Do Conditional Cash Transfers Reduce Hypertension?

Emma Aguila (USC), William H. Dow (UC Berkeley), Felipe Menares (UC Berkeley)*,
Susan W. Parker (UMD), Jorge Peniche (USC), Soomin Ryu (U-M)

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Abstract

Progresa, an anti-poverty conditional cash transfer program, has been a model for similar programs in more than 60 countries. Numerous studies have found positive impacts on schooling, the nutritional and health status of children and adolescents, and household consumption. However, the effects on the health of older adult beneficiaries have been particularly understudied. In this paper we analyze the effects of *Progresa* on middle-aged and older adult health, focusing on a high prevalence chronic condition: hypertension. Our results show that *Progresa* had significant benefits in terms of improved hypertension diagnosis and use of treatment drugs. However, we did not find significant changes in uncontrolled hypertension as measured by systolic and diastolic blood pressure biomarkers in household survey data. Thus, while cash transfer programs may facilitate financial access to healthcare visits and the ability to buy prescribed medicines, by itself the program might not improve hypertension outcomes without complementary healthcare system follow-up to ensure dosage titration and medication adherence.

Keywords: Hypertension, Conditional cash transfers, Elderly, Health, Mexico

* Corresponding author: Felipe Menares, University of California at Berkeley, Department of Demography. Email: fmenares@berkeley.edu.

1. Introduction

Hypertension can be easily detected in the community and primary care facilities, and effective drugs are available at low cost for treating patients (Suchard al, 2019). However, hypertension and high blood pressure are responsible for 8.5 million related deaths worldwide (Zhou B et al., 2021a), accounting for 14% of global mortality and significant morbidity (Fisher and Curfman, 2018). Thus, improving treatment access, utilization, and quality for patients with hypertension is an objective of many global, regional, and national initiatives and programs (NCD-RisC, 2021). Complementing these supply-side initiatives, demand-side social policies that improve households' economic well-being may also enhance ability to engage in care.

Mexico offers a unique opportunity to study the effect of a large social income-support program eon hypertension. In 1997, Mexico introduced a conditional cash transfer (CCT) program *Progresa-Oportunidades-Prospera* (hereinafter referred to as "*Progresa*") that has been a model for similar programs in more than 60 countries (Baird et al., 2014; Fiszbein et al., 2009; Parker and Todd, 2017). [1] An impressive body of research on *Progresa* has documented effects on numerous outcomes related to education, health, and economic outcomes. With respect to health, a number of studies have found impacts on children's growth and nutrition, as well as impacts on maternal health and adult outcomes. (Gertler, 2004; Lagarde et al., 2009; Parker and Todd, 2017; Rivera-Hernandez et al., 2016).

However, only a few studies have examined the effects of *Progresa* on the health of older adults. Barham and Rowberry (2013) found that five years after the implementation of *Progresa*, it led to

[1] The original name was *Progresa*, changed to *Oportunidades* under the Fox administration, and changed again to *Prospera* under the Calderon administration.

an average reduction of 4% in county-level mortality rates for those over age 65, primarily because of decreases in infectious diseases and diabetes-related death. Behrman and Parker (2013) suggested that six years after, *Progresa* increased the healthcare use of older adults -50 years or older- but improved self-reported health only for women but not men.

Paradoxically, Fernald et al. (2008) found for adults 18 to 65 years old that households with larger cash transfer amounts had higher body mass index, increased prevalence of overweight and obesity, and *higher* blood pressure. However, this unexpected finding was based on studying an income dose-response mechanism, by comparing households receiving different amounts of transfers based on variation in numbers/ages of children; that dose-response mechanism is important to isolate, but does not reflect the full potential impact of a conditional cash transfer program such as *Progresa*. The paper did also report effects of the overall program, finding that in treatment households enrolled 18 months earlier than control households, the program *reduced* hypertension. The authors speculate about several potential pathways, which are relevant to interpreting our analysis as well: while income effects may increase the demand for health care, they may also increase the demand for high energy foods, including sugary beverages, which contribute to weight gain and can thus raise hypertension. Any unintended adverse income effects on nutritional intake could be offset though by health clinic check-ups and health education sessions which were a required part of the program conditionality in order to receive the cash transfers. The relative effects via health care utilization versus diet could also change over time; the Fernald et al. study finding adverse hypertension effects was only among the early roll-out experimental communities studied between 1997 and 2003, and has not yet been replicated in the full population and after the full program roll-out.

The present paper uses nationally representative Mexican surveys from 2000 to 2018 to study whether and to what extent the scaled-up *Progresa* conditional cash transfer program improved diagnosis and treatment access and reduced uncontrolled hypertension. We focus on adults ages 50 and older, who have much higher hypertension levels than younger adults ((in the Fernald et al. (2008) sample, only 14% (n=285) were ages 50 and over). To our knowledge, this is the first study to analyze the effects of *Progresa* on hypertension diagnosis, access to treatment, and uncontrolled hypertension levels on a large sample of older adults. We find *Progresa* improved diagnosis and access to hypertension treatment, but we do not find statistically significant effects on uncontrolled hypertension. Our findings highlight this type of program's relevance to diagnosing and providing access to treatment, but suggests that other complementary policies may be required to modify uncontrolled hypertension. These findings are important in a country such as Mexico which already has high levels of obesity and hypertension, and in which projections indicate that without further action there will be an estimated increase of 151% in the number of individuals needing care for hypertension (Sudharsanan and Geldsetzer, 2019).

Our study is organized as follows. The context section describes the *Progresa* program in Mexico. Data and methods section presents the data and our sample, outcome variables, and covariates that we use in our research. The research design and methodology section describe our identification strategy and empirical methods. The results section presents our main findings and describes our robustness tests. Lastly, the discussion section provides the conclusion and a discussion of our findings.

2. Context

2.1. *Progresa-Oportunidades-Prospera* CCT program

Progresa began in small rural communities in 1997. Its crucial feature is conditional monetary transfers to low-income families, with the recipients of the transfers being primarily household mothers. Specifically designed to reduce the number of people living in extreme poverty, the program sought to break the intergenerational transmission of poverty by investing in education, nutrition, and health (Yaschine, 2019). Some transfers are conditional on children attending school; others are conditional on family members visiting health clinics. Several studies have demonstrated the positive effects of this program, boosting the use of preventive services overall and improving the health of rural populations (Gutiérrez et al., 2005; Parker & Todd, 2017).

By 2017, the program had served 6.6 million households (27 million individuals), representing 22.7% of the country's population. The program expanded into urban areas but remained largely rural, with two-thirds of its household beneficiaries living in communities with less than 2,500 inhabitants. The program was ended in December 2018. The average family in *Progresa* received MXN $800 pesos monthly (equivalent to US $90.20 at 2019 purchasing power parity (PPP)).[2] In addition, starting in 2006 (after the initial roll-out period studied by Fernald et al. 2018) adults ages 70 and older started receiving MXN$250 pesos monthly (US$46.82 PPP); by 2018, this had increased to MXN$370 pesos (US$42.17 PPP). The program was means-tested, with both geographic and household-level targeting.

