was active in the labour market in the past 12 months. The region of residence, age group (15 to 30 years, 31 to 45 years, and 46 or older), education level as defined by the highest level of education completed (none, primary, secondary, high school, and university), marital status (cohabitating couple, separated or divorced, single, and widowed), and household size are also used.

6.3.2 Sample Description

Like other longitudinal surveys, the MxFLS suffers from different types of non-response. Attrition, a type of non-response specific to longitudinal surveys, occurs when baseline participants are not able or willing to participate in subsequent waves of the survey. The reasons behind attrition can be death, serious illness, national or international migration, or simple refusal (see Uhrig 2008 for a review of the reasons of panel attrition). Item non-response, on the other hand, occurs when participants have missing information in some parts of the survey. This type of non-response may be caused by unwillingness to provide information that is considered sensitive, or simply because the answer is unknown.

The survey context is also important to understand item non-response (Frick and Grabka 2005); the complexity of surveys like the MxFLS may well explain at least part of this problem. In either case, if non-response is completely random, the results would be unaffected and simple case-wise deletion would be a valid alternative (Rubin 1987). This is unlikely, however, and therefore constitutes a potential source of bias that must be addressed.

To account for multiple events affecting longitudinal samples over time, weighting and imputation methods are the most common ways of dealing with attrition and item non-response, respectively (Jenkins 2011). While specific weights can be constructed to address the research question of interest (e.g. Jenkins 2009, Contoyannis et al. 2004, Jones et al. 2006), those normally provided by the survey administrators are often employed. These weights are designed to produce estimates that represent the population from which the sample was drawn and to adjust for non-response. Imputed data is also frequently provided by the survey administrators, especially for variables such as income, with relatively high item non-response rates.

Both weighting and imputation, however, normally rely on different assumptions about non-response patterns that have to be considered. Many studies on income inequality and mobility have found that differential attrition does not have a substantial impact on the conclusions (see a detailed discussion of this in chapter 3 of Jenkins 2011). Using the British Household Panel Survey and the European Community Household Panel to analyse socioeconomic determinants of health, Jones et al. (2006) also show that health-related attrition has little impact on the results. Frick and Grabka (2005), on the other hand, show that using only non-imputed data from the German Socioeconomic Panel Study significantly underestimates income mobility.

Overall, the MxFLS has relatively low levels of attrition. In particular, 9.2 per cent of the participants 15 years and older at baseline was lost to follow-up at wave 2, while an additional 7.3 per cent was lost to follow-up at wave 3 (Table 6.1). General response rates of the MxFLS are also good but vary across books. For example, the book that contains information about household consumption has a response rate of 95 per cent at baseline, while the book on adult cognitive ability has a response rate of 85 per cent. Non-response in SAH, however, is relatively high. If no proxy responses are considered, between 17 per cent and 22 per cent of the participants have missing SAH information; only after considering proxy responses the item non-response decreases to 10 per cent approximately (Table 6.1). In contrast, SAH non-response in the British Household Panel Survey is less than 1 per cent (Lynn 2006).

If we consider both participation in all three waves and complete SAH information (including proxy responses), we end up with a balanced sample of 15,088 individuals or 45,264 wave-individual observations, which constitutes the main analytic sample. The weights of the MxFLS provided are used in the main analysis, as these adjust for non-response.[42] Section 6.5.3, however, explores other specifications to assess the robustness of the results, including unweighted estimates, multiple imputation, non-proxy information only, and inequality estimates using the unbalanced sample.

[42] The survey materials available at the website of the MxFLS include a document that explains the calculation of the weights. In sum, the weights are first calculated at the household level as the inverse of the joint probability of selecting this last sampling unit. These weights imply three types of adjustments: 1) to account for non-response, 2) for projections to the entire population, and 3) for calibration. Once the household weights are adjusted, individual weights for each book (with and without proxy responses) are calculated.

Table 6.1. MxFLS non-response

(sample of individuals 15 years and older at baseline)

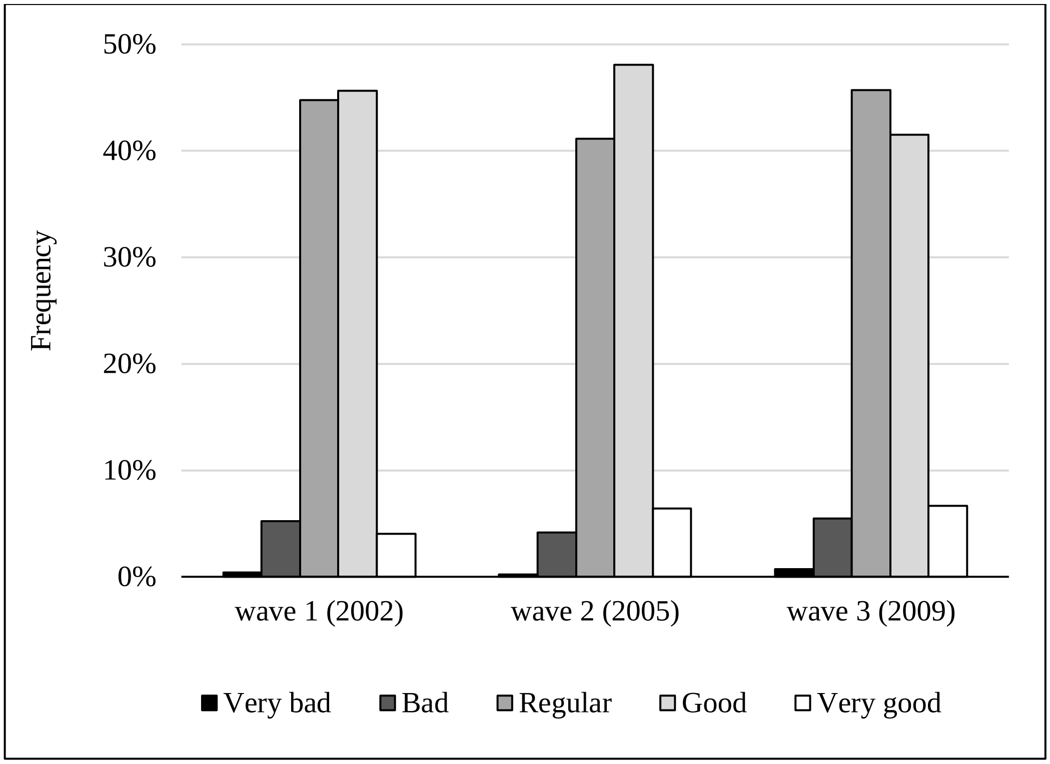
Wave	Individuals	Survival rate	Drop-outs	Attrition rate	Complete SAH information (no proxy)	Complete SAH information (with proxy)	Item non-response
1	23,724				19,778	21,610	8.9%
2	21,550	90.8%	2,174	9.2%	16,936	19,091	11.4%
3	19,971	84.2%	1,579	7.3%	15,546	17,635	11.7%

Notes: Only baseline participants considered (individuals added to replenish the sample in the second and third waves are excluded from the analyses). 53 observations with no information of age at baseline are also excluded.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Figure 6.1 shows the distribution of SAH by survey wave. Most of the individuals have regular or good health. The share of those reporting very bad and bad health is slightly higher in the last wave, but the difference is not clear enough to claim that the distribution became worse over the period. Table 6.2 shows the sociodemographic characteristics of the sample. About half of these individuals were female, active in the labour market, and lived in rural areas at baseline. Their education level was generally low (11 per cent reported no formal education and 43 per cent had only completed primary education), and nearly two thirds lived with their couple. The sample is roughly equally distributed across the five regions.

Figure 6.1. Self-assessed health by survey wave



Notes: Respondents who participated in all three waves and have complete SAH (proxy information considered), n=15,088; unweighted percentages.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Table 6.2. Baseline characteristics of the balanced sample (unweighted figures)

	%/mean	n
Age (mean)	37.8	15,088
15 to 30 years	39.2%	5,913
31 to 45 years	30.5%	4,597
46 years or more	30.3%	4,578
Female	55.0%	8,298
Marital status		
Cohabitating couple	63.5%	9,584
Divorced or separated	3.9%	588
Single	28.1%	4,244
Widowed	4.4%	670
Highest education level completed		
None	10.9%	1,633
Primary	43.0%	6,472
Secondary	26.1%	3,924
High School	13.1%	1,972
University	7.0%	1,048
Worked in the past 12 months	53.5%	8,078
Household size (mean)	5.0	15,088
Rural	47.4%	7,154
Region		
South-south east	21.4%	3,228
Centre-occident	19.7%	2,965
Centre	18.3%	2,758
Northeast	19.5%	2,943
Northwest	21.2%	3,194

Notes: The balanced sample include respondents who participated in all three waves and have complete SAH (proxy information considered), n=15,088.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

6.3.3 Measuring Inequality in Health

To analyse inequality in health status, we employ the Cowell and Flachaire (2017) inequality measure specifically developed to deal with ordinal variables such as SAH. Let n_k be the number of persons in each SAH category k = 1, 2,…, 5, where 1 is the least desired category (very bad health) and 5 is the most desired category (very good health). Then, the status of individual *i* who is in category *k(i)* must be a function of either:

$$\sum_{l=1}^{k(i)} n_l \qquad \text{or} \qquad \sum_{l=1k(i)}^{K} n_l \tag{6.1}$$

Normalising by the size of total population, $n = \sum_1^K n_k$, so that individual's status is between 0 and 1 we have:

$$s_i = \frac{1}{n}\sum_{l=1}^{k(i)} n_l \qquad \text{or} \qquad s_i{}' = \frac{1}{n}\sum_{l=1k(i)}^{K} n_l \tag{6.2}$$

where s_i and $s_i{}'$ are the downward and upward looking definitions of individual's status, respectively. If there was perfect equality, all the individuals would be in the same category and both expressions would be equal to one; this maximum status is the reference point. Therefore, inequality measurement amounts to aggregate the information vector with the status of all individuals in relation to the equality vector of ones (1,1,…1).

Based on a set of elementary axioms, Cowell and Flachaire (2017) show that inequality must take the form of an index in the following class:

$$I_\alpha(s) = \frac{1}{\alpha[\alpha-1]}\left[\frac{1}{n}\sum_{i=1}^{n} s_i^\alpha - 1\right], \alpha \in \mathbb{R}, \alpha \neq 0,1 \tag{6.3}$$

where $\alpha < 1$ indicates the sensitivity of the index to different parts of the health distribution. In particular, high values of α produce indices that are more sensitive to high-status inequality, while low and negative values produce indices that are more sensitive to low status. Depending on whether we use the definitions of status s_i or $s_i{}'$ (2) to calculate $I_\alpha(s)$ (3), we will have an index of ordinal inequality based on a downward or upward looking status concept. The limiting form for the case where $\alpha = 0$ is:

$$I_0(s) = -\frac{1}{n}\sum_{i=1}^{n} log s_i \tag{6.4}$$

As can be seen in equations 6.5 to 6.7 the Cowell and Flachaire class of indices is actually similar to the well-known Generalised Entropy class of inequality measures GE_α (Cowell 1980, Shorrocks 1980). The second, however, takes the mean $\mu(s)$ as the reference point, which makes sense only if the measure of status is cardinal. Therefore, when ordinal variables such as SAH are employed, a common approach is to use an arbitrary cardinalisation to estimate GE_α. We use this approach in section 5.3 to test whether these results differ from those obtained using the Cowell and Flachaire inequality measures.

$$GE_\alpha(s) = \frac{1}{\alpha[\alpha-1]}\left[\frac{1}{n}\sum_{i=1}^{n}\left[\frac{s_i}{\mu(s)}\right]^{\alpha} - 1\right], \alpha \in \mathbb{R}, \alpha \neq 0,1 \tag{6.5}$$

$$GE_0(s) = \frac{1}{n}\sum_{i=1}^{n} log\,\frac{s_i}{\mu(s)} \tag{6.6}$$

$$GE_1(s) = \frac{1}{n}\sum_{i=1}^{n} \frac{s_i}{\mu(s)} log\,\frac{s_i}{\mu(s)} \tag{6.7}$$

Percentile bootstrap with 1,000 replications is used to calculate confidence intervals, i.e., we generate 1,000 bootstrap samples by resampling with replacement from the observed data, and then we estimate I_α^b (or GE_α^b), with b =1,…,1000, for each bootstrap sample. The percentile confidence interval is then

$$CI_{percentile} = \left[c_{0.025}^b, c_{0.975}^b\right] \tag{6.8}$$

where $c_{0.025}^b$ and $c_{0.975}^b$ are the 2.5th and 97.5th percentiles of the Empirical Distribution Function of the bootstrap statistics.

All the routines to estimate the Cowell-Flachaire indices were programmed in Stata 14.2. The routine created by Jenkins to estimate generalised entropy measures was also used (Jenkins 2006).

6.3.4 Measuring Mobility in Health

Transition matrices or contingency tables provide a simple alternative to explore mobility. These matrices have been widely used to analyse mobility with categorical data such as employment status, educational attainment, or income quintiles (e.g. Ferrie 2005, Corak and Piraino 2010). Let S denote the set of all possible health status values, with S =[0,1] and subsets $S_1, \ldots, S_k \subset S$ such that $U_{k=1}^K S_k = S$. Also, let n_{kl} be the number of individuals in S_k at time t_0 and S_l at time t_1. The transition matrix P is therefore a $K \times K$ array with elements

$$p_{kl} = \frac{n_{kl}}{\sum_{j=1}^K n_{kj}} \tag{6.9}$$

If nobody remains in the same position (perfect mobility), all the elements in the diagonal are equal to zero; if everybody stays in the same position (no mobility), all the elements in the diagonal are equal to one.

Mobility indices, however, provide a more useful approach that takes advantage of all the available information at the individual level. In particular, we use the Cowell and Flachaire (2016) mobility index that has at least two important advantages compared to other commonly used mobility measures: it is able to capture nonlinear relationships, and it separates the definition of individual's status from the definition of mobility.

