Dying for More: Cash Transfers Effect on Older Adult Mortality in Mexico*

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Abstract

We study the impact of an unconditional cash transfer to alleviate the rural poverty of the older adult population ages 70 and over. Using Mexico's universe of death records and a triple difference-in-differences research design, we show that mortality from among age-eligible population in localities covered by this program increased by 4.7%. We also find that mortality increase is significantly larger among the poorer population as proxied by being ineligible for formal employment sector social insurance at 7.6% increase in deaths. Work-in-progress is testing the hypothesis that this unexpected result is partly driven by an increase in cardiovascular disease-related deaths, potentially due to increased consumption of obesogenic foods.

Keywords: Mortality, Health Policy

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1 Introduction

The economic consequences of rapid population aging have become one of the main challenges of the century.[1] According to the United Nations, in 2021, 10% of the people were aged 65 or above globally and is projected to rise to 16% by 2050 (Wilmoth et al., 2023). Among OECD countries, around 13% of people aged 66 and above are in relative income poverty, with higher shares among low and middle-income countries (OECD, 2023). The most common policy to address poverty has been to implement cash transfer programs.[2] Despite the growing body of literature documenting the effect of income on health, less is understood about whether cash transfers are effective at improving the health of older adults. Empirical progress is difficult due to the lack of credible mediators that link health outcomes with income shocks through behavioral changes.

Empirical estimates of the effects of cash grants on older adults health and mortality are accordingly mixed: there is recent evidence for both positive (Jensen and Richter, 2004; Salm, 2011; Barham and Rowberry, 2013; Miglino et al., 2023) and negative (Snyder and Evans, 2006; Evans and Moore, 2011; Fitzpatrick and Moore, 2018; Schwandt, 2018) impacts. In spite of the inconclusive findings, these studies consistently emphasize the mediating role of healthcare utilization, diet, and cardiovascular conditions like hypertension and diabetes. These are important outcomes since they contribute to the leading causes of death (e.g., heart disease, stroke) in many countries. In this paper, we study a non-contributory pension program to determine whether an income increase among poor older adults can improve their health.

We study Mexico's most significant pension reform in the past 20 years: the nationwide non-contributory Pension Program for the Elderly (PPE). The program guaranteed a basic pension every two months for those aged and residentially eligible, independent of their gender, income, and whether they ever contributed to social security and received benefits.[3] The program is colloquially known as "70 y más" and initially targeted individuals 70 and older living in rural localities. Given the popularity of the program, localities, and ages covered by the program expanded in a staggered fashion, as well as the inclusion of means-tested assignments.

[1] It is the inevitable result of the demographic transition—the trend towards longer lives and smaller families—that is taking place even in countries with relatively youthful populations

[2] There is a large body of literature documenting the beneficial effects of these programs in targeting young children and mothers summarized by Bastagli et al. (2016); Millán et al. (2019)

[3] Close to the Mexican PPE is the non-contributory pension established in 2006 in Chile, which granted a permanent cash transfer to those aged 65 and above, conditional on income. Its impact on health is largely studied in Miglino et al. (2023).

Leveraging rich administrative data and the timing of the "70 y más" program's coverage expansions, we evaluate the impact of this cash transfer on health outcomes. Our data comes from Mexico's Health Statistics and includes the age at death, place of residence, and causes of death for each death. We use this dataset to construct age-locality group cells and classify them as treated (or not) based on locality size eligibility and age coverage by the program in each expansion (e.g., Initially, the program targeted localities with less than 2,500 people, followed by later expansions based on population locality size). Given the size of the localities, we do not always observe deaths for a given locality-age group in the population; thus, our outcomes are the counts of total deaths, and our leading research design is a triple difference-in-difference model using a Poisson regression (Chen and Roth, 2024; Mullahy and Norton, 2024).

We find that the cash transfers led to a 4.7% increase in mortality for people aged 70 and above in covered localities. We show that affected mostly uninsured and those covered by -*Seguro Popular*-, with more than 7.5% increase in deaths, and smaller and insignificant effects on the insured under private providers.[4] The smaller effects on previously insured population suggest that insurance may decrease the mortality effect of "70 y Mas", consistent with the protective characteristics of health insurance. However, it is hard to distinguish from the fact that the insured group tends to be higher SES, and we would expect to have a smaller "70 y Mas" effect among this insured group. We also examine mortality effects on cardiovascular and circulatory disease-related causes, which previous research suggests that income shocks could be linked to the increase in mortality (Snyder and Evans, 2006; Dobkin and Puller, 2007; Evans and Moore, 2011; Rehkopf et al., 2014). We document that mortality increases by around 5% for these diseases, but it only rises by 3.8% for the rest, but differences are not statistically significant.

In an earlier version of this work, Feeney (2017) attempts to link the consumption of obesogenic foods and the larger increase in deaths to cardiovascular and circulatory disease-related causes. He couples a regression discontinuity design with household expenditure surveys to document large income effects on diet and consumption of obesogenic foods. This increases the prevalence of cardiovascular diseases, demonstrated by significant gains in body mass index (BMI) and hypertension. The economic costs of the increase in mortality are large: about 30% of the total expected benefit paid to recipients. Such "back of envelope" calculations highlight the substantial gains from mitigating these adverse effects in the future.

This paper contributes to several strands of the literature. First, our work primarily relates to research that examines the income shocks to the older adults on mortality (Jensen and Richter,

[4] *Seguro Popular* started it phased rolled-out during our period of study

2004; Snyder and Evans, 2006; Salm, 2011; Evans and Moore, 2011; Barham and Rowberry, 2013; Aguila et al., 2015; Fitzpatrick and Moore, 2018; Schwandt, 2018; Miglino et al., 2023). More broadly, our research adds novel evidence on the socioeconomic determinants of health (Cutler et al., 2006; Adda et al., 2009; Evans and Moore, 2012; Andersson et al., 2015; Chetty et al., 2016). We contribute to this literature by focusing on a large-scale cash grant to older adults, showing that income shock led to the worsening of health outcomes.

Our work also contributes to understanding the income effects on cardiovascular disease morbidity (e.g., obesity, hypertension) and associated risk factors affecting mortality (Snyder and Evans, 2006; Dobkin and Puller, 2007; Balan-Cohen, 2008; Adda et al., 2009; Salm, 2011; Evans and Moore, 2011; Rehkopf et al., 2014; Andersson et al., 2015; Ahammer et al., 2017; Aguila et al., 2024). Furthermore, the results add to our broader knowledge of linkage income transfers to chronic cardiovascular disease incidence (Fernald and Adler, 2008; Asfaw, 2011; Forde et al., 2012; Leroy et al., 2013; Fernald, 2013; Hidrobo et al., 2014; Salinas-Rodríguez et al., 2014; Juárez-González and Pfutze, 2014; Galiani et al., 2016). This paper is one of the first studies to present causal evidence linking income transfers to (increases in) chronic cardiovascular disease incidence and mortality. In an earlier version, (Feeney, 2017) pooled data from multiple sources to connect changes in cardiovascular disease risk factors measured in household surveys to cardiovascular disease-specific mortality identified in the vital statistics registry. Prior studies have not benefited from combining these data sources to identify clear mechanisms linking income transfers to mortality.

The remainder of the paper proceeds as follows: Section 2 describes the institutional background and the "70 y más" program. Section 3 provides details on data sources and the sample construction. Section 4 presents our empirical strategy and the main results, and in section 5, we conclude.