[2] MXN$ are Mexican pesos. The 2019 PPP exchange rate from Mexican pesos to U.S. dollars purchasing power parity (PPP) was obtained from the Organization for Economic Co-operation and Development (OECD), 2021.

2.2. Hypertension

Hypertension is a dangerous chronic condition but is largely asymptomatic. Blood pressure is recorded with systolic and diastolic measurements, the first is the force at which the heart pumps blood around the body, and the second is the resistance to the blood flow in the blood vessels. Typically measured in millimeters of mercury (mmHg), blood pressure is generally considered high above 140 mmHg systolic and 90 mmHg diastolic, although lower thresholds are sometimes used to indicate risk and increasingly elevated levels above these thresholds are even more dangerous. Uncontrolled hypertension can lead to heart attacks, strokes, and aneurysms and a shortened life expectancy (Zhou D et al., 2018).

Hypertension is still a growing public health concern in Mexico. The country has recently experienced an increase in the share of deaths from non-communicable chronic conditions, which now represent the country's most severe public health issues. The National Health and Nutrition Survey (acronym in Spanish: ENSANUT) reported prevalence figures of 17.6% of adults ages 50 or more, of which 34.0% were unaware they had hypertension. Furthermore, among adults above 20 previously diagnosed with hypertension, 79.3% received pharmacological treatment, but only 45.6% were adequately controlled (Campos et al., 2018), and costs related to hypertensive diseases have been estimated to account for at least 14% of the total health budget (Villarreal-Ríos et al., 2002).

Hypertension-related diseases generally require life-long medication in the absence of major lifestyle changes; fortunately anti-hypertensive drugs have been shown to be an extremely effective and highly cost-efficient treatment (Marquez-Padilla, 2021).

3. Data and Sample Construction

3.1. Data Sources

Our measure of *Progresa* exposure is implemented at a municipality-level (to avoid endogeneity concerns with individual enrollment), derived from government administrative records on *Progresa* beneficiaries. This dataset provides us with the number of households registered in a municipality for the program each year. Detailed *Progresa* administrative records are not publicly available, but we use summary enrollment data provided by the central *Progresa* administrative office for the years 1997-2018. Our main explanatory variable of interest, *Progresa* penetration, indicates the intensity of treatment of *Progresa* exposure (proportion of households in the program in each municipality and year), by imputing an annual denominator of households based on the number of households in a municipality from the national Census data for 2000, 2005, 2010, and 2020.

Our hypertension-related dependent variables are individual-level records from the nationally representative ENSANUT survey. These repeated cross-sectional surveys include questions related to self-reported hypertension diagnosis and treatment, as well as objective blood pressure measurements. The data include geographic identifiers at the municipality level, allowing our *Progresa* exposure variable to be merged in. We analyze data from every ENSANUT round available during *Progresa's* existence: 2000, 2006, 2012, 2016, and 2018 rounds (comparable rounds are not available in the immediate pre-program period). The ENSANUT uses a probabilistic multistage stratified cluster sampling design with state, regional, and national representativeness for urban and rural strata of the full Mexican population. The ENSANUT surveys are publicly available from the National Institute of Public Health (INSP) and the Mexican Statistical Agency (INEGI). The surveys were conducted between October and May in 1999-2000, 2005–2006 and 2011–2012, May and October in 2016, and July and June in 2018-2019. Detailed descriptions of the ENSANUT methodology are published elsewhere (Sepúlveda et al., 2007, Olaiz-Fernandez et al., 2006, Romero-Martinez et al., 2013, Romero-Martinez et al., 2017, Romero-Martinez et al., 2019a, Romero-Martinez et al., 2019b). All participants provided informed consent prior to their participation. The INSP Ethics Review Board of Mexico approved the study protocol.

Additional municipal-level control variables were based on census and health care administrative data. Mexico's National Population Council (CONAPO) has derived a municipality-level marginality index from Census data as a measure of local poverty. We linearly interpolated values for years not available. The index uses the following variables: municipality density (population per square kilometer); the percentage of households with no piped water, with no electricity, with no wastewater disposal, and with a dirt floor; the percentage of the population over 14 that are illiterate; the percentage of the population over four who speak an indigenous language; the percentage of employed working in the primary sector; and the number of occupants per household.

We also use health infrastructure administrative records between 2000 and 2017, which includes the number of clinics, hospitals, mobile clinics, health brigades, medical residents, and doctors and nurses in contact with patients at the municipality level. Census data and marginality indexes are publicly available from INEGI and CONAPO, respectively (Consejo Nacional de Población (CONAPO), 2021; INEGI, 2021). Health infrastructure data is publicly available and provided by the Ministry of Health (Secretaria de Salud, 2022).

3.2. Sample Construction

We pool the repeated cross-sectional ENSANUT rounds from 2000 to 2018, analyzing an individual-level dataset of adults ages 50 and over. We follow a similar methodology to Barham and Rowberry (2013), that analyzed the effects of *Progresa* on older adults mortality. We link the ENSANUT panel dataset at the municipality level with the *Progresa* penetration, as well as municipality-level controls (the marginality index and health infrastructure records from the Ministry of Health).

One complication in the municipality-level exposure is that municipality boundaries changed during this period, because some were divided into two or more, merged with another existing municipality, or switched states. Thus, to consistently define geographic areas of treatment, we recoded municipalities into a slightly smaller number of "super municipalities" that could be identified consistently over time, based on 1995 boundaries. For this purpose, we identified all municipalities in 2018 and recoded them back to the municipalities of origin in 1995. However, 67 municipalities split into two or more municipalities during this period, and others merged with other municipalities, resulting in larger geographic areas that included more than one municipality of origin in 1995. Therefore, we decided to create a unique identifier that includes all the merged or divided municipalities that overlapped with the same 1995 geographic area, named the *Super municipality identifier*. Our dataset includes the *super municipality* ID that allows us to analyze respondents across time with the original 1995 geographic area. In doing so, we avoid attenuation bias from measurement errors because of the misallocation of the treatment within a geographic area. Thus, the recoding results in a consistent panel of municipalities from 2000 to 2018 of 2,400 municipalities each year. To our knowledge, previous studies analyzing the effects of *Progresa* using longitudinal methods have not considered geographic changes in municipalities' boundaries.