Let u_i and v_i denote the status of individual *i* at time t_0 and time t_1, respectively, where $u_i, v_i \in S$ and S =[0,1], then the profile $z \coloneqq \{(u_i, v_i)_{i=1,\dots,n}\}$ contains all the information about mobility for the population of *n* individuals. Based on a set of axioms on mobility orderings over all possible pairs *z*, Cowell and Flachaire (2016) derived the following class of mobility measures that are independent of the population size and the scale of status:

$$M_\alpha = \frac{1}{\alpha[\alpha-1]n}\sum_{i=1}^{n}\left[\left[\frac{u_i}{\mu_u}\right]^{\alpha}\left[\frac{v_i}{\mu_v}\right]^{1-\alpha} - 1\right], \alpha \in \mathbb{R}, \alpha \neq 0,1 \qquad (6.10)$$

where μ_u and μ_v are the means of u ad v, respectively, and α is a sensitivity parameter that characterises the particular members of the class. Positive values of α produce indices that are sensitive to downward movements, while negative α's produce indices that are sensitive to upward movements. The limiting forms for the cases where $\alpha = 0$ and $\alpha = 1$ are, respectively:

$$M_0 = -\frac{1}{n}\sum_{i=1}^{n}\frac{v_i}{\mu_v}\, ln\left(\frac{u_i}{\mu_u}\Big/\frac{v_i}{\mu_v}\right) \tag{6.11}$$

$$M_1 = \frac{1}{n}\sum_{i=1}^{n}\frac{u_i}{\mu_u}\, ln\left(\frac{u_i}{\mu_u}\Big/\frac{v_i}{\mu_v}\right) \tag{6.12}$$

Since we are employing an ordinal measure of health, proportions are used to define status:[43]

$$u_i = \widehat{F_0}(x_{oi}), \text{ and } v_i = \widehat{F_1}(x_{1i}) \tag{6.13}$$

where $\widehat{F_K}(x) = \frac{1}{n}\sum_{j=1}^{n} I(x_{kj} \leq x)$ is the empirical distribution function of individual health in periods k=1, 2, and I(.) is an indicator function equal to 1 if its argument is true and equal to 0 otherwise. Percentile bootstrap with 1,000 replications is also used to calculate confidence intervals.

6.4 Results

6.4.1 Inequality in Health

Figures 6.2 and 6.3 show the results of the Cowell and Flachaire inequality index (equations 6.3 and 6.4), using both the downward and upward looking definitions of status. In both cases, the point estimates suggest that health inequality increased between 2002 and 2009, but this change is only statistically significant when the upward looking definition is

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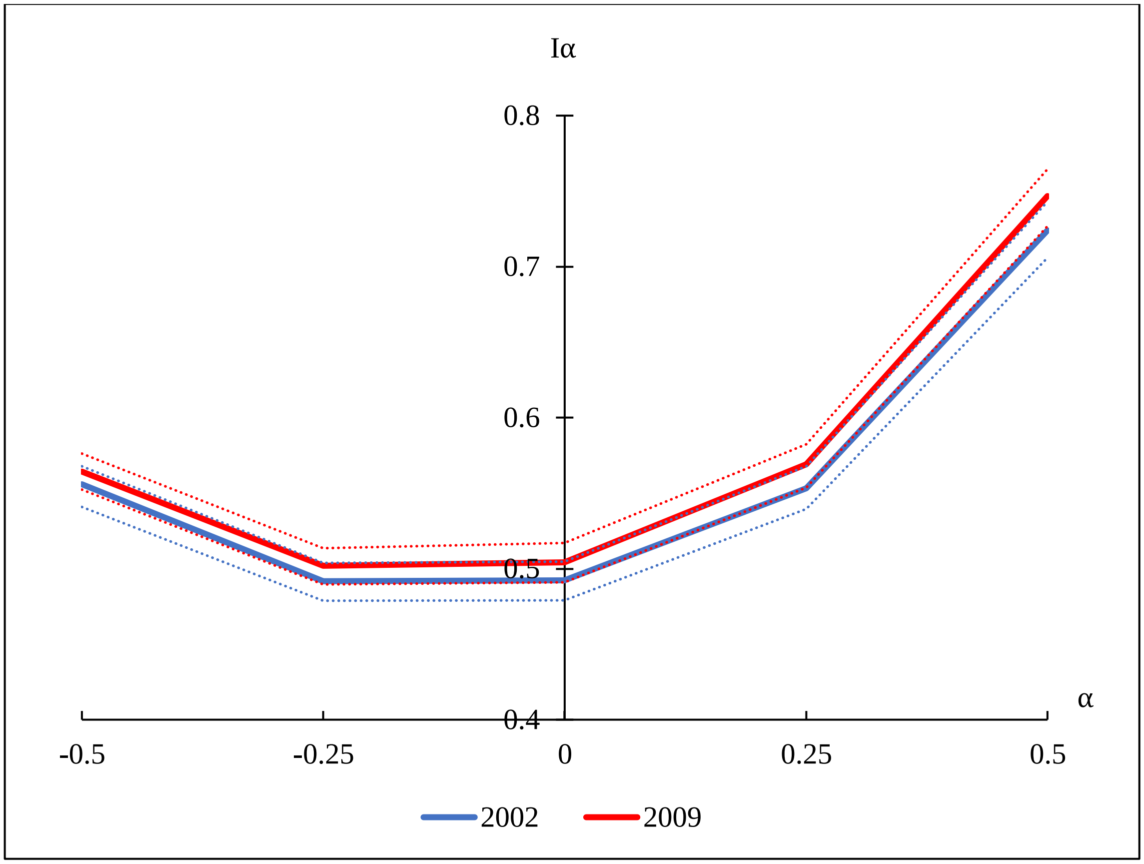
[43] In other contexts (e.g. analyses of income mobility), different status concepts may be derived from a given data and the class of mobility measures M_α can be calculated for each status concept. Therefore, equations 3 to 5 can be actually considered a "superclass" of mobility measures (Cowell and Flachaire 2011).

used. If we hold constant the definition of status, the conclusion is the same for different values of the sensitivity parameter α. Therefore, only the adoption of different status definitions affects the conclusions.

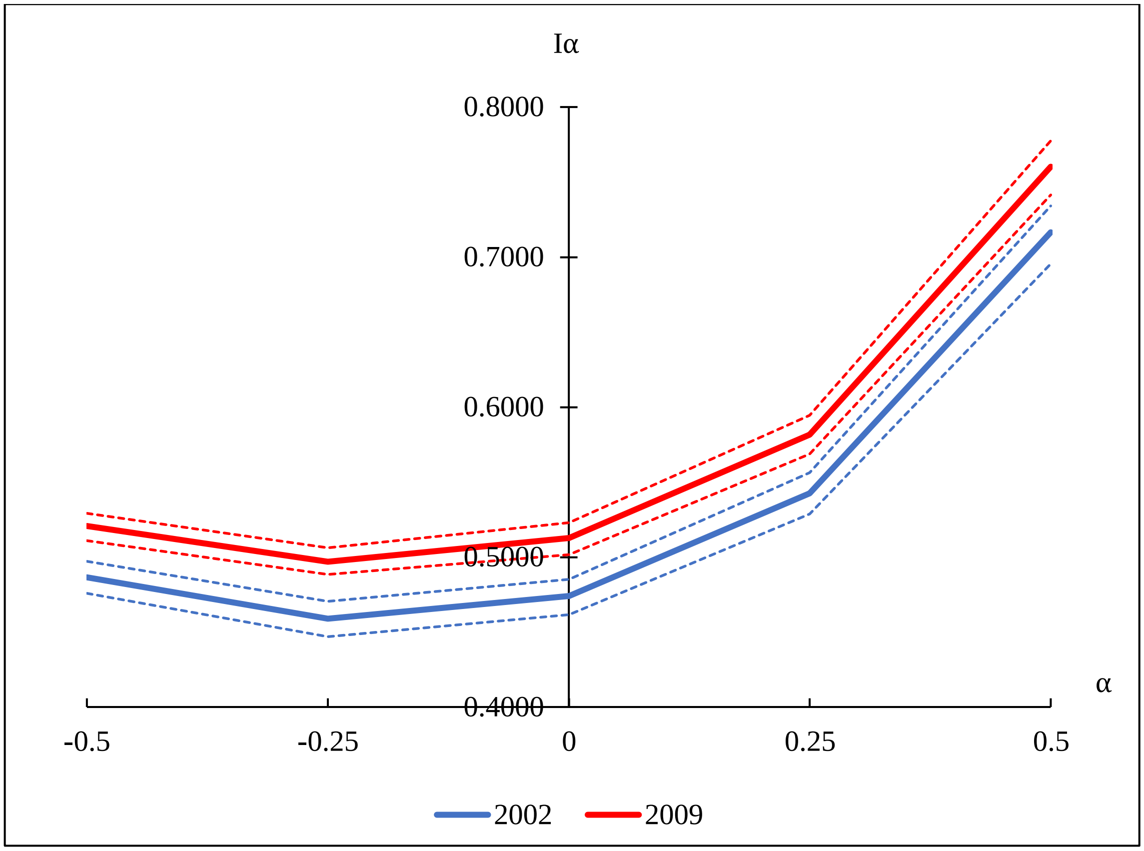
Figure 6.2. Health inequality during the public insurance expansion in Mexico. Downward looking status (balanced sample, weighted estimates)



Notes: Inequality is measured with the Cowell and Flachaire inequality index; the dotted lines represent 95 per cent confidence intervals estimated using bootstrap with 1,000 replications. The balanced sample includes the respondents who participated in all three waves of the MxFLS and have complete SAH information (proxy information considered); n=15,088.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Figure 6.3. Health inequality during the public insurance expansion in Mexico. Upward looking status (balanced sample, weighted estimates)



Notes: Inequality is measured with the Cowell and Flachaire inequality index; the dotted lines represent 95 per cent confidence intervals estimated using bootstrap with 1,000 replications. The balanced sample includes the respondents who participated in all three waves of the MxFLS and have complete SAH information (proxy information considered); n=15,088.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Table 6.3 further analyses health inequality among population subgroups holding the sensitivity parameter at α = 0. As explained above (section 6.3.1), this is to account for the possibility that different groups of the population consider different cut point levels when reporting SAH, but also to assess whether inequality patterns vary among these population groups. The results obtained are similar to the results for the total population. If the downward looking definition of status is employed, inequality in health seems stable across both rural and urban areas, males and females, and cohorts, but increasing if the upward looking version is considered. The only group for which the increase is not statistically significant even if the upward looking status definition is used is the older cohort.

Table 6.3. Health inequality during the public insurance expansion in Mexico by baseline characteristics. Balanced sample, weighted estimates

(sensitivity parameter α = 0)

	Downward looking status			Upward looking status			
	2002	2005	2009	2002	2005	2009	n
Total	0.492	0.503	0.504	0.474	0.497	0.513	15,088
	[0.479, 0.505]	[0.490, 0.515]	[0.491, 0.516]	[0.461, 0.485]	[0.484, 0.508]	[0.502, 0.524]	
Area of residence							
Urban	0.485	0.504	0.507	0.471	0.499	0.514	7,934
	[0.469, 0.500]	[0.487, 0.519]	[0.492, 0.523]	[0.455, 0.486]	[0.484, 0.513]	[0.501, 0.527]	
Rural	0.497	0.499	0.492	0.473	0.485	0.505	7,154
	[0.481, 0.512]	[0.483, 0.514]	[0.476, 0.509]	[0.458, 0.487]	[0.470, 0.499]	[0.491, 0.518]	
Sex							
Male	0.489	0.500	0.510	0.466	0.485	0.511	6,790
	[0.469, 0.506]	[0.482, 0.517]	[0.490, 0.527]	[0.446, 0.483]	[0.467, 0.501]	[0.494, 0.527]	
Female	0.490	0.501	0.497	0.477	0.502	0.511	8,298
	[0.472, 0.508]	[0.483, 0.518]	[0.480, 0.516]	[0.460, 0.493]	[0.486, 0.516]	[0.494, 0.525]	

(continues) Table 6.3. Health inequality during the public insurance expansion in Mexico by baseline characteristics. Balanced sample, weighted estimates

(sensitivity parameter α = 0)

Age							
15-30 years	0.452	0.481	0.487	0.439	0.462	0.485	5,913
	[0.430, 0.470]	[0.461, 0.502]	[0.467, 0.507]	[0.417, 0.460]	[0.442, 0.481]	[0.464, 0.503]	
31-45 years	0.474	0.483	0.470	0.465	0.497	0.508	4,597
	[0.448, 0.496]	[0.458, 0.505]	[0.442, 0.494]	[0.442, 0.486]	[0.474, 0.516]	[0.490, 0.527]	
46+ years	0.500	0.491	0.496	0.493	0.496	0.503	4,578
	[0.475, 0.524]	[0.465, 0.514]	[0.470, 0.521]	[0.472, 0.512]	[0.474, 0.514]	[0.482, 0.521]	

Notes: Inequality is measured with the Cowell and Flachaire inequality index; 95 per cent confidence intervals, estimated using bootstrap with 1,000 replications, are in brackets. The balanced sample includes the respondents who participated in all three waves of the MxFLS and have complete SAH information (proxy information considered).