2 "70 y Mas" and Social Security Policies in Mexico

Mexico has several social security systems that provide pensions and health care/insurance, but they often exclude older Mexicans who do not have experience in the formal labor market (Aguila et al., 2015).[5] The Mexican Secretariat of Social Development (SEDESOL) implemented two ma-

[5]The main system is Instituto Mexicano del Seguro Social (IMSS), which covers approximately 30% of the country's population. To be eligible for IMSS social security payments as of 2007, individuals need to have contributed to the fund for 1,250 weeks. The retirement age for these pensions is 65. Employees contribute 1.75% of wages,

jor policies over the last two decades to better address the economic security of those ineligible for these programs. The first was a large-scale public health insurance program called Seguro Popular in 2002, which aimed to increase access to affordable health care. The second (the focus of this paper) was a non-contributory pension scheme, Pension para Adultos Mayores in late 2007. The pension is essentially an unconditional cash transfer targeting older adults. It is non-contributory because recipient individuals (and their employers) do not contribute to the fund during their working lives. Individuals who initially qualified for this program were 70 or older. The program is often referred to as "70 y Más" in reference to the age eligibility. Additionally, recipients were only eligible if they resided in communities (localidades, or localities) of a certain population size.[6]

"The 70 y Más" program paid a monthly cash transfer equivalent to MX$500, roughly equal to US$ 40 (during the study period), delivered every two months as a sum of MX$ 1,000.[7] We estimate this represented around 30% of household monthly income for the average qualifying household with at least one member age 70 and over. Individuals were able to sign up for the pension program with a current, government-issued identification card that displayed their date of birth and address. Surviving family members of deceased participants were also awarded a lump sum transfer equivalent to one payment period of the stipend (MX$1,000) when they reported the death of their pensioner, an important issue we address later.

The initial population limit for participating localities was 2,500 individuals or fewer at the start of the program in the second half of 2007. The limit expanded to include localities with

and employers contribute 6.9%. The guaranteed minimum monthly pension is MX$ 1,754/month. Other systems of pensions and health insurance include a specific fund for state employees, Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado (ISSSTE), as well as specific funds for state oil enterprise employees and the military and maritime services.

[6]While "70 y Más" has been the largest program both in scale and contribution amount to address pensioners outside of the formal system, it has not been the only one. Since 2001, select individual Mexican states and the Federal District have also implemented state-specific non-contributory pensions with varying eligibility requirements and benefit levels. These states are: Baja California Norte, Sinaloa, Jalisco, Tabasco, Chiapas, Quintana Roo, and the Yucatán. I address the potential contamination of these state policies later on. Additionally, the Progresa/Oportunidades program instituted a social pension in 2006, also targeting individuals 70 years and older who lived in households already qualifying for the Progresa/Oportunidades program, but the penetration of this program was low during the study period for this paper.

[7]SEDESOL partnered with TELECOM and BANSEFI to distribute these payments, the same banking organizations used to distribute payments for the Progresa/Oportunidades program. Payments were distributed in person (pensioners could pick up the cash at a *mesa de atención*), but recipients could opt to receive a direct deposit in their bank account if they had one. This option would eventually become the dominant mode of transfer when the program expanded to urban areas. The exact benefit delivery schedule is not fixed and often changed: participating individuals in different localities received cash on different days of the month, all across the two-month payment period. The disbursement was well-publicized by local organizations and newspapers and was available through a telephone hotline.

populations up to 20,000 individuals in 2008 and attempted to expand a third time to cover localities with populations up to 30,000 in 2009.[8] In the program's first phase, enrollment reached about 1.1 million beneficiaries, which SEDESOL equates with near-complete take-up. SEDESOL published a similarly high take-up rate for localities eligible in 2008 (90%) (Juárez-González and Pfutze, 2014). By then, the number of beneficiaries across all eligible localities (populations ≤ 20,000) reached 1.7 million, covering just over 40% of all individuals aged 70 and over in Mexico. However, the take-up of the program dropped significantly when the program attempted to expand in 2009. While the program was well-publicized in advance for localities eligible in the first two years, this was not the case for those eligible in 2009 and thus are excluded from the analysis. They represent less than 1% of the localities and have higher socioeconomic status than the rural localities, which were the program's primary targets in 2007 and 2008.

No means testing was incorporated into the program until 2012 when it expanded to urban localities. However, this only applied to new beneficiaries who also received other social security payments, such as those from IMSS or ISSSTE. In 2014, the program expanded again by reducing the age eligibility from 70 to 65.

3 Data and Sample Construction

The primary mortality dataset is an individual-level death registry coming from death certificates. This dataset provides us with each individual's cause of death, birth year, and sex. It comprises every death in the country between 2002 and 2011, almost 5 million records. Furthermore, the vital statistics registry data includes key information on the deceased needed to determine eligibility for the non-contributory pension program: state, municipality, and locality of residence, the population size of the locality of residence, and health insurance status that proxies for access to formal pensions (not directly observable in the death certificates) used to restrict the sample to the policy-relevant group. All are available from Instituto Nacional de Estadastica y Geografía (INEGI) in Mexico.[9]

An important issue to consider when using the vital statistics registry is the data quality. Mexico is generally considered to have good quality vital statistics, but the assessment may not be

[8] This limit refers to the total population of a locality as specified in the 2005 census, not the size of the pension-eligible population over 70.

[9] The study horizon cannot be extended to years prior to 2002 because locality identifiers were not made available in public use vital statistics data until 2002. These are needed to identify which deceased were living in localities eligible for "70 y Más."

accurate for older individuals in rural localities where contact with medical personnel needed to verify and register a death is unreliable (Mikkelsen et al., 2015). Deaths may go unreported, or the cause of death may be misreported on the death certificate.[10] The "70 y Más" program introduced incentives that may have affected these reporting patterns, potentially leading to spurious mortality changes. Surviving family members of a deceased program recipient are awarded a cash lump sum equivalent to one payment period of the program stipend (MX$ 1,000) when they report the death to officials. While the payment counters incentives to collect transfers after a pension recipient has died, it may encourage deaths to be reported that would not have been in the absence of the program. Additionally, the roll-out of Mexico's public health insurance program, Seguro Popular (SP), which continued to expand throughout Mexico during "70 y Más," may have similarly affected reporting of deaths since it would have removed financial barriers to doing so. Both SP and the pension stipend may have increased healthcare-seeking behavior and contact with doctors (required to make the cause of death determination), leading to more accurate and timely reporting of deaths and causes of death.[11] Prior literature suggests that welfare programs such as this one have effects on reporting accuracy (Barham and Rowberry, 2013; Bhalotra et al., 2019).

We control for vital statistics reporting quality to limit the bias from changes in vital statistics reporting practices. We include the following variables available from the vital statistics data: the lag time between the date the death occurred and the date the death was registered and the type of doctor who signed the death certificate. The inclusion of these specific variables is informed by similar studies using vital statistics data in low- and middle-income countries and Word Health Organization (W.H.O.) guidelines for identifying good quality vital statistics reporting systems (Barham and Rowberry, 2013; Organization et al., 2013). Additionally, we control for other programs in place during our study period, which could be confounding the result. First, using administrative data from *Progresa* beneficiaries at the locality level, we follow (Barham and Rowberry, 2013; Aguila et al., 2024) include a continuous variable measuring the penetration for the program at the locality level. Furthermore, we also include an indicator of whether or not the locality was covered by *Seguro Popular*. Finally, we use locality-level census data from the 2000, 2005, and 2010 census records to yearly interpolate the population and weight our models for the

[10] When an individual dies outside of a medical facility, the family must call a doctor to complete an official death certificate and determine the cause of death, usually for some fee. When this is completed, the family then arranges for a funeral home to collect the body, which starts the administrative process of registering the death. A relative must then go to the office of civil registration and exchange the certificate for the *acta de defunción*. The death certificate is then passed to the Ministry of Health and registered in the vital statistics database.