3.3. Outcome Variables

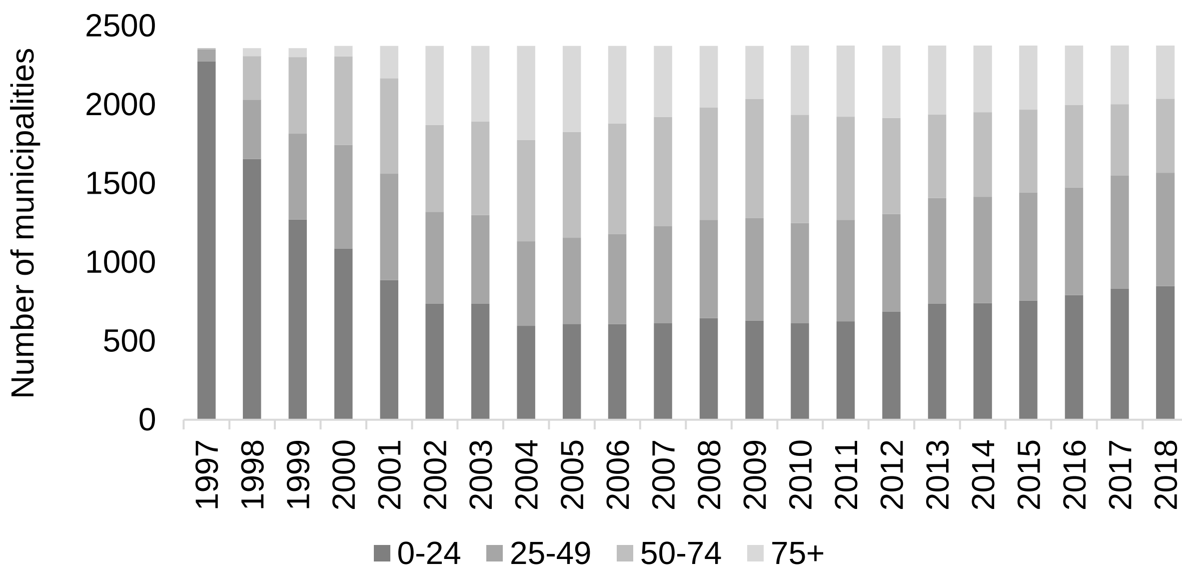
We measured hypertension-related outcomes using self-reported responses to the following questions: (i) for diagnosis, we use "Has a doctor ever told you that you have high blood pressure or hypertension?"; (ii) for treatment, "Are you currently taking medication to control high blood pressure?". Blood pressure was measured twice by a trained nurse in the dominant arm using a mercury sphygmomanometer on two different visits. The first reading was carried out after at least five minutes of seated rest. The second was taken five minutes after the first. Based on the average of the first and second readings, we define uncontrolled hypertension as having a systolic blood pressure ≥140 mmHg or a diastolic blood pressure ≥90 mmHg. In the 2000, 2006, and 2016 waves, the ENSANUT survey attempted to measure blood pressure in all adults; in 2012 and 2018 they attempted to measure blood pressure in a random subsample of adults above the age of 20. Overall, non-response was around 5%, except in 2018, with a non-response rate of 14% and in 2006, with a non-response rate of 23% (Barquera et al., 2010; Campos-Nonato et al., 2013; Campos-Nonato et al., 2018; Campos-Nonato et al., 2019). Appendix Tables A.6-A.11 shows the robustness of the findings, specifically when 2006 and 2018 survey rounds are dropped.

4. Research design and methodology

4.1. Identification strategy

As with previous studies such as Barham and Rowberry (2013), we estimate the impact of *Progresa* using municipality-level variation. Although *Progresa* was rolled-out at the finer level of localities, we follow previous literature in analyzing it at the larger municipality level, as the large number of localities changing geographic boundaries over time makes consistent geographic identification challenging when analyzing repeated cross-sectional data. Localities were incorporated into the program over time, starting in 1997. We exploit the annual variation in the *Progresa* penetration differing between municipalities as a comparison to identify the program effect. We define the *Progresa* penetration across municipalities over time as the proportion of households benefiting from the program. The identifying assumption, in this case, is that the trends in hypertension-related outcomes across municipalities with different intensities of treatment between surveys would have been the same in the absence of the program. As a robustness check, we also present models that add as a covariate the one-year *lead* of *Progresa* penetration (which should be insignificant and have no effect on the current *Progresa* coefficient, if our identification assumptions hold).

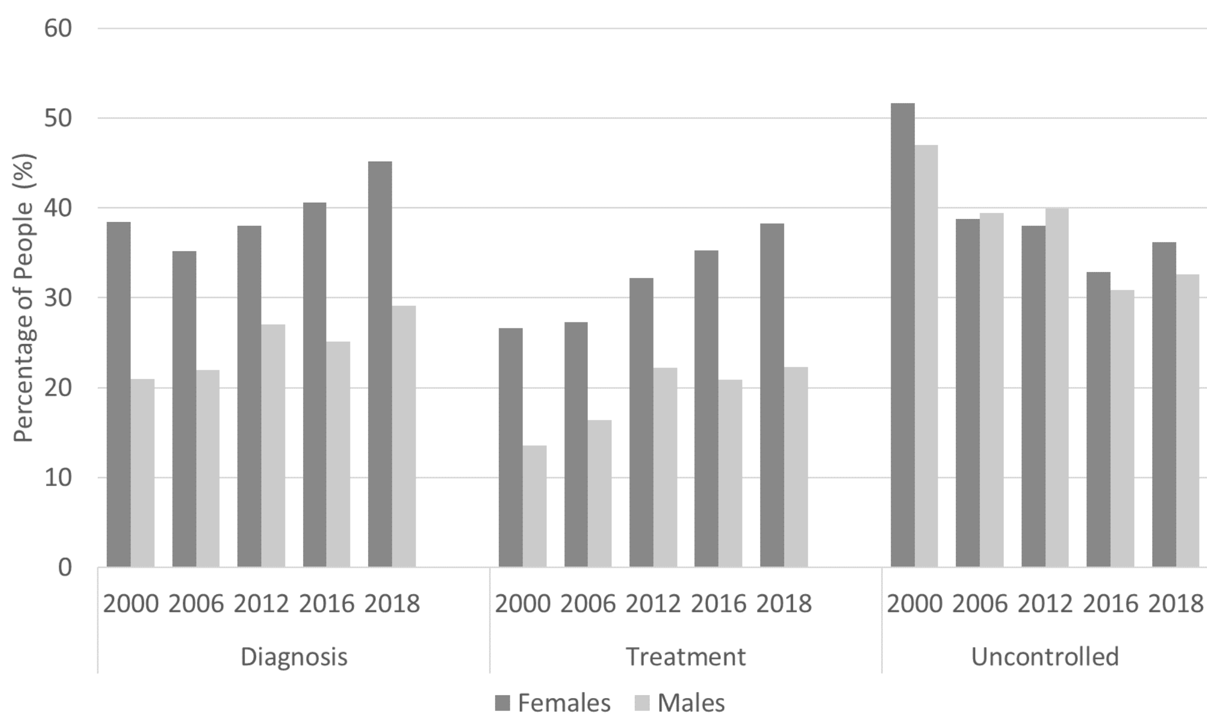
Figure 1: *Progresa* penetration over Time, Municipality-level.