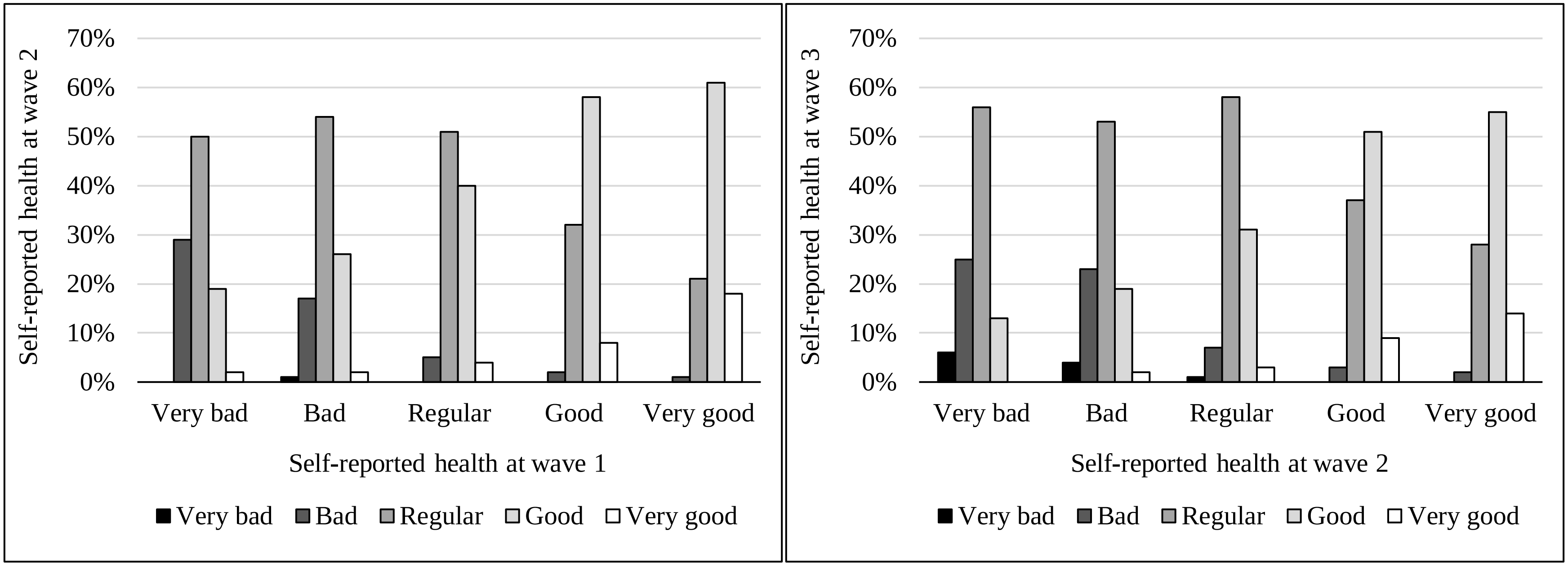
Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

6.4.2 Mobility in Health

The results presented so far indicate that the distribution of health remained stable in Mexico during the past decade, or probably worsen (became more unequal) according to one of the definitions of status employed. Now we exploit individual changes in health between points of time to analyse mobility. In particular, we are interested in the extent to which health status in the previous period affects the distribution of health in the current period.

Figure 6.4 shows the distribution of SAH at wave 2 (or 3) by SAH at wave 1 (or 2). It seems clear that it is more likely to stay in the same state than to transition to another, especially if we look at the extreme categories. Those with very good health at wave 1, for example, are more likely to have very good health at wave 2. Similarly, those with very bad health at wave 2 are more likely to have very bad health at wave 3. The transition matrices in Table 6.4 present an alternative way of analysing this. The rows indicate health in the previous period, t-1 (or t-2 in the case of panel C), while the columns indicate health in the current period, t. In general, the larger percentages are located in the diagonal or close to the diagonal, which is also an indicator of persistence in health. Additionally, we can see that the values in the diagonal that correspond to lower categories of health increased, but those that correspond to upper categories decreased. This suggests that overall mobility was likely stable.

Figure 6.4. Self-assessed health at wave t by self-assessed health at wave t-1



Notes: Unweighted percentages using the balanced panel (respondents who participated in all three waves of the MxFLS and have complete SAH information); n=15,088.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Table 6.4. Transition matrices, self-assessed health in Mexico

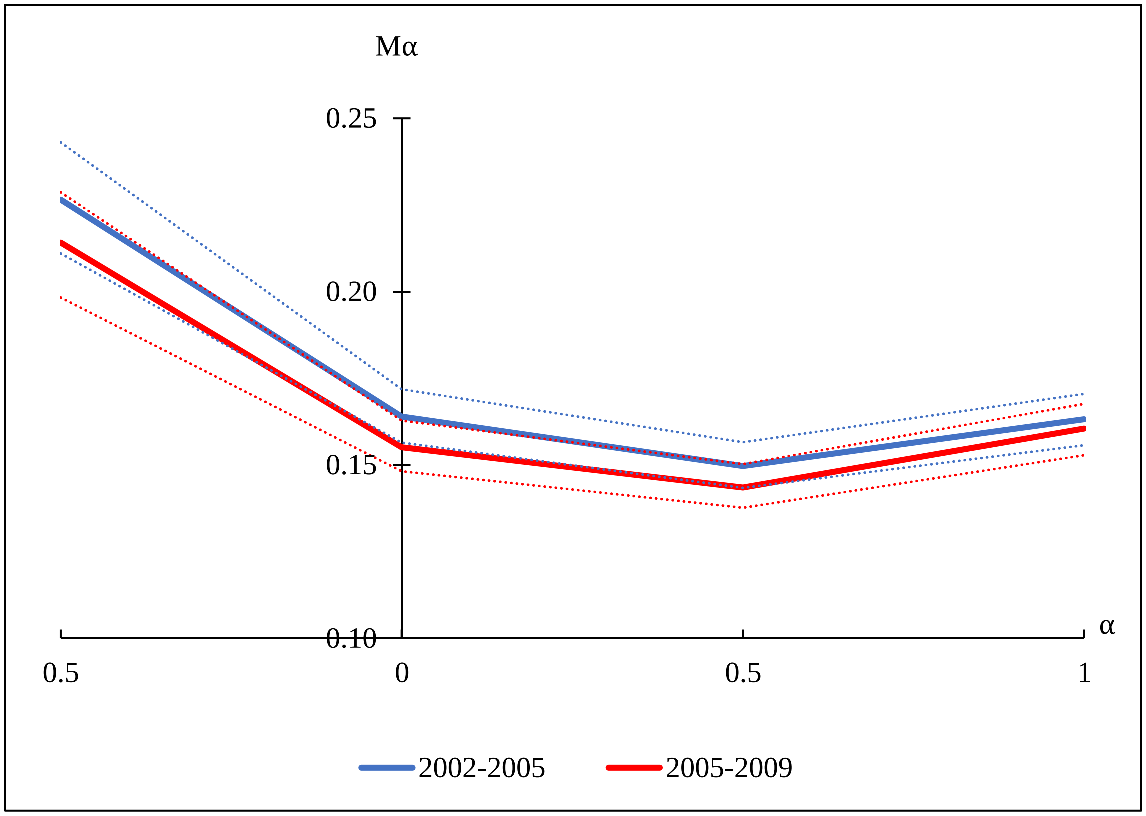
Panel A. Self-assessed health at wave 2 by self-assessed health at wave 1							
				2005			
		Very bad	Bad	Regular	Good	Very good	n
2002	Very bad	0%	29%	50%	19%	2%	58
	Bad	1%	17%	54%	26%	2%	784
	Regular	0%	5%	51%	40%	4%	6,755
	Good	0%	2%	32%	58%	8%	6,887
	Very good	0%	1%	21%	61%	18%	604
	n	32	631	6,210	7,251	964	15,088
Panel B. Self-assessed health at wave 3 by self-assessed health at wave 2							
				2009			
		Very bad	Bad	Regular	Good	Very good	n
2005	Very bad	6%	25%	56%	13%	0%	32
	Bad	4%	23%	53%	19%	2%	631
	Regular	1%	7%	58%	31%	3%	6,210
	Good	0%	3%	37%	51%	9%	7,251
	Very good	0%	2%	28%	55%	14%	964
	n	104	825	6,896	6,260	1,003	15,088
Panel C. Self-assessed health at wave 3 by self-assessed health at wave 1							
				2009			
		Very bad	Bad	Regular	Good	Very good	n
2002	Very bad	10%	19%	50%	19%	2%	58
	Bad	3%	23%	55%	18%	2%	784
	Regular	1%	6%	57%	32%	4%	6,755
	Good	0%	3%	36%	52%	9%	6,887
	Very good	1%	1%	24%	54%	19%	604
	n	104	825	6,896	6,260	1,003	15,088

Notes: Unweighted percentages using the balanced panel (respondents who participated in all three waves of the MxFLS and have complete SAH information); n=15,088.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Figure 6.5 better depicts the behaviour of mobility in health over the period studied. While the point estimate of the Cowell-Flachaire mobility index (equations 10 to 12) indicates a decrease in mobility, the change is not statistically significant. This result holds for different values of the sensitivity parameter α.

Figure 6.5. Mobility in health during the health insurance expansion in Mexico (balanced panel, weighted estimates)



Note: Mobility is measured with the Cowell and Flachaire mobility index; 95 per cent confidence intervals, estimated using bootstrap with 1,000 replications, are in brackets. The balanced sample includes the respondents who participated in all three waves of the MxFLS and have complete SAH information (proxy information considered); n=15,088.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

6.4.3 Robustness Checks

This section examines whether some of the assumptions underlying the results in the previous section are likely fulfilled. In particular, we have a better look at the potential effects of non-response and the choice of the inequality measure.

<u>Reconsidering non-response</u>

To assess whether attrition may be biasing inequality estimates, we recalculated the Cowell and Flachaire index using the unbalanced sample. Table 6.5 shows that these estimates are consistent with the main results discussed above.[44] In sum, they suggest that health inequality increased between 2002 and 2009, although the changes are only statistically significant if the upward-looking status concept is adopted. This conclusion holds, however, for negative and positive values of the parameter α.

[44] The sample used to estimate the weighted figures for waves 2 and 3 is slightly lower as some individuals have no weights assigned in the survey databases. While there is no clear explanation, the consistency of the unweighted results using the same sample suggests that the impact of these missing weights is negligible.

Table 6.5. Health inequality during the public insurance expansion in Mexico. Unbalanced sample, weighted and unweighted estimates

α	2002 (n = 21,610)	2005 (n = 18,194)	2009 (n = 17,572)	2002 (n = 21,610)	2005 (n = 19,091)	2009 (n = 17,635)
		weighted results			unweighted results	
Panel A. Downward looking status						
-0.5	0.572	0.580	0.574	0.573	0.573	0.582
	[0.561, 0.582]	[0.566, 0.591]	[0.561, 0.585]	[0.567, 0.578]	[0.566, 0.579]	[0.576, 0.588]
0	0.506	0.516	0.512	0.510	0.512	0.519
	[0.496, 0.517]	[0.505, 0.526]	[0.498, 0.525]	[0.505, 0.514]	[0.507, 0.516]	[0.513, 0.524]
0.5	0.740	0.756	0.756	0.744	0.750	0.762
	[0.725, 0.756]	[0.740, 0.772]	[0.733, 0.774]	[0.739, 0.749]	[0.745, 0.755]	[0.756, 0.767]
Panel B. Upward looking status						
-0.5	0.492	0.505	0.519	0.492	0.494	0.518
	[0.484, 0.501]	[0.497, 0.512]	[0.509, 0.529]	[0.488, 0.496]	[0.491, 0.498]	[0.515, 0.521]
0	0.483	0.502	0.514	0.483	0.491	0.514
	[0.473, 0.493]	[0.492, 0.510]	[0.503, 0.525]	[0.479, 0.487]	[0.487, 0.496]	[0.510, 0.518]

(continues) Table 6.5. Health inequality during public insurance expansion in Mexico. Unbalanced sample; weighted and unweighted estimates

0.5	0.729	0.752	0.764	0.730	0.740	0.766
	[0.713, 0.744]	[0.737, 0.768]	[0.745, 0.781]	[0.725, 0.735]	[0.733, 0.745]	[0.760, 0.771]

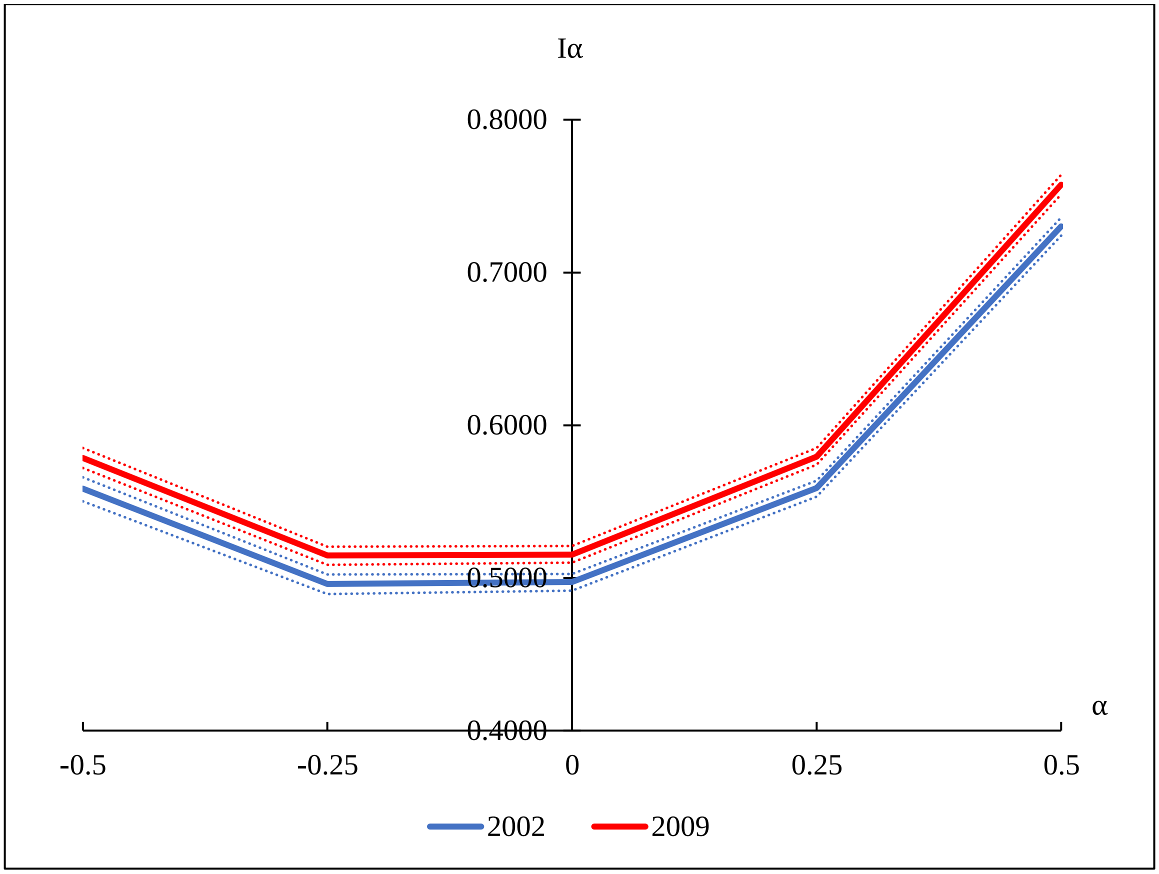
Notes: Inequality is measured with the Cowell and Flachaire inequality index; 95 per cent confidence intervals, estimated using bootstrap with 1,000 replications, are in brackets. The unbalanced sample includes the respondents who participated in any of the three waves of the MxFLS (except for new entrants at wave 2 and 3) and have complete SAH information (proxy information considered).