[11] *Seguro Popular* began in 2002 among a select group of municipalities and rolled out in a quasi-random fashion across Mexico, covering all municipalities by 2006. However, large portions of the population within eligible municipalities often remained uncovered by SP, so further efforts continued to push enrollment in subsequent years.

population size.

We restrict our sample to deaths between 55 and 90 years old. This allows us to properly capture the program's effects on ages with a similar mortality schedule around the eligibility threshold of 70 years. We then combine individual death records to construct cells with the counts of deaths at the locality level for every age. We classify each resulting cell as covered or non-covered using the locality and age eligibility by each of the program expansions in 2007 and 2008, based on locality size below 2,500 people and 20,000, respectively.

Our sample excludes the 2009 and 2012 expansions because i) the 2009 expansion did not have enough take up, and therefore, it would not capture the full program effect and bias our result downward. These were localities below 30,000 people. ii) the 2012 expansion covered all localities, including urban localities, preventing us from a valid control group after its expansion. However, we take advantage of the definition of rurality, and we use the localities that expanded in 2012 between 30,000 and 100,000 population size as control.[12] By doing that, we avoid comparisons to large urban centers where mortality patterns may be very different from those observed in smaller, less populated regions. Therefore, the analysis will focus on key health and mortality outcomes for those localities where take-up was high and eligible in 2007 and 2008, before the 2012 and 2014 expansions. Finally, we continue to exclude the small number of localities eligible in 2009 because it can bias our results when using it as a control or treatment because the take-up was low (with populations 20,001-30,000).

4 The Impact of the "70 y Más" Pension Program

We begin this section by presenting our empirical strategy, the main estimates of the program's effect on mortality, and robustness checks.

4.1 Empirical Strategy

The phased rolled-out of the program geographic coverage and age eligibility allows us to implement a staggered difference-in-difference-in-differences research design. In particular, we can use the timing of coverage among different localities and age eligibility to study changes in age-locality

[12] 100,000 is the cut-off for localities considered to be "urban," according to INEGI. The results are not sensitive to this cutoff point.

level outcomes before and after coverage. Because of confidentiality, we cannot construct death rates since we do not observe the population exposed in every locality for every age. In addition, there are many localities with zero deaths for a given age. Thus, the outcomes of interest will be yearly counts within a locality for a given age (e.g., deaths in locality A among people 65 years old in a given year), and we fit Poisson models for counts using a log link, with a general specification given by:

$$y_{alt} = \exp(\alpha_{lxa} + \gamma_{lxt} + \delta_{txa} + \beta \times 70yMas_{alt} + \Pi_{lxt})\epsilon_{alt}, \tag{1}$$

where y_{alt} is the count of deaths for those aged a in locality l in period t. $70ymas_{at}$ is an indicator that equals one from the first time a locality with deaths above 70 is covered and onward, i.e., the treatment is an absorbing state. α_{lxa} represents fixed effects that control for time-invariant unobservables specific to a locality-age group, γ_{lxt} are time-variant fixed effects that account for year-specific locality shocks common across ages, and δ_{txa} are time-variant fixed effects that account for age-eligible shocks common across localities. We also include a vector of controls, Π_{lxt}, to account for time-variant locality characteristics, such as marginality index, *Progresa* penetration, *Seguro Popular* coverage, and proxies for data quality, such as the average lag of death registration and the share of deaths certified by a medical doctor. Finally, ϵ_{alt} is the error term orthogonal to the fixed effects and clustered (two-way) by age and, by eligible locality groups, the level of treatment. We weight the models by an estimate of the size of the population in each locality every year. In this model, identification of the *causal* effect of the "70 y más" program is predicated upon the assumption that—conditional on time-invariant locality-age cell indicators and locality and age-specific year aggregate shocks—there are no unobserved factors that correlated with both the timing of coverage and other determinants of health outcomes.

Following Chen and Roth (2024), our parameter of interest is the average proportional treatment effect on the treated. This is the percentage change in the average outcome for the covered group in the post-treatment period. Conveniently, the $\hat{\theta}_{ATT\%}$ can be recovered from $\exp(\hat{\beta}) - 1$, where $\hat{\beta}$ is the estimator obtained from the Poisson model given by equation (1).[13] Thus, we would

[13]The Poisson quasi-maximum likelihood (QMLE) consistently estimates the population coefficient β, which satisfies $\exp(\beta) - 1 = \frac{E[Y(1)]}{E[Y(0)]} - 1 = \theta_{ATE\%}$. The parameter identified through the Poisson model is known as a rate ratio (RR). A rate ratio, sometimes called an incidence density ratio or incidence rate ratio, is the relative difference measure used to compare the incidence rates of events occurring at any given time (**?**). Therefore, the interpretation of the value of a rate ratio is similar to that of the risk ratio.

expect the $\hat{\theta}_{ATT\%}$ to be negative if the program led to a relative decrease in deaths among the covered locality-age group and positive otherwise. The parameter of interest in 1 is the result of the three-way interaction between an indicator for eligible localities in 2007 or 2008 (l), an indicator for those deaths with ages above 70 ($\mathbb{1}(Age \geq= a)$), and an indicator for the post period for a given group of localities ($l_{(t)}$).

In this case, identification of the causal effect of the program $\hat{\theta}_{ATT\%}$ is predicated upon the assumption that in the absence of treatment, the *percentage changes* in the mean would have been the same for the covered and non-covered locality and age groups.[14] As in Wooldridge (2023), this can be formalized using a "ratio" version of the parallel trends assumption, sometimes referred to as the "parallel relative trends" assumption. Intuitively, states that if the treatment had not occurred, the average percentage change in the mean outcome for the covered group would have been the same as the average percentage change in the mean outcome for the non-covered group. Under the assumption of parallel trends, we can estimate the counterfactual percentage change in the mean outcome for the covered group using the observed percentage change for the non-covered group.

To assess the plausibility of this parallel relative trends assumption, we examine the dynamic effects of "70 y más" using event studies around the time when the locality-age group becomes covered. We use 5 years before and 3 years after each expansion to be consistent across expansions.[15] To estimate this dynamic version of our difference-in-difference-in-differences specification, we use a leads-and-lags model in event time, with the first expansion year set to zero. Specifically, we estimate the following equation:

$$y_{alt} = \exp\left(\alpha_{lxa} + \gamma_{lxt} + \delta_{txa} + \sum_{k=-5}^{-2} \beta_k D_{alt}^k + \sum_{k=0}^{3} \beta_k D_{alt}^k + \Pi_{lxt}\right) \epsilon_{alt}, \tag{2}$$

where $D_{alt}^k = 1[t = 70yMas_{al}+k]$, and $70yMas_{al}$ is the timing of coverage of a locality elegibile-age group al. In other words, D_{alt}^k is a dummy variable indicating that a locality with deaths above age 70, al, was included in the program k periods ago (or will be included k periods ahead, for negative values of k). We normalize the coefficients such that $\beta_{k=-1} = 0$, i.e, treatment is re-coded in event

[14] Since the treated and control groups might have different pre-treatment means, assuming parallel trends *in levels* could be a strong assumption, i.e., it may be unreasonable to expect that time-varying factors have equal level effects on the outcome between the group of eligible and non-eligible locality age groups.