Notes: This figure shows the trend in *Progresa* penetration for all municipalities in Mexico between 1997 and 2018. *Progresa* penetration is the ratio of households receiving *Progresa* benefits to the total number of households in a municipality. *Progresa* penetration is estimated for the following bins: 0-24%, 25-49%, 50-74%, and 75% or more.

In Figure 1, we plot the *Progresa* penetration across all municipalities over time. There, we can see that the share of municipalities with a *Progresa* penetration above 25% increases over time. In particular, most of the variation happened between 2000 and 2006; the extend of municipality-level variation between 2000 and 2006 is further illustrated in Appendix Figure A.1. In Figure 2, we plot our outcomes of interest across the survey years, by sex. There we can see the share of people diagnosed with hypertension by a medical doctor increased by about 8 percentage points between 2000 and 2018 for males and females, although males were diagnosed proportionally more than females. In the case of treatment, we see an increase for males and females, but females seek treatment more than males in the period. Finally, there is a decrease in the share of people having blood pressure measurements in the hypertensive range.

Figure 2: Respondents with hypertension diagnosed, treated and uncontrolled from the ENSANUT Survey years.



Notes: This figure shows the proportion of people with hypertension related outcomes for each year of the survey by sex. We measure hypertension diagnosis and treatment using self-reported response to the following questions: "Has a doctor told you that you have high blood pressure or hypertension?", and "Are you currently taking meds to control high blood pressure?", respectively. We define hypertension uncontrolled as having a systolic blood pressure ≥140 mmHg or a diastolic blood pressure ≥90 mmHg. Systolic and Diastolic blood pressures are average between 1st and 2nd measurement. All estimates are weighted using ENSANUT survey sample weights.

4.2. Empirical model

We implement a generalized difference-in-differences (DiD) linear probability model controlling for the municipality and survey year fixed effects, where the person-level average treatment effect is estimated using the following equation:

$$HTA_{imt} = \alpha_t + \delta_m + \beta_0 Progresa_{mt} + \gamma X_{mt} + \rho Z_i + \epsilon_{imt}, \quad (1)$$

where HTA_{imt} is the respondent hypertension-related outcome for a person i in municipality m in time t, and *Progresa* is the pentration of treatment, α_t are survey year-fixed effects to control for general time trends common to all municipalities. δ_m, are municipality fixed effects, included to capture time-invariant municipality-level unobservables.[3] X_{mt} is a vector of municipality controls including the marginality index, total number of hospitals, medical residents, health brigades, nurses, and doctors. Z_i are individual controls such as sex, age, and education level. Standard errors are clustered at the municipality level to account for intracluster, serial correlation. All models employ sample weights available in each of the ENSANUT surveys.

Table 1 shows summary statistics by ENSANUT wave for the main explanatory variable of interest and each of the controls used in our regressions. "*Progresa* current" is the penetration for the year

[3] To the extent that non-eligibles (non-poor in a municipality) benefit from the improved supply of healthcare services or the health education program, the program effects may be over-estimated. Bobonis and Finan (2002) found no evidence of health spillover effects on the non-eligibles in *Progresa* localities using the *Progresa* randomized evaluation database.

of the survey. In line with Figure 1 and A.1, we can see that most of the aggregate time series variation comes from the increase between 2000 and 2006, and between 2016 and 2018.

Table 1: Weighted independent variables

	2000	2006	2012	2016	2018
Program (Municip)					
Progresa current	0.117	0.197	0.191	0.194	0.271
Progresa lead	0.144	0.193	0.189	0.191	0.271
Demographics (Indiv)					
Sex (1 = female)	0.523	0.539	0.527	0.525	0.553
Age	62.414	62.884	62.454	62.118	63.649
No education	0.247	0.216	0.172	0.168	0.188
Some primary	0.393	0.352	0.292	0.254	0.3
Primary	0.167	0.202	0.204	0.215	0.217
Secondary	0.068	0.086	0.14	0.165	0.154
High School	0.02	0.062	0.078	0.082	0.066
Higher education	0.104	0.081	0.114	0.116	0.074
Infrastructure (Municip)					
Hospitals	1.371	1.666	1.726	1.854	1.131
Health Brigades	0.227	0.252	0.053	0.04	0.022
Medical Residents	41.754	48.55	49.533	58.507	25.888
Doctors	226.767	201.233	263.216	298.347	159.463
Nurses	311.127	399.509	515.187	592.948	323.443
Poverty (Municip)					
Marginality Index	-1.076	-1.084	-1.075	-1.001	-0.581

Note: Demographics are individual-level controls. Program, health infrastructure, and Poverty (marginality index) are measured at the municipality level.

Our parameter of interest β_0 captures the intervention effect if the *Progresa* penetration (proportion of households covered by *Progresa*) increases from zero to one (i.e., 0% to 100% of households in a municipality become *Progresa* beneficiaries). The estimate of the treatment effect will be unbiased if unobserved time-varying municipality characteristics are not correlated with the treatment variable. For the denominator, we linearly interpolated the number of households using the Census data to match the survey's years, thus we also assume that any endogenous migration is small enough to be ignorable.[4][5] The average *Progresa* penetration for municipalities in 2000, the first year of the ENSANUT was 12% and reached 27% by 2018.

5. *Progresa* impact on hypertension related outcomes

5.1. Main Results

From 2000 to 2018, more older adults reported that physicians diagnosed their hypertension, and treated it with anti-hypertensive medications. Table 2 presents the generalized difference-in-differences regression effects of *Progresa* on hypertension-related outcomes for those aged 50 and older. Columns (1-3) present the pooled effect of the program on the probability of diagnosis, and columns (4-6) and (7-9) show the program's effect on hypertension treatment and uncontrolled hypertension, respectively. The first model (columns 1, 4, and 7) for each outcome show the primary municipality-year fixed effects model with no further municipality controls; the second and third show robustness checks.

Columns (1) and (4) in Table 2 show a positive and statistically significant point estimate of the *Progresa* penetration at the 1% level on the probability of being diagnosed and receiving hypertension treatment. For example, a ten-percentage point (i.e., within sample) expansion in *Progresa* raised diagnosis by 2.3 percentage points and treatment by 3 percentage points of

[4] Linear interpolation of the household data will not be an accurate estimation if there are sizable migration flows of older adults that are correlated with *Progresa*. Given the short duration of the analysis, and that migration of older adults is low, any measurement error should be minimized. In addition, Stecklov et al. (2005) demonstrated that for people under age 60, *Progresa* had no effect on domestic migration.