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

In addition, we recalculated the Cowell and Flachaire index for the balanced sample without weights. While the results are again similar, these estimates provide stronger evidence of an increase in health inequality between 2002 and 2009, as this change is not only statistically significant for the upward looking definition of status, but also for the downward looking definition (Figure 6.6 and Figure 6.7). The unweighted estimates of health mobility, on the other hand, confirm that it remained stable over the period studied. To facilitate the comparison, the first two columns of Table 6.6 show the weighted estimates of mobility that correspond to Figure 6.5 above, while the last two columns show the unweighted estimates.

Figure 6.6. Health inequality during the public insurance expansion in Mexico.

Downward looking status (balanced sample, unweighted estimates)

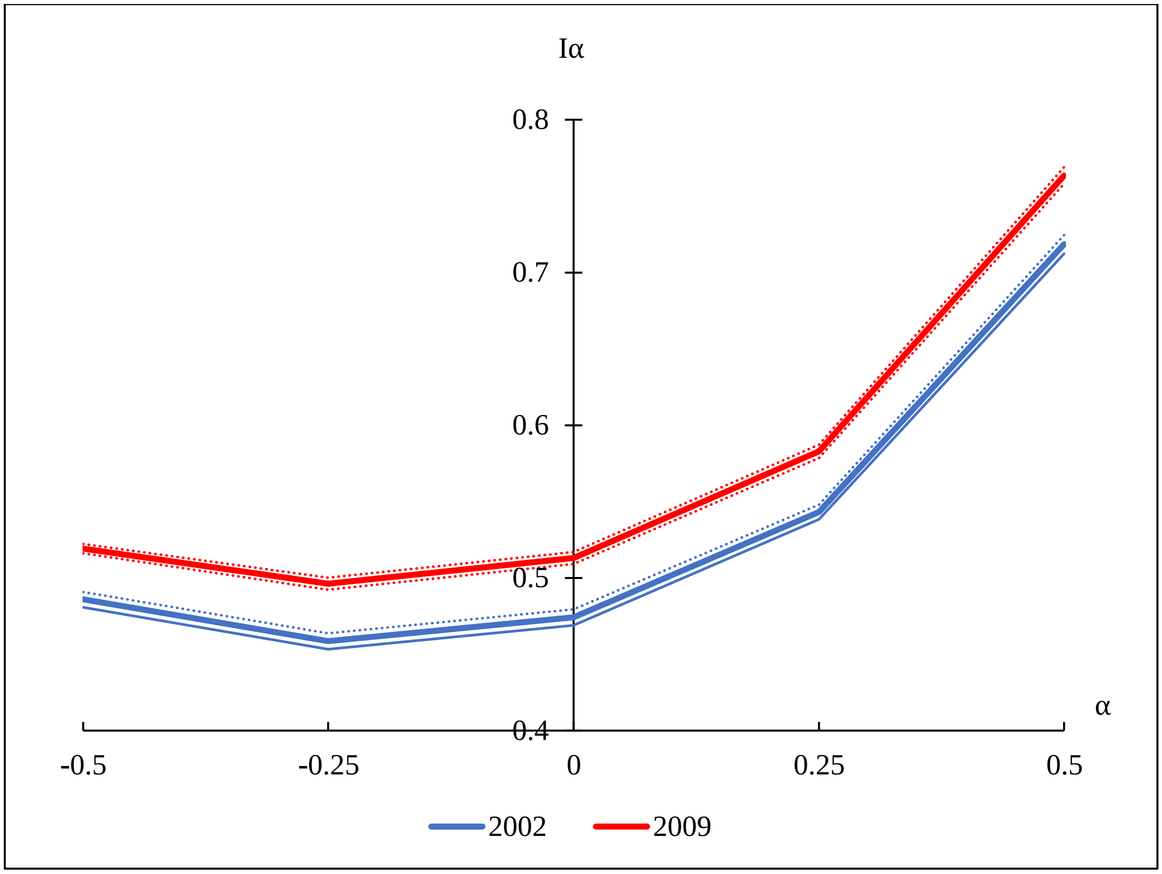


Notes: Inequality is measured with the Cowell and Flachaire inequality index; the dotted lines represent 95 per cent confidence intervals estimated using bootstrap with 1,000 replications. The balanced sample includes the respondents who participated in all three waves of the MxFLS and have complete SAH information (proxy information considered); n=15,088.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Figure 6.7. Health inequality during the public insurance expansion in Mexico.

Upward looking status (balanced sample, unweighted estimates)



Notes: Inequality is measured with the Cowell and Flachaire inequality index; the dotted lines represent 95 per cent confidence intervals estimated using bootstrap with 1000 replications. The balanced sample includes the respondents who participated in all 3 waves of the MxFLS and have complete SAH information (proxy information considered); n=15,088.

Source: own estimates based on the Mexican Family Life Survey (MxFLS).

Table 6.6. Health mobility during the public insurance expansion in Mexico. Balanced sample, weighted and unweighted estimates

α	2002-2005	2005-2009	2002-2005	2005-2009
	weighted results		unweighted results	
-0.5	0.227	0.214	0.236	0.221
	[0.211, 0.243]	[0.198, 0.229]	[0.224, 0.247]	[0.211, 0.232]
0	0.164	0.155	0.171	0.162
	[0.156, 0.172]	[0.148, 0.163]	[0.166, 0.175]	[0.158, 0.167]
0.5	0.150	0.143	0.155	0.152
	[0.143, 0.157]	[0.138, 0.150]	[0.151, 0.159]	[0.148, 0.156]
1	0.163	0.160	0.167	0.170
	[0.156, 0.171]	[0.153, 0168]	[0.163, 0.172]	[0.164, 0.175]

Notes: Mobility is measured with the Cowell and Flachaire mobility index. 95 per cent confidence intervals estimated using bootstrap with 1,000 replications are in brackets. The balanced sample includes the respondents who participated in all three waves of the MxFLS and have complete SAH information (proxy information considered); n=15,088.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

As noted before, proxy information of SAH was considered to avoid missing a large number of observations due to item non-response. If the individuals with proxy information, however, are systematically different from the rest of the sample, the results would be biased. The indices were therefore recalculated using only the information directly reported by the individuals. Table 6.7 shows that the magnitude of these estimates is only slightly lower, but the pattern is the same. If we use the downward looking definition of status, no significant change is found between 2002 and 2009, but if we use the upward looking definition the increase in health inequality is statistically significant.

Table 6.7. Health inequality during the public insurance expansion in Mexico. Balanced sample with no proxy SAH information, weighted estimates

	2002	2005	2009
Panel A. Downward looking status			
α=0	0.483	0.499	0.491
	[0.468, 0.497]	[0.485, 0.511]	[0.475, 0.505]
Panel B. Upward looking status			
α=0	0.471	0.500	0.511
	[0.457, 0.485]	[0.488, 0.512]	[0.499, 0.522]

Notes: Inequality is measured with the Cowell and Flachaire inequality index; 95 per cent confidence intervals, estimated using bootstrap with 1,000 replications, are in brackets. The balanced sample includes the respondents who participated in all three waves of the MxFLS and have complete SAH information (no proxy responses are considered for these estimates); n=11,897.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Since attrition does not seem to affect the conclusions, we conducted a final test focused on item non-response. As mentioned above, imputation methods are widely used to deal with this type of non-response.[45] Survey administrators of the British Household Panel Survey, for example, use hot-deck imputation and predictive mean matching, depending on the nature of the variable that is being imputed (Jenkins 2011). But many different approaches are available. Here we use multiple imputation to account for uncertainty in the imputation strategy (Rubin 1987). In particular, we use multivariate imputation with chained equations (MICE) to take advantage of any SAH information available for individuals with missing values for some waves. This imputation method basically imputes

[45] Imputation methods can also be applied to replace the missing values caused by attrition (see an application of imputation methods to deal with attrition in health surveys in Härkänen et al. 2016). As other simpler tests described above suggest that the effect of attrition is negligible in this case, however, we only use imputation to replace missing values of SAH for those who participated in all the three waves of the MxFLS.

multiple variables iteratively through a sequence of univariate imputation models, with fully conditional specifications of prediction equations (i.e., all the variables except the one being imputed are included in a prediction equation). The model specified for the univariate imputation was an ordered logistic regression, with sex, age group, area and region of residence, marital status, education, household size, and participation in the labour market as independent variables.[46]

The sample for the imputed exercise include all the individuals who participated in all three waves of the MxFLS (n = 19,971; see Table 6.1 above); proxy information was ignored, i.e., SAH responses provided by proxy informants were also treated as missing values. Since we also used percentile bootstrap with 1,000 replications to calculate confidence intervals, the number of imputations was set to five to simplify the computation procedure.[47] This implies that we estimated the inequality index for all five imputed datasets generated for each bootstrap sample. The estimated values of the index for each bootstrap sample were combined using Rubin's rule (Rubin 1987), which basically amounts to calculating an average. Table 6.8 shows that the results obtained for the parameter α=0 are similar to those presented above. An increase if health inequality between 2002 and 2009 is noted, although the increase is statistically significant for both the downward and upward looking definition of status.

[46] Some of the independent variables had incomplete information for 75 individuals of the balanced panel (less than 0.5 per cent). These observations were excluded from the analyses.
[47] According to Schafer (1999) there is normally no practical benefit to using more than five imputations.

Table 6.8. Health inequality in Mexico. Balanced sample with multiple imputation of SAH, unweighted estimates

	2002	2005	2009
Panel A. Downward looking status			
α=0	0.498	0.506	0.512
	[0.494, 0.504]	[0.501, 0.512]	[0.506, 0.519]
Panel B. Upward looking status			
α=0	0.477	0.492	0.515
	[0.473, 0.481]	[0.487, 0.500]	[0.510, 0.521]

Notes: Inequality is measured with the Cowell and Flachaire inequality index; 95 per cent confidence intervals, estimated using bootstrap with 1,000 replications, are in brackets. The balanced sample includes the respondents who participated in all three waves of the MxFLS; n=19,896. Missing information of SAH was imputed.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

Measuring inequality with the Generalised Entropy index

Although the Generalised Entropy measures (GE_α) are suitable for cardinal variables, in this section we assess whether the results obtained using this indicator substantially vary from the results obtained using the Cowell and Flachaire index. The GE_α index was calculated using equations 6.5 to 6.7 above with the status of individual i, s_i, simply indicated by the category number of SAH (1 for very bad SAH, 2 for bad SAH, and so on).

Table 6.9 shows that the Generalised Entropy estimates are consistent with those obtained using the upward looking definition of status. For α=-1,0,1, this measure indicates that inequality in health increased over the period studied. These results hold for the balanced and unbalanced panel, with or without weights, except for some alphas for the weighted figures where the change between 2002 and 2009 is not statistically significant.

Costa and Cowell (2016) had previously analysed the correlation between health inequality rankings across 70 countries using both the Cowell and Flachaire index (with the downward and upward looking definitions of status) and the GE index for different values of the sensitivity parameter α. Their results indicate that both measures resulted in similar patterns of inequality across countries only for the extreme case of $\alpha = 0.99$. This analysis, however, shows that both indices can give more consistent results for the analyses of within-country inequality patterns.

Table 6.9. Health inequality in Mexico using the Generalised Entropy Index

	α	2002	2005	2009	2002	2005	2009
			weighted results			unweighted results	
Panel A. Balanced panel							
	-1	0.024	0.023	0.026	0.024	0.022	0.028
		[0.022, 0.025]	[0.022, 0.025]	[0.025, 0.028]	[0.023, 0.025]	[0.021, 0.023]	[0.027, 0.029]
	0	0.021	0.021	0.023	0.021	0.020	0.025
		[0.020, 0.022]	[0.020, 0.022]	[0.022, 0.024]	[0.020, 0.022]	[0.020, 0.021]	[0.024, 0.026]
	1	0.019	0.020	0.022	0.020	0.019	0.023
		[0.019, 0.020]	[0.019, 0.021]	[0.021, 0.023]	[0.019, 0.020]	[0.019, 0.020]	[0.022, 0.024]
n		15,088	15,088	15,088	15,088	15,088	15,088
Panel B. Unbalanced panel							
	-1	0.025	0.026	0.027	0.025	0.024	0.028
		[0.024, 0.027]	[0.024, 0.028]	[0.026, 0.029]	[0.024, 0.026]	[0.023, 0.025]	[0.027, 0.030]
	0	0.022	0.023	0.024	0.022	0.022	0.025
		[0.021, 0.023]	[0.022, 0.024]	[0.023, 0.025]	[0.022, 0.023]	[0.021, 0.022]	[0.024, 0.026]

(continues) Table 6.9. Health inequality in Mexico using the Generalised Entropy Index

1	0.021	0.021	0.022	0.021	0.020	0.023
	[0.020, 0.021]	[0.019, 0.021]	[0.022, 0.023]	[0.020, 0.021]	[0.020, 0.021]	[0.022, 0.023]
n	21,610	18,194	17,572	21,610	19,091	17,635

Notes: 95 per cent confidence intervals, estimated using bootstrap with 1,000 replications, are in brackets. The balanced sample (panel A) includes the respondents who participated in all three waves of the MxFLS and have complete SAH information (proxy information considered); the unbalanced sample (panel B) includes the respondents who participated in any of the three waves of the MxFLS (except for new entrants at wave 2 and 3) and have complete SAH information.