[15] This is the largest window that allows us to work with a balanced panel of events, i.e., $t = -5$ in 2002 for the first wave of coverage in 2007, and $t = 3$ in 2011 for the last wave of coverage in 2008. Unfortunately, we cannot go back because of the absence of locality identifiers in the administrative records, preventing us from assigning the treatment eligibility. Likewise, we cannot go more than 2011 because, in 2012, the program covered all localities in the country.

time relative to the year before each locality age group was included in a "70 y más" expansion. Therefore, the β_k coefficients can be interpreted as the effect of "70 y más" coverage on the count of deaths y_{alt} for each k period relative to the year before the coverage of a locality-age group al in the "70 y Más" program.

4.2 "70 y Más" Impact on Older Adult Mortality

We begin by exploring the impact of reform on mortality using raw data. In Figure 1, we plot the change in the number of deaths in covered localities above and below age eligibility against non-covered localities for each expansion. We separate the analyses by grouping those insured under any of the private insurances (IMSS, ISSSTE, PEMEX, and others) and those uninsured combined with those recently covered by public insurance, *Seguro Popular*. For the combined group of unisured and those recently covered by *Seguro Popular*, Panel (a) shows that the growth in deaths covered by the 2007 expansion increased compared to the non-covered group after two periods from the expansion. Panel (b) shows that deaths of localities covered in 2008 also increased proportionally more than deaths of non-covered a year after the expansion, although the difference between covered and non-covered is smaller than in panel (a). Panels (c) and (d) show the evolution of insured deaths. While for both groups of covered localities, there was an increase in deaths during the period; we can see that there is not a clear difference between localities covered in 2007 and 2008 and those not covered for the same period. Even though all deaths increased, those uninsured and covered by *Seguro Popular* increased far more than those insured. It is likely that the overall increase in deaths could be attributed to the aging population.

Although previous evidence is purely descriptive, it suggests that the "70 y más" program could be associated with the overall increase in deaths in the period, especially for uninsured and recently covered by *Seguro Popular* living in localities targeted in 2007 and 2008 expansions. To formally study this hypothesis—and quantify the impact—we present the results of our staggered triple difference-in-differences research design. Table 1 presents the estimates obtained from the model (1). Our main result is presented in Column (1), which considers the count of all deaths as the dependent variable. Consistent with the preliminary evidence, we find a statistically significant impact of the "70 y más" program on mortality, with the average risk of dying from people above 70 living in localities that went from uncovered to covered increasing by 4.7% after the pension program. This effect is a weighted average across all localities and ages above and below 70, as well as expansions.

To assess the dynamics of the impact on mortality, Figure 2, panel (a), presents the event study estimates obtained from model (2) using the count of deaths as the dependent variable. The horizontal axis shows the years relative to the coverage expansion, with event time zero denoting the first year of expansion. We omit event time -1 so that all estimates are relative to the year before the expansion. Point estimates of leads and lags are plotted along with their 95% confidence intervals. The figure shows that pre-period estimates are not statistically different from zero, a result in line with our assumption of parallel relative trends. Moreover, the figure shows that the number of deaths in treated localities and aged 70 or above, increased after two periods of coverage, which can be related to the fact that the intervention started the second half of the semester for 2007 expansion, biasing our result downwards.

Recent literature on two-way fixed effects estimators has shown that estimates from linear models can differ from the group's average treatment on the treated (ATT) in the presence of treatment effect heterogeneity (De Chaisemartin and d'Haultfoeuille, 2020; Callaway and Sant'Anna, 2021; Sun and Abraham, 2021). However, we believe it is not much of a concern in our design since we only study two consecutive expansions without the potential bias or negative weight that could be related to the treatment effect heterogeneity related to longer periods of expansion between early and later localities.

To complement our results, we also study whether the program had a different impact depending on the insurance coverage. In column (2) of Table 1, we present the estimates obtained from model (1) interacted with those privately insured and combining those uninsured and recently covered by *Seguro Popular* as reference. We find that mortality decreased by 7.6% in the uninsured and *Seguro Popular* group as a consequence of "70 y Más". This effect, larger than the impact on the population as a whole, is consistent with the fact that deaths come from a sample of people whom medical care is scarce or was recently provided, i.e., they recently enrolled *Seguro Popular*. Furthermore, the interaction capturing the effect of those privately insured is negative, providing us with suggestive evidence of the protective evidence of health care insurance and different SES from those in the reference group of uninsured or recently publicly insured. Panel (b) and (c) of Figure 2 show the event study for uninsured and *Seguro Popular* combined and insured, respectively. Similar to the dynamics observed for all deaths, Panel (b), shows that differences between covered and non-covered localities were almost nonexistent before the pension program. However, the number of deaths in covered localities increased after the program expanded. Consequently, Panel (c) shows smaller and relatively stable coefficients after the provision of pension by "70 y más".

In light of recent research suggesting that some diseases may be more responsive to shock in income than others (Snyder and Evans, 2006; Adda et al., 2009; Ahammer et al., 2017; Aguila et al., 2024), we study the differential impact of the program on deaths (1) from causes related to cardiovascular and circulatory diseases, and (2) mortality from non-cardiovascular/non-circulatory disease-related causes. Cardiovascular disease-related mortality includes causes of death attributable to ischemic heart disease, stroke, diabetes, among many others. Major risk factors for these diseases are obesity, weight gain, and high blood pressure. Non-circulatory/non-cardiovascular disease related mortality includes all other causes of death, group into the following categories: infections, accidents (traffic and other types), cancers, respiratory illnesses, kidney disease and digestive illnesses, congenital disorders, violence, and a small minority of "other" causes unrelated to the cardiovascular/circulatory system.

We estimate a variant of the model (1) that includes an interaction between the $70yMas_{alt}$ indicator and a variable that equals one for deaths classified as cardiovascular diseases related. Columns (3) to (5) of Table 1 present our results. Column (3) shows that mortality rose by 3.8% among non-cardiovascular diseases, while for the cardiovascular increased by 5.5%. Columns (4) and (5) show similar results when we consider deaths from uninsured and *Seguro Popular* combined, and also among insured deaths. However, the differences between the cardiovascular and non-cardiovascular are not significantly different. Table 2 columns 6 and 7 present the stratified results for all deaths.

5 Conclusion

We analyze the effects of a large cash transfer program on adult health and mortality outcomes vis-a-vis a non-contributory pension targeting the poor in Mexico. Contrary to the limited evidence from similar programs in other low- and middle-income settings published recently, we find an increase in mortality of 3-8%. The higher end of this range is among the generally poorer population who did not have access to social insurance coverage through formal employment programs such as IMSS. In this uncovered population, we include individuals whose death certificates code them as uninsured and those (generally previously uninsured) who have been recently covered by the Seguro Popular health insurance program. It is unclear to what extent the formal social security programs were protective versus them simply being a marker for higher socioeconomic status.