[5] 2% of the municipalities have a *Progresa* penetration slightly greater than one. These are mostly municipalities in which all localities in the municipality participated in the program. The ratio may be greater than one due to measurement error arising from the linear interpolation of the household counts, resulting in a smaller number of households than the actual household beneficiaries. Results are not sensitive to top-coding this small number of observations.

Table 2: *Progresa* program effect on the probability of hypertension related outcomes

	Diagnosed			Treated			Uncontrolled		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Progresa penetration	0.2330***	0.2593***	0.3857**	0.2996***	0.3162***	0.4308**	0.2016*	0.1601	-0.0277
	(0.08974)	(0.09234)	(0.16883)	(0.07747)	(0.08316)	(0.16931)	(0.11729)	(0.12307)	(0.21282)
Progresa lead (t+1)			-0.1800			-0.1630			0.2667
			(0.20242)			(0.20397)			(0.24654)
Constant	-0.1726***	-0.1871***	-0.1738**	-0.3230***	-0.3269***	-0.3148***	-0.0290	-0.0370	-0.0596
	(0.04096)	(0.06542)	(0.06556)	(0.04120)	(0.06296)	(0.06333)	(0.05146)	(0.07433)	(0.07516)
Municipality-level Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Municipality and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	53377	52761	52761	53377	52761	52761	37824	37335	37335

Notes: This table shows the results obtained from estimating the generalized difference-in-differences presented in equation (1) using linear probability regressions. We measured hypertension diagnosis and treatment using self-reported response to the following questions: "Has a doctor told you that you have high blood pressure or hypertension?", and "Are you currently taking meds to control high blood pressure?", respectively. We define hypertension uncontrolled as having a systolic blood pressure ≥140 mmHg or a diastolic blood pressure ≥90 mmHg. Systolic and Diastolic blood pressures are average between 1st and 2nd measurement. All regressions consider survey sample weights and control for individual demographic characteristics: age, sex, and education level and survey year fixed effects. Standard errors are clustered at the municipality level. *Progresa* penetration captures the intervention effect on hypertension related outcomes, i.e., the effect when 0% of households in a municipality are *Progresa* beneficiaries goes up to 100%. For example, a ten-percentage point expansion in *Progresa* raised diagnosis by 2.3 percentage points and treatment by 3 percentage points for people aged 50 and older. *Progresa* lead is a falsification test, whether future expansions in the program are related to current outcomes. Municipality level stands for time-varying characteristics controlling for variables that are likely correlated with poverty, such as the marginality index and healthcare infrastructure. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

hypertension for people aged 50 and older. In 2018, *Progresa* coverage reached an average of 27%, so the average municipality program effect represents an increase of approximately 10% in the probability of being diagnosed relative to the 2000 level.[6] Column (7) shows no effect of *Progresa* on the probability of having uncontrolled hypertension, although the confidence intervals are fairly large [-0.029, 0.432].[7]

5.2. Robustness checks

This section explores various threats to the validity of the estimates (Table 2, columns 2-3, 5-6, 8-9). We test whether the point estimates are sensitive to the inclusion of time-varying municipality characteristics in columns (2), (5), and (8) by controlling for variables that are likely correlated with poverty, such as the marginality index and healthcare infrastructure. These controls may be endogenous if *Progresa* led to these variables' changes, so we only include the controls as a robustness check.

There is some evidence that the supply of healthcare services increased to ensure that the quality of services did not deteriorate with the increase in healthcare service utilization resulting from the program (Bautista- Arredondo et al., 2006) and that beneficiaries could therefore meet the health conditions. Healthcare expanded in both treatment and comparison municipalities; however, if the healthcare expansion timing was correlated with *Progresa* expansion, this might impact our model

[6] Percentage of people diagnosed in 2000 * Coefficient * *Progresa* penetration in 2018. i.e, 0.304*1.233*0.271 = 0.1015

[7] The sample size for uncontrolled hypertension differs from diagnosis and hypertension treatment sample, because for the 2012 survey, blood pressures measurements were a random sample of adults. We tested weather this subsample led to different results on the diagnosis and treatment outcomes. We restricted our diagnosis and hypertension treatment samples to the uncontrolled hypertension sample and results remain qualitatively and quantitatively unchanged. The point estimate of the effect of *Progresa* on the probability of diagnosis decrease to 0.1989, and it significant at 10%, but within the original confidence interval [-0.022, 0.420]. While for the effect on the probability of being treated, decreases to 0.2883, and is still significant at 1%.

interpretation. We see though in Table 2 that the point estimates on the *Progresa* penetration between the models are not significantly different, providing evidence that changes in the healthcare supply are not driving the results. In addition, the similarity in results with and without observable time-varying characteristics provides some confidence that differences in the time-varying observables are not biasing the results.

$$HTA_{i,t,m} = \alpha_t + \delta_m + \beta_0 Progresa_{m,t} + \beta_1 Progresa_{m,t+1} + \epsilon_{m,t,i}, \qquad (2)$$

Second, we test whether future expansions in the program are related to current outcomes. Thus, we lead the *Progresa* penetration variable as a falsification test captured by β_1 in equation (2). If β_1 is not significantly different from zero, then the post-intervention trends for hypertension-related outcomes are statistically similar across municipalities. The lead coefficient on the treatment variable in columns (3), (6), and (9) is negative and not significantly different from zero, while the current *Progresa* penetration variable is still positive and significant.

Appendix Tables A.1-A.3 show our results by sex, finding no evidence of significant differences between males and females. Even though all monetary grants are given to the mother of the family, it does not seem that they benefit more than males regarding hypertension-related outcomes. Appendix Tables A.4 and A.5 further investigate our results on uncontrolled hypertension by using continuous blood pressure measurements as the outcome of interest. Again, we find no evidence of *Progresa* effect on blood pressure measurement, based on the average of the first and second readings of systolic and diastolic.

Finally, Appendix Tables A.6-A.10 includes further sensitivity analyses. Because of the higher missingness rates in 2006 for measured blood pressure, in column (2) we show results excluding

2006 data; the results are similar to our main results in Table 2 (reproduced in column 1). In addition, because healthcare infrastructure variables were not available in 2018, in column (3) we show results excluding 2018 data; again, the point estimates on the treatment variable excluding 2018 are similar to those in Table 2.

6. Discussion

The study found that the *Progresa* program improves hypertension diagnosis and treatment among older adults. The program provided cash transfers to low-income families, which may have facilitated better healthcare access and increased treatment for hypertension through helping to pay transportation, clinic fees, and medicine costs. Health care information visits required as part of the program's conditionality requirements could have also contributed to these effects.