Source: Own estimates based on the Mexican Family Life Survey (MxFLS).

6.5 Discussion

The main objective of this Chapter was to analyse the evolution of health inequalities in Mexico over the last decade. Instead of following the common approach that focuses on the concentration of health on income, we used a class of measures appropriate to deal with categorical indicators of SAH to analyse pure health inequalities. The results indicate that the distribution of health worsen in Mexico between 2002 and 2009, although the change is only consistent for the upward looking definition of status. Together with the lack of mobility in health observed, we can conclude that Mexico is becoming more rigid.

While short study periods could be expected to provide little opportunity for movement in general, Hauck and Rice (2004) actually found evidence of large mobility in mental health in the UK over the 1990s decade. In contrast, Contoyannis et al. (2004) found strong persistence in self-reported health status in the UK in the same period. Our findings are in line with the latter.

Teruel et al. (2012) previously analysed the effects of increased coverage through the Seguro Popular on perceived health status. They used data from the MxFLS and propensity score matching to create a suitable comparison group drawn from those still uninsured at the time of collection of the third wave. At baseline, those who gained insurance through the SP were more likely to report bad health than the comparison group, but the findings suggest that a 6 per cent increase in the probability of reporting good health among the former can be attributed to the programme. How can we reconcile this result with ours? While the Seguro Popular may helped improve SAH among beneficiaries, it seems that other factors shape the overall distribution of health.

Unfortunately, available data for Mexico does not allow analysing the extent to which different economic, institutional, and environmental factors affect health disparities. Evidence for China suggests that income inequality is an important determinant of health disparities, as the highest income group has access to high quality health care services. In particular, Baeten et al. (2013) argue that the contribution of income inequality to health inequality is between 25 per cent and 30 per cent. Wang and Yu (2016) also show that common indicators of income inequality such as the Gini coefficient and the Theil index are positively associated with health disparities. Income inequality in Mexico declined over the past decade, however (Esquivel 2015, Organisation for Economic Co-operation and Development 2014a). This decline has been attributed to increases in remittances among low income households, and reductions in labour income and non-labour income (government transfers) inequalities (Esquivel 2015, Esquivel et al. 2010).

Costa and Cowell (2016), on the other hand, suggest that institutional performance, in particular, better government effectiveness is associated with health inequality declines. According to the Worldwide Governance Indicators (Kaufmann et al. 2010), government effectiveness in Mexico declined from 0.24 in 2002 to 0.17 in 2009. Other indicators of governance such as regulatory quality, control of corruption, and political stability and absence of violence present much larger drops. Therefore, these factors could be key to explain the pattern of health disparities in Mexico. Additionally, lifestyle and preventive behaviour could also be drivers of health inequality patterns. In particular, an obesity epidemic has evolved in Mexico over the period of the SP implementation (e.g. Colchero and Sosa-Rubí 2012).

In sum, while further analysis on the potential drivers of health inequalities is needed, the Mexican experience suggests that insurance coverage can improve health levels but may be not enough to reduce health disparities and promote health mobility.

7. Conclusions

7.1 Summary of the Findings

The objective of this thesis has been to analyse health, financial and distributional aspects of an ambitious health insurance expansion that took place in Mexico during the past decade. These aspects are relevant to evaluate health systems in general and policy interventions such as the SP in particular (World Health Organization 2000), and can encompass lessons for similar proposals elsewhere. More specifically, this thesis has focused on three research questions summarised below.

First, I analysed whether the SP reduced infant and neonatal mortality. Most infant death causes such as pneumonia, measles, HIV/AIDS, and other conditions leading to neonatal deaths are preventable through further access to health care, which allows the dissemination of essential information and provides early identification and treatment of such conditions. Therefore, IMR and NMR are important indicators of the effectiveness of health services in the context of an insurance expansion. Theoretically, one can expect positive effects of the SP as the interventions included in the benefit package address the main causes of morbidity and mortality among infants. However, one can also think of factors that could reduce the potential effect of the programme such as insufficient quality and/or quantity of health care, ex-ante moral hazard that could reduce preventive behaviours, or a relatively more important role of behavioural and environmental features. Indeed, conflicting evidence from previous studies that analysed other insurance expansions suggest that increased coverage does not necessarily result in health improvements. Hence, evidence from the insurance expansion can shed some light into the question.

More specifically, the findings of Chapter 4 of this thesis indicate that the SP led to a 3.9 per cent reduction in both IMR and NMR. Nonetheless, this effect was concentrated in urban, more populated, and less marginalised municipalities. As this type of municipalities have been traditionally better equipped and were thus better prepared to offer all the interventions from the benefit package, a plausible explanation is that persistent disparities in health care access might have influenced the effects of the programme. Indeed, although the SP encompassed some additional investment, it did not make up for the extensive infrastructural shortages across the Mexican territory. Hence, the effects of the programme tend to concentrate in areas where such infrastructure is in place. These results indicate that insurance expansion alone does not suffice to improve health; it needs to be accompanied with basic investments and more generally a reduction in barriers to access to health inputs.

Second, I analysed whether public health insurance modified the capacity of Mexican households to smooth consumption after severe health shocks. That is, I attempted to identify the contribution of public health insurance in the form of social security and, more recently, the Seguro Popular programme. The evidence on the welfare consequences of health shocks for LMIC is scarce. The first studies on the question conducted in the 1990s suggested that households were indeed able to maintain their consumption levels in the occurrence of unexpected health events, but more recent studies found that households could not avert large consumption drops. In principle, the implementation of the SP was expected to exert a protective effect on financial wellbeing in the event of health shocks, as previous studies had found that the programme reduced medical expenditures. But health shocks may also reduce the household’s ability to generate income and the SP does not provide coverage for that non-health specific risk. Chapter 5 shows that unexpected health events such as accidents and the deterioration in physical capacity are associated with large declines in non-medical consumption. Social security seems to provide protection against both types of shocks, but the endogeneity-corrected estimates indicate that the SP only protects consumption against one specific type of shock: accidents. Therefore, income losses associated with disability shocks, for which the programme does not offer protection, are likely larger than medical care expenditures. Consistent with this finding, we observed that reduced ability to perform ADLs among more important income earners lead to larger consumption drops. These results are indicative of the limited consumption smoothing effects of public health insurance programmes, since alternative risks that remain uninsured will likely continue exerting effects on consumption.

Finally, given that health insurance expansions can influence access to health care, it is important to understand the effects beyond overall health outcomes, and more specifically, to focus on the distribution of such outcomes across the population. Hence, I analysed whether the patterns of health inequality and mobility changed over the period in which the SP coverage was progressively extended. As mentioned above, the effect of insurance coverage on health outcomes is debated, but the effect on perceived health status is clearer according to recent evidence (Finkelstein et al. 2012). In particular, a previous study found that the SP increased the probability of reporting good health by 6 per cent (Teruel et al. 2012). Little is known about the potential effect on the distribution of health, however. On the other hand, the analysis of health inequality has largely focused on income-related health inequalities, which raises some conceptual and methodological concerns. Chapter 6 addressed these concerns by using two recently developed indices to analyse pure health inequality and mobility in Mexico. The results indicate that health inequality increased during the past decade, although the change is only statistically significant if an upward-looking definition of status is adopted. At the same time, no changes in mobility in health were observed. Hence, these results are suggestive of the limited effects that health insurance expansions have on reducing health disparities. Indeed, health inequality and mobility likely depend on a myriad of factors beyond health care such as lifestyle, government effectiveness, and absence of violence, among many others. Specifically, Mexico has been subject to an obesity epidemic in the period (e.g. Colchero and Sosa-Rubí 2012), which has affected more deprived population groups that might have benefited from the SP. Additionally, different indicators of governance that could also be key determinants of health disparities present important reductions over the period of the SP expansion (Kaufmann et al. 2010). Consequently, alternative underlying factors might be driving health inequality patterns instead.

7.2 Limitations and Further Research

The results of this thesis are not without important limitations. Below I highlight those that I consider more salient and suggest some directions to extend our understanding of the effects of the Mexican insurance expansion.

The main limitation of the infant mortality analysis is that similar data were not available to further explore the specific channels through which the SP contributed to the reduction of infant deaths in Mexico. Hospital registries cover a limited number of municipalities, but information on other levels of attention could be probably useful if made available. Also, since child health is related to later life outcomes (Currie and Cole 1993, Behrman and Rosenzweig 2004), it would be interesting to explore the impact of the SP on long-term health.

The second analysis showed that the SP seems to be protecting households against the risk of catastrophic health expenditures in the event of health shocks. However, the results also suggested that the protection provided by the SP is incomplete, especially in cases were households' ability to generate income is significantly affected. Future studies should investigate in more detail the consequences of different health shocks to shed light on the relative importance of the associated risks. Further analysis on the social security component that protects against the risk of income losses could also be relevant to inform about the welfare gains of such insurance.

The third analysis showed that the implementation of the SP was not associated with reductions in health inequality, neither with improvements in health mobility. This does not imply, however, that the SP had no effect on the distribution of health, but rather that factors outside the health system may have played a more important role as previous studies suggest (Wang and Yu 2016, Costa and Cowell 2016). Unfortunately, the longitudinal survey employed in the analysis was not suitable to further analyse the contribution of institutional, socioeconomic, and other factors to the shape of the health distribution; future studies should certainly move in this direction.

Finally, while the results of this thesis together with previous findings suggest that the SP has improved financial protection and overall levels of health, other studies have raised concerns about its effects on the labour market (Knaul et al.

2012). Although most studies had found small or not significant effects of the SP on formal employment (e.g., Azuara and Marinescu 2013, Campos and Knox 2013), Bosch and Campos (2014) more recently showed that between 4 to 5 per cent additional formal positions would have been created in the absence of the programme. Future studies should therefore evaluate the welfare effects of the programme as a whole.

7.3 Policy Implications and Recommendations

The IMR is an important indicator of social development, as it reflects the availability, access, and utilisation of health services. Indeed, one of the eight Millennium Development Goals (MDGs) agreed in 2000 was the reduction of child deaths, most of which occur during the first year of life. The Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development adopted in 2015, also include the reduction of preventable deaths of newborns and children under five years. During the 1990s, the IMR in Mexico already exhibited a downward trend associated to the implementation of highly cost-effective interventions for the general population —such as massive vaccination campaigns—, and some targeted interventions —such as the health component of the PROSPERA programme. It was not clear, however, whether this trend could be sustained without further improvements in health access.

Between 2000 and 2011, the IMR fell from 15.4 to 12.7 infant deaths per 1,000 live births. Similarly, the NMR fell from 9.4 to 8.0 neonatal deaths per 1,000 live births. Chapter 4 indicates that this reduction was at least in part associated to the implementation of the SP. As more countries are in the quest for universal coverage and interventions to fulfil the infant mortality target of the SDGs are being implemented, the SP experience can be enlightening, in particular for countries in similar stages of the epidemiological transition. Nonetheless, the observed heterogeneity in the effects deserves special attention. This is not the first analysis that suggests that the SP effects have been stronger in areas with better supply of health professionals and infrastructure. Bleich et al. (2007) and Grogger et al. (2015) also reach a similar conclusion when analysing the effect of the SP on blood control and catastrophic spending, respectively. Therefore, the Mexican government should focus on the reduction of persistent gaps in health supply across the country and between health care providers.

While Chapter 5 shows that the SP has protected households against the risk of impoverishing medical expenditures, it also shows that unexpected health events entail other risks for which only social security beneficiaries are protected. Moreover, it shows that an important share of the population was still uninsured at the beginning of this decade. This situation reveals a deep problem: marked difference in access to social protection persist. At the beginning of the current administration, large debates on the reforms that the country required took place. One of these debates involved the necessity to reform the system for social protection to establish a minimum level of wellbeing for the entire population (Chávez et al. 2012). This included guaranteeing a minimum income, health insurance, life and disability insurance, and a minimum pension. The convergence of all public health care providers was an important component too. The fiscal reform that was also envisioned would provide the resources to fulfil that objective. But almost six years later only a mild fiscal reform was approved, and the system for social protection has been practically unaltered. To overcome institutional fragmentation, persistent differences in the quality of services and coverage, duplication of programmes, among other problems, but especially to guarantee access to social protection as a civil right independent of work status, the Mexican government should focus on this long-postponed reform of the system for social protection.

Lastly, Chapter 6 shows that overall improvements in health measured as individual's perceived health (or IMR as in Chapter 4) do not necessarily imply improvements in the distribution of health. Further studies to understand the causes of health disparities are certainly required, but if policy makers are indeed interested in the distribution rather than just overall levels of health, a first step is to start monitoring health inequality using measures such as those introduced in this thesis. While international organisations such as the WHO and the OECD normally include Mexico in their endeavour to monitor inequality in health (e.g World Health Organization 2000; Organisation for Economic Co-operation and Development 2014b, 2015), there is no clear initiative at the local level. For example, the National Council for the Evaluation of Social Development Policy (*Consejo Nacional de Evaluación de la Política de Desarrollo Social*, CONEVAL) —the institution in charge of poverty measurement and other activities oriented towards the achievement of social development objectives—, currently estimates some inequality indicators, but these only include the Gini coefficient and two inter-decile ratios to measure income disparities. Furthermore, there is limited coordination between public health and health care system initiatives, which can explain why measures of health equity do not show major shifts since the introduction of the SP.