We find that deaths from cardiovascular diseases had a larger percentage increase than non-

cardiovascular deaths, though this difference is not statistically significant. In ongoing work, we are exploring the hypothesis that the direction and magnitude of this estimate are due to a positive income effect on food consumption, particularly for foods rich in processed carbohydrates and starches, sugars, fats, and cholesterol. This diet could lead to an increase in cardiovascular disease prevalence, although the magnitude and time lag of such effects is still unclear. If it were part of the explanation, it could be important to identify mitigating nutritional programs that could counteract these adverse dietary behavioral changes.

The results of this study reflect back on the question: can policy levers like cash transfers address low human capital investment and improve contemporaneous outcomes among vulnerable adult populations? The findings paint a nuanced picture, even if they are not an exhaustive analysis of all potential inputs to well-being. Large cash transfers have the potential to improve welfare among low-income settings, but these gains are offset by sizable, adverse health and mortality effects that have high costs in poor, rural environments.

While the findings are among the first to document these unintended and adverse effects among low-income settings, they are relevant to other countries besides Mexico, where chronic disease burdens from obesity, hypertension, and other cardiovascular conditions are rising, and experimentation with this type of cash transfer policy is increasingly common. The findings do not strictly pertain to pension programs but are likely generalizable to other types of cash-based welfare policies, such as universal basic income. The results add a novel valence to the relationship between income and health, complicating broader, positive associations in much of the economics and public health literature.

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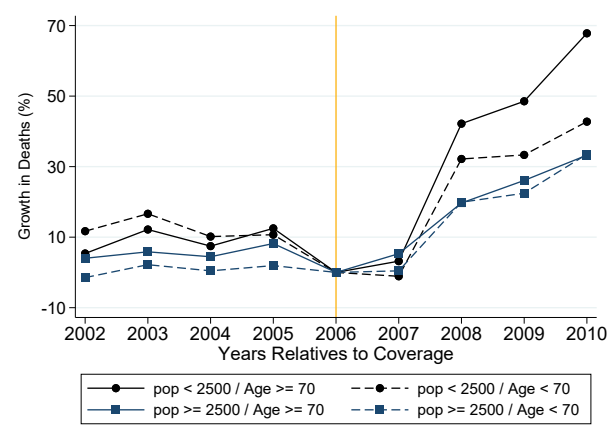
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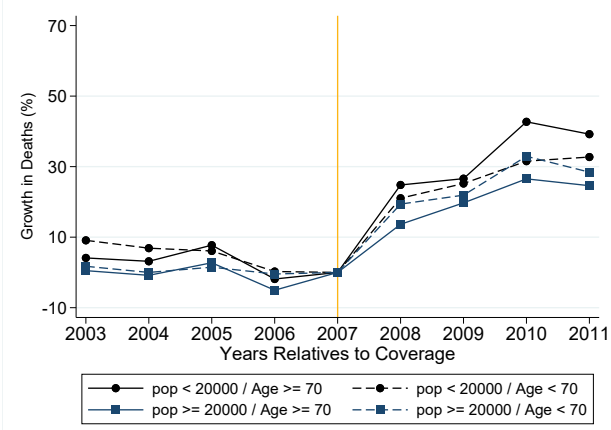
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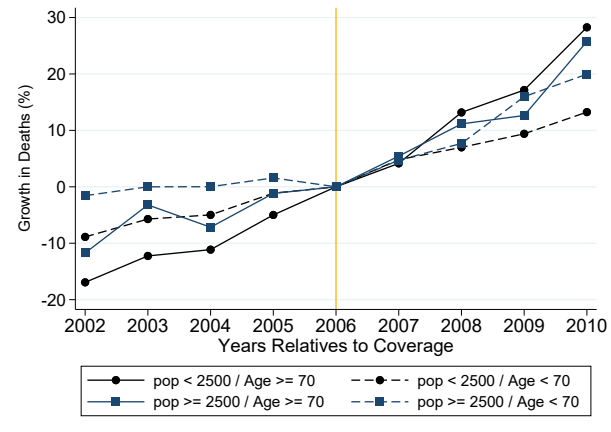
Figure 1: Growth in Deaths by Sample of Health Insurances