However, these improvements in utilization did not result in statistically significantly improved hypertension levels. It is important to note though that the confidence intervals are wide enough that they cannot rule out potentially meaningful improvements in hypertension, although the primary model (Table 2, column 7) can rule out all but tiny *adverse* effects on hypertension. Thus our findings do not support Fernald et al. *adverse* hypertension effects estimated from their cash dose-response models. To the extent that the effects on hypertension were null, it is unknown if this is due to factors such as insufficient medication/dosage titration, or perhaps low medication adherence; future work on these mechanisms would be of interest (Campos et al, 2018).

Income support programs in low-income settings have the potential to substantially improve healthcare access and prevention among older adults, including for high-priority conditions such as hypertension (Berhman and Parker, 2013). However, it is essential to note that improved access alone may not ensure improved health outcomes. Further work is needed to ensure that improved access is complemented by effective treatment and management of hypertension.

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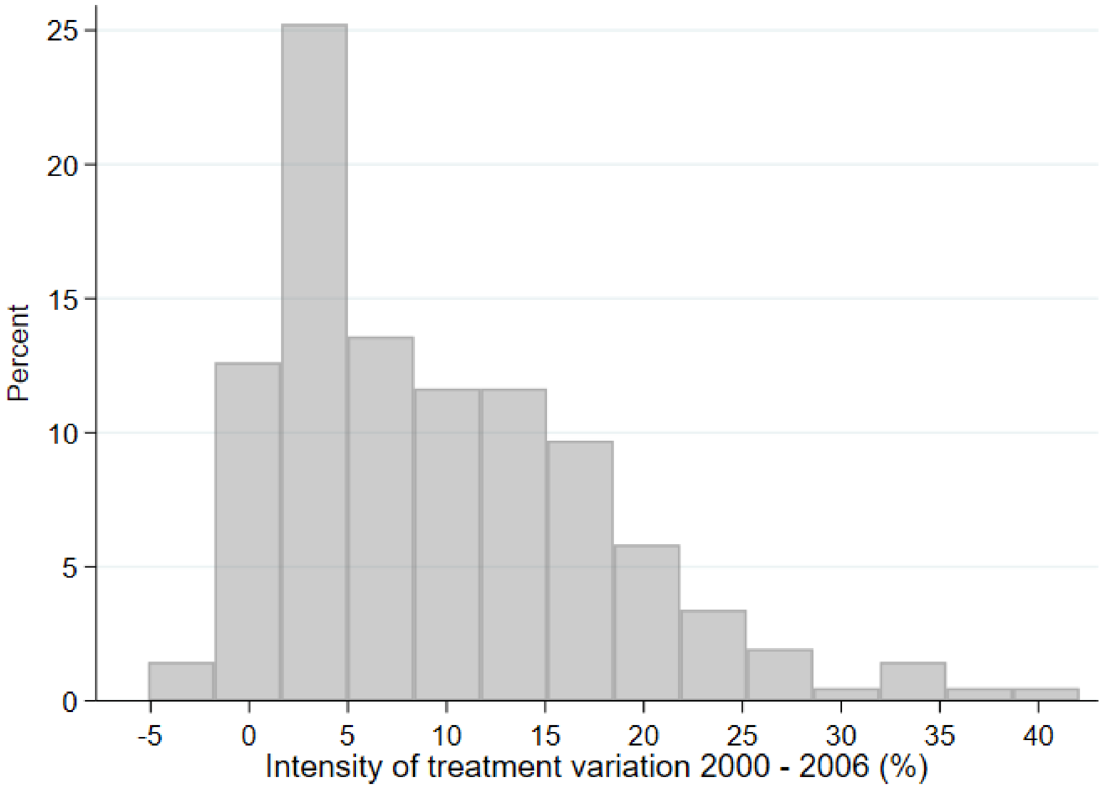
Appendix

Figure A.1: *Progresa* penetration variation from 2000 to 2006: Municipality-level histogram



Notes: This figure shows the histogram across municipalities of the absolute difference in the municipality-level *Progresa* penetration between 2000 and 2006.

Table A.1: *Progresa* program effect on the probability of hypertension diagnosis

	(1) All	(2) All	(3) All	(4) Females	(5) Females	(6) Females	(7) Males	(8) Males	(9) Males
Progresa penetration	0.2330***	0.2593***	0.3857**	0.2149	0.2170	0.4128	0.2685**	0.3086**	0.3727
	(0.08974)	(0.09234)	(0.16883)	(0.14324)	(0.14542)	(0.27473)	(0.13070)	(0.13617)	(0.25751)
Progresa lead (t+1)			-0.1800			-0.2757			-0.0923
			(0.20242)			(0.31817)			(0.29242)
Constant	-0.1726***	-0.1871***	-0.1738***	-0.0010	0.0170	0.0376	-0.2184***	-0.2458***	-0.2389***
	(0.04096)	(0.06542)	(0.06556)	(0.05586)	(0.09496)	(0.09844)	(0.05457)	(0.08598)	(0.08914)
Municipality-level Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Municipality and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	53377	52761	52761	30968	30608	30608	22409	22153	22153

Notes: This table shows the results obtained from estimating the generalized difference-in-differences presented in equation (1) using linear probability regressions for the gender-pooled results, and separately for females and males. We measured hypertension diagnosis using self-reported response to the following questions: "Has a doctor told you that you have high blood pressure or hypertension?". All regressions consider survey sample weights and control for individual demographic characteristics: age, sex, and education level and survey year fixed effects. Standard errors are clustered at the municipality level *Progresa* penetration captures the intervention effect on hypertension related outcomes, i.e., the effect when 0% of households in a municipality are *Progresa* beneficiaries goes up to 100%. *Progresa* lead is a falsification test, whether future expansions in the program are related to current outcomes. Municipality level stands for time-varying characteristics controlling for variables that are likely correlated with poverty, such as the marginality index and healthcare infrastructure. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table A.2: *Progresa* program effect on the probability of hypertension treatment in the full sample

	(1) All	(2) All	(3) All	(4) Females	(5) Females	(6) Females	(7) Males	(8) Males	(9) Males
Progresa penetration	0.2996***	0.3162***	0.4308**	0.3720***	0.3687***	0.6986***	0.2110*	0.2320*	0.1071
	(0.07747)	(0.08316)	(0.16931)	(0.11344)	(0.11770)	(0.26044)	(0.11700)	(0.12578)	(0.21480)
Progresa lead (t+1)			-0.1630			-0.4647			0.1800
			(0.20397)			(0.30386)			(0.24214)
Constant	-0.3230***	-0.3269***	-0.3148***	-0.1880***	-0.1412	-0.1066	-0.3374***	-0.3734***	-0.3870***
	(0.04120)	(0.06296)	(0.06333)	(0.05443)	(0.09295)	(0.09498)	(0.05217)	(0.08006)	(0.07892)
Municipality-level Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Municipality and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	53377	52761	52761	30968	30608	30608	22409	22153	22153