References

Adams, P., Hurd, M.D., McFadden, D., Merrill, A. and Ribeiro, T. (2003) "Healthy, wealthy and wise? Tests for direct causal paths between health and socioeconomic status" *Journal of Econometrics,* 112:3-56.

Alam, K. and Mahal A. "Economic impacts of health shocks on households in low and middle income countries: a review of the literature" *Globalization and Health,* 10:21.

Arrow, K.J. and Debreu, G. (1954) "Existence of an equilibrium for a competitive economy" *Econometrica,* 22: 265-290.

Avendano, M. (2012) "Correlation or causation? Income inequality and infant mortality in fixed effects models in the period 1960-2008 in 34 OECD countries" *Social Science & Medicin*e, 75:754-760.

Azuara, O. and Marinescu, I. (2013) "Informality and the expansion of social protection programs: evidence from Mexico" *Journal of Health Economics,* 32:938-950.

Baeten, S., Van Ourti, T. and van Doorslaer, E. (2013) "Rising inequalities in income and health in China: who is left behind?" *Journal of Health Economics,* 32:1214-1229.

Baeza, C.C. and Packard, T.G. (2006) *Beyond Survival: Protecting Households from Health Shocks in Latin America*. Washington, DC: The World Bank.

Baicker, K., Taubman, S., Allen, H., Bernstein, M., Gruber, J., Newhouse, J.P., Schneider, E., Wright, B., Zaslavsky, A., Finkelstein, A and Oregon Health Study Group (2013) "The Oregon Experiment — Effects of Medicaid on Clinical Outcomes" *New England Journal of Medicine,* 368(18):1713-1722.

Baily, M.N. (1978) "Some Aspects of Optimal Unemployment Insurance" *Journal of Public Economics*, 10:379-402.

Barham, T. (2011) "A healthier start: The effect of conditional cash transfers on neonatal and infant mortality in rural Mexico" *Journal of Development Economics*, 94:74-85.

Barraza-Lloréns, M., Papopoulou, G. and Díaz, B.Y. (2013) "Income-related inequalities and inequities in health and health care utilization in Mexico, 2000-2006" *Revista Panamericana de Salud Publica*, 33(2):122-130.

Barros, R. (2008) "Wealthier But Not Much Healthier: Effects of a Health Insurance Program for the Poor in Mexico" *Department of Economics Working Paper*, 09-002. Stanford, CA: Stanford University.

Behrman J.R. and Rosenzweig M.R. (2004) "Returns to Birthweight" *The Review of Economics and Statistics*, 86(2):586-601.

Bleich, S.N., Cutler, D.M., Adams, A.S., Lozano, R. and Murray, C.J.L. (2007) "Impact of insurance and supply of health professionals on coverage of treatment for hypertension in Mexico: population based study" *BMJ*, 335:875.

Bosch, M., Cobacho, M.B. and Pages, C. (2012) "Taking Stock of Nine Years of Implementation of Seguro Popular in Mexico. Lessons for Developing Countries" *Inter-American Development Bank Technical Notes*, IDB-TN-442. Washington, DC: Inter-American Development Bank.

Bosch, M. and Campos-Vázquez, R.M. (2014) "The Trade-Offs of Welfare Policies in Labor Markets with Informal Jobs: The Case of the "Seguro Popular" Program in Mexico" *American Economic Journal: Economic Policy*, 6(4):71-99.

Braine, T. (2006) “Mexico’s quest for a complete mortality data set” *Bulletin of the World Health Organization*, 84(3):161-256.

Bronchetti, E.T. (2012) “Workers’ compensation and consumption smoothing” *Journal of Public Economics*, 96(5):495-508.

Brook, R.H., Ware, J.E., Rogers, W.H., Keeler, E.B., Davies, A.R., Donald, C.A., Goldberg, G.A., Lohr, K.N., Masthay, P.C. and Newhouse, J.P. (1983) “Does free care improve adults’ health?” *New England Journal of Medicine*, 309(23):1426-1434.

Bryce, J., Victora, C.G. and Black, R.E. (2013) “The unfinished agenda in child survival” *The Lancet*, 382:1049-59.

Burström, B. and Fredlund, P. (2001) “Self rated health: Is it as good a predictor of subsequent mortality among adults in lower as well as in higher social classes?” *Journal of Epidemiology and Community Health*, 55:836-840.

Camacho, A. and Conover, E. (2013) “Effects of subsidized health insurance on newborn health in a developing country” *Economic Development and Cultural Change*, 61(3):633-658.

Cameron A.C. and Trivedi P.K. (2009) *Microeconometrics Using Stata*. Texas: Stata Press.

Campos-Vázquez, R.M. and Knox, M.A. (2013) “Social Protection Programs and Employment. The Case of Mexico’s Seguro Popular Program” *Economía Mexicana*, 22(2):403-448.

Cercone, J., Pinder, E., Pacheco Jimenez, J. and Briceno, R. (2010) “Impact of Health Insurance on Access, Use, and Health Status in Costa Rica” in Escobar, M.L., Griffin, C.C. and Shaw, R.P., eds. *The Impact of Health Insurance in Low- and Middle-Income Countries*. Washington DC:

Brookings Institution Press.

Chávez Presa, J.A., Hernández Trillo, F. and López Calva, L.F. (2012) *El México del 2012. Reformas a la Hacienda Pública y al Sistema de Protección Social*. Mexico City: Centro de Estudios Espinosa Yglesias.

Chetty, R. and Looney A. (2006) "Consumption Smoothing and the Welfare Consequences of Social Insurance in Developing Economies" *Journal of Public Economics*, 90:2351-2356.

Chetty, R. and Finkelstein, A. (2013) "Social Insurance: Connecting Theory to Data", in Auerbach, A.J., Chetty, R., Feldstein, M. and Saez, E. eds. *Handbook of Public Economics, vol. 5*. Amsterdam: Elsevier.

Chiapa, C. (2008) "Insurance and Health Effects of PROGRESA in Rural Mexico" *PhD thesis*. Boston, MA: Boston University.

Cochrane, J.H. (1991) "A Simple Test of Consumption Insurance" *Journal of Political Economy*, 99(5):957-976.

Colchero, M.A. and Sosa-Rubí, S.G. (2012) "Heterogeneity of income and lifestyle determinants of body weight among adult women in Mexico, 2006" *Social Science & Medicine*, 75:120-128.

Comisión Nacional de Protección Social en Salud (2005) *Informe de resultados 2004*. Mexico City: Comisión Nacional de Protección Social en Salud (CNPSS), Ministry of Health.

Comisión Nacional de Protección Social en Salud (2008) *Informe de resultados 2007*. Mexico City: Comisión Nacional de Protección Social en Salud (CNPSS), Ministry of Health.

Comisión Nacional de Protección Social en Salud (2009) *Informe de resultados 2008*. Mexico City: Comisión Nacional de Protección Social en Salud

(CNPSS), Ministry of Health.

Comisión Nacional de Protección Social en Salud (2012) *Catálogo universal de servicios de salud CAUSES 2012*. Mexico City: Comisión Nacional de Protección Social en Salud (CNPSS), Ministry of Health.

Comisión Nacional de Protección Social en Salud (2014) *Informe de resultados 2013*. Mexico City: Comisión Nacional de Protección Social en Salud (CNPSS), Ministry of Health.

Comisión Nacional de Protección Social en Salud (2015) *Informe de resultados 2014*. Mexico City: Comisión Nacional de Protección Social en Salud (CNPSS), Ministry of Health.

Comisión Nacional de Protección Social en Salud (2016) *Informe de resultados 2015*. Mexico City: Comisión Nacional de Protección Social en Salud (CNPSS), Ministry of Health.

Commission on Social Determinants of Health (2008) *Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health*. Geneva: World Health Organization (WHO).

Consejo Nacional de Evaluación de la Política de Desarrollo Social (2013) *Uso de una Encuesta Panel Para Evaluaciones de Impacto: Ensayo Metodológico con la ENNVIH*. México City: Consejo Nacional de Evaluación de la Política de Desarrollo Social (CONEVAL).

Consejo Nacional de Población (1994) *Desigualdad regional y marginación municipal en México, 1990*. Mexico City: Consejo Nacional de Población.

Consejo Nacional de Población (2001) *Índice de marginación, 2000*. Mexico City: Consejo Nacional de Población (CONAPO).

Consejo Nacional de Población (2006) *Índice de marginación, 2005*. Mexico City: Consejo Nacional de Población (CONAPO).

Consejo Nacional de Población (2011) *Índice de marginación por entidad federativa y municipio 2010.* Mexico City: Consejo Nacional de Población (CONAPO).

Consejo Nacional de Población (2012) *Documento metodológico: Proyecciones de la población de México 2010-2050*. Mexico City: Consejo Nacional de Población (CONAPO).

Contoyannis, P. and Jones, A. (2004) "Socio-economic status, health and lifestyle" *Journal of Health Economics,* 23(5):965-95.

Contoyannis, P., Jones, A.M. and Rice, N. (2004) "The dynamics of health in the British Household Panel Survey" *Journal of Applied Econometrics,* 19:473-503.

Cook, B., McGuire, T., Lock, K. and Zaslavsky, A. (2010) "Comparing methods of racial and ethnic disparities measurement across different settings of mental health care" *Health Services Research*, 45(3):825-847.

Corak, M. and Piraino, P. (2010) "Intergenerational Earnings Mobility and the Inheritance of Employers" *IZA Discussion Paper*, 4876. Bonn: IZA—Institute of Labor Economics.

Costa-Font, J. and Cowell, F.A. (2016) "Inequalities: Does Status Matter?" *LSE International Inequalities Institute Working Paper*, 6. London: London School of Economics and Political Science.

Costa-Font, J. and Hernández-Quevedo, C. (2013) "Inequalities in self-reported health: a meta-regression analysis" *LSE Health working paper series in health policy and economics*, 32/2013. London: London School of Economics and Political Science.

Cowell, F.A. (1980) "On the structure of additive inequality measures" *Review of Economic Studies,* 47:521-531.

Cowell, F.A. and Flaichaire, E. (2017) "Inequality with ordinal data" *Economica*, 84, 290-321.

Cowell, F.A. and Flaichaire, E. (2016) "Measuring Mobility" *Public Economics Programme Discussion Paper*, 9. London: London School of Economics and Political Science.

Currie, J. and Cole, N. (1993) "Welfare and child health: The link between AFDC participation and birth weight" *The American Economic Review*, 971-985.

Currie, J. and Thomas, D. (1995) "Medical Care for Children: Public Insurance, Private Insurance and Racial Differences in Utilization" *The Journal of Human Resources,* 30(1):135-62.

Currie, J. and Gruber, J. (1996) "Health insurance eligibility, utilization of medical care, and child health" *Quarterly Journal of Economics,* 111:431-466.

Cutler, D.M. and Zeckhauser, R.J. (2000) "The anatomy of health insurance" in Culyer, A.J. and Newhouse, J.P. (eds.) *Handbook of Health Economics, volume 1*. Amsterdam: Elsevier.

Davidson, R., and MacKinnon, J.G. (2004) *Econometric Theory and Methods*. New York: Oxford University Press.

Deaton, A.S. and Paxson, C.H. (1998) "Ageing and inequality in income and health" *American Economic Review, Papers and Proceedings,* 88:248-253.

De Allegri, M., Ridde, V., Louis, V.R., Sarker, M., Tiendrebéogo, J., Yé, M., Müller, O. And Jahn, A. (2012) "The impact of targeted subsidies for facility-based delivery on access to care and equity — evidence from a population-based study in rural Burkina Faso" *Journal of Public Health Policy*, 33(4):439-453.

Dow, W.H. and Schmeer, K.K. (2003) “Health insurance and child mortality in Costa Rica” *Social Science & Medicine*, 57:975-986.

Dubay, L., Joyce, T., Kaestner, R. and Kenney, G. (2001) “Changes in prenatal care timing and low birth weight by race and socioeconomic status: Implications for the Medicaid expansions for pregnant women” *Health Services Research,* 36(2):373-398.

Dzakpasu, S., Powell-Jackson, T. and Campbell, O.M. (2014) “Impact of user fees on maternal health service utilization and related health outcomes: a systematic review” *Health Policy and Planning,* 29(2):137-150.

Erreygers, G. and Van Ourti, T. (2010) “Measuring socioeconomic inequality in health, health care and health financing by means of rank-dependent indices: A recipe for good practice” *Tinbergen Institute, Discussion Paper,* TI 2010-076/3. Amsterdam: Tinbergen Institute.

Esquivel, G., Lustig, N. and Scott, J. (2010) “Mexico: A Decade of Falling Inequality: Market Forces or State Action?” in López, L.F. and Lustig, N., eds. *Declining Inequality in Latin America: A Decade of Progress?* Washington, DC: Brookings Institution Press; New York: United Nations Development Programme.

Esquivel, G. (2015) *Desigualdad extrema en México. Concentración del poder económico y político*. Mexico City: OXFAM México.

Eternod, M. (2012) “Metodología para calcular la razón de mortalidad materna: un mejor registro y un indicador deficiente” *Reality, Data and Space. International Journal of Statistics and Geography,* 3(1):24-69.

Ferrie, J.P. (2005) "History Lessons: The End of American Exceptionalism? Mobility in the United States Since 1850" *The Journal of Economic Perspectives*, 19(3):199-215.

Finkelstein, A., Taubman, S., Wright, B., Bernstein, M., Gruber, J., Newhouse, J.P., Allen, H., Baicker, K. and Oregon Health Study Group (2012) "The Oregon Health Insurance Experiment: Evidence from the First Year" *Quarterly Journal of Economics*, 127(3):1057-1106.