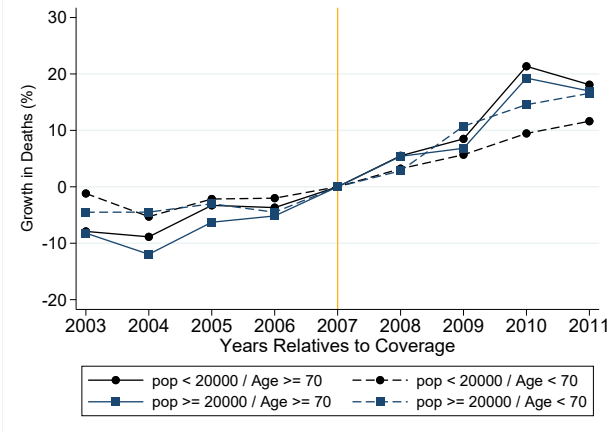
(a) 2007 - Uninsured + *Seguro Popular*



(b) 2008 - Uninsured + *Seguro Popular*



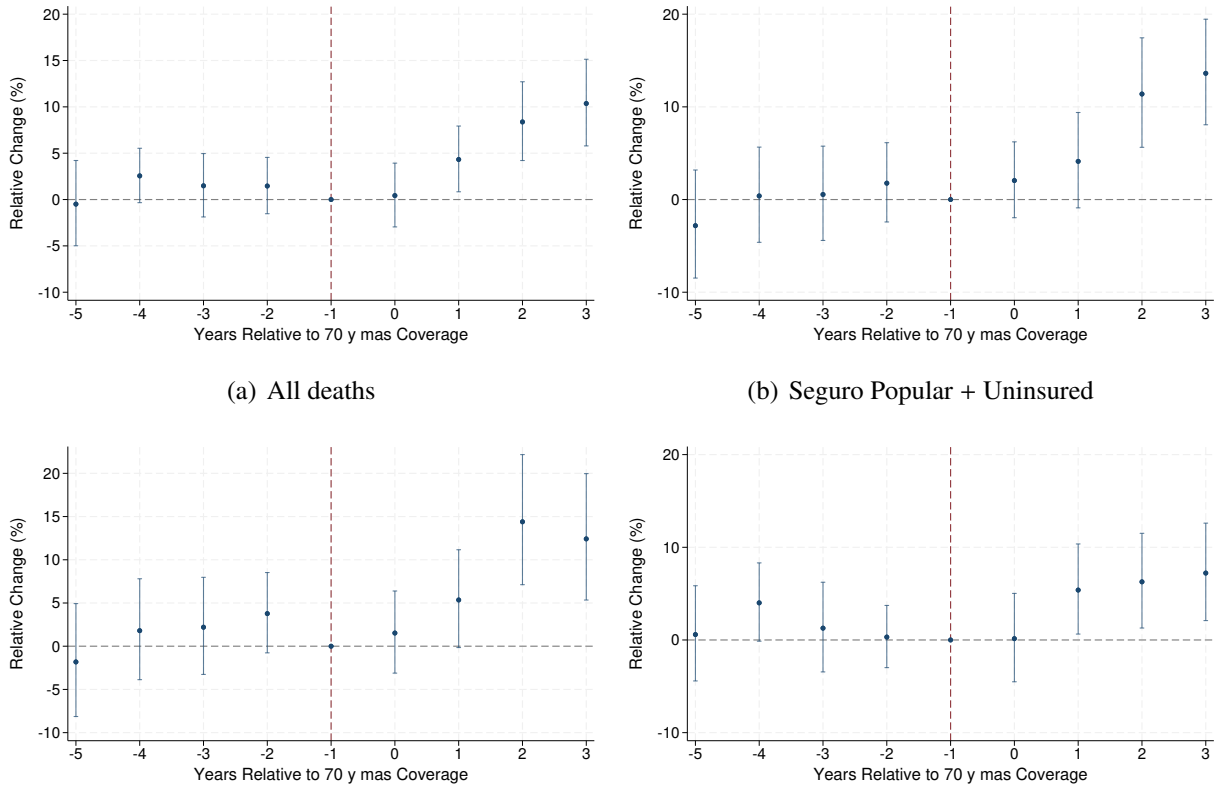
(c) 2007 - Insured



(d) 2008 - Insured

Notes: This figure uses raw data to show the growth in deaths above and below 70 years old for the localities covered by each "70 y más" expansion and the localities non-covered in the period. All changes in deaths are reported in percentages and calculated with respect to the year before each expansion. The vertical solid yellow line represents one year before the expansion.

Figure 2: Event Studies: 70 y Mas Impact on Deaths



(a) All deaths

(b) Seguro Popular + Uninsured

(c) Uninsured

(d) Insured (Private)

Notes: This figure shows the results obtained from estimating the dynamic difference-in-differences-in-differences using the count of deaths as the dependent variable in a Poisson regression. All regressions control for the locality, age, and year fixed effects, as well as locality-age eligibility, year-locality eligibility, and year-age eligibility fixed effects. Standard errors are clustered at the level of treatment: locality-age. The relative change reported in the y-axis corresponds to percent changes by subtracting 1 from the rate ratio, i.e., $\hat{\theta}_{ATT\%} = exp(\hat{\beta}) - 1$. Each estimate captures the effect in each period relative to one year before each group of diseases started to be covered. 95% confidence intervals for $\hat{\theta}_{ATT\%}$ are computed using the delta method for univariate transformations on the coefficient estimated from the Poisson regression. The period of analysis is from 2002 to 2011. All regressions control for locality-level time-varying covariates: Marginality Index, Percentage of deaths medically certified, Lag of death registration, Penetration of *Progresa*, and *Seguro Popular* eligibility. Regressions are weighted using the total interpolated yearly population at the locality level.

Table 1: "70 y Más" Impact on Deaths

	Main		By Sample and Diseases Interaction		
	All Deaths		All Deaths	Uninsured and *Seguro Popular*	Insured (Private)
	(1)	(2)	(3)	(4)	(5)
After 70 y Más	0.0468	0.0759	0.0380	0.0664	0.0226
	(0.0145)	(0.0176)	(0.0168)	(0.0210)	(0.0230)
After 70 y Más					
× Insured		-0.0390			
		(0.0194)			
After 70 y Más					
× Cardiovascular			0.0170	0.0131	0.0241
			(0.0183)	(0.0238)	(0.0275)
Deaths	1,054,686	1,054,686	1,054,686	612,027	442,659
Deaths ∈ Cov. Localities (year before coverage)	51,350	51,350	51,350	30,868	20,482
No. Localities	31,778	31,778	31,778	30,416	20,610
Locality Controls	Y	Y	Y	Y	Y
Weights	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Locality FE	Y	Y	Y	Y	Y
Age FE	Y	Y	Y	Y	Y
Year x Age FE	Y	Y	Y	Y	Y
Year x Locality FE	Y	Y	Y	Y	Y
Age x Locality FE	Y	Y	Y	Y	Y

This table shows the results obtained from estimating a Poisson difference-in-differences-in-differences regression using the count of deaths as the dependent variable. Standard errors are clustered at the level of treatment: locality-age. The reported coefficient corresponds to percent changes by subtracting 1 from the rate ratio, i.e., $\hat{\theta}_{ATT\%} = exp(\hat{\beta}) - 1$. Each estimate captures the effect post-treatment for those groups in eligible localities above 70 years of age relative to deaths in non-eligible localities. Standard errors are computed using the delta method for univariate transformations on the coefficient estimated from the Poisson regression. The period of analysis is from 2002 to 2011. All regressions control for locality-level time-varying covariates: Marginality Index, Percentage of deaths medically certified, Lag of death registration, Penetration of *Progresa*, and *Seguro Popular* eligibility. Regressions are weighted using the total interpolated yearly population at the locality level.

Table 2: "70 y Más" Impact on Deaths: Stratified Results

	Main	By Insurance				By Diseases	
	All Deaths	Uninsured	*Seguro Popular*	Insured	Uninsured and *Seguro Popular*	Cardio-Vascular	Non CVD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
After 70 y Más	0.0468	0.0631	0.0672	0.0345	0.0751	0.0544	0.0390
	(0.0145)	(0.0180)	(0.0376)	(0.0181)	(0.0176)	(0.0178)	(0.0168)
Deaths	1,054,686	487,842	124,185	442,659	487,842	489,867	564,819
Deaths ∈ Cov. Localities (year before coverage)	51,350	25,456	5,412	20,482	25,456	23,962	27,388
No. Localities	31,778	28,617	19,057	20,610	30,416	27,494	29,398
Locality Controls	Y	Y	Y	Y	Y	Y	Y
Weights	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y
Locality FE	Y	Y	Y	Y	Y	Y	Y
Age FE	Y	Y	Y	Y	Y	Y	Y
Year x Age FE	Y	Y	Y	Y	Y	Y	Y
Year x Locality FE	Y	Y	Y	Y	Y	Y	Y
Age x Locality FE	Y	Y	Y	Y	Y	Y	Y

This table shows the results obtained from estimating a Poisson difference-in-differences-in-differences regression using the count of deaths as the dependent variable. Standard errors are clustered at the level of treatment: locality-age. The reported coefficient corresponds to percent changes by subtracting 1 from the rate ratio, i.e., $\hat{\theta}_{ATT\%} = exp(\hat{\beta}) - 1$. Each estimate captures the effect post-treatment for those groups in eligible localities above 70 years of age relative to deaths in non-eligible localities. Standard errors are computed using the delta method for univariate transformations on the coefficient estimated from the Poisson regression. The period of analysis is from 2002 to 2011. All regressions control for locality-level time-varying covariates: Marginality Index, Percentage of deaths medically certified, Lag of death registration, Penetration of *Progresa*, and *Seguro Popular* eligibility. Regressions are weighted using the total interpolated yearly population at the locality level.