Notes: This table shows the results obtained from estimating the generalized difference-in-differences presented in equation (1) using linear probability regressions for the gender-pooled results, and separately for females and males. We measured hypertension treatment using self-reported response to the following questions: "Are you currently taking meds to control high blood pressure?". All regressions consider survey sample weights and control for individual demographic characteristics: age, sex, and education level and survey year fixed effects. Standard errors are clustered at the municipality level. *Progresa* penetration captures the intervention effect on hypertension related outcomes, i.e., the effect when 0% of households in a municipality are *Progresa* beneficiaries goes up to 100%. *Progresa* lead is a falsification test, whether future expansions in the program are related to current outcomes. Municipality level stands for time-varying characteristics controlling for variables that are likely correlated with poverty, such as the marginality index and healthcare infrastructure. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table A.3: *Progresa* program effect on the probability of uncontrolled hypertension

	(1) All	(2) All	(3) All	(4) Females	(5) Females	(6) Females	(7) Males	(8) Males	(9) Males
Progresa penetration	0.2016* (0.11729)	0.1601 (0.12307)	-0.0277 (0.21282)	0.2241 (0.15835)	0.1902 (0.15868)	-0.0772 (0.27626)	0.1445 (0.17663)	0.0978 (0.18792)	-0.1006 (0.31763)
Progresa lead (t+1)			0.2667 (0.24654)			0.3770 (0.32605)			0.2851 (0.35835)
Constant	-0.0290 (0.05146)	-0.0370 (0.07433)	-0.0596 (0.07516)	-0.0867 (0.06051)	-0.0148 (0.09081)	-0.0464 (0.09451)	0.0946 (0.08405)	-0.0061 (0.11597)	-0.0319 (0.11808)
Municipality-level Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Municipality and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	37824	37335	37335	22634	22340	22340	15190	14995	14995

Notes: This table shows the results obtained from estimating the generalized difference-in-differences presented in equation (1) using linear probability regressions for the gender-pooled results, and separately for females and males. We define hypertension uncontrolled as having a systolic blood pressure ≥140 mmHg or a diastolic blood pressure ≥90 mmHg. Systolic and Diastolic blood pressures are average between 1st and 2nd measurement. All regressions consider survey sample weights and control for individual demographic characteristics: age, sex, and education level and survey year fixed effects. Standard errors are clustered at the municipality level. *Progresa* penetration captures the intervention effect on hypertension related outcomes, i.e., the effect when 0% of households in a municipality are *Progresa* beneficiaries goes up to 100%. *Progresa* lead is a falsification test, whether future expansions in the program are related to current outcomes. Municipality level stands for time-varying characteristics controlling for variables that are likely correlated with poverty, such as the marginality index and healthcare infrastructure. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table A.4: *Progresa* program effect on continuous systolic blood pressure

	(1) All	(2) All	(3) All	(4) Females	(5) Females	(6) Females	(7) Males	(8) Males	(9) Males
Progresa penetration	4.355 (4.7698)	3.249 (4.9332)	-3.205 (8.8682)	7.005 (6.5334)	7.079 (6.3323)	-0.753 (11.9041)	-0.528 (5.7956)	-3.692 (6.3535)	-12.321 (13.4623)
Progresa lead (t+1)			9.164 (10.4791)			11.033 (14.6117)			12.398 (15.3304)
Constant	113.812*** (2.2371)	111.558*** (2.9551)	110.782*** (3.0939)	111.916*** (2.8040)	109.800*** (3.8830)	108.878*** (3.9937)	117.609*** (3.0357)	115.428*** (4.1467)	114.307*** (4.2595)
Municipality-level Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Municipality and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	37957	37462	37462	22714	22417	22417	15243	15045	15045

Notes: This table shows the results obtained from estimating the generalized difference-in-differences presented in equation (1) using linear probability regressions for the gender-pooled results, and separately for females and males. All regressions consider survey sample weights and control for individual demographic characteristics: age, sex, and education level and survey year fixed effects. Standard errors are clustered at the municipality level. *Progresa* penetration captures the intervention effect on hypertension related outcomes, i.e., the effect when 0% of households in a municipality are *Progresa* beneficiaries goes up to 100%. *Progresa* lead is a falsification test, whether future expansions in the program are related to current outcomes. Municipality level stands for time-varying characteristics controlling for variables that are likely correlated with poverty, such as the marginality index and healthcare infrastructure. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table A.5: *Progresa* program effect on continuous diastolic blood pressure

	(1) All	(2) All	(3) All	(4) Females	(5) Females	(6) Females	(7) Males	(8) Males	(9) Males
Progresa penetration	0.5533	-1.9099	-13.9845*	5.4854	3.9360	-9.0503	-6.5660	-9.9811**	-21.4522**
	(3.39468)	(3.65351)	(7.32290)	(4.61819)	(4.81420)	(9.46236)	(4.32822)	(4.41789)	(8.25943)
Progresa lead (t+1)			17.1496**			18.3024*			16.4950*
			(7.91848)			(10.19334)			(9.55848)
Constant	85.8488***	86.4012***	84.9506***	82.0085***	84.7444***	83.2094***	89.5762***	88.1678***	86.6796***
	(1.36911)	(1.92730)	(1.94436)	(2.01099)	(2.73167)	(2.75852)	(1.67762)	(2.54500)	(2.62217)
Municipality-level Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Municipality and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	38018	37527	37527	22773	22477	22477	15245	15050	15050

Notes: This table shows the results obtained from estimating the generalized difference-in-differences presented in equation (1) using linear probability regressions for the gender-pooled results, and separately for females and males. All regressions consider survey sample weights and control for individual demographic characteristics: age, sex, and education level and survey year fixed effects. Standard errors are clustered at the municipality level. *Progresa* penetration captures the intervention effect on hypertension related outcomes, i.e., the effect when 0% of households in a municipality are *Progresa* beneficiaries goes up to 100%. *Progresa* lead is a falsification test, whether future expansions in the program are related to current outcomes. Municipality level stands for time-varying characteristics controlling for variables that are likely correlated with poverty, such as the marginality index and healthcare infrastructure. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table A.6: *Progresa* program effect on the probability of hypertension diagnosis – sensitivity to excluding years with higher missing data rates

	(1) Full Sample	(3) Excluding 2006	(5) Excluding 2018
Progresa penetration	0.2593***	0.2688**	0.2307**
	(0.09234)	(0.11984)	(0.10020)
Municipality-level Controls	Yes	Yes	Yes
Municipality and Year Fixed Effects	Yes	Yes	Yes
Observations	52761	39666	43105