Fleurbaey, M. and Schokkaert, E. (2011) "Equity in Health and Health Care" in Pauly, M.V., McGuire, T.G. and Barros, P.P., eds. *Handbook of Health Economics, Volume 2.* Amsterdam: North Holland.

Frenk, J., González-Pier, E., Gómez-Dantés, O., Lezana, M.A. and Knaul, F.M. (2006) "Comprehensive reform to improve health system performance in Mexico" *The Lancet*, 368:1524-1534.

Frick, J.R. and Grabka, M.M. (2005) "Item nonresponse on income questions in panel surveys: Incidence, imputation and the impact on inequality and mobility" *Allgemeines Statistisches Archiv*, 89:49-61.

Gakidou, E., Murray, C. and Frenk, J. (2000) "Defining and measuring health inequality" *Bulletin of the World Health Organization*, 78(1):42-52.

Gakidou, E., Lozano, R., González-Pier, E., Abbott-Klafter, J., Barofsky, J.T., Bryson-Cahn, C., Feehan, D.M., Lee, D.K., Hernández-Llamas, H. and Murray, C.J.L. (2006) "Assessing the effect of the 2001-06 Mexican health reform: an interim report card" *The Lancet*, 368:1920-1935.

Gertler, P. and Gruber J. (2002) "Insuring Consumption Against Illness" *American Economic Review*, 92(1):51-70.

Gertler, P., Levine, D.I. and Moretti E. (2009) "Do Microfinance Programs Help Families Insure Consumption Against Illness?" *Health Economics*, 18:257-273.

Giedion, U. and Díaz, B.Y. (2010) "A review of the evidence" in Escobar, M.L., Griffin, C.C. and Shaw, R.P., eds. *The Impact of Health Insurance in Low- and Middle-Income Countries*. Washington DC: Brookings Institution Press.

Giedion, U., Flórez, C.E., Díaz, B.Y., Alfonso, E., Pardo, R. and Villar, M. (2010) "Colombia's Big Bang Health Insurance Reform" in Escobar, M.L., Griffin, C.C. and Shaw, R.P., eds. *The Impact of Health Insurance in Low- and Middle-Income Countries*. Washington DC: Brookings Institution Press.

Giedion, U., Alfonso, E. and Díaz, B.Y. (2013) *The Impact of Universal Coverage Schemes in the Developing World: A Review of the Existing Evidence*. Washington DC: The World Bank.

González Cervera, A.S. and Cárdenas, R. (2005) "Una aproximación a la medición del subregistro de nacimientos en las estadísticas vitales de México" *Estudios Demográficos y Urbanos*, 20(3):619-625.

González-Pier, E., Gutiérrez-Delgado, C., Stevens, G., Barraza-Lloréns, M., Porras-Condey, R., Carvalho, N., Lonich, K., Dias, R.H., Kulkarni, S., Casey, A., Murakami, Y., Ezzati, M. and Salomon, J.A. (2006) "Priority setting for health interventions in Mexico's System of Social Protection in Health" *The Lancet*, 368:1608-1618.

Grogger, J., Arnold, T., León, A.S. and Ome, A. (2015) "Heterogeneity in the effect of public health insurance on catastrophic out-of-pocket health expenditures: the case of Mexico" *Health Policy and Planning*, 30:593-599.

Groot, W. (2000) "Adaptation and scale of reference bias in self-assessments of quality of life" *Journal of Health Economics*, 19(3):403-420.

Gruber, J. (1997) "The Consumption Smoothing Benefits of Unemployment Insurance" *The American Economic Review*, 87(1):192-205.

Gruber, J. (2003) "Medicaid" in Moffitt, R.A., ed. *Means-Tested Transfer Programs in the United States*. Chicago: University of Chicago Press.

Gruber, J., Hendren, N. and Townsend, R.M. (2014) "The Great Equalizer: Health Care Access and Infant Mortality in Thailand" *American Economic Journal: Applied Economics*, 6(1):91-107.

Gutiérrez, J.P., Rivera-Dommarco, J., Shamah-Levy, T., Villalpando-Hernández, S., Franco, A., Cuevas-Nasu, L., Romero-Martínez, M. and Hernández-Ávila, M. (2012) *Encuesta Nacional de Salud y Nutrición 2012. Resultados Nacionales*. Cuernavaca, Mexico: Instituto Nacional de Salud Pública.

Hammitt, J.K. and Robinson, L.A. (2011) "The Income Elasticity of the Value per Statistical Life: Transferring Estimates between High and Low Income Populations" *Journal of Benefit-Cost Analysis*, 2(1):1-29.

Härkänen, T., Karvanen, J., Tolonen, H., Lehtonen, R., Djerf, K., Juntunen, T. and Koskinen, S. (2016) "Systematic handling of missing data in complex study designs—experiences from the Health 2000 and 2011 Surveys" *Journal of Applied Statistics*, 43(15):2772-2790.

Hauck, K. and Rice, N. (2004) "A longitudinal analysis of mental health mobility in Britain" *Health Economics*, 13:981-1001.

Haupt, A., Kane, T. and Haub, C. (2011) *Population Reference Bureau's Population Handbook.* Washington DC: Population Reference Bureau.

Horton, R. (2006) "Mexican health reforms: global lessons, local solutions" *The*

Lancet, 368:1480.

Instituto Nacional de Salud Pública (2005) "No nos puede pasar que, esperando las 100 intervenciones del Seguro Popular, se deterioren las 13 intervenciones del Paquete Básico de Oportunidades" in Gómez Dantés, O., ed. *Seguro Popular de Salud. Siete Perspectivas*. Cuernavaca, Mexico: Instituto Nacional de salud Pública (INSP).

Instituto Nacional de Estadística y Geografía (2013) *Los Objetivos de Desarrollo del Milenio en México. Informe de avances 2013*. Aguascalientes, Mexico: Instituto Nacional de Estadística y Geografía (INEGI).

Jones, G., Steketee, R.W., Black, R.E., Bhutta, Z.A., Morris, S.S. and The Bellagio Child Survival Study Group (2003) "How many child deaths can we prevent this year?" *The Lancet*, 362:65-71.

Kaufmann, D., Krayy, A. and Mastruzzi, M. (2010) *The Worldwide Governance Indicators: Methodology and Analytical Issues*. Retrieved from: www.govindicators.org.

King, G., Gakidou, E., Imai, K., Lakin, J., Moore, R.T., Nall, C., Ravishankar, N., Vargas, M., Téllez-Rojo, M.M., Hernández-Ávila, J.E., Hernández-Ávila, M. and Hernández Llamas, H. (2009) "Public policy for the poor? A randomised assessment of the Mexican universal health insurance programme" *The Lancet*, 373:1447-1454.

King, M., Smith, A. and Gracey, M. (2009) "Indigenous health part 2: the underlying causes of the health gap" *The Lancet*, 374:76-85.

Knaul, F.M., Arreola-Ornelas, H., Méndez-Carniado, O., Bryson-Cahn, C., Barofsky, J., Maguire, R., Miranda, M. and Sesma, S. (2006) "Evidence is good for your health system: policy reform to remedy catastrophic and impoverishing health spending in Mexico” *The Lancet*, 368:1828-41.

Knaul, F., González-Pier, E., Gómez-Danés, O., García-Junco, D., Arreola-Ornelas, H., Barraza-Lloréns, M., Sandoval, R., Caballero, F., Hernández-Ávila, M., Juan, M., Kershenobich, D., Nigenda, G., Ruelas, E., Sepúlveda, J., Tapia, R., Soberón, G., Chertorivski, S. and Frenk, J. (2012) “The quest for universal health coverage: achieving social protection for all in Mexico” *The Lancet*, 380:1259-1279.

Jenkins, S.P. (2006) “Estimation and interpretation of measures of inequality, poverty, and social welfare using Stata” *North American Stata Users' Group Meetings*, Boston, MA. Retrieved from: http://econpapers.repec.org/paper/bocasug06/16.

Jenkins, S.P. (2009) “Marital Splits and Income Changes over the Longer Term” in Brynin, M. and Ermisch, J.F., eds. *Changing Relationships.* London: Routledge.

Jenkins, S.P. (2011) *Changing Fortunes: Income Mobility and Poverty Dynamics in Britain.* Oxford: Oxford University Press.

Jones, A.M. and López Nicolás, A. (2004) “Measurement and explanation of socioeconomic inequality in health with longitudinal data” *Health Economics*,13:1015-1030.

Jones, A.M., Koolman, X. and Rice, N. (2006) “Health-Related Non-Response in the British Household Panel Survey and European Community Household Panel: Using Inverse-Probability Weighted Estimators in Non-Linear Models” *Journal of the Royal Statistical Society, Series A*, 169:543-569.

Lakin, J.M. (2010) “The End of Insurance? Mexico’s Seguro Popular, 2001-2007” *Journal of Health Politics, Policy and Law*, 35(3):313-352.

Lagarde, M. and Palmer, N. (2011) "The impact of user fees on access to health services in low- and middle-income countries" Cochrane Database of Systematic Reviews, 4:1-70.

Le, C.T. and Eberly, L.E. (2016) *Introductory Biostatistics*. New Jersey: John Wiley & Sons, Inc.

Levy, H. (2002) "The economic consequences of being uninsured" *ERIU Working Paper,* 12. Ann Arbor, MI: Economic Research Initiative on the Uninsured (ERIU), University of Michigan.

Levy, H. and Meltzer, D. (2008) "The impact of health insurance on health" *Annual Review of Public Health,* 29:399-409.

Lindeboom, M. and van Doorslaer, E. (2004) "Cut-point shift and index shift in self-reported health" *Journal of Health Economics,* 23(6):1083-1099.

Lindelow, M. and Wagstaff, A. (2005) "Health Shocks in China: Are the Poor and Uninsured Less Protected?" *World Bank Policy Research Working Paper*, 3740. Washington, DC: The World Bank.

Lozano, R., Soliz, P., Gakidou, E., Abbott-Klafter, J., Feehan, D.M., Vidal, C., Ortiz, J.P. and Murray, C.J.L. (2006) "Benchmarking of performance of Mexican states with effective coverage" *The Lancet*, 368:1729-1741.

Lozano-Ascencio, R. (2008) "¿Es posible seguir mejorando los registros de las defunciones en México?" *Gaceta Medica de Mexico,* 144(6):525-533.

Lynn, P. (2006) *Quality Profile: British Household Panel Survey Version 2.0: Waves 1 to 13: 1991-2003*. Colchester: Institute for Social and Economic Research, University of Essex.

Macinko, J., Starfield, B. and Shi, L. (2003) "The Contribution of Primary Care Systems to Health Outcomes within Organization for Economic Cooperation and Development (OECD) Countries, 1970-1998" *Health Services Research*, 38(3):831-865.

Mathers, C.D., Fat, D.M., Inoue, M., Rao, C. and Lopez, A. (2005) "Counting the dead and what they died from: an assessment of the global status of cause of death data" *Bulletin of the World Health Organization*, 83(3):171-177.

Meer, J. and Rosen, H.S. (2004) "Insurance and the utilization of medical services" *Social Science & Medicine,* 58:1623-1632.

Mohanan, M. (2011) "Causal Effects of Health Shocks on Consumption and Debt: Quasi-Experimental Evidence from Bus Accident Injuries" *Review of Economics and Statistics*, 95(2):673-681.

Murray, C.J.L., Tandon, A., Salomon, J. and Mathers, C.D. (2001) "Enhancing cross-population comparability of survey results" *GPE Discussion Paper,* 35. Geneva: WHO/EIP.

Newhouse, J.P. (1993) *Free for all?: lessons from the Rand Health Insurance Experiment*. Cambridge, MA: Harvard University Press.

Nolte, E., Wait, S. and McKee, M. (2006) *Investing in health: benchmarking health systems*. London: Nuffield Trust.

Nyman, J.A. (1999) "The value of health insurance: the access motive" *Journal of Health Economics,* 18:141-152.

Nyman, J.A. (2001) "The income transfer effect, the access value of insurance and the Rand health insurance experiment" *Journal of Health Economics*, 20:295-298.

O'Donnell, O., van Doorslaer, E., Wagstaff, A. and Lindelow, M. (2008) *Analyzing health equity using household survey data*. Washington, DC: The World Bank.

Organisation for Economic Co-operation and Development (2005) *OECD Reviews of Health Systems. Mexico*. Paris: Organisation for Economic Co-operation and Development (OECD).

Organisation for Economic Co-operation and Development (2014a) *Focus on Inequality and Growth*. Paris: Organisation for Economic Co-operation and Development (OECD).

Organisation for Economic Co-operation and Development (2014b) *All on Board.Making Inclusive Growth Happen*. Paris: Organisation for Economic Co-operation and Development (OECD).

Organisation for Economic Co-operation and Development (2015) *Pensions at a Glance 2015: OECD and G20 indicators*. Paris: Organisation for Economic Co-operation and Development (OECD).

Organisation for Economic Co-operation and Development (2015) *Health at a Glance 2015: OECD Indicators*. Paris: Organisation for Economic Co-operation and Development (OECD).

Parker, S. and Rubalcava, L.N. (2011) “Identificación y análisis de los efectos en las condiciones de salud de los afiliados al Seguro Popular” *CIDE working paper*. Mexico City: Centro de Investigación y Docencia Económicas (CIDE).

Pfutze, T. (2015) “The Effects of Mexico’s Seguro Popular Health Insurance on Infant Mortality: An Estimation with Selection on the Outcome Variable” *World Development*, 59:475-486.

Presidencia de la República (2013) *Primer Informe de Gobierno 2012-2013*. Mexico City: Presidencia de la República.

Presidencia de la República (2015) *Tercer Informe de Gobierno 2014-2015*. Mexico

City: Presidencia de la República.