Appendix

Dying for More: Cash Transfers Effect on Older Adult Mortality in Mexico

Felipe Menares and Kevin Feeney and William H. Dow

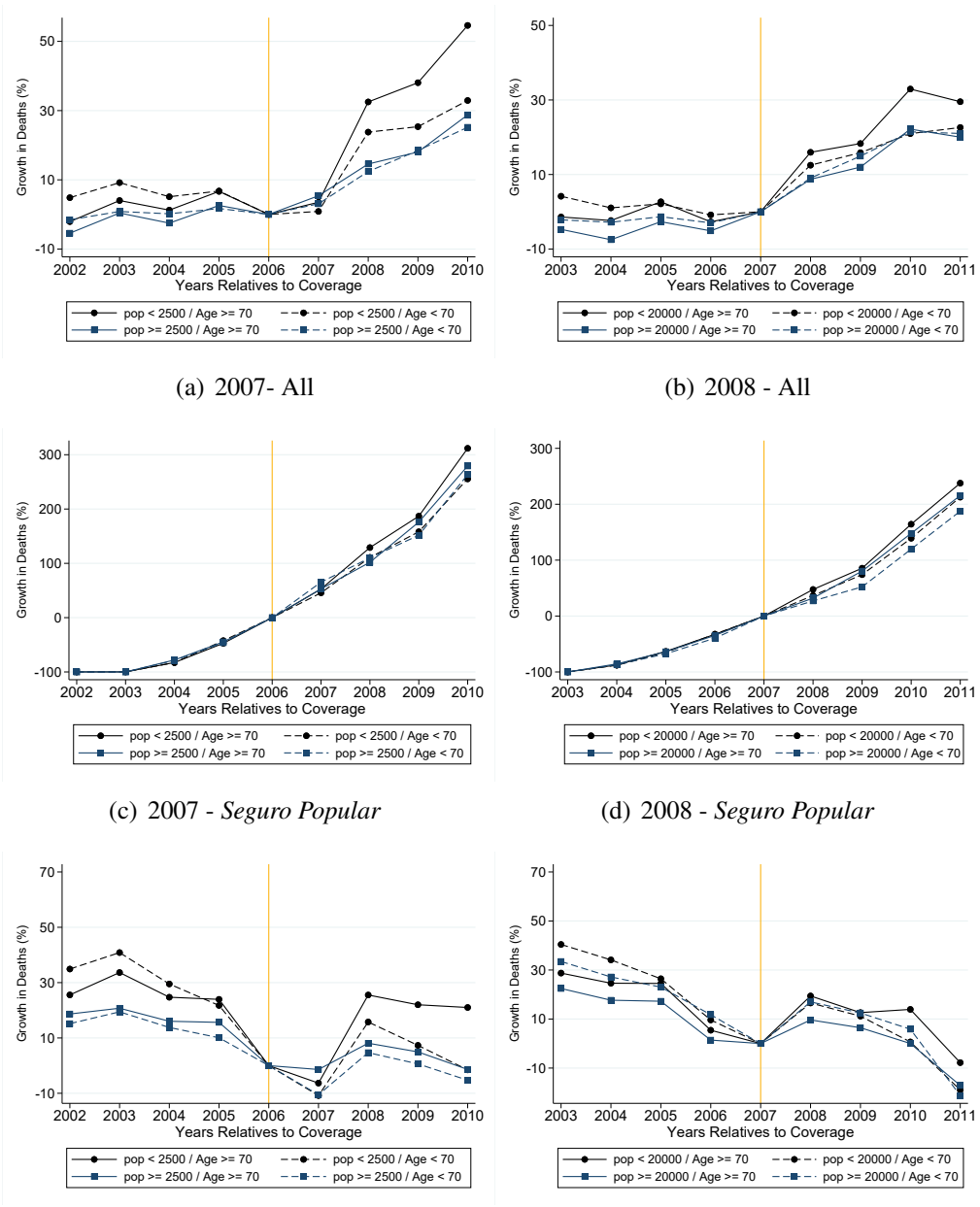
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Appendix A: Additional Figures and Tables

Figure A.1: Growth in Deaths



(a) 2007- All

(b) 2008 - All

(c) 2007 - *Seguro Popular*

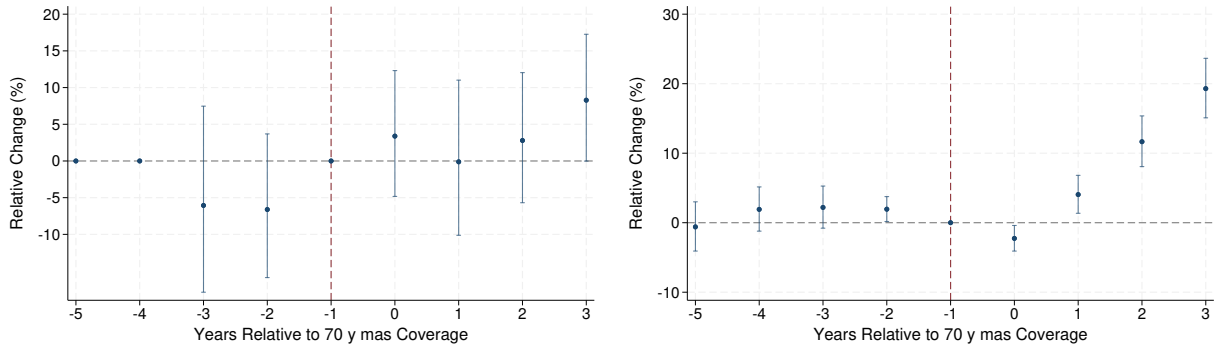
(d) 2008 - *Seguro Popular*

(e) 2007 - Uninsured

(f) 2008 - Uninsured

Notes: This figure uses raw data to show the growth in deaths above and below 70 years old for the localities covered by each "70 y más" expansion and the localities non-covered in the period. All changes in deaths are reported in percentages and calculated with respect to the year before each expansion. The vertical solid yellow line represents one year before the expansion.

Figure A.2: Event Studies: 70 y Mas Impact on Deaths: Additional Results and Weights

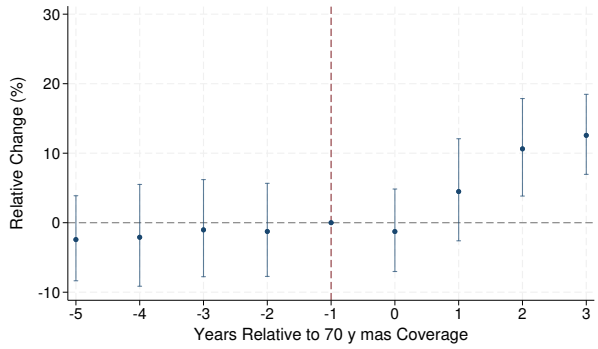


(a) Seguro Popular

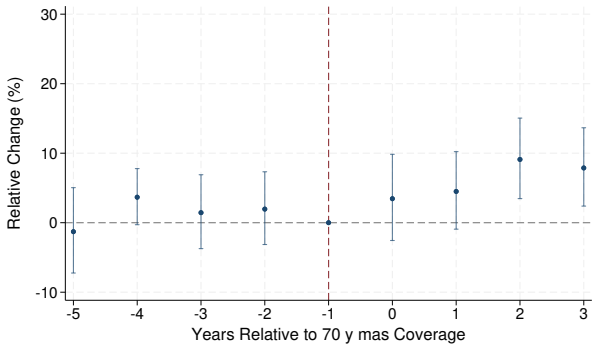
(b) All Deaths Unweighted

Notes: This figure shows the results obtained from estimating the dynamic difference-in-differences-in-differences using the count of deaths as the dependent variable in a Poisson regression. All regressions control for the locality, age, and year fixed effects, as well as locality-age eligibility, year-locality eligibility, and year-age eligibility fixed effects. Standard errors are clustered at the level of treatment: locality-age. The relative change reported in the y-axis corresponds to percent changes by subtracting 1 from the rate ratio, i.e., $\hat{\theta}_{ATT\%} = exp(\hat{\beta}) - 1$. Each estimate captures the effect in each period relative to one year before each group of diseases started to be covered. 95% confidence intervals for $\hat{\theta}_{ATT\%}$ are computed using the delta method for univariate transformations on the coefficient estimated from the Poisson regression. The period of analysis is from 2002 to 2011. All regressions control for locality-level time-varying covariates: Marginality Index, Percentage of deaths medically certified, Lag of death registration, Penetration of *Progresa*, and *Seguro Popular* eligibility. Regressions are weighted using the total interpolated yearly population at the locality level.