Notes: This table shows the results obtained from estimating the generalized difference-in-differences presented in equation (1) using linear probability regressions. We tested whether excluding the 2006 or 2018 survey round would influence the findings due to the missingness on blood pressure measurement and to the absence of health infrastructure variables, respectively. We measured hypertension diagnosis using self-reported response to the following questions: "Has a doctor told you that you have high blood pressure or hypertension?". All regressions consider survey sample weights and control for individual demographic characteristics: age, sex, and education level and survey year fixed effects, except model (1), which does not control for individual demographic characteristics. Standard errors are clustered at the municipality level. *Progresa* penetration captures the intervention effect on hypertension related outcomes, i.e., the effect when 0% of households in a municipality are *Progresa* beneficiaries goes up to 100%. For example, a ten-percentage point expansion in *Progresa* raised diagnosis by 2.3 percentage points and treatment by 3 percentage points for people aged 50 and older. Municipality level stands for time-varying characteristics controlling for variables that are likely correlated with poverty, such as the marginality index and healthcare infrastructure. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table A.7: *Progresa* program effect on the probability of hypertension treatment – sensitivity to excluding years with higher missing data rates

	(1) Full Sample	(3) Excluding 2006	(5) Excluding 2018
Progresa penetration	0.3162***	0.3437***	0.3846***
	(0.08316)	(0.10757)	(0.08991)
Municipality-level Controls	Yes	Yes	Yes
Municipality and Year Fixed Effects	Yes	Yes	Yes
Observations	53738	39666	43105

Notes: This table shows the results obtained from estimating the generalized difference-in-differences presented in equation (1) using linear probability regressions. We tested whether excluding the 2006 or 2018 survey round would influence the findings due to the missingness on blood pressure measurement and to the absence of health infrastructure variables, respectively.. We measured hypertension treatment using self-reported response to the following questions: "Are you currently taking meds to control high blood pressure?". All regressions consider survey sample weights and control for individual demographic characteristics: age, sex, and education level and survey year fixed effects, except model (1), which does not control for individual demographic characteristics. Standard errors are clustered at the municipality level. *Progresa* penetration captures the intervention effect on hypertension related outcomes, i.e., the effect when 0% of households in a municipality are *Progresa* beneficiaries goes up to 100%. For example, a ten-percentage point expansion in *Progresa* raised diagnosis by 2.3 percentage points and treatment by 3 percentage points for people aged 50 and older. Municipality level stands for time-varying characteristics controlling for variables that are likely correlated with poverty, such as the marginality index and healthcare infrastructure. Significance levels: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.8: *Progresa* program effect on the probability of uncontrolled hypertension – sensitivity to excluding years with higher missing data rates

	(1) Full Sample	(3) Excluding 2006	(5) Excluding 2018
Progresa penetration	0.1601 (0.12307)	0.1294 (0.16350)	0.1771 (0.15892)
Municipality-level Controls	Yes	Yes	Yes
Municipality and Year Fixed Effects	Yes	Yes	Yes
Observations	37335	27427	29269

Notes: This table shows the results obtained from estimating the generalized difference-in-differences presented in equation (1) using linear probability regressions. We tested whether excluding the 2006 or 2018 survey round would influence the findings due to the missingness on blood pressure measurement and to the absence of health infrastructure variables, respectively. We define hypertension uncontrolled as having a systolic blood pressure ≥140 mmHg or a diastolic blood pressure ≥90 mmHg. Systolic and Diastolic blood pressures are average between 1st and 2nd measurement. All regressions consider survey sample weights and control for individual demographic characteristics: age, sex, and education level and survey year fixed effects, except model (1), which does not control for individual demographic characteristics. Standard errors are clustered at the municipality level. *Progresa* penetration captures the intervention effect on hypertension related outcomes, i.e., the effect when 0% of households in a municipality are *Progresa* beneficiaries goes up to 100%. For example, a ten-percentage point expansion in *Progresa* raised diagnosis by 2.3 percentage points and treatment by 3 percentage points for people aged 50 and older. Municipality level stands for time-varying characteristics controlling for variables that are likely correlated with poverty, such as the marginality index and healthcare infrastructure. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table A.9: *Progresa* program effect on continuous systolic blood pressure – sensitivity to excluding years with higher missing data rates

	(1) Full Sample	(3) Excluding 2006	(5) Excluding 2018
Progresa penetration	3.2494 (4.93321)	1.7733 (6.92165)	3.8500 (6.08081)
Municipality-level Controls	Yes	Yes	Yes
Municipality and Year Fixed Effects	Yes	Yes	Yes
Observations	38282	27554	29309

Notes: This table shows the results obtained from estimating the generalized difference-in-differences presented in equation (1) using linear probability regressions. We tested whether excluding the 2006 or 2018 survey round would influence the findings due to the missingness on blood pressure measurement and to the absence of health infrastructure variables, respectively. Systolic blood pressures are average between 1st and 2nd measurement. All regressions consider survey sample weights and control for individual demographic characteristics: age, sex, and education level and survey year fixed effects, except model (1), which does not control for individual demographic characteristics. Standard errors are clustered at the municipality level. *Progresa* penetration captures the intervention effect on hypertension related outcomes, i.e., the effect when 0% of households in a municipality are *Progresa* beneficiaries goes up to 100%. For example, a ten-percentage point expansion in *Progresa* raised diagnosis by 2.3 percentage points and treatment by 3 percentage points for people aged 50 and older. Municipality level stands for time-varying characteristics controlling for variables that are likely correlated with poverty, such as the marginality index and healthcare infrastructure. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table A.10: *Progresa* program effect on continuous diastolic blood pressure – sensitivity to excluding years with higher missing data rates

	(1) Full Sample	(3) Excluding 2006	(5) Excluding 2018
Progresa penetration	-1.9099 (3.65351)	-2.1633 (4.17421)	-1.6749 (5.27413)
Municipality-level Controls	Yes	Yes	Yes
Municipality and Year Fixed Effects	Yes	Yes	Yes
Observations	37527	27584	29375

Notes: This table shows the results obtained from estimating the generalized difference-in-differences presented in equation (1) using linear probability regressions. We tested whether excluding the 2006 or 2018 survey round would influence the findings due to the missingness on blood pressure measurement and to the absence of health infrastructure variables, respectively. Diastolic blood pressures are average between 1st and 2nd measurement. All regressions consider survey sample weights and control for individual demographic characteristics: age, sex, and education level and survey year fixed effects, except model (1), which does not control for individual demographic characteristics. Standard errors are clustered at the municipality level. *Progresa* penetration captures the intervention effect on hypertension related outcomes, i.e., the effect when 0% of households in a municipality are *Progresa* beneficiaries goes up to 100%. For example, a ten-percentage point expansion in *Progresa* raised diagnosis by 2.3 percentage points and treatment by 3 percentage points for people aged 50 and older. Municipality level stands for time-varying characteristics controlling for variables that are likely correlated with poverty, such as the marginality index and healthcare infrastructure. Significance levels: *** p<0.01, ** p<0.05, * p<0.1