Rivera, J.A., Sotres-Alvarez, D., Habicht, J.P., Shamah, T. and Villalpando, S. (2004) "Impact of the Mexican program for education, health, and nutrition (Progresa) on rates of growth and anemia in infants and Young children: a randomized effectiveness study" *JAMA*, 291:2563-2570.

Rubalcava, L. and Teruel, G. (2006) "Encuesta Nacional Sobre Niveles de Vida de los Hogares, Primera Ronda" *Universidad Iberoamericana Working Paper*. Mexico City: Universidad Iberoamericana.

Rubalcava, L. and Teruel, G. (2008) "Encuesta Nacional sobre Niveles de Vida de los Hogares, Segunda Ronda" *Universidad Iberoamericana Working Paper*. Mexico City: Universidad Iberoamericana.

Rubalcava, L. and Teruel, G. (2013) "Encuesta Nacional sobre Niveles de Vida de los Hogares, Tercer Ronda" *Universidad Iberoamericana Working Paper*. Mexico City: Universidad Iberoamericana.

Rubin, D.B. (1987) *Multiple Imputation for Non-Response in Surveys*. New York: John Wiley and Sons.

Sadana, R., Mathers, C.D., Lopez, A.D., Murray, C.J.L. and Iburg, K. (2000) "Comparative analysis of more than 50 household surveys on health status" *GPE Discussion Paper*, 15. Geneva: EIP/GPE/EBD.

Sáenz de Miera Juárez, B. (2017). "The role of public health insurance in protecting against the costs of ill health" *WIDER Working Paper*, 2017/3. Helsinki: United Nation University.

Salas, C. (2002) "On the empirical association between poor health and low socioeconomic status at old age" *Health Economics*, 11:207-220.

Sartorius, B.K.D. and Sartorius, K. (2014) “Global infant mortality trends and attributable determinants — an ecological study using data from 192 countries for the period 1990-2011” *Population Health Metrics*, 12:29.

Schafer, J.L. (1999) “Multiple imputation: a primer” *Statistical Methods in Medical Research*, 8:3-15.

Secretaría de Salud (2002) “Acuerdo por el que la Secretaría de Salud da a conocer las Reglas de Operación e indicadores de gestión y evaluación del Seguro Popular de Salud” *Diario Oficial de la Federación* (DOF), 15 March 2002. Retrieved from: http://www.salud.gob.mx/unidades/cdi/nom/compi/a040703.html.

Secretaría de Salud (2011) “Manual de Llenado del Certificado de Nacimiento. Subsistema de Información sobre Nacimientos (SINAC)” Mexico City: Secretaría de Salud.

Sepúlveda, J., Bustero, F., Tapia, R., Rivera, J., Lozano, R., Oláiz, G., Partida, V., García-García, L. and Valdespino, J.L. (2006a) “Improvement of child survival in Mexico: the diagonal approach” *The Lancet*, 368:2017-2027.

Sepúlveda, J., Valdespino, J.L. and García-García, L. (2006b) “Cholera in Mexico: The paradoxical benefits of the last pandemic” *International Journal of Infectious Diseases*, 10:4-13.

Servan-Mori, E., Wirtz, V., Avila-Burgos, L. and Heredia-Pi, H. (2015) “Antenatal Care Among Poor Women in Mexico in the Context of Universal Health Coverage” *Maternal and Child Health Journal*, 19:2314-2322.

Shi, L. and Starfield, B. (2001) “The Effect of Primary Care Physician Supply and Income Inequality on Mortality Among Blacks and Whites in US Metropolitan Areas” *American Journal of Public Health*, 91(8):1246-1250.

Shorrocks, A.F. (1978) “Income inequality and income mobility” *Journal of Economic Theory,* 19:376-393.

Shorrocks, A.F. (1980) “The class of additively decomposable inequality measures” *Econometrica*, 48:613-625.

Skoufias, E., Davis, B. and Vega, S. (1999) *Targeting the poor in Mexico: an evaluation of the selection of households into OPORTUNIDADES*. Washington, DC: International Food Policy Research Institute.

Skoufias, E. and McClafferty, B. (2001) *Is Progresa working? Summary of the results of an evaluation by IFPRI*. Washington, DC: International Food Policy Research Institute.

Skoufias, E. (2007) “Poverty alleviation and consumption insurance: Evidence from PROGRESA in Mexico” *The Journal Socio-Economics,* 36:630-649.

Sommers, B.D., Baicker, K. and Epstein, A.M. (2012) “Mortality and access to care among adults after state Medicaid expansions” *The New England Journal of Medicine*, 367:1025-1034.

Sommers, B.D., Gawande, A.A. and Baicker, K. (2017) “Health Insurance Coverage and Health—What the Recent Evidence Tells Us” *The New England Journal of Medicine*, 377:586-593.

Sosa-Rubí, S.G., Galárraga, O. and López-Ridaura, R. (2009) “Diabetes treatment and control: the effect of public health insurance for the poor in Mexico” *Bulletin of the World Health Organization*, 87:512-519.

Tang, S., Meng, Q., Chen, L., Bekedam, H., Evans, T. and Whitehead, M. (2008) “Tackling the challenges to health equity in China” *The Lancet*, 372:1493-1501.

Teruel Belismelis, G., Castro, M. and Guadarrama, R. (2012) "Estudio sobre los efectos del Seguro Popular en la utilización de servicios médicos y en la salud de los afiliados" *CIDE working paper*. Mexico City: Centro de Investigación y Docencia Económicas (CIDE).

Townsend, R.M. (1994) "Risk and Insurance in Village India" *Econometrica,* 62(3):539-591.

Uhrig, S.C.N. (2008) 'The Nature and Causes of Attrition in the British Household Panel Study" *ISER Working Paper*, 2008-05. Colchester: Institute for Social and Economic Research, University of Essex.

Urquieta-Salomón, J. and Villarreal, H.J. (2016) "Evolution of health coverage in Mexico: evidence of progress and challenges in the Mexican health system" *Health Policy and Planning,* 31:28-36.

van Doorslaer, E. and Jones, A.M. (2003) "Inequalities in self-reported health: Validation of a new approach to measurement" *Journal of Health Economics,* 22:61-87.

van Doorslaer, E., Koolman, X. and Jones, A.M. (2004) "Explaining income-related inequalities in doctor utilisation in Europe" *Health Economics,* 13:629-647.

van Doorslaer, E. and Van Ourti, T. (2011) "Measuring inequality and inequity in health and health care" in Glied, S. and Smith, P., eds. *Oxford handbook on health economics.* Oxford: Oxford University Press.

Victora, C.G. and Peters, D.H. (2009) "Seguro Popular in Mexico: is premature evaluation healthy?" *The Lancet,* 373:1404-1405.

Viscusi, W.K. and Aldy, J.E. (2003) "The Value of a Statistical Life: A Critical Review of Market Estimates Throughout the World" *The Journal of Risk and Uncertainty*, 27(1):5-76.

Viscus, W.K. and Gayer, T. (2005) “Quantifying and Valuing Environmental Health Risks” in Maler, K.G. and Vincent, J.R., eds. *Handbook of Environmental Economics*. Amsterdam: Elsevier.

Wagstaff, A. and van Doorslaer, E. (2000) “Equity in health care financing and delivery” in Culyer, A.J. and Newhouse, J.P., eds. *Handbook of Health Economics*. Amsterdam: North Holland.

Wagstaff, A., van Doorslaer, E. and Watanabe, N. (2003) “On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam” *Journal of Econometrics,* 112:207-223.

Wagstaff, A. and Pradhan, M. (2005) “Health Insurance Impacts on Health and Nonmedical Consumption in a Developing Country” *Policy Research Working Paper 3563*. Washington DC: The World Bank.

Wagstaff, A. (2007) “The Economic Consequences of Health Shocks: Evidence from Vietnam” *Journal of Health Economics,* 26:82-100.

Wang, H. and Yu, Y. (2016) “Increasing health inequality in China: An empirical study with ordinal data” *Journal of Economic Inequality*, 14:41-61.

World Health Organization (2000) *The World Health Report 2000. Health Systems: Improving Performance*. Geneva: World Health Organization (WHO).

World Health Organization (2010) *The world health report. Health systems financing: the path to universal coverage*. Geneva: World Health Organization (WHO).

World Health Organization (2012) *Trends in maternal mortality: 1990 to 2010*. Geneva: World Health Organization (WHO).

Appendix. Mexican municipalities created in 1990-2016

State	Municipality of origin	New municipality	Date of creation
Aguascalientes	Aguascalientes	El Llano	01/03/92
Aguascalientes	Aguascalientes	San Francisco de los Romo	01/03/92
Baja California	Tijuana	Playas de Rosarito	21/07/95
Baja California Sur	Comondú	Loreto	20/08/92
Guerrero	Zapotitlán Tablas	Acatepec	23/03/93
México	*Chalco*	*Valle de Chalco Solidaridad*	*09/11/94*
México	*Ixtapaluca*		
México	*La Paz*		
México	*Chicoloapan*		
Quintana Roo	Cozumel	Solidaridad	28/07/93
San Luis Potosí	Tamazunchale	Matlapa	02/12/94
San Luis Potosí	Ciudad del Maíz	El Naranjo	02/12/94
Tlaxcala	Sanctorum de Lázaro Cárdenas	Benito Juárez	09/10/95
Tlaxcala	Terrenate	Emiliano Zapata	27/09/95
Tlaxcala	Terrenate	Lázaro Cárdenas	27/09/95
Tlaxcala	*Chiautempan*	*La Magdalena Tlaltelulco*	*18/08/95*
Tlaxcala	*Tepeyanco*		
Tlaxcala	Tetlatlauca	San Damián Texoloc	27/09/95
Tlaxcala	Chiautempan	San Francisco Tetlanohcan	18/08/95
Tlaxcala	Tetaltlahuca	San Jerónimo Zacualpan	27/09/95
Tlaxcala	Tzompantepec	San José Teacalco	18/08/95
Tlaxcala	Tepeyanco	San Juan Huactzinco	11/08/95
Tlaxcala	Zacatelco	San Lorenzo Axocomanitla	02/10/95
Tlaxcala	Xaltocan	San Lucas Tecopilco	02/10/95
Tlaxcala	Ixtacuixtla de Mariano Matamoros	Santa Ana Nopalucan	02/10/95
Tlaxcala	Nativitas	Santa Apolonia Teacalco	09/08/95
Tlaxcala	Zacatelco	Santa Catarina Ayometla	15/08/95
Tlaxcala	Acuamanala de Miguel Hidalgo	Santa Cruz Quilehtla	11/08/95
Tlaxcala	Tepeyanco	Santa Isable Xiloxoxtla	15/08/95
Campeche	*Champotón*	*Calakmul*	*31/12/96*

Campeche	*Hopelchen*		
Campeche	*Carmen*	*Candelaria*	*19/06/98*
Campeche	*Champotón*		
Campeche	*Escárcega*		
Chiapas	Chenalho	Aldama	16/07/99
Chiapas	Ocosingo	Benemérito de las Américas	16/07/99
Chiapas	Las Margaritas	Maravilla Tenejapa	16/07/99
Chiapas	Ocosingo	Marques de Comillas	16/07/99
Chiapas	Ángel Albino Corzo	Montecristo de Guerrero	16/07/99
Chiapas	Simojovel	San Andrés Duraznal	16/07/99
Chiapas	Larrainzar	Santiago del Pinar	16/07/99
Sonora	Etchojoa	Benito Juárez	26/12/96
Sonora	Guaymas	San Ignacio Río Muerto	26/12/96
Veracruz	*Cosamaloapan de Carpio*	*Carlos A. Carrillo*	*30/11/96*
Veracruz	*Chacaltianguis*		
Veracruz	*Mecayapan*	*Tatahuicapan de Juárez*	*20/03/97*
Veracruz	*Soteapan*		
Veracruz	*Minatitlán*	*Uxpanapa*	30/01/97,
Veracruz	*Jesús Carranza*		17/05/97
Veracruz	*Hidalgotitlán*		
Veracruz	*Las Choapas*		
Zacatecas	Guadalupe	Trancoso	17/11/99
Guerrero	*Cuajinicuilapa*	*Marquelia*	*11/12/01*
Guerrero	*Azoyú*		
México	San Felipe del Progreso	San José del Rincón	01/01/02
México	Tejupilco	Luvianos	01/01/02
Guerrero	*Atlixtac*	*José Joaquín de Herrera*	*10/12/02*
Guerrero	*Chilapa de Álvarez*		
Guerrero	*Metlatónoc*	*Cochoapa el Grande*	*10/12/02*
Guerrero	*Tlacoachistlahuaca*		
México	Jaltenco	Tonanitla	03/12/03
Veracruz	Playa Vicente	Santiago Sochiapan	29/12/03
Veracruz	*Tecolutla*	*San Rafael*	*29/12/03*
Veracruz	*Martínez de la Torre*		
Zacatecas	*Benito Juárez*	*Santa María de la Paz*	*17/11/04*
Zacatecas	*Juchipila*		

Zacatecas	*Teul de González Ortega*		
Zacatecas	*Atolinga*		
Zacatecas	*Tepechitlán*		
Zacatecas	*Jalpa*		
Zacatecas	*Apozol*		
Guerrero	*Marquelia*	*Juchitán*	*07/06/05*
Guerrero	*Cuajinicuilapa*		
Guerrero	*Azoyú*		
Guerrero	*Malinaltepec*	*Iliatenco*	*25/11/05*
Guerrero	*San Luis Acatlán*		
Jalisco	Arandas	San Ignacio Cerro Gordo	31/07/06
Quintana Roo	Solidaridad	Tulum	10/05/08
Quintana Roo	Othón P. Blanco	Bacalar	17/02/11

Note: The new municipalities that were segregated from more than one municipality are in italics.

Source: Information publicly available on the website of the National Institute of Statistics and Geography (INEGI).