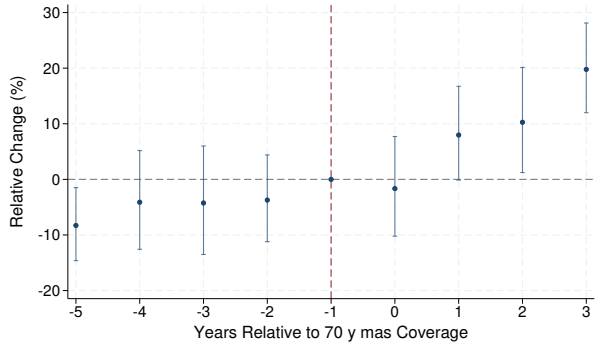
Figure A.3: Event Studies: 70 y Mas Impact on Deaths by Year of Expansion and Sample



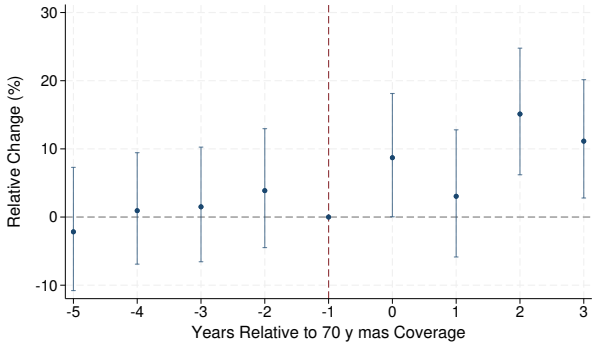
(a) All Deaths - 2007



(b) All Deaths - 2008



(c) Seguro Popular + Uninsured - 2007



(d) Seguro Popular + Uninsured - 2008 Expansion

Notes: This figure shows the results obtained from estimating the dynamic difference-in-differences-in-differences using the count of deaths as the dependent variable in a Poisson regression. All regressions control for the locality, age, and year fixed effects, as well as locality-age eligibility, year-locality eligibility, and year-age eligibility fixed effects. Standard errors are clustered at the level of treatment: locality-age. The relative change reported in the y-axis corresponds to percent changes by subtracting 1 from the rate ratio, i.e., $\hat{\theta}_{ATT\%} = exp(\hat{\beta}) - 1$. Each estimate captures the effect in each period relative to one year before each group of diseases started to be covered. 95% confidence intervals for $\hat{\theta}_{ATT\%}$ are computed using the delta method for univariate transformations on the coefficient estimated from the Poisson regression. The period of analysis is from 2002 to 2011. All regressions control for locality-level time-varying covariates: Marginality Index, Percentage of deaths medically certified, Lag of death registration, Penetration of *Progresa*, and *Seguro Popular* eligibility. Regressions are weighted using the total interpolated yearly population at the locality level.

Table A.1: "70 y Más" Impact on Deaths by Insurance

	By Sample		By Insurance Sample	
	All Deaths		Uninsured and Insured (Private)	Uninsured and *Seguro Popular*
	(1)	(2)	(3)	(4)
After 70 y Más	0.0597	0.0759	0.0640	0.0626
	(0.0182)	(0.0176)	(0.0180)	(0.0180)
After 70 y Más				
× Insured + *Seguro Popular*	-0.0173			
	(0.0165)			
After 70 y Más				
× Insured		-0.0390	-0.0280	
		(0.0194)	(0.0184)	
After 70 y Más				
× *Seguro Popular*				0.0013
				(0.0338)
Deaths	1,054,686	1,054,686	930,501	612,027
Deaths ∈ Covered	51,350	51,350	45,938	30,868
Localities (year before coverage)				
No. Localities.	31,778	31,778	30,746	30,416
Locality Controls	Y	Y	Y	Y
Weights	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Locality FE	Y	Y	Y	Y
Age FE	Y	Y	Y	Y
Year x Age FE	Y	Y	Y	Y
Year x Locality FE	Y	Y	Y	Y
Age x Locality FE	Y	Y	Y	Y

This table shows the results obtained from estimating a Poisson difference-in-differences-in-differences regression using the count of deaths as the dependent variable. Standard errors are clustered at the level of treatment: locality-age. The reported coefficient corresponds to percent changes by subtracting 1 from the rate ratio, i.e., $\hat{\theta}_{ATT\%} = exp(\hat{\beta}) - 1$. Each estimate captures the effect post-treatment for those groups in eligible localities above 70 years of age relative to deaths in non-eligible localities. Standard errors are computed using the delta method for univariate transformations on the coefficient estimated from the Poisson regression. The period of analysis is from 2002 to 2011. All regressions control for locality-level time-varying covariates: Marginality Index, Percentage of deaths medically certified, Lag of death registration, Penetration of *Progresa*, and *Seguro Popular* eligibility. Regressions are weighted using the total interpolated yearly population at the locality level.

Table A.2: "70 y Más" Impact on Deaths by Cardiovascular Disaeses

	Main	by Type of Insurance			
	All Deaths	Uninsured	*Seguro Popular*	Uninsured and *Seguro Popular*	Insured
	(1)	(2)	(3)	(4)	(5)
After 70yMás	0.0380	0.0524	0.0279	0.0664	0.0226
	(0.0168)	(0.0255)	(0.0379)	(0.0210)	(0.0230)
After 70yMás					
× Cardiovascular	0.0170	0.0187	0.0819	0.0131	0.0241
	(0.0183)	(0.0333)	(0.0652)	(0.0239)	(0.0278)
No. Deaths	1,054,686	487,842	124,185	612,027	442,659
No. Deaths ∈ covered localities (year before coverage)	51,350	25,456	5,412	30,868	20,482
No. Localities.	31,778	28,617	19,057	30,416	20,610
Locality Controls	Y	Y	Y	Y	Y
Weights	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Locality FE	Y	Y	Y	Y	Y
Age FE	Y	Y	Y	Y	Y
Year x Age FE	Y	Y	Y	Y	Y
Year x Locality FE	Y	Y	Y	Y	Y
Age x Locality FE	Y	Y	Y	Y	Y

This table shows the results obtained from estimating a Poisson difference-in-differences-in-differences regression using the count of deaths as the dependent variable. Standard errors are clustered at the level of treatment: locality-age. The reported coefficient corresponds to percent changes by subtracting 1 from the rate ratio, i.e., $\hat{\theta}_{ATT\%} = exp(\hat{\beta}) - 1$. Each estimate captures the effect post-treatment for those groups in eligible localities above 70 years of age relative to deaths in non-eligible localities. Standard errors are computed using the delta method for univariate transformations on the coefficient estimated from the Poisson regression. The period of analysis is from 2002 to 2011. All regressions control for locality-level time-varying covariates: Marginality Index, Percentage of deaths medically certified, Lag of death registration, Penetration of *Progresa*, and *Seguro Popular* eligibility. Regressions are weighted using the total interpolated yearly population at the locality level.